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A Comparative Study on Emergency Response System (ERS) in Japan and Myanmar

Ms. Thandar Aung
Upper Divisional Clerk
Relief and Resettlement Department
Ministry of Social Welfare, Relief and Resettlement
Myanmar

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1. INTRODUCTION

"**Emergency management**, as it is defined by FEMA, is the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters". A crisis or emergency is a threatening condition that requires urgent action. Effective emergency action can avoid the escalation of an event into a disaster. Emergency management involves plans and institutional arrangements to engage and guide the efforts of government, non-government, voluntary and private agencies in comprehensive and coordinated ways to respond to the entire spectrum of emergency needs. The expression "disaster management" is sometimes used instead of emergency management.

Federal Emergency Management Agency (FEMA) of the United States has given eight principles/doctrines of emergency management. The summary provided below lists these eight principles and provides a brief description of each:

1. **Comprehensive** - emergency managers consider and take into account all hazards, all phases, all stakeholders and all impacts relevant to disasters.
2. **Progressive** - emergency managers anticipate future disasters and take preventive and preparatory measures to build disaster-resistant and disaster resilient communities.
3. **Risk-driven** - emergency managers use sound risk management principles (hazard identification, risk analysis, and impact analysis) in assigning priorities and resources.
4. **Integrated** - emergency managers ensure unity of effort among all levels of government and all elements of a community.
5. **Collaborative** - emergency managers create and sustain broad and sincere relationships among individuals and organizations to encourage trust, advocate a team atmosphere, build consensus, and facilitate communication.
6. **Coordinated** - emergency managers synchronize the activities of all relevant stakeholders to achieve a common purpose.
7. **Flexible** - emergency managers use creative and innovative approaches in solving disaster challenges.
8. **Professional** - emergency managers value a science and knowledge-based approach based on education, training, experience, ethical practice, public stewardship and continuous improvement.

Four phases of emergency management are:

1. Mitigation/Prevention,
2. Preparedness,
3. Response
4. Recovery.

Response can be defined as the provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. Disaster response is predominantly focused on immediate and short-term needs and is sometimes called 'disaster relief'. It is important to practice response activities in pre-disaster phase to ensure effective response during post-disaster situation. The division between this response stage and the subsequent recovery stage is not clear-cut. Some response actions, such as the supply of temporary housing and water supplies, may extend well into the recovery stage.

Public Awareness - Public awareness is a key factor in effective disaster risk reduction. Its development is pursued, for example, through the development and dissemination of information through media and educational channels, the establishment of information centers, networks, and community or participation actions, and advocacy by senior public officials and community leaders.

Early Warning – Early Warning System is “the set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss”. This definition given by the UNISDR encompasses the range of factors necessary to achieve effective responses to warnings. A people-centered early warning system necessarily comprises four key elements: knowledge of the risks; monitoring, analysis and forecasting of the hazards; communication or dissemination of alerts and warnings; and local capabilities to respond to the warnings received. The expression “end-to-end warning system” is also used to emphasize that warning systems need to span all steps from hazard detection through to community response.

Contingency Planning - ERS would not be effective and efficient until or unless all actors know actions to be taken and procedures to be followed in a given case of emergency. This calls for contingency planning. UNISDR defines contingency planning as “a management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations.” Contingency planning has to be a part of overall DRR process. It aims to focus at hazard, risk and vulnerability analysis, simulation exercise, response planning, defining or roles and responsibilities of various stakeholders, emergency support functions (ESFs), standard operating procedures (SOPs), resource mobilization, SAR activities. The contingency planning needs to be tested regularly through mock drills and improved and updated at regular intervals. Good contingency planning will result in coordinated and effective response.

Emergency services include agencies such as civil protection authorities, police, fire, ambulance, paramedic and emergency medicine services, Red Cross and Red Crescent societies, and specialized emergency units of electricity, transportation, communications and other related services organizations.

2. DISASTER MANAGEMENT SYSTEM OF JAPAN

2.1 Overview of Disaster Management Planning in Japan

In Japan Disaster Management Planning is done at three levels namely:

National Level: Basic Disaster Management Plan - This plan is a basis for disaster reduction activities and is prepared by the Central Disaster Management Council based on the Disaster Countermeasures Basic Act, 1961. The Basic Disaster Management Plan states comprehensive and long-term disaster reduction issues such as disaster management related systems, disaster reduction projects, early and appropriate disaster recovery and rehabilitation, as well as scientific and technical research. The first Basic DMP was prepared in 1963 and subsequently revised several times. The plan was revised entirely in 1995 based on the experiences of the Great Hanshin-Awaji Earthquake. It now consists of various plans for each type of disaster, where tangible countermeasures to be taken by each stakeholder such as the national and local governments, public corporations and other entities are described for easy reference according to the disaster phases of prevention and preparedness, emergency response, as well as recovery and rehabilitation. Changes were effected in the plan in December, 2011 based on the recommendations from the Central Disaster Management Council’s technical committee for reviewing earthquake and tsunami measures based on the lessons from the GEJET. The plan, it has been decided, shall be continuously revised in future in order to reflect further policy development based on the GEJET and other disasters.

Department/Organizational Level: Disaster Management Operation Plan - Disaster Management Operation Plan: This is a plan made by each designated government organization and designated public corporation based on the Basic Disaster Management Plan.

Prefectural/Local Level: Local Disaster Management Plan: This is a plan made by each prefectural and municipal disaster management council, subject to local circumstances and based on the Basic Disaster Management Plan.

The plans at all levels have been prepared and regularly revised and updated incorporating the lessons learnt and changes made in the Basic DMP prepared at the national level. DMP is the main document which is referred to for disaster management and emergency response.

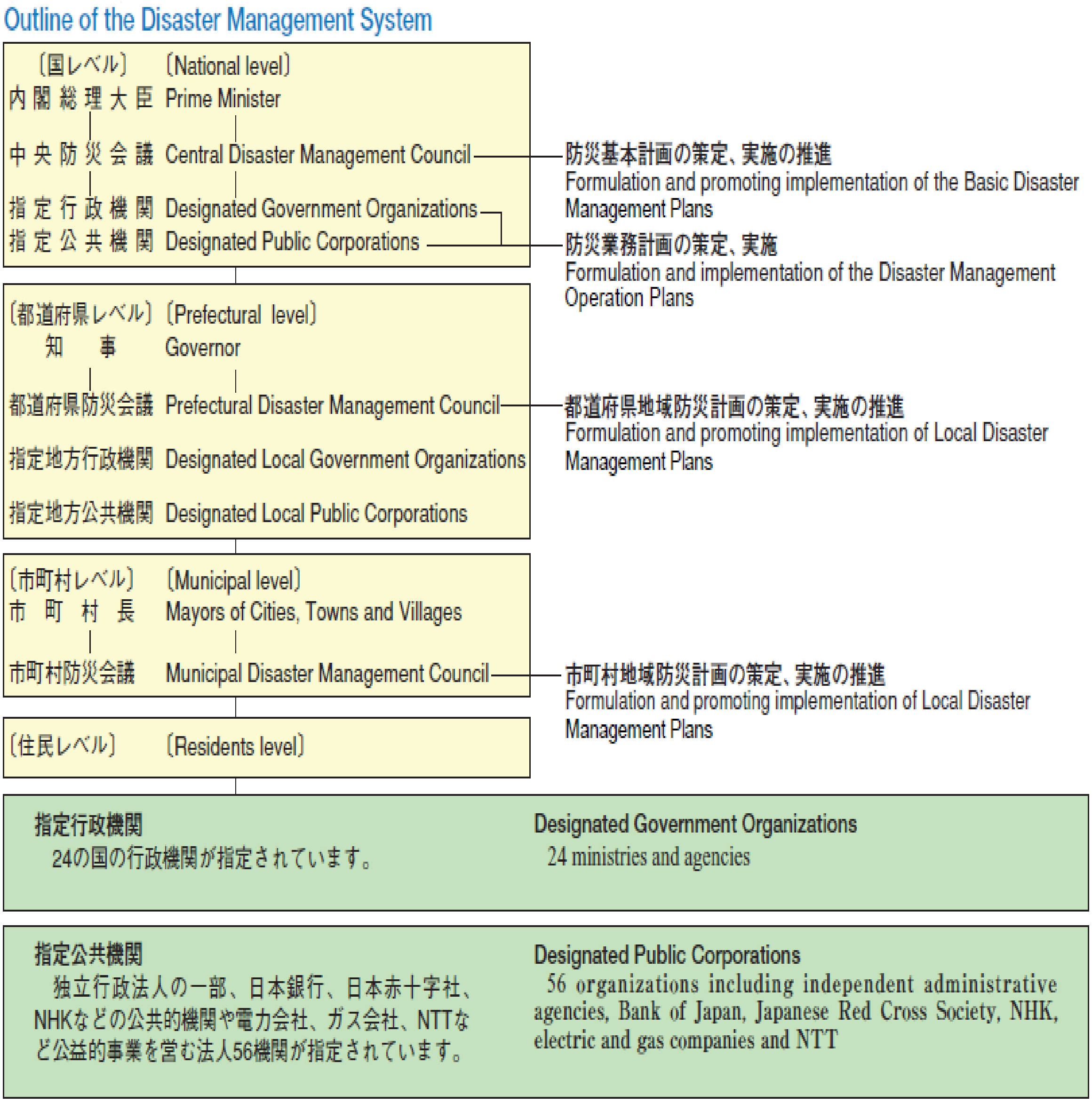

Outline of the Disaster Management System
〔国レベル〕 〔National level〕
内閣総理大臣 Prime Minister
中央防災会議 Central Disaster Management Council
指定行政機関 Designated Government Organizations
指定公共機関 Designated Public Corporations
防災基本計画の策定、実施の推進
Formulation and promoting implementation of the Basic Disaster Management Plans
防災業務計画の策定、実施
Formulation and implementation of the Disaster Management Operation Plans
〔都道府県レベル〕 〔Prefectural level〕
知事 Governor
都道府県防災会議 Prefectural Disaster Management Council
指定地方行政機関 Designated Local Government Organizations
指定地方公共機関 Designated Local Public Corporations
都道府県地域防災計画の策定、実施の推進
Formulation and promoting implementation of Local Disaster Management Plans
〔市町村レベル〕 〔Municipal level〕
市町村長 Mayors of Cities, Towns and Villages
市町村防災会議 Municipal Disaster Management Council
市町村地域防災計画の策定、実施の推進
Formulation and promoting implementation of Local Disaster Management Plans
〔住民レベル〕 〔Residents level〕
指定行政機関
24の国の行政機関が指定されています。
Designated Government Organizations
24 ministries and agencies
指定公共機関
独立行政法人の一部、日本銀行、日本赤十字社、NHKなどの公共的機関や電力会社、ガス会社、NTTなど公益的事業を営む法人56機関が指定されています。
Designated Public Corporations
56 organizations including independent administrative agencies, Bank of Japan, Japanese Red Cross Society, NHK, electric and gas companies and NTT

Figure (1) Outline of the disaster management system in Japan

2.2 Legal and Institutional Framework in Japan

In Japan, various laws that are related disaster management have been developed and strengthened experiences of large-scale natural disasters and accidents over the years. These laws cover all phases of disaster management – preparedness, prevention/mitigation, response and recovery/rehabilitation phases. According to the latest brochure of Disaster Management System in Japan, only 3 laws has been enacted to regulate disaster response activities at national level: 1) Disaster Relief Act - 1947 year 2) Fire Services Act -1948 year 3) Flood Control Act – 1949 year - whereas the numbers of the laws regulating other phases of disaster management are considerably more: 7 Basic Acts; 18 with regard to Disaster Prevention and Preparedness; 23 Disaster Recovery and Reconstruction.

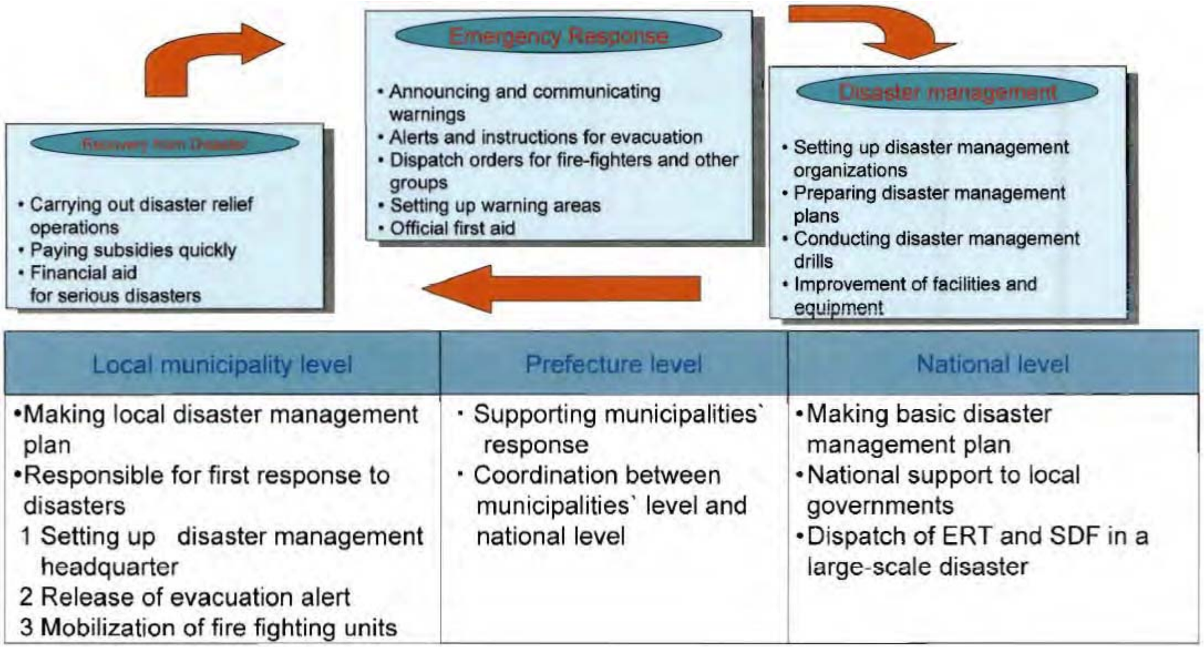
The first act i.e. Disaster Relief Act dates back to 1947 passed after the 1946 Nankai earthquake. Thereafter every disaster led to learning and experience and it led to passing of new legislation. There is almost a separate legislation for each disaster and separate legislation for every aspect of disasters such as prevention, preparedness, response, rehabilitation and recovery, building standard, financial measures, earthquake insurance, etc. The turning point for strengthening the disaster management system came after the immense damage caused by the Ise-wan Typhoon in 1959, and led to the enactment of the Disaster Countermeasures Basic Act in 1961, which formulates a comprehensive and strategic disaster management system in Japan. The DM system has further been strengthened following the lessons learnt from large-scale disasters such as the Great Hanshin-Awaji Earthquake, 1995. The learning of the 2011 Great East Japan Earthquake and Tsunami (GEJET) and nuclear disaster has been incorporated in the Disaster Countermeasures Basic Act by amending it in June, 2012 and by making changes in Basic Disaster Management Plan in December, 2011. The most notable piece of legislation is the Act passed in 2002 namely 'Act on Special Measures for Promotion of Tonankai and Nankai Earthquake Disaster Management'. The country is expecting big earthquake which may arise out of Tonankai and Nankai troughs and this legislation aims at reducing possible impact from these earthquakes and preparing the country to face them.

At the national level Central Disaster Management Council, the apex body for DM in Japan is housed within the Cabinet Office headed by the Prime Minister. Along with a series of reforms of the central government system in 2001, the post of Minister of State for DM was newly established to integrate and coordinate disaster reduction policies and measures of ministries and agencies. In the Cabinet Office, which is responsible for securing cooperation and collaboration among related government organizations in the wide-razing issues, the Director-General of Disaster Management is mandated to undertake the planning of basic disaster management policies and response to large-scale disasters, as well as conduct overall coordination.

Additionally, taking into account the lessons learned from the Great Hanshin-Awaji Earthquake, 1995, the Cabinet Secretariat system was also strengthened, including the appointment of the Deputy Chief Cabinet Secretary for Crisis Management and the establishment of the Cabinet Information Collection Center, to strengthen risk management functions to address emergencies such as large-scale disasters and serious accidents.

The enactment of the Disaster Countermeasures Basic Act (DCBA) is considered to be the turning point in the history of modern disaster management system of Japan. Adopted in 1961, two years after the Ise-wan Typhoon which caused tremendous destructions and loss of more 5000 people, the DCBA defined protection of national land as well as citizens' lives, livelihoods, and property from natural disasters as a national priority.

The DCBA lays down the national level framework for the disaster management. The act has provisions governing the following matters: Definition of responsibilities of disaster management, Disaster Management Organizations, Disaster Management Planning System, Disaster Prevention and Preparedness, Disaster Emergency Response, Disaster Recovery and Rehabilitation, Financial Measures, State of Disaster Emergency. The Disaster Countermeasures Basic Act and related laws complement each other as general legislation and detailed legislation, the latter consisting of specific laws established in response to various specific needs.


Emergency Response
• Announcing and communicating warnings
• Alerts and instructions for evacuation
• Dispatch orders for fire-fighters and other groups
• Setting up warning areas
• Official first aid
Recovery from Disaster
• Carrying out disaster relief operations
• Paying subsidies quickly
• Financial aid for serious disasters
Disaster management
• Setting up disaster management organizations
• Preparing disaster management plans
• Conducting disaster management drills
• Improvement of facilities and equipment

Local municipality level	Prefecture level	National level
•Making local disaster management plan •Responsible for first response to disasters 1 Setting up disaster management headquarter 2 Release of evacuation alert 3 Mobilization of fire fighting units	· Supporting municipalities` response · Coordination between municipalities` level and national level	•Making basic disaster management plan •National support to local governments •Dispatch of ERT and SDF in a large-scale disaster

Figure (2) Basic Scheme of the DCBA

2.3 Public Awareness in Japan

A number of factors contribute to the high incidence of natural disasters in Japan. First, the country is subject to extreme climatic variations, such as seasonal rain fronts and typhoons, as well as heavy snowfall on the Sea of Japan side of the archipelago. Second, Japan's topography is rugged and there are many faults and steep inclines. Third, Japan is located in the Pacific earthquake belt and is frequently struck by earthquakes, while its complex coastline is vulnerable to tsunamis. And fourth, Japan is located in the circum-Pacific zone, in which almost all the volcanoes of the world are concentrated, and has 67 active volcanoes-one-tenth of the world total.

Between the end of World War II and the late 1950s, when Japan's defenses against disasters were weakened by the war, the country was hit by a series of major typhoons, violent earthquakes, and other calamities, and over 1,000 lives were lost virtually every year. The Ise Bay Typhoon of September 1959 killed more than 5,000 people, the biggest toll in the postwar era. It prompted the establishment of a planned and comprehensive disaster prevention administration system, and in 1961 the Disaster Countermeasures Basic Act was enacted. Thereafter measures for prevention, emergency relief, and recovery were linked interactively under a system that ensured a planned and comprehensive approach to disaster countermeasures. The enactment of the Forest Conservation and Flood Control Urgent Measures Law in March 1960 was followed by the planned implementation of flood control measures and other projects designed to enhance Japan's ability to defend against disasters. In June 1960 a decision was reached to observe a "Disaster Prevention Day" each year on September 1 as a means of disseminating disaster prevention knowledge and raising public awareness.

“Disaster Prevention Day” disaster drill for 2013 (Figure (3)) was held in Kyoto. In this drill, many people can study not only emergency response system such as relief, evacuation and emergency support food and water when earthquake disaster occurs but also exercises for public awareness such as earthquake and flood. In addition, many people and children can study about disaster awareness in Kyoto University (Figure (4)). In university, there are many interesting places such as Research center for Landslides, Debris avalanche Research center, Water resources research center, Strong earthquake response center, Wind research center, Earthquake disaster research center, and Supercomputer. Many young people and many adult people can get as knowledge not only disaster awareness but also impacts of disaster due to experiments in future. And earth manual project in Kaeru Caravan, Sannomiya (Figure (5)) is a project that can raise awareness for different people and can get many experiences.

Figure (3) Disaster Drill for "Disaster Prevention Day" in Kyoto

Figure (4) Kyoto University

Figure (5) Earth Manual Project in Kaeru Caravan, Sannomiya

In addition, Japan Meteorological Agency (JMA) distributes different disaster leaflets to public.

2.4 Early Warning System in Japan

2.4.1 Early Warning System of Japan Meteorological Agency (JMA)

Japan Meteorological Agency (JMA) is the sole national authority responsible for issuing weather/tsunami warnings and advisories, earthquake early warning/alerts, and other disaster warning and is required to provide reliable and timely information to governmental agencies and residents for the purposes of natural disaster prevention and mitigation. Within the structural framework of Japan's central government, the JMA is placed as an extra-ministerial bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). When a Heavy Rain Warning is issued, Sediment Disaster Alerts are issued jointly by MLIT and prefectural government civil engineering bureaus when sediment-related damage caused by heavy rain is considered likely within the next few hours. JMA is also responsible for providing flood forecasting services in collaboration with central and local river management authorities. These services include flood warnings and advisories covering 407 rivers (as of March 2011) throughout the country that have been designated by these authorities as sites of potential flood disasters. Flood forecasting systems for 289 of the 407 rivers are managed jointly by JMA and the MLIT, and the other 118 are managed jointly by JMA and prefectural governments. JMA operationally monitors seismic and volcanic activity throughout the country and issues relevant warnings and information to mitigate damage caused by disasters related to earthquakes, tsunamis and volcanic eruptions. JMA began issuing volcanic warnings and volcanic forecasts for each active volcano in Japan on Dec 1, 2007 to mitigate damage from volcanic activity. Volcanic warnings are issued in relation to expected volcanic disasters, and specify the municipalities where people need to take action. Volcanic forecasts are issued for less active volcanoes or those that become so.

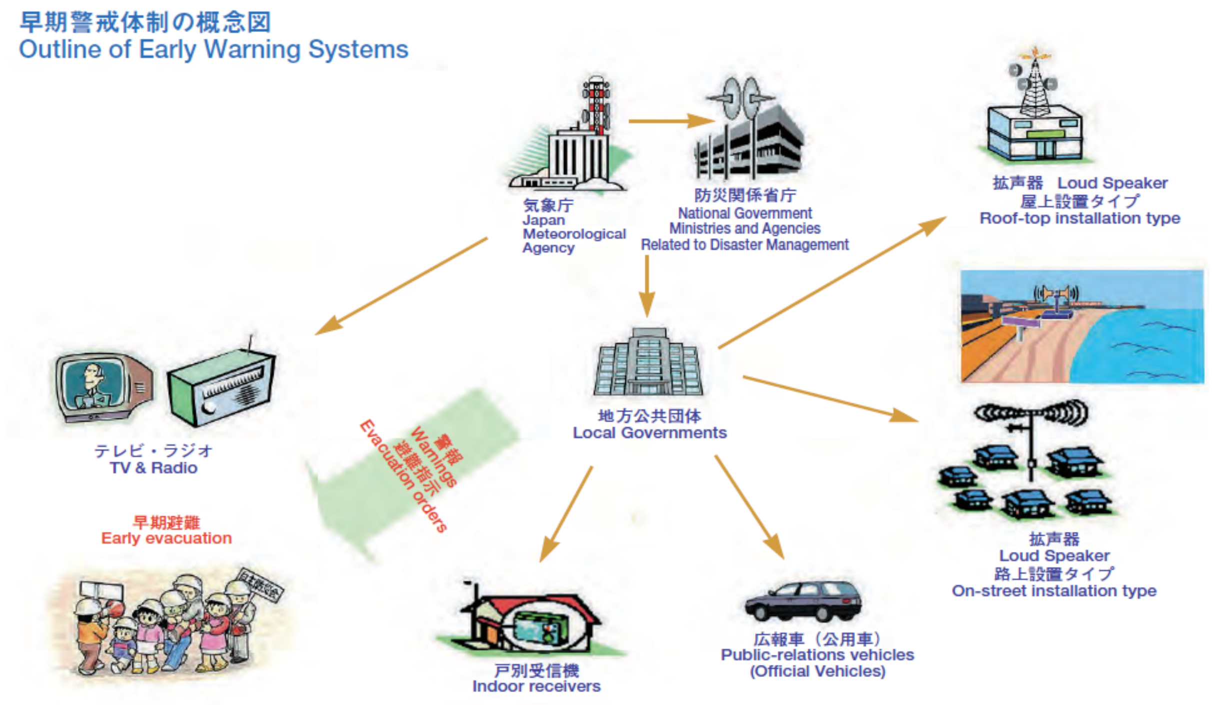

早期警戒体制の概念図
Outline of Early Warning Systems
気象庁
Japan
Meteorological
Agency
防災関係省庁
National Government
Ministries and Agencies
Related to Disaster Management
拡声器 Loud Speaker
屋上設置タイプ
Roof-top installation type
地方公共団体
Local Governments
テレビ・ラジオ
TV & Radio
警報
Warnings
避難指示
Evacuation orders
早期避難
Early evacuation
拡声器
Loud Speaker
路上設置タイプ
On-street installation type
戸別受信機
Indoor receivers
広報車（公用車）
Public-relations vehicles
(Official Vehicles)

Figure (6) Outline of Early Warning System in Japan

2.4.2 Dissemination information of Forecast and Early Warning

In order to prevent and mitigate damage caused by natural disasters and support prompt disaster prevention activities, JMA disseminates weather information and warnings via various channels to government disaster prevention agencies, local governments, the mass media and the public. An outline of EWS in Japan is given in Figure (6). For this purpose, the Agency maintains direct communication links with meteorological offices and central/local governments. Strong communication with municipal governments that play direct roles in disaster management and mitigation in affected areas is essential. Such communication is ensured via various channels for information dissemination, such as prefectural governments, NTT (Nippon Telegraph and Telephone Corporation), J-ALERT (an instant information broadcasting system introduced by the Fire and Disaster Management Agency (FDMA) and the Internet. To support prompt disaster mitigation activities by local governments, the Agency has introduced a new information provision system called the Information Network for Disaster Prevention (INDiP), which enables effective and rapid dissemination of data in both text and graphic form. INDiP (Figure (7)) connects disaster prevention agencies and local governments with JMA headquarters via the Internet and provides detailed weather information and warnings tailored to individual municipalities. Information for maritime users is transmitted via the JMH radio facsimile broadcast service operated by JMA and fishery radio communications services. Such information is also disseminated within the framework of the Global Maritime Distress and Safety System (GMDSS), i.e. via the NAVTEX broadcast service of the Japan Coast Guard for seas in the vicinity of Japan, and via the Safety-Net broadcast service for ships in the high seas via the maritime satellite INMARSAT. Nowadays, the Internet plays a vital role for JMA in the public dissemination of a wide range of meteorological information not only on forecasts but also on historical and current observation data.

Nowadays, the Internet and mobile phone devices play a vital role for JMA in the dissemination of wide-ranging meteorological information not only on forecasts but also on historical and current observational data - including those of other organizations - to the public.

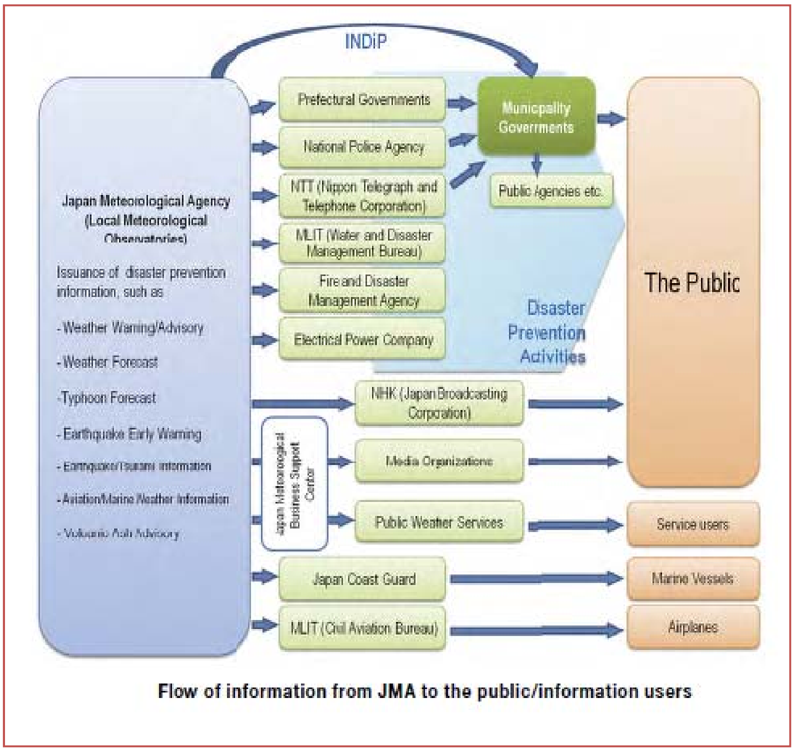
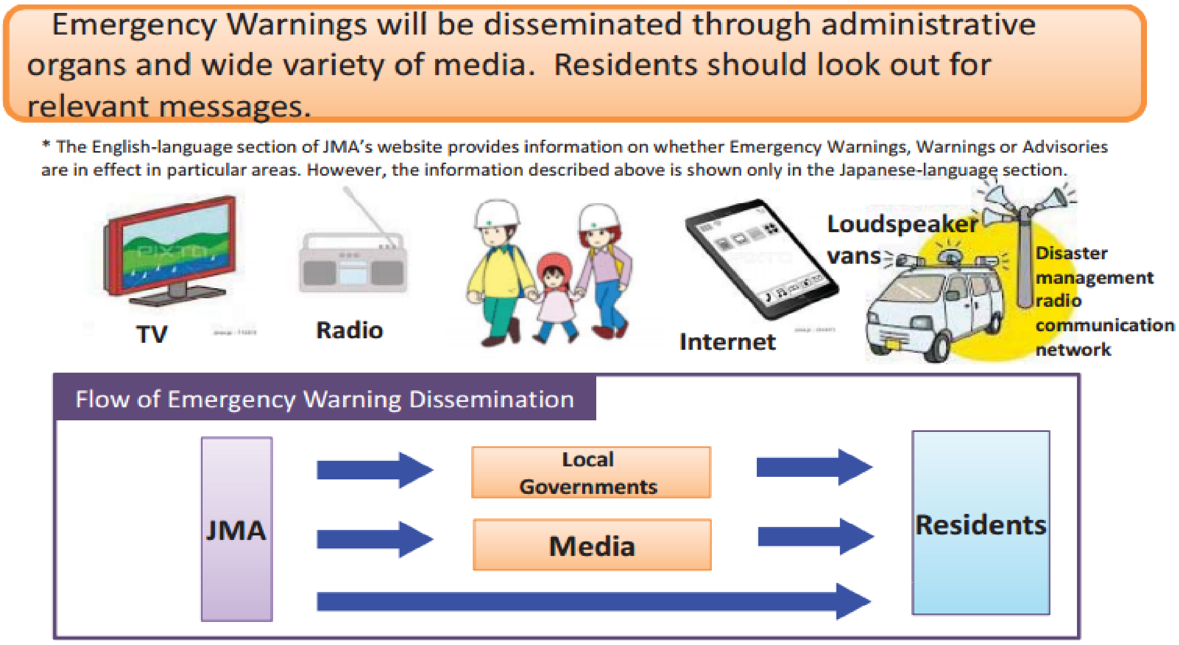

INDiP
Japan Meteorological Agency (Local Meteorological Observatories)
Issuance of disaster prevention information, such as
- Weather Warning/Advisory
- Weather Forecast
-Typhoon Forecast
- Earthquake Early Warning
- Earthquake/Tsunami information
- Aviation/Marine Weather Information
- Volcanic Ash Advisory
Prefectural Governments
National Police Agency
NTT (Nippon Telegraph and Telephone Corporation)
MLIT (Water and Disaster Management Bureau)
Fire and Disaster Management Agency
Electrical Power Company
Municipality Governments
Public Agencies etc.
Disaster Prevention Activities
The Public
NHK (Japan Broadcasting Corporation)
Japan Meteorological Business Support Center
Media Organizations
Public Weather Services
Service users
Japan Coast Guard
Marine Vessels
MLIT (Civil Aviation Bureau)
Airplanes
Flow of information from JMA to the public/information users

Figure (7) INDiP Network


Emergency Warnings will be disseminated through administrative organs and wide variety of media. Residents should look out for relevant messages.

* The English-language section of JMA's website provides information on whether Emergency Warnings, Warnings or Advisories are in effect in particular areas. However, the information described above is shown only in the Japanese-language section.

TV
Radio
Internet
Loudspeaker vans
Disaster management radio communication network
Flow of Emergency Warning Dissemination
JMA
Local Governments
Media
Residents

Figure (8) Emergency Warnings Dissemination by using Media and Flow of Emergency Warning Dissemination

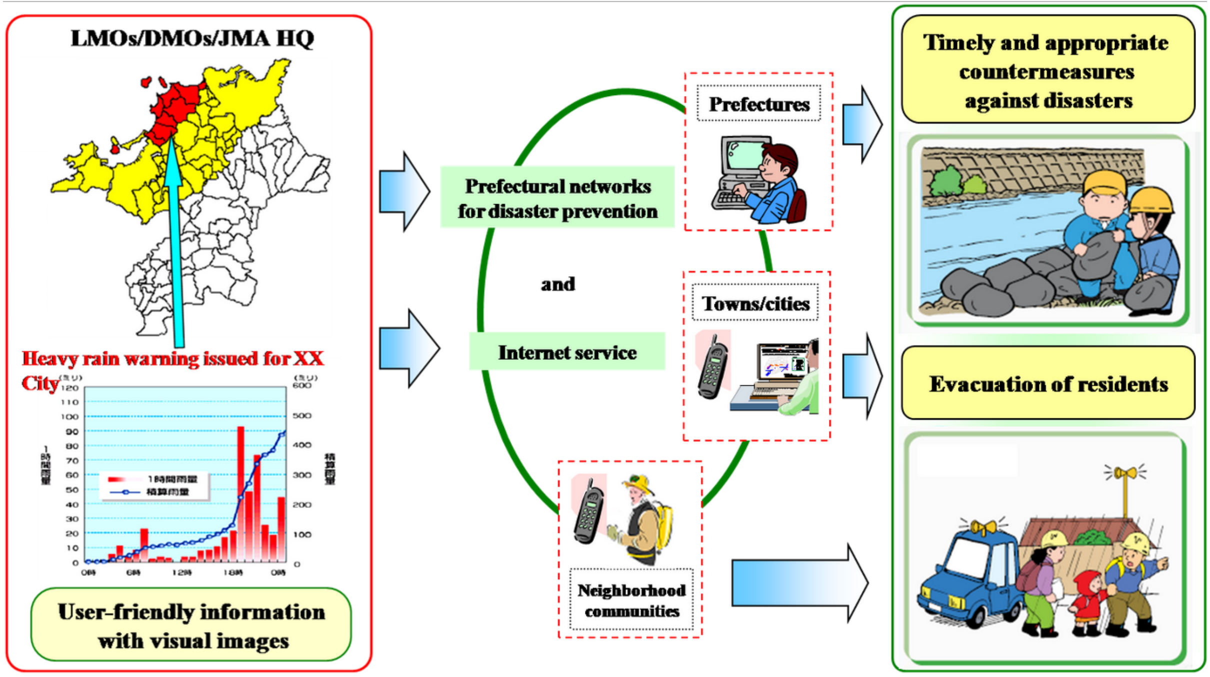

LMOs/DMOs/JMA HQ
Heavy rain warning issued for XX City
User-friendly information with visual images
Prefectural networks for disaster prevention
and
Internet service
Prefectures
Towns/cities
Neighborhood communities
Timely and appropriate countermeasures against disasters
Evacuation of residents

Figure (9) Weather Forecast and Warning and flow thereof

2.4.3 Utilization of Earthquake Early Warning Information

Earthquake Early Warning (EEW) information announces the estimated hypocenter and magnitude of an earthquake as well as the estimated arrival time of the S-wave of the earthquake and seismic intensity in each area. This information is made possible by detecting the P-wave near the epicenter and immediately processing the data since there is a difference in the speed of the P-wave, which arrives faster, and the S-wave, which arrives later and causes more severely destructive phenomena. In the case of a large-scale ocean trench-type earthquake, there may be a time lag (several seconds to several tens of seconds) between the issuance of the EEW information and the start of severe shaking (when the S-wave arrives). This can be a critical time to be used for mitigating damage by stopping trains and elevators, extinguishing flames or crawling under tables.

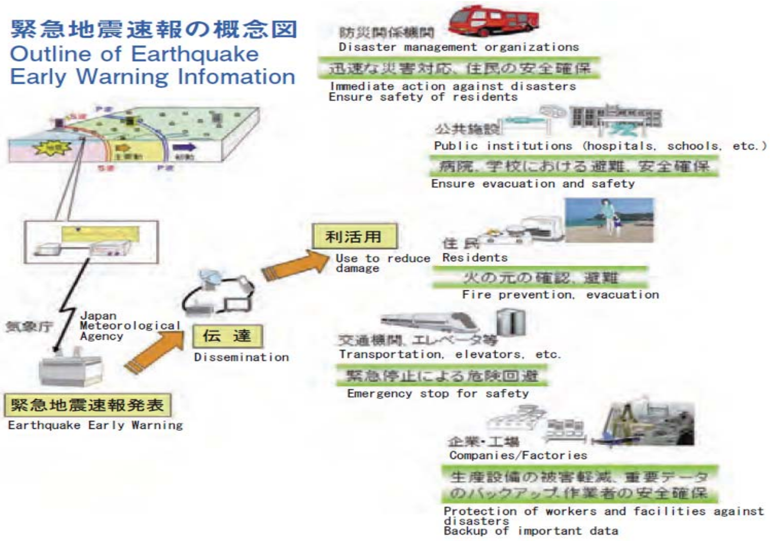
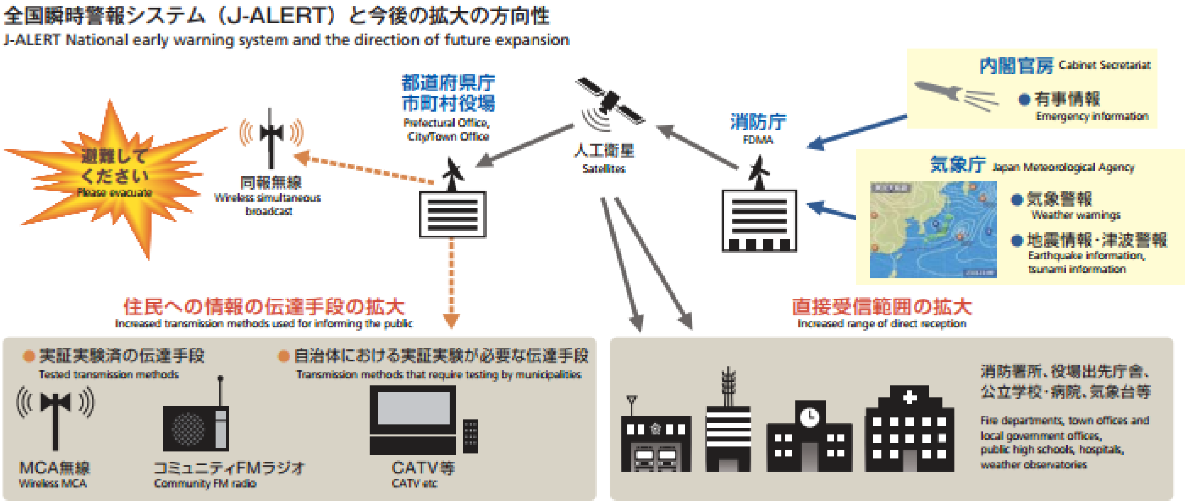

緊急地震速報の概念図
Outline of Earthquake Early Warning Infomation
気象庁
Japan Meteorological Agency
緊急地震速報発表
Earthquake Early Warning
伝 達
Dissemination
利活用
Use to reduce damage
防災関係機関
Disaster management organizations
迅速な災害対応、住民の安全確保
Immediate action against disasters
Ensure safety of residents
公共施設
Public institutions (hospitals, schools, etc.)
病院、学校における避難、安全確保
Ensure evacuation and safety
住民
Residents
火の元の確認、避難
Fire prevention, evacuation
交通機関、エレベータ等
Transportation, elevators, etc.
緊急停止による危険回避
Emergency stop for safety
企業・工場
Companies/Factories
生産設備の被害軽減、重要データのバックアップ作業者の安全確保
Protection of workers and facilities against disasters
Backup of important data

Figure (10) Outline of Earthquake Early Warning

2.4.4 J-Alert System

J-Alert is the system to immediately transmit emergency information such as Emergency Earthquake information, tsunami warning, information of ballistic missiles, which people have no enough time to deal with, is transmitted to the municipalities by using satellite (via the Fire and Disaster Management Agency, the Cabinet Secretariat, and JMA). It became operational on 09 February 2007 and on 01 October 2007 started sending the emergency earthquake information. As of first March 2010, 344 municipalities have introduced this system. Among them, automatic activation system of radio broadcasting and community FM has been introduced to 282 municipalities. The J-Alert framework has been given in Figure (11).



全国瞬時警報システム（J-ALERT）と今後の拡大の方向性
J-ALERT National early warning system and the direction of future expansion
避難してください
Please evacuate
同報無線
Wireless simultaneous broadcast
都道府県庁
市町村役場
Prefectural Office, City/Town Office
人工衛星
Satellites
消防庁
FDMA
内閣官房 Cabinet Secretariat
● 有事情報
Emergency information
気象庁 Japan Meteorological Agency
● 気象警報
Weather warnings
● 地震情報・津波警報
Earthquake information, tsunami information
住民への情報の伝達手段の拡大
Increased transmission methods used for informing the public
● 実証実験済の伝達手段
Tested transmission methods
● 自治体における実証実験が必要な伝達手段
Transmission methods that require testing by municipalities
MCA無線
Wireless MCA
コミュニティFMラジオ
Community FM radio
CATV等
CATV etc
直接受信範囲の拡大
Increased range of direct reception
消防署所、役場出先庁舎、公立学校・病院、気象台等
Fire departments, town offices and local government offices, public high schools, hospitals, weather observatories

Figure (11) J-Alert System

2.4.5 Integrated Disaster Management Information System

The development of a quick and accurate communications system is essential for the effective use of early warning information. The Japan Meteorological Agency has therefore built an online system linking disaster management organizations of the national and local governments and media organizations. Disaster management organizations have also been developing radio communications networks exclusively for disasters: the Central Disaster Management Radio Communications System (Figure (12)) which connects national organizations; the Fire Disaster Management Radio Communications System which connects firefighting organizations across the country; and prefectural and municipal disaster management radio communications systems which connect local disaster management organizations and residents. The Cabinet Office has developed the Central Disaster Management Radio Communications System so that designated government organizations and designated public corporations can use telephones or facsimiles via a hotline, and has prepared an image transmission circuit so that pictures of disaster situations can be transmitted from helicopters in real-time. Furthermore, as a backup for terrestrial communications, a satellite communications system has also been constructed. Simultaneous wireless communications systems using outdoor loudspeakers and indoor radio receivers are used to disseminate disaster information to residents. Tsunami and severe weather warnings are widely provided to citizens via TV and radio broadcasts.

Based on the experiences of the Great Hanshin-Awaji Earthquake, the Cabinet Office has been developing an integrated disaster management information system that helps to grasp the situation of the disaster early on and promotes information sharing among relevant organizations, thereby enabling quick and appropriate decision-making for emergency response operations. Key components of the information management system of Japan are as under:-

i) **Earthquake Disaster Information System (DIS)** – DIS is automatically activated upon the receipt of earthquake (intensity level 4 or greater) information from the JMA to estimate the approximate distribution of seismic intensity and scale of damage (human suffering and building damage) within 30 minutes.

ii) **Real Damage Analysis System by Artificial Satellite (RAS)** - RAS uses satellite images to assess actual disaster damage when it is otherwise difficult to determine the disaster situation due to the disruption of transportation and communications networks.

iii) **Disaster Information Sharing Platform (PF)** - PF is a common information sharing system with a standardized information format, where various disaster information are provided by ministries and agencies, local governments, relevant organizations and residents, can be posted and freely accessed by all.

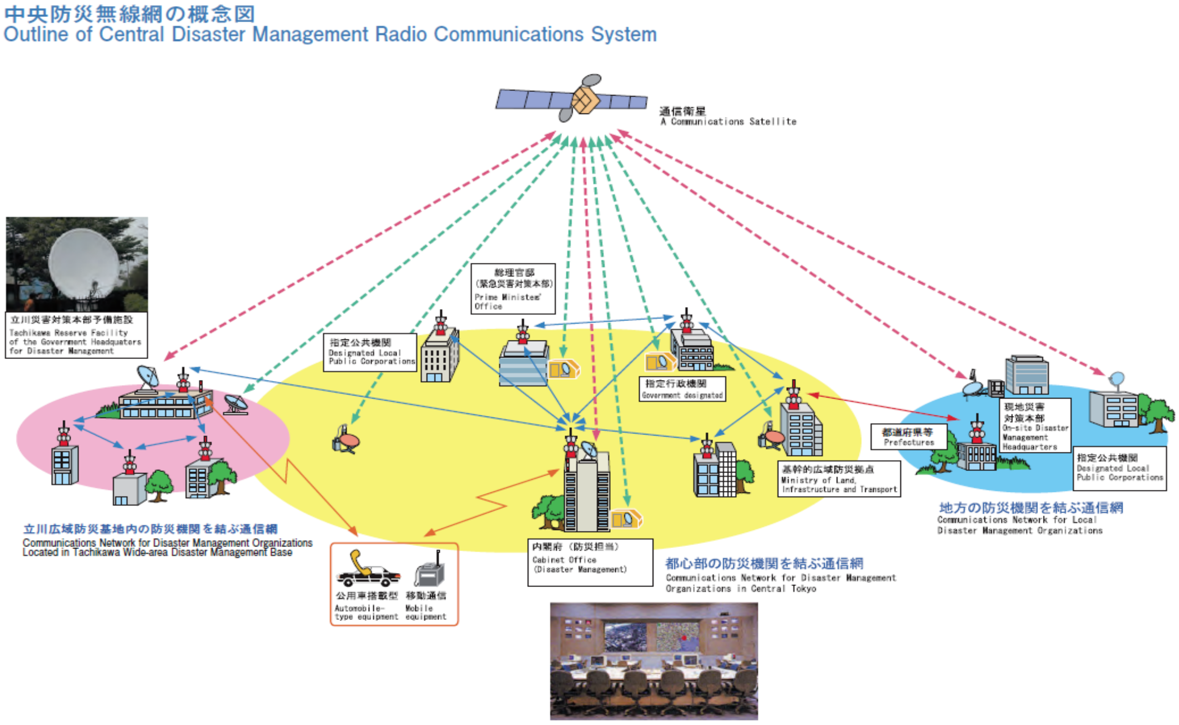

中央防災無線網の概念図
Outline of Central Disaster Management Radio Communications System
通信衛星
A Communications Satellite
立川災害対策本部予備施設
Tachikawa Reserve Facility of the Government Headquaters for Disaster Management
指定公共機関
Designated Local Public Corporations
総理官邸
(緊急災害対策本部)
Prime Ministers' Office
指定行政機関
Government designated
都道府県等
Prefectures
現地災害対策本部
On-site Disaster Management Headquarters
指定公共機関
Designated Local Public Corporations
基幹的広域防災拠点
Ministry of Land, Infrastructure and Transport
立川広域防災基地内の防災機関を結ぶ通信網
Communications Network for Disaster Management Organizations Located in Tachikawa Wide-area Disaster Management Base
公用車搭載型
Automobile-type equipment
移動通信
Mobile equipment
内閣府（防災担当）
Cabinet Office (Disaster Management)
都心部の防災機関を結ぶ通信網
Communications Network for Disaster Management Organizations in Central Tokyo
地方の防災機関を結ぶ通信網
Communications Network for Local Disaster Management Organizations

Figure (12) Outline of Central Disaster Management Radio Communication System in Japan

2.5 Emergency Response Management in Japan

2.5.1 Outline of Emergency Response System

As a constituent element of the entire disaster management system, emergency response phase in Japan is managed at 3 levels. It is the direct responsibility of municipalities to carry out emergency response operations, such as firefighting, rescue, ambulance service within its territory whereas prefectural governments are authorized to render assistance. National government and its relevant bodies oversee the whole coordination process during the phase and provide local governments with necessary information about the hazard while local governments provide the national government agency with the damage information, and if the scope of the disaster elevates beyond the response capabilities of the municipality puts in action its own disaster response forces. Depending on the scale of the disaster, ad hoc emergency headquarters on all 3 levels, within designated public organizations if there is such a need, (electric power corporations, Japan Railway Company etc.) as well as on-site response headquarters are established.

The national and local governments need to quickly collect and share disaster and damage information, and secure communications so that they can carry out effective emergency activities such as search and rescue and medical operations. Based on such information, local governments set up a disaster management headquarters and related organizations establish their own operations mechanism.

The national government collects disaster information at the Cabinet Information Collection Center 24 hours a day. When a large-scale disaster strikes, an emergency team composed of the director generals of the respective ministries and agencies gathers immediately at the Crisis Management Center in the Prime Minister's Office to grasp and analyze the disaster situation, and report the results to the Prime Minister. Inter-ministerial meetings at the ministerial or high-ranking senior-official level are held to decide basic response policies if necessary. According to the level of damage, the government may establish a Headquarters for Major Disaster Management (headed by the Minister of State for Disaster Management) or a Headquarters for Extreme Disaster Management (headed by the Prime Minister).

Additionally, a government investigation team headed by the Minister of State for Disaster Management may be dispatched, or an onsite response headquarters maybe established.

2.5.2 Wide-Areas Support System

In the case of large-scale disasters that exceed the response capabilities of the affected local government, various wide-area support mechanisms are mobilized by the National Police Agency (Inter-prefectural Emergency Rescue Unit), Fire and Disaster Management Agency(Emergency Fire Rescue Team), and Japan Coast Guard. Furthermore, the Self-Defense Forces can be dispatched for emergency response activities upon request from the governor of the affected prefectural government.

Also, the disaster medical assistance teams (DMATs) will be dispatched to provide wide-area medical-transport services. These teams transport severely injured persons via Self-Defense Forces vehicles to ho spitals outside the stricken zone.

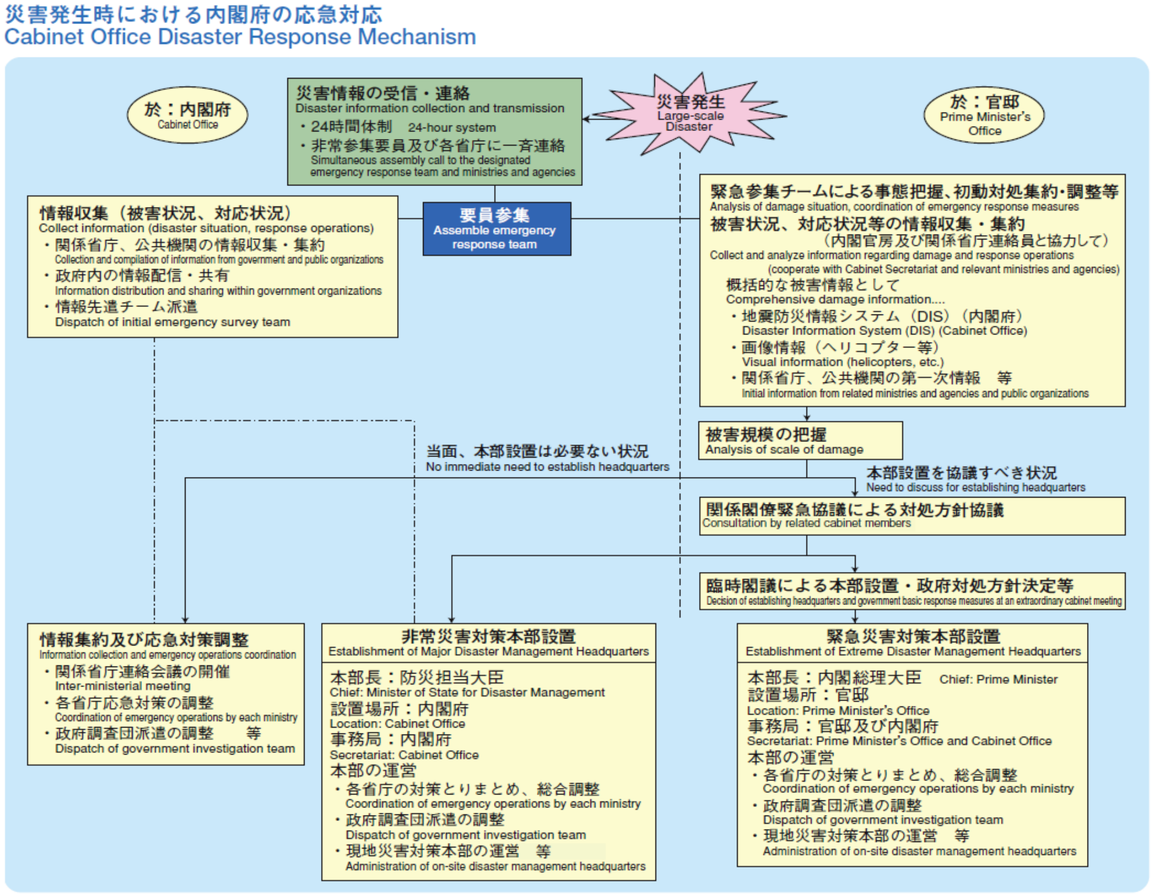
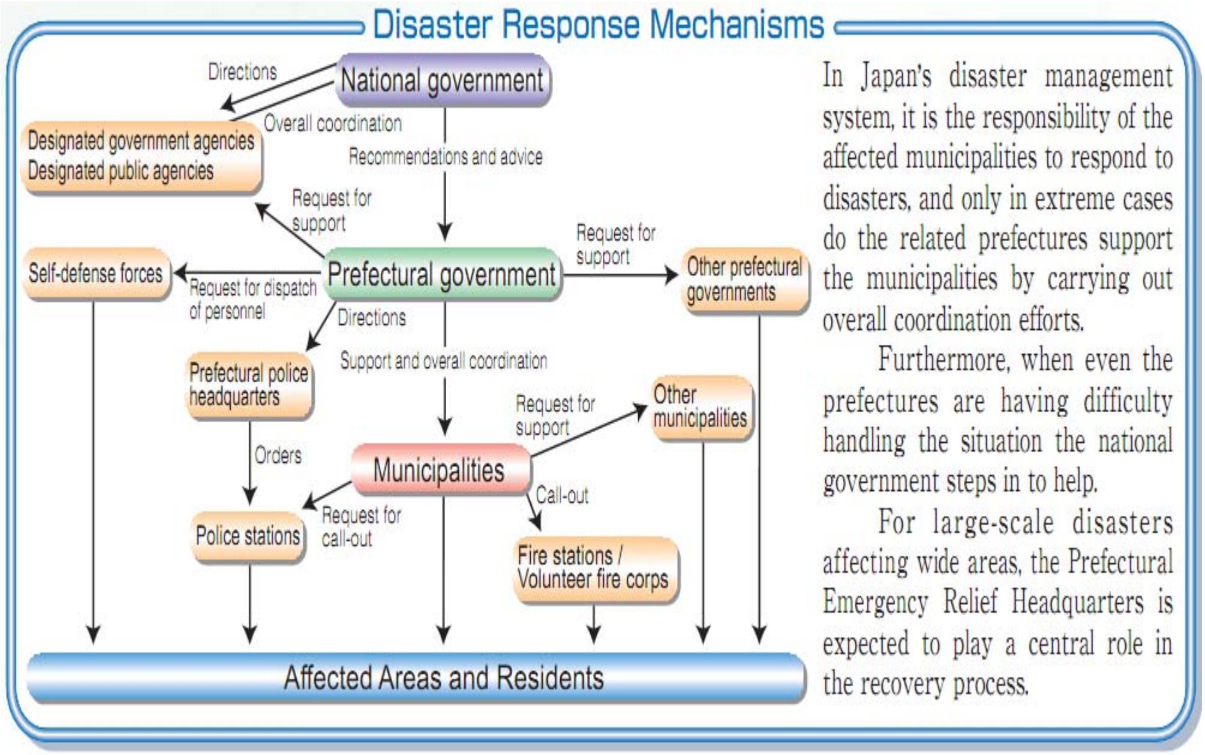

災害発生時における内閣府の応急対応
Cabinet Office Disaster Response Mechanism
於：内閣府
Cabinet Office
災害情報の受信・連絡
Disaster information collection and transmission
・24時間体制　24-hour system
・非常参集要員及び各省庁に一斉連絡
Simultaneous assembly call to the designated emergency response team and ministries and agencies
災害発生
Large-scale Disaster
於：官邸
Prime Minister's Office
情報収集（被害状況、対応状況）
Collect information (disaster situation, response operations)
・関係省庁、公共機関の情報収集・集約
Collection and compilation of information from government and public organizations
・政府内の情報配信・共有
Information distribution and sharing within government organizations
・情報先遣チーム派遣
Dispatch of initial emergency survey team
要員参集
Assemble emergency response team
緊急参集チームによる事態把握、初動対処集約・調整等
Analysis of damage situation, coordination of emergency response measures
被害状況、対応状況等の情報収集・集約
（内閣官房及び関係省庁連絡員と協力して）
Collect and analyze information regarding damage and response operations
(cooperate with Cabinet Secretariat and relevant ministries and agencies)
概括的な被害情報として
Comprehensive damage information....
・地震防災情報システム（DIS）（内閣府）
Disaster Information System (DIS) (Cabinet Office)
・画像情報（ヘリコプター等）
Visual information (helicopters, etc.)
・関係省庁、公共機関の第一次情報　等
Initial information from related ministries and agencies and public organizations
被害規模の把握
Analysis of scale of damage
当面、本部設置は必要ない状況
No immediate need to establish headquarters
本部設置を協議すべき状況
Need to discuss for establishing headquarters
関係閣僚緊急協議による対処方針協議
Consultation by related cabinet members
臨時閣議による本部設置・政府対処方針決定等
Decision of establishing headquarters and government basic response measures at an extraordinary cabinet meeting
情報集約及び応急対策調整
Information collection and emergency operations coordination
・関係省庁連絡会議の開催
Inter-ministerial meeting
・各省庁応急対策の調整
Coordination of emergency operations by each ministry
・政府調査団派遣の調整　等
Dispatch of government investigation team
非常災害対策本部設置
Establishment of Major Disaster Management Headquarters
本部長：防災担当大臣
Chief: Minister of State for Disaster Management
設置場所：内閣府
Location: Cabinet Office
事務局：内閣府
Secretariat: Cabinet Office
本部の運営
・各省庁の対策とりまとめ、総合調整
Coordination of emergency operations by each ministry
・政府調査団派遣の調整
Dispatch of government investigation team
・現地災害対策本部の運営　等
Administration of on-site disaster management headquarters
緊急災害対策本部設置
Establishment of Extreme Disaster Management Headquarters
本部長：内閣総理大臣　Chief: Prime Minister
設置場所：官邸
Location: Prime Minister's Office
事務局：官邸及び内閣府
Secretariat: Prime Minister's Office and Cabinet Office
本部の運営
・各省庁の対策とりまとめ、総合調整
Coordination of emergency operations by each ministry
・政府調査団派遣の調整
Dispatch of government investigation team
・現地災害対策本部の運営　等
Administration of on-site disaster management headquarters

Figure (13) Cabinet Office Disaster Response Mechanism


Disaster Response Mechanisms
National government
Directions
Overall coordination
Designated government agencies
Designated public agencies
Recommendations and advice
Request for support
Self-defense forces
Request for dispatch of personnel
Prefectural government
Request for support
Other prefectural governments
Directions
Prefectural police headquarters
Support and overall coordination
Request for support
Other municipalities
Orders
Municipalities
Call-out
Request for call-out
Police stations
Fire stations / Volunteer fire corps
Affected Areas and Residents

In Japan's disaster management system, it is the responsibility of the affected municipalities to respond to disasters, and only in extreme cases do the related prefectures support the municipalities by carrying out overall coordination efforts.

Furthermore, when even the prefectures are having difficulty handling the situation the national government steps in to help.

For large-scale disasters affecting wide areas, the Prefectural Emergency Relief Headquarters is expected to play a central role in the recovery process.

Figure (14) Disaster Response Mechanism

2.5.3 Emergency Management System, Hyogo Prefecture, Japan

The Disaster Management Center- Learning from 1995 Hanshin-Awaji earthquake, Hyogo Prefecture established state-of-the-art Disaster Management Centre (DMC) with Phoenix Disaster Management System in the year 2000, a government facility specializing in disaster management. The DMC serves as the central base for the preparedness and information collection, base for rescue activities and administrative office of the emergency relief headquarter. The DMC is housed in a separate building consisting of six floors and one basement opposite to the prefectural buildings. It is an earthquake resistant structure seismically isolated. An underground pathway connects the center with the prefectural buildings.

The center is equipped with independent and back-up essential services such as water, electricity, air-conditioning, etc. The Administrative Office of the Emergency Relief Headquarters (Figure (15)) is used as the office of the Disaster Management Division during normal time, but used as emergency headquarter during emergencies. To ensure efficient emergency activities, such a as information collection, the room layout is functional and highly flexible with spacious desks. The Emergency Relief Headquarter Control Room (Figure (16)) serves as the central base for disaster management activities. This room is equipped with Phoenix System which provides the latest information on disaster damage.

To ensure inter-agency coordination the DMC has a cooperative organization staff room which is used by staff who deals with Self-Defence Forces, the police, fire-fighting authorities, lifeline companies and other entities involved in damage prevention when a disaster occurs.

Broadcasting equipment (Figure (17) is installed in the DMC to provide information directly to local residents in the prefecture when a disaster occurs. Emergency broadcast is delivered via an AM radio station. Information and communication devices have been installed in the network control room, including server, the heart of Phoenix, and radio communication devices that utilize satellite communication networks. The devices are protected from seismic vibration by a base-isolation floor.

Figure (15) Administrative Office of the Emergency Relief Headquarter

Figure (16) Network Control Room

Figure (17) Broadcasting Room

The Hyogo DMC offers a variety of hardware and software-related functions so that it can fully play its role as a hub for disaster prevention activities. DMC has facilities with multiple redundancies that prevent government office building from failing to function even during a disruption of lifelines. The DMC also acts as concentration and unification point for the different disaster prevention-related offices that are scattered within the prefectural government buildings.

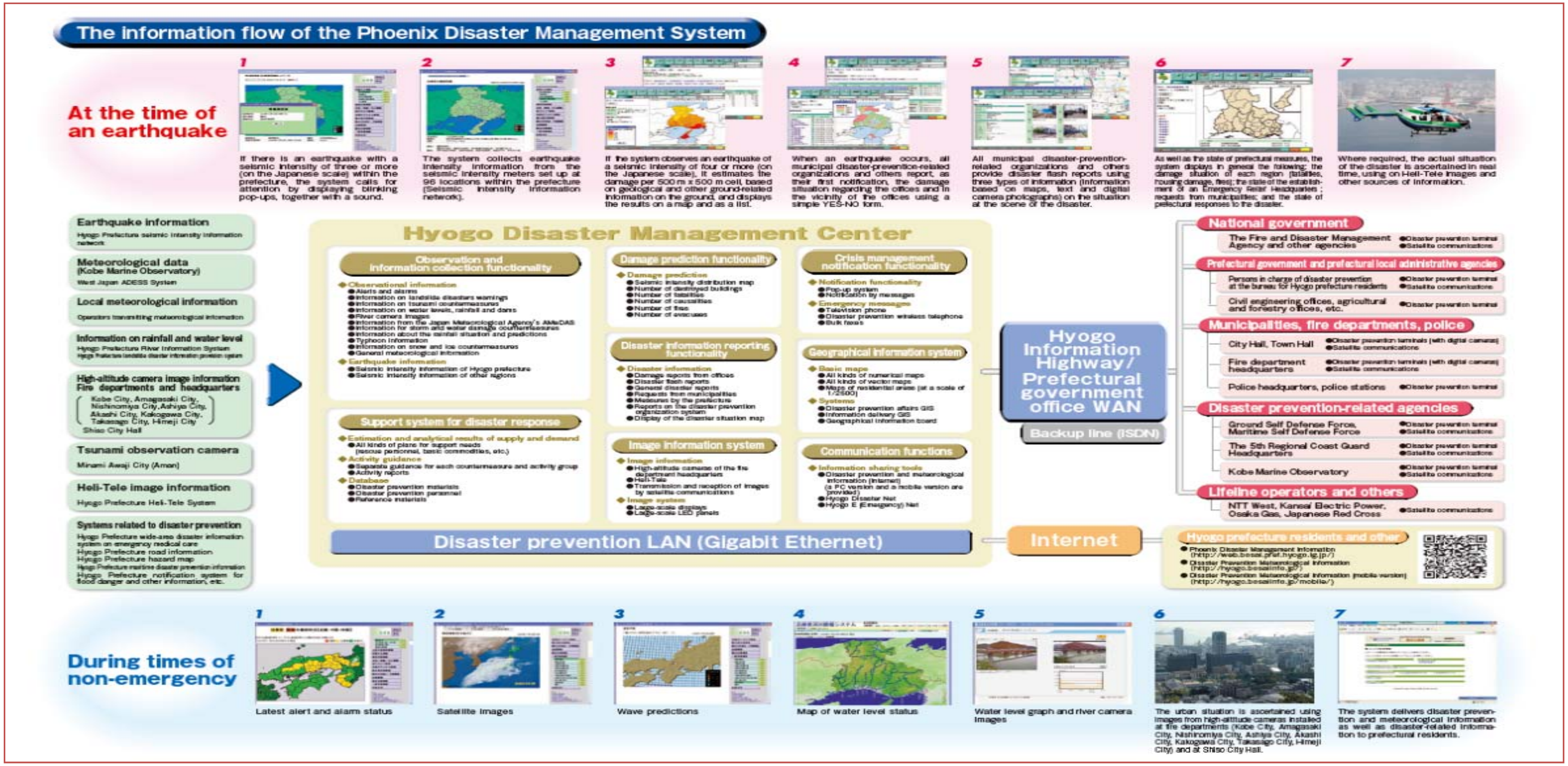
All facilities necessary for the 24-hour watching and prompt response system such as night duty rooms have been provided in the DMC. Near the center, standby staffs are provided with 76 accommodation units consisting of three buildings for initial response mobilization just after the occurrence of a disaster. To call up standby staff, promptly, each unit is connected with the center through broadcasting equipment. In the DMC, food and blankets for immediate use for three days are stored so that emergency relief headquarter staff can devote all their attention to emergency response without external supply.

Phoenix Disaster Management System - Phoenix Disaster Management system employed in the DMC is a web-enabled comprehensive disaster prevention information system that can quickly respond to earthquakes and other any kind of disaster, based on the lessons learnt of the Great Hanshin Awaji Earthquake. It facilitates the initial and emergency response at the time of a disaster at prefectural agencies, municipalities, fire department, police headquarters, police stations, Fire and Disaster Management Agency, Self-Defence Forces, coast guard headquarters and lifeline operators, as well as other related agencies, and strengthen cooperation and coordination with relevant organizations. Communication support features, such as e-mail and electronic bulletin boards contribute to flexible information sharing between agencies and organizations involved in disaster prevention.

This system has functions including the collection and provision of disaster and meteorological information, damage and prediction, disaster flash report, a display of disaster situation map and the estimation of supply and demand and it acts as a total system supporting decisions made by the emergency relief headquarter in rapid and accurate emergency response. Concerning the initial response by the Prefectural Emergency Relief Headquarter, the system displays the flow and procedures for each prevention measure item and also record processing status, together with the progressive management of initial response.

It is a large-scale network of a total length of approximately 1100 km that has been established as fundamental information infrastructure to promote information technology within prefecture, and connects key locations within the prefecture with optical fibre lines. High reliability has been achieved for the system through the use of a high-speed and high capacity (10Gbps), a monitoring and maintenance regime running 365 days a year. The system connects key locations such as the prefectures general building and the regional agencies of the prefectural government with a dedicated digital line in a loop, utilizing the Hyogo Information Highway and the prefectural government WAN as its main transmission channels. From each access point, the municipalities, fire department headquarters and other organizations are connected by dedicated optic fibre lines, thus covering the entire prefecture. Also, in order to ensure security, transmission use a dedicated disaster prevention, VPN has been created within the network. The system connects the prefectural government office with all municipalities, fire department headquarter, etc. using a satellite communication line. Also the prefectural government office is connected with the bureau for prefectural residents and civil engineering offices, etc. by a terrestrial radio line. This system is not only utilized in times of non-emergency for uses including the disaster prevention wireless phone, for the sending bulk faxes function and image transmission, but is also used for reception and transmission of Heli-Tele images and other information at times of disaster. During normal time this system is used to share information on disaster prevention to citizens and other stakeholders. The information flow of the Phoenix Disaster Management System used by the DMC in case of disasters such as earthquake, etc. and at normal times is given in Figure (18).

Hyogo Prefectural Emergency Management and Training Center - The prefecture has set-up Hyogo Wide-Area Emergency Management Network at four different locations of the prefecture to stock-pile essential relief material and Hyogo Prefectural Emergency Management and Training Centre located at Miki General Disaster Prevention Park, few kilometres away from DMC, an area which was not affected during the 1995 earthquake. It acts as a back-up center for DMC too. This facility, in normal times, is a center of training for staff on emergency management, a sports complex and storage facility for relief material. The center has the same communication and network facility as the DMC. Interestingly, the ground floors below the sitting areas of sports stadium are being used as storage spaces for relief goods. During emergencies, the entire sports stadium is converted into a central place for dispatch of relief material to the affected area of the prefecture.



The information flow of the Phoenix Disaster Management System

At the time of an earthquake

1 If there is an earthquake with a seismic intensity of three or more (on the Japanese scale) within the prefecture, the system calls for attention by displaying blinking pop-ups, together with a sound.

2 The system collects earthquake intensity information from the seismic intensity meters set up at 96 locations within the prefecture (Seismic Intensity Information network).

3 If the system observes an earthquake of a seismic intensity of four or more (on the Japanese scale), it estimates the damage per 500 m x 500 m cell, based on geological and other ground-related information on the ground, and displays the results on a map and as a list.

4 When an earthquake occurs, all municipal disaster-prevention-related organizations and others report, as their first notification, the damage situation regarding the offices and in the vicinity of the offices using a simple YES-NO form.

5 All municipal disaster-prevention-related organizations and others provide disaster flash reports using three types of information (information based on maps, text and digital camera photographs) on the situation at the scene of the disaster.

6 As well as the state of prefectural measures, the system displays in general the following: the damage situation of each region (fatalities, housing damage, fires); the state of the establishment of an Emergency Relief Headquarters; requests from municipalities; and the state of prefectural responses to the disaster.

7 Where required, the actual situation of the disaster is ascertained in real time, using on Heli-Tele images and other sources of information.

Earthquake information
Hyogo Prefecture seismic intensity information network

Meteorological data (Kobe Marine Observatory)
West Japan ADESS System

Local meteorological information
Operators transmitting meteorological information

Information on rainfall and water level
Hyogo Prefecture River Information System
Hyogo Prefecture landslide disaster information provision system

High-altitude camera image information Fire departments and headquarters
(Kobe City, Amagasaki City, Nishinomiya City, Ashiya City, Akashi City, Kakogawa City, Takasago City, Himeji City)
Shiso City Hall

Tsunami observation camera
Minami Awaji City (Aman)

Heli-Tele image information
Hyogo Prefecture Heli-Tele System

Systems related to disaster prevention
Hyogo Prefecture wide-area disaster information system on emergency medical care
Hyogo Prefecture road information
Hyogo Prefecture hazard map
Hyogo Prefecture maritime disaster prevention information
Hyogo Prefecture notification system for flood danger and other information, etc.

Hyogo Disaster Management Center

Observation and information collection functionality
- ◆ Observational information
  - ● Alerts and alarms
  - ● Information on landslide disasters warnings
  - ● Information on tsunami countermeasures
  - ● Information on water levels, rainfall and dams
  - ● River camera images
  - ● Information from the Japan Meteorological Agency's AMeDAS
  - ● Information for storm and water damage countermeasures
  - ● Information about the rainfall situation and predictions
  - ● Typhoon information
  - ● Information on snow and ice countermeasures
  - ● General meteorological information
- ◆ Earthquake information
  - ● Seismic intensity information of Hyogo prefecture
  - ● Seismic intensity information of other regions

Support system for disaster response
- ◆ Estimation and analytical results of supply and demand
  - ● All kinds of plans for support needs (rescue personnel, basic commodities, etc.)
- ◆ Activity guidance
  - ● Separate guidance for each countermeasure and activity group
  - ● Activity reports
- ◆ Database
  - ● Disaster prevention materials
  - ● Disaster prevention personnel
  - ● Reference materials

Damage prediction functionality
- ◆ Damage prediction
  - ● Seismic intensity distribution map
  - ● Number of destroyed buildings
  - ● Number of fatalities
  - ● Number of casualties
  - ● Number of fires
  - ● Number of evacuees

Disaster information reporting functionality
- ◆ Disaster information
  - ● Damage reports from offices
  - ● Disaster flash reports
  - ● General disaster reports
  - ● Requests from municipalities
  - ● Measures by the prefecture
  - ● Reports on the disaster prevention organization system
  - ● Display of the disaster situation map

Image information system
- ◆ Image information
  - ● High-altitude cameras of the fire department headquarters
  - ● Heli-Tele
  - ● Transmission and reception of images by satellite communications
- ◆ Image system
  - ● Large-scale displays
  - ● Large-scale LED panels

Crisis management notification functionality
- ◆ Notification functionality
  - ● Pop-up system
  - ● Notification by messages
- ◆ Emergency messages
  - ● Television phone
  - ● Disaster prevention wireless telephone
  - ● Bulk faxes

Geographical information system
- ◆ Basic maps
  - ● All kinds of numerical maps
  - ● All kinds of vector maps
  - ● Maps of residential areas (at a scale of 1/2500)
- ◆ Systems
  - ● Disaster prevention affairs GIS
  - ● Information delivery GIS
  - ● Geographical information board

Communication functions
- ◆ Information sharing tools
  - ● Disaster prevention and meteorological information (Internet) (a PC version and a mobile version are provided)
  - ● Hyogo Disaster Net
  - ● Hyogo E (Emergency) Net

Disaster prevention LAN (Gigabit Ethernet)

Hyogo Information Highway/ Prefectural government office WAN

Backup line (ISDN)

Internet

National government

The Fire and Disaster Management Agency and other agencies	●Disaster prevention terminal ●Satellite communications

Prefectural government and prefectural local administrative agencies

Persons in charge of disaster prevention at the bureau for Hyogo prefecture residents	●Disaster prevention terminal ●Satellite communications
Civil engineering offices, agricultural and forestry offices, etc.	●Disaster prevention terminal

Municipalities, fire departments, police

City Hall, Town Hall	●Disaster prevention terminals (with digital cameras) ●Satellite communications
Fire department headquarters	●Disaster prevention terminals (with digital cameras) ●Satellite communications
Police headquarters, police stations	●Disaster prevention terminal

Disaster prevention-related agencies

Ground Self Defense Force, Maritime Self Defense Force	●Disaster prevention terminal ●Satellite communications
The 5th Regional Coast Guard Headquarters	●Disaster prevention terminal ●Satellite communications
Kobe Marine Observatory	●Disaster prevention terminal ●Satellite communications

Lifeline operators and others

NTT West, Kansai Electric Power, Osaka Gas, Japanese Red Cross	●Satellite communications

Hyogo prefecture residents and other
- ● Phoenix Disaster Management Information (http://web.bosai.pref.hyogo.lg.jp/)
- ● Disaster Prevention Meteorological Information (http://hyogo.bosaiinfo.jp/)
- ● Disaster Prevention Meteorological Information (mobile version) (http://hyogo.bosaiinfo.jp/mobile/)

During times of non-emergency

1 Latest alert and alarm status

2 Satellite images

3 Wave predictions

4 Map of water level status

5 Water level graph and river camera images

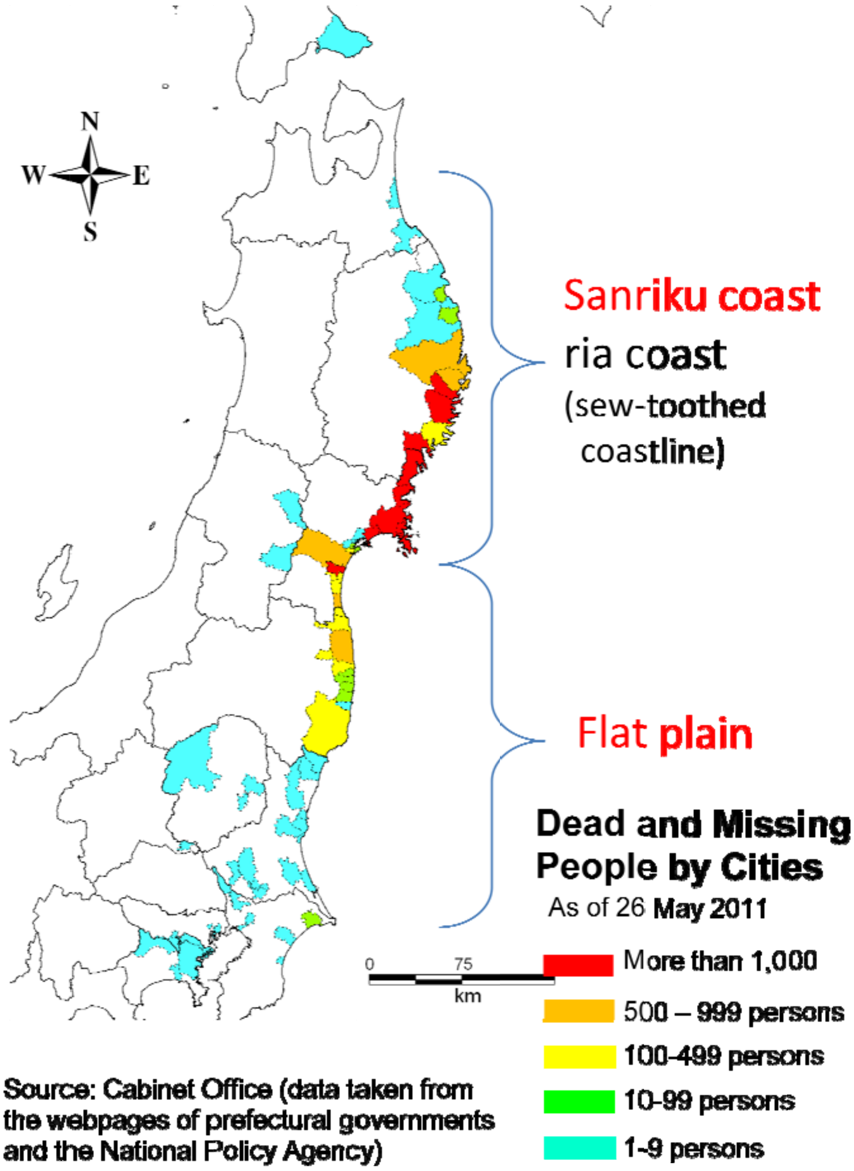
6 The urban situation is ascertained using images from high-altitude cameras installed at fire departments (Kobe City, Amagasaki City, Nishinomiya City, Ashiya City, Akashi City, Kakogawa City, Takasago City, Himeji City) and at Shiso City Hall.

7 The system delivers disaster prevention and meteorological information as well as disaster-related information to prefectural residents.

Figure (18) Flow Chart giving flow of information of the Phoenix Disaster Management System

2.6 Case Study on Great East Japan Earthquake (GEJE)

On March 11, 2011 at 14:46 JST (5:46 GMT), a magnitude 9.0 earthquake occurred 130 kilometers east-southeast of Ojika Peninsula. Within less an hour, tsunami waves measuring up to 40 meters high crashed almost 6 miles inland, inundating 561square kilometers. In the aftermath of Great East Japan Earth (GEJE), 15,534 people confirmed dead and 7,092 people missing. The numbers of completely damaged buildings were 111,044 and half of partially destroyed buildings were approximately 400 thousand buildings.


N
W
E
S
Sanriku coast
ria coast
(sew-toothed
coastline)
Flat plain
Dead and Missing
People by Cities
As of 26 May 2011
0
75
km
🟥 More than 1,000
🟧 500 – 999 persons
🟨 100-499 persons
🟩 10-99 persons
🟦 1-9 persons

Source: Cabinet Office (data taken from the webpages of prefectural governments and the National Policy Agency)

Figure (19) Inundated Areas by Tsunami

Immediately after the disaster in Japan, the government established an emergency response team headed by the prime minister. Within a day, the Ministry of Defense ordered deployment of all the available resources of the country's military, the Japan Self-Defense Forces (JSDF), which included 110,000 active and reserve troops. The government also dispatched nearly 28,000 members of the National Police Force and the Fire and Disaster Management Agency. In addition to "official" responders, the government moved quickly to organize and coordinate volunteer efforts, including the Japanese Red Cross, which serves as an auxiliary to the government for disaster relief. The Japan Civil Network for Disaster Relief in East Japan served as an overall coordinating body for over 300 organizations, including government offices, non-governmental agencies, and civil society organizations. Other prompt actions included allocation of almost $50 billion for critical tasks, such as debris removal, temporary housing, and restoring infrastructure. As a result, among other marks of progress within the days and weeks following the disasters, is that major transportation networks (not including those in proximity to the Fukushima nuclear plant) had been restored.

After the earthquake occurred, broadcasting companies including NHK (Japan's public broadcasting corporation) and local operators interrupted regular programming to provide disaster-related information. For example, NHK delivered emergency earthquake warnings, followed by news reports on a continuing basis starting 2 minutes after the earthquake occurred on the company's 8 channels. People were able to watch many of those programs on their mobile phones in areas where the electricity supply had failed. The programs were delivered by one-segment broadcasting (A mobile terrestrial digital audio video and data broadcasting service in Japan). One-seg TV on mobile phone also proved life savior for many. The EW alert and warnings received through it saved many lives.

Social media such as Twitter, Face Book, Mixi, Webpages or Blogs, etc. were used extensively during the GEJE for various purposes, such as search, rescue, and fundraising. Social media and the internet were found to be highly reliable regardless of the users' role, location, or the extent to which they were affected by the disaster. Users found social media to be extremely beneficial in general to an overwhelming degree. For directly affected individuals and people in the affected areas, the strongest reasons for using social media were convenience and their mass dissemination capacity.

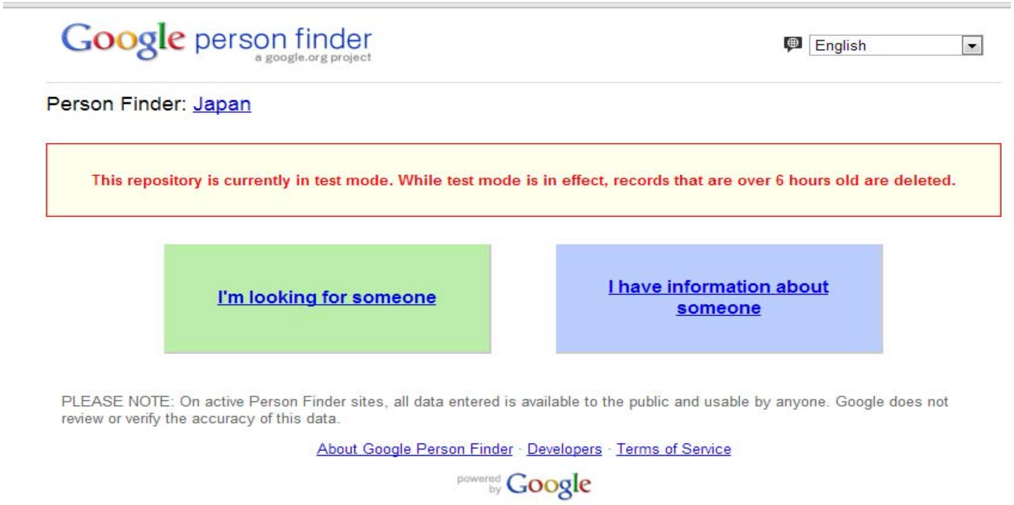
Immediately after the disaster, the communication systems developed by local governments did not work because of power failures and a lack of emergency backup power supply. As many as 120 television relay stations in 11 prefectures stopped functioning because of the loss of commercial electricity during the initial period of the disaster, and as many as 4 radio relay stations shut down. Ministry of Information and Communication (MIC) distributed 10,000 portable radio receivers to evacuation shelters, and requested equipment manufacturers such as Panasonic and Sony, to distribute over 40,000 portable radio receivers. Emergency FM radio also played a crucial role in providing information to local residents. In the Tohoku area, 25 emergency broadcasting stations specializing in disaster information were set up. Many volunteers and government officials contributed to the operation of such local radio stations.

FM Radio at first, only announced information such as bathing times and food rationing information for those living in the town. Later the content became less about daily life than about supporting and comforting the residents. FM radio provided locally customized information, such as information about aftershocks, or the availability of local services and activities related to people's everyday needs. This kind of information was beneficial immediately after the disaster, while different information was required as reconstruction progressed. Some entertainment programs were presented 6 to 9 months after the disaster. Social media and community radio reached two distinct age groups: social media for the younger generation and community radio for the older generation.

GEJE caused immense damage and congestion in telephone infrastructure, including 1.9 million fixed-line services and 29,000 mobile phone base stations. The disaster management radio communications networks of national and local governments are generally considered to be more robust and resilient than public fixed networks. But in the GEJE many towns and villages, particularly those located along the Pacific coastline, suffered various levels of damage to their radio communications systems, including both community announcement systems with loud speakers and mobile systems on emergency vehicles. Compared to terrestrial communication infrastructures, satellite phones and satellite communication systems were less vulnerable. Satellite phones, in particular, played a vital role in emergency communication among local governments and rescue organizations. Satellite mobile phones provided voice and internet communication capabilities for disaster management organizations, evacuation shelters, and staff working on infrastructure rehabilitation, among others. Portable and truck-mounted satellite earth stations were used by disaster relief organizations and media entities to transmit video images from disaster sites.

Some mobile phone carriers introduced an emergency messaging service whereby the terminal device converted voice recordings into voice files that could then be sent via packet transmission. Other mobile phone carriers also followed suit. These services were used some 14 million times following the GEJE. Voice messages were widely used to confirm whether family members and relatives were safe.

Media Used during Disaster- Digital signage network is effective tool for information provision at the time of disaster. After the earthquake, all the train services stopped and there was terrible traffic jam in Tokyo. About 5 million people were not able to go home. Digital signage system was used as media to provide information. Google Person Finder is an important tool to help reconnect people after a disaster event. The Google Person Finder (Figure (20)) let people enter an inquiry about a missing person or provide information for interested parties. Google person finder was widely used to search for the missing person and unite families separated during disasters. In total over 600,000 person names were registered.


Google person finder
a google.org project
English
I'm looking for someone
I have information about someone
About Google Person Finder · Developers · Terms of Service
powered by Google

Person Finder: Japan

This repository is currently in test mode. While test mode is in effect, records that are over 6 hours old are deleted.

PLEASE NOTE: On active Person Finder sites, all data entered is available to the public and usable by anyone. Google does not review or verify the accuracy of this data.

Figure (20) Google Person Finder

2.7 Opinions on Disaster Management in Japan

Japan is not only a leadership country among countries that are carried out for disaster risk reduction but also a country that practically distribute disaster knowledge into other countries. In addition, disaster management, disaster policies and practices are more effective than other countries. Disaster management in Japan is carried out at every stage of disaster prevention, emergency response to disaster, and recovery and reconstruction following disaster. The loss of life and property could have been far greater if the country's policies and practices had been less effective. The main best elements of that DRM system in Japan are:

1. Investments in structural measures (such as reinforced buildings and seawalls), cutting-edge risk assessments, early-warning systems, and hazard mapping—all supported by sophisticated technology for data collection, simulation, information, and communication, and by scenario building to assess risks and to plan responses (such as evacuations) to hazards
2. A culture of preparedness, where training and evacuation drills are systematically practiced at the local and community levels and in schools and workplaces
3. Stakeholder involvement, where the national and local government, communities, NGOs, and the private sector all know their role
4. Effective legislation, regulation, and enforcement—for example, of building codes that have been kept current
5. The use of sophisticated instrumentation to underpin planning and assessment operations.

3. CURRENT STATUS OF EMERGENCY RESPONSE SYSTEM IN MYANMAR

As situated in the Bay of Bengal and Andaman Sea, Myanmar is exposed to multiple natural hazards which include Cyclone, Storm surge, Floods, Landslide, Earthquake, Tsunami, Drought, Fire, and Forest Fire. Its coastal regions are exposed to Cyclone, Storm surge and Tsunami while major parts of the country are at risk from earthquake and fire. The flooding is a recurring phenomenon across the country while some parts of the country are exposed to landslide and drought risks. As per of the data from 2000-2001 to 2009-2010, fires constituted about 73% of reported disaster events, followed by floods (11%), storms (12%) and others (4%) including earthquakes, tsunami and landslides.

Natural disasters have had destructive impacts on the development gains and hinder the developmental interventions. Disaster risk management has received greater attention and government effort could be seen in various interventions to address country's growing need to secure and reduce impacts of potential disasters.

As a member of global and regional entities, Myanmar Disaster Risk Management is aligned with global and regional initiatives – Hyogo Frame work for Action (HFA) and ASEAN Agreement on Disaster Management and Emergency Response (AADMER). The Republic of the Union of Myanmar has disaster management set-up from national level, ministerial to local administration level. The institutional arrangement at national level has National Disaster Preparedness Central Committee (NDPCC) as the supreme agency for policy and decision making with sub-committees to support operationalization.

3.1 Legal System and Framework

Disaster Management related laws drew since last several years have been laid down the legal framework for the disaster management- preparedness, prevention/mitigation, response and recovery/rehabilitation phases. Rehabilitation Board Act (41/1950), Board of Development Affairs Act (11/1993), Epidemic Diseases Prevention Act (1/1995), Implementation of Insurance Act (6/1996) and Fire Services Act (1/1997) have been promulgated. Disaster management law was enacted disaster management law by the Parliament in 13 July 2013. According to latest disaster management law, there are nine chapters. The aims of disaster management law are to implement natural disaster management programmes in a systematic, prompt and effective manner, in order to mitigate disaster risk; to form the National Committee and local bodies for prompt, systematic and effective implementation of natural disaster management programmes in order to implement natural disaster management programmes; to coordinate with national and international government departments, organizations, civil society organizations, non-government organizations, international organizations, and regional organizations in carrying out natural disaster management activities; to protect and restore the environment affected by natural disasters; and to provide health, education, social and livelihood programmes to bring about better living condition for disaster-affected people.

3.2 Organization for Emergency Response System in Myanmar

3.2.1 National Platform of Disaster Risk Reduction

The National Disaster Preparedness Central Committees [NDPCC] under the chairmanship of the Vice-President 2 is the 13-member body for Disaster Management. The Union Minister for Social Welfare, Relief and Resettlement is the Co-Chairs and the Union Ministers of concerned ministries are members of the Agency. The Deputy Minister 2 of MoSWRR is the Secretary while Director General, Relief and Resettlement are the Joint Secretary of the Agency. There are 10 Sub-committees under NDPCC. State/Division-, District-, Township- and Village Tract-level Disaster Preparedness Committees have also been formed respectively. National Platform of Disaster Risk Reduction is shown in Figure (21).

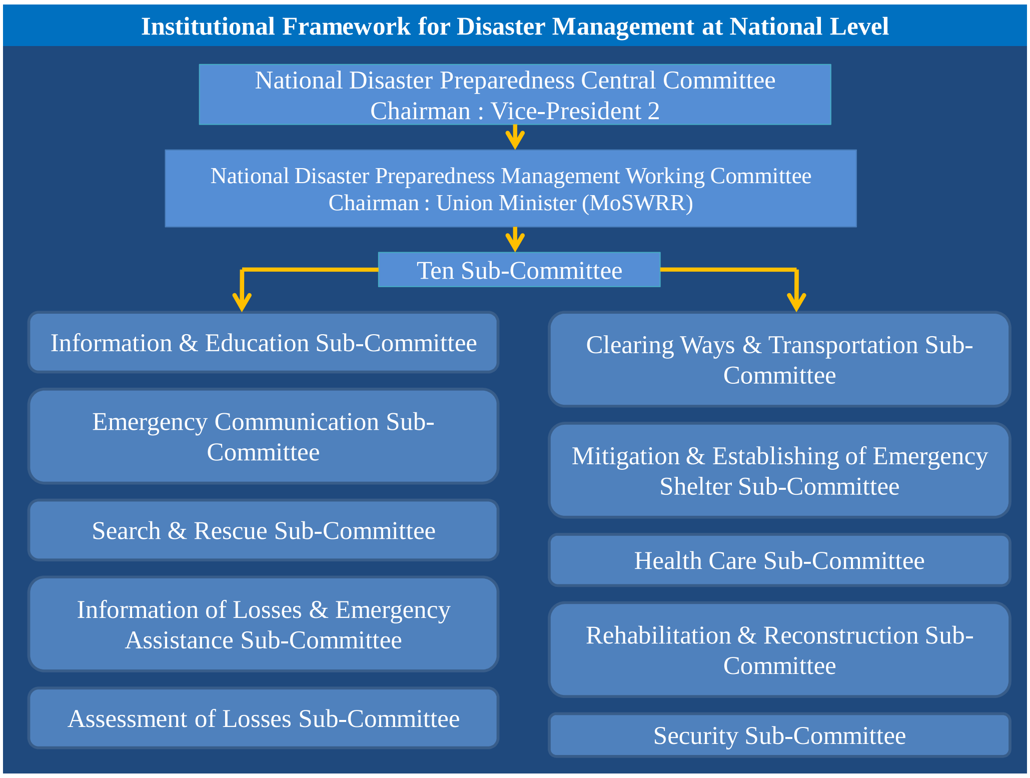

Institutional Framework for Disaster Management at National Level
National Disaster Preparedness Central Committee
Chairman : Vice-President 2
National Disaster Preparedness Management Working Committee
Chairman : Union Minister (MoSWRR)
Ten Sub-Committee
Information & Education Sub-Committee
Emergency Communication Sub-Committee
Search & Rescue Sub-Committee
Information of Losses & Emergency Assistance Sub-Committee
Assessment of Losses Sub-Committee
Clearing Ways & Transportation Sub-Committee
Mitigation & Establishing of Emergency Shelter Sub-Committee
Health Care Sub-Committee
Rehabilitation & Reconstruction Sub-Committee
Security Sub-Committee

Figure (21) National Organizations for Disaster Risk Reduction

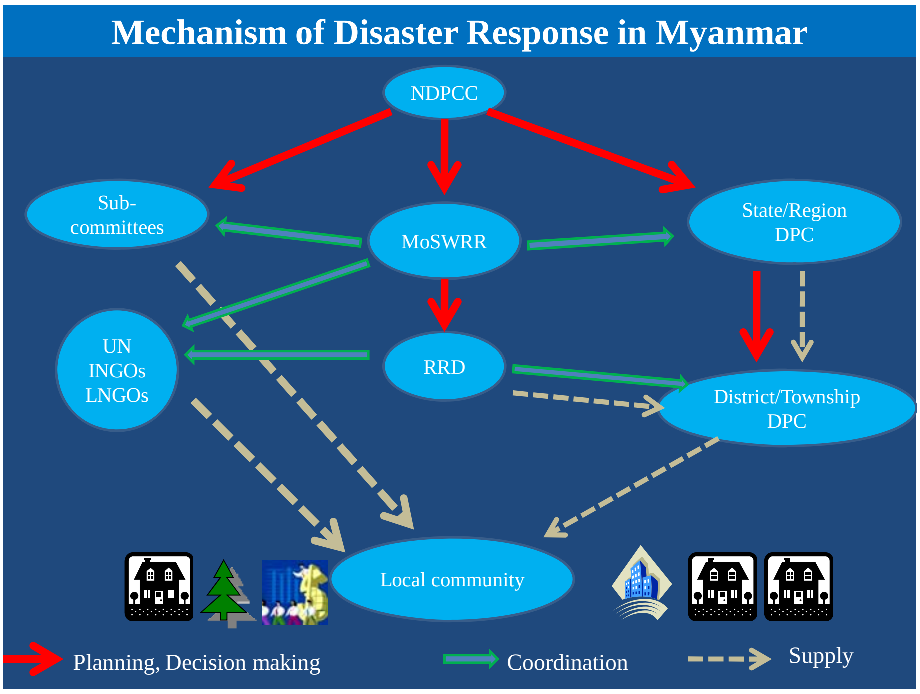


Figure (22) National Platform of Disaster Risk Reduction

3.2.2 Roles and Responsibilities of NDPCC

National Disaster Preparedness Central Committee has been formed by aiming at carrying out preparedness and safety measures for possible danger of natural disaster in the country and ensuring prompt and effective risk response in time of emergency. Duties and responsibilities of National Disaster Preparedness Central Committee are as follows:

- To form committees needed for implementation of the work procedures of the central committee, to outline polices on important tasks among various stages of works and to give necessary guidelines after reviewing the work progress.
- Laying out of policies and directives for the use of domestic forces in the face of natural disaster as necessary.
- Formulation of basic principles of coordination for the decisions that calls for international assistance.
- Distribution of State funds and State resources to places which are in need of help.
- Issuing orders and directives, if necessary, in the aftermath of natural disaster in order to perform relief and management works without having any difficulties and obstacles, to avoid malpractices on relief supplies and to ensure the rule of law, community peace and tranquility.

3.2.3 Roles and Responsibilities of National Disaster Preparedness Management Working Committee

National Natural Disaster Preparedness Management Work Committee is formed to systematically undertake preparedness measures for natural disasters, to swiftly carry out reliefs and aids and to implement policies and directives set by National Natural Disaster Preparedness Central Committee. Duties of National Disaster Preparedness Management Work Committee are as follows:

- to implement natural disaster preparedness management works such as disaster risk reduction, preparedness, reliefs, rehabilitations and reconstruction in line with policies, directives and procedures set by National Disasters Preparedness Central Committee
- to manage local aids for relief, resettlement and reconstruction and foreign aids when National Disasters Preparedness Central Committee assigns duties
- to encourage mass participation in natural disasters preparedness educative programme and tasks
- to occasionally report Management Work Committee’s undertakings to National Disasters Preparedness Central Committee
- to set up natural disasters forecasting system and the early warning system and to distribute news to the grass-root level in time when the warning is received from the warning system
- to assign duties to departments and organizations according to the size of natural disasters
- to supervise undertakings of Subcommittees and to coordinate Subcommittees
- to supervise works of subcommittees and coordinate their tasks
- to report Management Committee’s progresses to the Chairman of the Central Committee quarterly
- to supervise relief and resettlements in case of natural disasters

10 sub-committees of Natural Disaster Preparedness Management Work Committee are as follow:

- Information & Education Sub-Committee
- Emergency Communication Sub-Committee
- Search and Rescue Sub-Committee
- Information of Losses & Emergency Assistance Sub-Committee
- Assessment of Losses Sub-Committee
- Clearing ways & Transportation Sub-Committee
- Mitigation & Establishing of Emergency Shelter Sub-Committee
- Rehabilitation and Reconstruction Sub-Committee
- Health Care Sub-Committee
- Security Sub-Committee

3.2.4 Development Partners and other Agencies on DRR

The 2008 cyclone Nargis gave rise to the need for increased preparedness for and response to disasters in Myanmar. In the event that large numbers of people are affected, it is important that the Disaster Risk Management activities of all humanitarian organizations and various stakeholders are carried out in a more coordinates manner. Therefore, Network and agencies concerning Disaster Risk Management have been organized themselves to work hand in hand with government and the people of Myanmar in preparation for and responding to any of the potential disasters that may affect Myanmar. The agencies are such as UN agencies, NGOs/CBOs, professional bodies, and development partners including followings:

Development Partners and other Agencies	Roles and supports on DRR
MAPDRR Task Force led by RRD	Mechanisms to support and facilitate government interventions on Disaster Risk Management
Inter Agency Standing Committee (IASC) - coordinated by UN-OCHA	Emergency Response
DRR Working Group Myanmar – chaired by UNDP (2012)	A platform to share, update, coordinate and discuss various DRR activities and way forward
Myanmar Red Cross Society	Emergency Response First Aid Relief distribution
UNDP	Early Recovery Rehabilitation Reconstruction
UN-OCHA	Coordination in Disaster Response
UN-Habitat	Rehabilitation Reconstruction (Shelter)
MES	Hazard Assessment Preparedness
MGS	Hazard Assessment (Geological) Preparedness

3.2.5 IASC (Inter-Agency Standing Committee) Contingency Plan

The IASC (Inter-Agency Standing Committee) Contingency Plan is an inter-agency forum of UN and non-UN humanitarian partners founded in 1992, to strengthen humanitarian assistance. The overall objective of the IASC is to improve the delivery of humanitarian assistance to affected populations. The Committee was established following UN General Assembly Resolution 46/182 and resolution 48/57 confirmed that it should be the primary method for inter-agency coordination.

Contingency planning is a management tool used to ensure adequate arrangements are made in anticipation of a crisis. This is achieved primarily through the participation in the contingency planning process itself, as well as through follow-up actions and subsequent revisions of plans.

Experience from previous emergencies clearly indicates that effective response to humanitarian needs at the onset of a crisis depends on the level of preparedness and planning of agencies in the field, as well as the capacities and resources available to them. The overall objective of the Inter-Agency Contingency Planning Guidelines is to assist UN Country Teams and partners in planning how to respond to potential emergencies with appropriate humanitarian and protection.

These guidelines provide recommendations on how to engage in the contingency planning process, in order to develop common strategies and approaches to potential emergencies, and how to record the deliberations and results of this in contingency plans.

3.2.6 Emergency Services

Like other countries, Myanmar also maintains many emergency services namely fire, police, defence services, MRCS and ambulance. Except for the police and defence there is no uniform system of management of these services. The Police and Defence works under the state governments but fire and ambulance services are differently managed and run.

Ambulance services - run by multiple agencies such as Red Cross, health department, private health care organizations, charitable organizations, civil defence, etc.

Fire Services - The objectives of Myanmar Fire Services Department (FSD) is to protect and to prevent from fire disaster and natural disaster which insures losses and endanger-

(a) to the lives and properties of the people,
(b) to the State owned capital investment,
(c) to form and train firemen to become the reserve force of the State.

There are three kinds of fire brigades,

(a) Government fire brigade (equipped and paid),
(b) Voluntary (Auxiliary) fire brigade (unpaid volunteers),
(c) Reserve fire brigade (eg. factory, workshop, work site or business exposed to fire hazard).

Set-up and Functions - For operational purposes, the Myanmar FSD is divided into 7 states and 7 divisions. Included with NayPyiTaw. The state and divisional fire services departments are sub-divided into three grades. Townships FSD have been opened only in 45 out of 26 townships. At present there are 550 fire stations including 222 government fire stations and 328 voluntary fire stations. The township fire stations are divided into three grades. An “A” grade fire station comprises 21 firemen a “B” grade fire station, 10 firemen and a “C” grade fire station, 8 firemen. At present, FSD has 1720 fire appliances which are 759 fire engines (fire fighting trucks) 263 water browsers, 201 other supporting appliances and 497 portable fire pumps. The strength of FSD consists of 4778 fire personnel and the strength of voluntary firemen consists of over 249,324. Emergency phone number of FSD in Myanmar is 191.

In Emergency conditions, emergency search and rescue teams including Myanmar Red Cross Society in whole country have 72 teams. One team includes 100 people. Total are 7200 people.

Myanmar Red Cross Society- MRCS’s Disaster Preparedness & Response initiatives focus on reducing deaths, injuries, and impacts from natural disasters. The provision of timely and effective relief assistance to disaster areas is achieved through improved organizational preparedness. MRCS prepares for emergency situations through the following activities:

- Strengthening logistics, particularly warehouse capacity
- Establishing emergency response teams
- Strengthening communication and early warning systems
- Promoting coordination and collaboration with partners and authority
- Disseminating contingency plan and standard operating procedures
- Establishing and scaling up emergency management funds
- Enhancing MRCS branch organizational preparedness for disasters
- Improving township-level branches’ capacities
- Advocating and ensuring MRCS’s improved positioning in country context
- Encouraging sustainable volunteer-based recovery operations

Commercial First Aid Training - The Myanmar Red Cross Society is one of the few organizations in Myanmar that offer a certified First Aid training course to the general public. A sampling of our clientele includes airline staff, hotels, beach resorts, international schools, embassies and their staff, and other non-governmental organizations. MRCS are currently offering Basic First Aid and Refresher Courses.

Volunteers - Volunteers are the heart and soul of the Myanmar Red Cross. MRCS is fortunate enough to have one of the strongest volunteer bases in the world. Without vast RCV network, numbering in the hundreds of thousands, it would be impossible for us to carry out our vital services to the Myanmar public. RCVs work day and night to respond to some of Myanmar's worst disasters and are always the first responders to any emergency, small and large. Intelligent, driven, selfless, compassionate – our RCVs represent the best of what the Red Cross movement stands for, and are the hidden heroes behind all of our groundbreaking programs.

All of RCVs undergo a rigorous training program that follows the highest standards. MRCS begin RCV curriculum with Basic First Aid, which teaches the fundamentals of first response treatment. Following this, RCVs are expected to use their skills in the field for several years, before qualifying for a Standard Aid course. After completion of BFA and SFA and several years of field experience, RCVs can undergo a First Aid Instructor Course, which allows successful trainees to become certified First Aid trainers themselves.

This intensive yet rewarding training scheme ensures that the Myanmar Red Cross produces a highly capable and knowledgeable volunteer base, serving the needs of the most vulnerable populations in Myanmar.

In 2011, a total of 3,528 Red Cross Volunteers were involved in various activities – by serving as blood donors, relief operations, and providing emergency health and care. Approximately 54,341 people have benefited from these services. Facilitator training was given to 34 Red Cross Volunteers with Red Cross branches in locations where community-based health and disaster risk reduction programmes are being implemented. We wish to enable the facilitators to provide appropriate support to targeted communities – this support will include advocacy to community volunteers about the Red Cross.

3.3 PUBLIC AWARENESS OF MYANMAR

DRR in Myanmar is gradually improved and on the right track by government and internationals' collaboration and cooperation. Public awareness on DRM is important as simple Do's and Don'ts of disasters can save many lives during a disaster. It is important that the content of awareness messages should be consistent, clear and context specific and it should be conducted at regular intervals so that the knowledge is kept alive in the community to pass on from generation to generation and ensure that the disaster risk reduction become an integral part of the culture and everyday life of the community. Some educational activities have been carried out by Government, UN Agencies and NGOs such as Ministry of Education in collaboration with United Nations Children's Fund (UNICEF) has been working on integration of DRR into school curriculums. United Nations Education, Scientific and Cultural Organization (UNESCO) with Ministry of Education has developed and distributed Resource Pack in approximately 2000 schools in severely affected eight townships in delta and one township in Mandalay Region.

The RRD has been conducted State and Division Level short-term Disaster Management Courses for educative measure and public awareness on natural disaster reduction with the co-operation of other departments concerned such as Department of Metrology and Hydrology, Health Department, Irrigation Department, Myanmar Red Cross Society (MRCS), Myanmar Police Force and Fire Services Department. The courses are originated mostly from ADPC and workshops and discussion with government and NGOs for further training for local communities and grass root level as well as training of trainers. Disaster Risk Management of capacity

Training from 1977 to 2013 was opening in the Myanmar as shown in Table (1). In addition, Distribution of posters and pamphlets (Figure (23)), Training of Trainers on Disaster Risk Reduction – TOT, Disaster Management Course – DMC (State and Divisional level), Education Talks on Disaster Risk Reduction, Workshops and seminars (Both local and abroad), and CBDRR and CBDM training are carried out.

No	State/ Division	Opening Totle	Population	Remart
1	Kachin State	8	389	
2	Kayah State	5	192	
3	Kayin State	8	380	
4	Chin State	4	154	
5	Sagaing Division	6	270	
6	Tanintharу Division	9	430	
7	Bago Division	8	399	
8	Magway Division	9	368	
9	Mandalay Division	6	272	
10	Mon State	10	450	
11	Rakhine State	15	674	
12	Shan State	9	454	
13	Yangon Division	14	615	
14	Ayeyarwady Division	20	879	
	Total	131	5926	

Table (1) opening capacity Trainings from 1977 to 2013 in Myanmar

Wall Sheets and Posters

Pamphlets

Development of IEC materials for Public Awareness(in English)

Development of IEC materials for Public Awareness(in Myanmar)

MANUAL ON FIRE
Manual on Earthquake
Causes, Effects & Preparedness
MANUAL ON FLOOD

Figure (23) Wall Sheets, Posters, Pamphlets and IEC materials for public awareness

3.3.1 Planning for Public awareness, Education and Training of Myanmar in MAPDDR

Sub-Component 7.1: Awareness through International Day for Disaster Reduction
It will serve as the constant reminder of the pledge and dedication the country has made towards reducing the risk of disasters. The 13th October is being observed by United Nations as the International Day for Disaster Reduction and ASEAN Day for Disaster Reduction. In Myanmar, International Day for Disaster Reduction has been observed since 2010. The programs will include award scheme for best risk reduction practices, essays, articles and painting competitions, drills and demonstrations for the public. These programs will be up scaled to the whole country.

Sub-Component 7.2: National Public Awareness Program
Under the leadership of MDPA and MSWRR, directives will be issued to all Regional and State Disaster Preparedness Agencies for the development of 5-year public awareness programs corresponding to the local hazards and risk. Based on the Regional/State plans, the National Public Awareness Program will be prepared. On pilot basis, 20 townships each from Yangon, Mandalay, Bago, Rakhine and Shan Region/State will be selected for implementation of the program under the supervision of local Disaster Preparedness Agencies.

Sub-Component 7.3: Awareness through School and School Curriculum
The Department of Educational Planning and Training under the Ministry of Education has collaborated with UNICEF since the early 2000 on inclusion of disaster risk related lessons (basic causes and impacts of hazards) in Primary Life skills Curriculum. In secondary level particularly in grades 6, 7 and 8, the related lessons will be included in the revised curriculum which is still in the process of revision and trail in 3 townships. It also proposes to revise the curriculum of the Education Colleges in the relevant subjects in context of risk reduction. In collaboration with Ministry of Education, UNESCO has initiated Myanmar Education Recovery Programme since March 2009, which aims to develop processes, learning kits and trainings for developing relief and emergency response plans for disaster risk reduction education giving communities and children a role in the recovery and DRR process.

Sub-Component 7.4: Awareness through University Curriculum
Disaster risk reduction is an emerging field and requires research and development on its various sub-themes. The sub-component ‘Awareness through University Curriculum’ aims to create awareness and also promote research. The process can start with constitution of an Expert Panel consisting of university professors, educational specialists and disaster risk reduction professionals, which will identify suitable subjects along with DRR topics for incorporation. The course will be revised and accordingly course material will be developed. It will have component for research and development in area of disaster risk reduction.

Sub-Component 7.5: Expansion Plan for Disaster Management Training
Disaster management related trainings have been provided in Myanmar for government employees by Relief and Resettlement Department (RRD), Department of Health, Department of Traditional Medicine, Fire Services Department, Ministry of Education and other agencies. For Ministry of Education, UNESCO’s Myanmar Education Recovery Programme will build capacity of 150 township education officials and 2000 school principals in disaster awareness and preparedness through a series of educational planning and management modules.

The scope of the sub-component includes review of the existing training materials and to upgrade it at par with the international or regional courses. The proposed process includes (1)

Review of the feedbacks received from the participants of past trainings and (2) Constitution of Training Material Review Committee (with representatives from RRD, Health, FSD and MoE, and NGOs). Three priority training courses that should be taken up for review and upgrading are Disaster Management Course (DMC), Community based Disaster Risk Reduction (CBDRR) program and Training of Trainers (ToT) program. The revised materials on DMC and CBDRR will be tested in 20 selected townships in the first year of the project and the outcomes will be incorporated in the final materials before expanding the trainings to all states and Regions. Both trainings will incorporate livelihood related elements in the module. The target groups for the trainings will be local government authorities. The 20 townships to be selected will be the same as those under sub-component (7.2) 'National Public Awareness Program' from Yangon, Mandalay, Rakhine and Shan.

Sub-Component 7.6: Training for Emergency Preparedness and Response at Township Level

While the previous sub-component deals with the trainings on overall management and planning issues related to disaster risk reduction, this sub-component will focus on specific response tasks at the township level. The existing emergency preparedness and response curriculums will be reviewed, upgraded and pilot tested in 15 townships across Myanmar. The trainings will be conducted on First aids, Search and rescue, Warehouse management and Relief distribution. This component will be led by Fire Services Dept.

Sub-Component 7.7: Enhancing Training Capacities

This sub-component will be the continuation of the sub-component (7.5) 'Expansion Plan for Disaster Management Training'. The revised ToT trainings will be pilot tested in 10 townships in Mandalay Region and Rakhine State, same townships as in sub-components (7.2) 'National Public Awareness Program' and (7.5) 'Expansion Plan for Disaster Management Training', in the first year and any adjustments required will be carried out based on the experiences. It will also review the existing Training of Trainers (ToT) program of MSWRR.

Sub-Component 7.8: Special Awareness Program

The Special Awareness Program will concentrate on preparing and publishing materials on emerging issues like climate change as well as on specialized topics like livestock management. At the same time, the program will look at reaching special vulnerable groups and creating materials specifically for them. However, as the first activity, the subcomponent will support identification of one particular topic, designing and preparation of awareness materials and testing them at the community level in 6 townships in Mandalay and Ayeyarwady Region. Revisions will be undertaken as needed and the final version will be printed and distributed widely through both official and NGOs channels. Also, television series and radio talks will be organized to raise awareness on Disaster Risk Reduction.

Sub-Component 7.9: Establishment of Disaster Management Training Center

Myanmar is vulnerable to multiple hazards; hence there is a need of a dedicated national level institution for technical support on Disaster Management to Ministries, Departments and other institutions at Region/State and below levels. It will also act as the technical advisory body to Sub-Committees of MDPA. It will also collaborate with similar institutions in ASEAN and other countries for research and development. The existing Disaster Management Training Unit of RRD will be the key entity for creating a National Disaster Management Training Center in Myanmar. RRD with technical support from organizations like ADPC will lead this activity.

3.4 EARLY WARNING SYSTEM OF MYANMAR

3.4.1 Planning for Multi-hazard Early Warning Systems of Myanmar in MAPDDR

Sub-Component 3.1: Upgradation of Existing Early Warning Centers

The Department of Meteorology and Hydrology (DMH) has two Early Warning Centers, one each in Yangon and Nay Pyi Taw. Under this sub-component, the existing centers will be enhanced with further instrumentation. Also the capacity building of the Early Warning Centers staffs will be undertaken for further augmenting the interpretation and dissemination capacity. It will seek technical support from international agencies such as ADPC, UNDMT and ESCAP; particular linkage would be made with the ongoing RIMES's program on 'Indian Ocean End-to-end Multi-hazard Early Warning System'.

Sub-Component 3.2: Multi-hazard End-to-End Early Warning Dissemination System

Under this sub-component, a system will be designed and established for rapid transfer of official warnings issued from the Early Warning Center (link to sub-component (3.1) 'Upgradation of Existing Early Warning Centers') to the community level. To ensure effective dissemination of warning information, inter-ministerial arrangements will be formalized with clearly specified procedures. This can be built upon the existing mechanism as Monsoon Forums organized annually by the DMH where the capacities of many departments, in the role of the climate information users, have already been assessed. In addition, communication equipment will be provided at the township level to fully support the warning transmission activities and the possible usage of the off-shore and coastal communication system of Myanmar Posts and Telecommunications will be explored. The village volunteer groups or village committees set up under community based disaster preparedness by various agencies shall be utilized.

Sub-Component 3.3: Improved Meteorological Observation and Forecasting

This sub-component will identify the needs in meteorological observation and forecasting and will find ways to fill the gaps. Though assistance from external bodies will be sought in terms of state-of-the-art weather observation technology, a long term plan will be developed to ensure that the local capacities are enhanced and maintained and to upgrade the 102 existing stations of DMH and set up new stations, if required.

Sub-Component 3.4: Enhanced Flood Monitoring and Forecasting Capacities at Township Levels

Focusing on the flood risk reduction at township level, this sub-component will look at the formal inclusion of flood monitoring activity as part of existing plan of the Township Disaster Preparedness Agency. Specific orientation workshops will be organized in 16 townships: 3 each in Ayeyarwady, Mandalay, Sagaing, Kachin and Rakhine, and 1 township in Tanintharyi for orienting the Agency members on interpreting the flood forecast information provided by DMH and Irrigation Department on what kind of associated risks and impacts can be expected.

Sub-Component 3.5: Landslide Study and Monitoring

Modeling software should be installed to generate likely scenarios for landslide hazards. DMH, MES, MGS and the Engineering Geology Department of YTU, Public Works and GAD with their longstanding work on landslide should also be involved as key partners. On top of the modeling system, regular field inspection should be conducted to look for such signs as small rock falls and scar along the slopes in landslide prone area. Since this is an entirely new initiative, it is essential to establish partnerships and learn from other experienced Asian countries with the similar problem, namely China, Japan, Malaysia, Nepal, Philippines, India and Sri Lanka.

Sub-Component 3.6: Drought Study and Monitoring

Drought monitoring work, over the years, has been undertaken mainly by the Ministry of Agriculture and Irrigation. DMH has one center in Mandalay that devotes to drought monitoring and this can be further improved. The cooperative efforts between various concerned agencies such as Dept. of Agriculture Planning, Irrigation Dept., Dept. of Health, MOECAF and Livestock Breeding and Veterinary Dept. will also be encouraged (link to subcomponent (5.8) '*Sustainable Development in the Dry Zone Area to Protect/Mitigate Against Drought* '.

Sub-Component 3.7: Cyclone Tracking and Storm Surge Forecasts

The key activity under this component is to install advanced modeling software along with instruments (Radar) on cyclone and storm surge, at the DMH offices in Kyauk Phyu and Yangon, so that the storm tracks can be predicted and information sent to the Early Warning Center for issuance of timely warnings.

Sub-Component 3.8: Seismic Monitoring

Monitoring of seismic movements will be achieved through installation of high-tech seismic stations at the tactical locations such as around Sagaing and other active fault lines. To link up all individual station and ultimately to the Early Warning Center, a network of Global Positioning System (GPS) will be installed to get information on ground behavior.

Sub-Component 3.9: Oceanic and Tsunami Monitoring System

One of the key activities under the RIMES's Indian Ocean End-to-end Multi-hazard Early Warning System is to install buoys with data transmitter to detect any anomaly of the ocean wave along the coastlines of the Indian Ocean countries. The primary partner of RIMES in Myanmar is the Department of Meteorology and Hydrology (DMH) and the data obtained will be delivered directly to multi-hazard Early Warning Center at DMH.

Sub-Component 3.10: Forest Fire and Haze Monitoring System

Building upon the existing systems within the Forest Department, a GIS based monitoring system, with linkages to the ASEAN Scientific Monitoring Center in Singapore, Singapore Weather Information Portal, Global Environment Center in Malaysia and Indonesia Weather Center will be put in place to observe the forest fire incidents in the country. In connection, the National Haze Action Plan will be reviewed, revised and reactivated by MOECAF, with technical support from FSD, UN Agencies and ASEAN. Linkages to the proposed National Adaptation Plan of Action on Climate Change (NAPA) will also be identified. As for ground level implementation, five townships each in Chin and Shan States will be identified and trainings on forest fire prevention will be delivered for the community.

3.4.2 Department Of Meteorology and Hydrology (DMH) in Myanmar

The Department of Meteorology and Hydrology (DMH) is responsible for all tasks related to the works for mitigation and prevention of natural disasters including earthquakes monitoring and sea level observations to establish a Multi-Hazard Early Warning System.

The establishment of a broad band seismic stations network and tide gauge stations in Myanmar aims at understanding the level and type of seismic and tsunami hazard, while reducing the impact of future earthquake and tsunami. It also encourages the on-going activity for earthquake and tsunami disaster prevention in Myanmar. The seismological tasks performed by the Department of Meteorology and Hydrology are routine observation, providing information for the general public and related department for mitigation and prevention of earthquake and tsunami disaster. Those tasks and services are done on near real time and continuous for 24 hours every day. Once the Department of Meteorology and Hydrology's Stations detects an Earthquake within MYANMAR or far regions, the Department provides information to the government organization, disaster management authorities and mass media. Myanmar is one of the developing countries in south-east Asia. Its population was estimated at 50.7 million with a population growth rate of 0.9 % per year. The population density is about 75 people/sq km. Most of the people live along and near the Central Belt's, Delta and Coastal areas. One of the active fault (Sagaing Fault) runs north to south passing through the central region. According to the historical accounts, many of strong earthquakes had occurred and felt along the Sagaing Fault and Sunda Andaman Trench which is parallel to the Myanmar Coastal. These earthquake generators had been the focal point of many great earthquakes. Myanmar has about 1900 km long coastal line and can be divided into three parts namely, Rakhine coastal area (west) , Ayeyarwaddy Delta (central), and Tanintharyi coastal area (south) respectively. The Department of Meteorology and Hydrology has come up with a comprehensive plan of establishing a seismic and tide gauge networks. Tow tidal gauges and tow broadband seismometers have already been installed.

3.4.3 Weather Forecasting and Warning Services of DMH

The observational data in Myanmar is collected at the National Meteorological Centre (NMC) in Yangon by SSBs (HF transceivers) and via the Internet (e-mail). The international real-time data and products are exchanged via the GTS. Following the tragic 2004 Indian Ocean tsunami, the GTS system (Yangon-New Delhi and Yangon-Bangkok) was upgraded from 50 bps to 64/128 kbps with the funds from UN/ISDR Flash Appeal and VCP (F). The system, composed of a Local Area Network, Internet-based Communication System, Visualization System and additional PCs and accessories, was installed in 2007-2009 in NMC Yangon by NetSys, South Africa (completed in January 2009).

DMH provides the aviation meteorological services; meteorological and hydrological services for shipping and inland water transport; meteorological services to agriculture; hydrological services; and seismological services. DMH also conducts many training courses, including B.Sc (Hons) Meteorology and B.Sc (Hons) Hydrology Academic Courses, and Natural Disaster Prevention Course.

DMH issues the following forecasts, bulletins, news and reports: (1) Daily Weather Forecast; (2) 10-day and Monthly Weather Forecast; (3) Sea Route Forecast; (4) Aviation Forecast; (5) Special Weather Forecast; (6) Water-level Forecast; (7) Lowest Water-level Forecast; (8) Water-level Bulletin; (9) General Forecast for Southwest Monsoon; (10) Pre-, Mid- and Post- monsoon Weather Forecast; (11) Analysis of Pre-, Mid- and Post-monsoon Rainfall Condition; (12) Hydrologic Summary; (13) Special Weather Condition; (14) Technical Report for Southwest Monsoon; and (15) Seismological News.

DMH issues warnings as follows: (1) Storm Warning; (2) Storm Surge Warning; (3) Strong Wind Warning; (4) Port Warning; (5) Heavy Rainfall Warning; (6) Untimely Rainfall Warning; (7) Flood Warning; (8) Significant Weather Report for Aircraft; (9) Special Weather Report for the Airport (SPECI); (10) Fog Warning; and (11) Tsunami Warning.

In accordance with the meteorological law, the above forecasts and warnings are disseminated by DMH to Government authorities; local authorities; UN Offices, NGOs and other relevant organizations; national media and the general public through telephone; fax; mobile phone; Internet (website and e-mail); VHF; port wireless; AFTN (aviation) and Radio/TV and print media.

3.4.4 Seismic and Tsunami Activities in Myanmar

Myanmar lies on earthquake belt of Himalayan range. The northeastern part of the Indian plate subcontinent is seismically active. It comprises of east-west extending eastern Himalaya belt, which marks the collision boundary between the under thrusting Indian plate and the Eurasia plate; approximately N–S extending Indo-Burmese Arc (IBA), which extends further southward to join the Andaman Arc and the Eastern Himalayan Syntaxes (EHS), which lies at the junction of the above two. Subduction occurs along the Andaman arc. The Indian (IN) plate motion with respect to Eurasia (EU) is highly oblique to the margin on the subduction zone, the right-lateral shear motion occurring along the Sumatra fault evolves northward into the rift system of the Andaman Sea. The Burma plate is thus delineated in the east by the Sumatra fault, which follows the line of arc volcanoes and the rift segments of the Andaman Sea. The right-lateral Sagaing shear fault shown in the Figure is delineated in the west by the Andaman-Nicobar Trench. The Department of Meteorology and Hydrology (DMH) start to observe the sea level after the Great Sumatra Earthquake of 2004. The seismic records show that there have been at least 15 major earthquakes bearing magnitude $M \geq 7.0$ within the territory of Myanmar for the past 100 years. The seismicity in Myanmar is attributable to the following two reasons:

- The continued subduction (with collision only in the north) of the northward-moving Indian Plate underneath the Burma Platelet (which is a part of the Eurasian Plate) at an average rate of 5.5 cm/yr (5.5 Found by the author) and
- The northward movement of the Burma Platelet from a spreading centre in the Andaman Sea at an average rate of 2.5 – 3.0 cm/yr. Very large over thrusts along the Western Fold Belt resulted from the former movement, and the Sagaing and related faults from the latter movement. Intermittent jerks along these major active faults resulted in the majority of earthquakes in Myanmar.

3.4.5 Monitoring Network in Myanmar

Seismic Stations

The Department of Meteorology and Hydrology (DMH) Myanmar has introduced seismological monitoring activities since 1963. The DMH installed its first seismograph, named WILLMORE and SPENGNETHER (U.S.A) in 1963 at Yangon and Mandalay, but now not operating. Since this instrument used photo-paper as a hard copy, it was very difficult to obtain real time events. The next generation seismograph was visual recording seismograph (Katsujima-Japan) installed in DMH Yangon as well as Mandalay in1977. Katsujima long period seismograph was installed at Yangon in 1984. Also Katsujima solar power seismograph was installed at Sittwe in 1984 and at Dawei in 1985 as well. The next one is a digital strong motion seismograph (K2) in 1995, but not operating. Ten sets of modern strong motion accelerograph, ETNA-SI, were donated by OYO Corporation, Japan, through WSSI and were installed at ten different stations in Myanmar during the year 2001-2002. Two sets of digital seismograph were installed in DMH at Yangon and Mandalay in April 2003, which were donated by Yunnan Seismological Bureau, Peoples Republic of China. As shown in Figure (24).

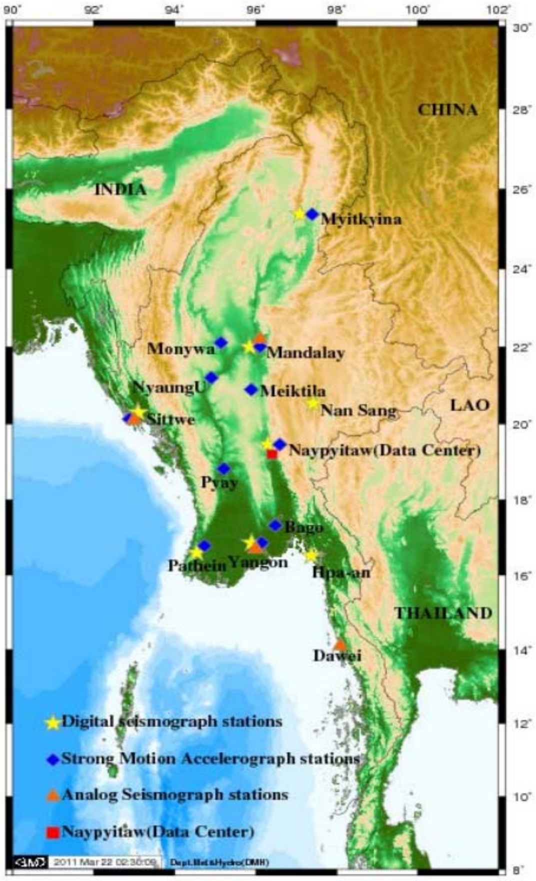

CHINA
INDIA
LAO
THAILAND
Myitkyina
Monywa
Mandalay
NyaungU
Meiktila
Nan Sang
Sittwe
Naypyitaw(Data Center)
Pyay
Bago
Pathein
Yangon
Hpa-an
Dawei
Digital seismograph stations
Strong Motion Accelerograph stations
Analog Seismograph stations
Naypyitaw(Data Center)
90°
92°
94°
96°
98°
100°
102°
30°
28°
26°
24°
22°
20°
18°
16°
14°
12°
10°
8°

Figure (24) Present Seismic Network in Myanmar

Seismic Equipments

There are four analog seismological stations at Yangon, Mandalay, Sittwe, and Dawei, enquired with Japan Katsujima short-period seismographs for monitoring earthquakes in and near the country. Only in Yangon, capital city of Myanmar, one Japanese Katsujima short-period seismograph, one Japanese Katsujima long-period seismograph, ETNA-SI strong motion accelerograph and broad band digital seismograph altogether four seismographs are installed. For strong motion analysis, ten sets of strong motion accelerographs are installed in Yangon, Mandalay, Naung Oo, Sittwe, Pathein, Bago, Phay, Myitkyina, Monywa and Meiktila, the two sets of digitized broad band seismographs are installed in Yangon and Mandalay. The seismological stations of Myanmar are shown in Figure (24).

Tide Gauge stations

The Department of Meteorology and Hydrology (DMH) start to observe the sea level after the Great Sumatra Earthquake of 2004.The DMH was installed two sea level tide gauges at Myanmar coastal area, Mawlamyine and Sittwe which were donated by Asian Disaster Preparedness Center (ADPC) in July 2006. The Department of Meteorology and hydrology (DMH) obtain the sea level data from the IOC website (http://ilikai.soest.hawaii.edu/uhslc /htmld/d0328W.html). As shown in Figure (25) existing tide gauge stations and proposed tide gauge stations.

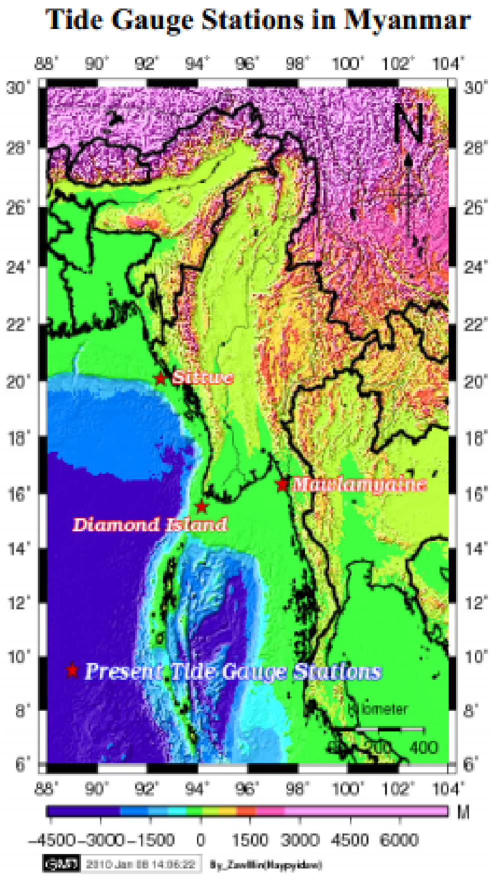

Tide Gauge Stations in Myanmar
88° 90° 92° 94° 96° 98° 100° 102° 104°
30° 28° 26° 24° 22° 20° 18° 16° 14° 12° 10° 8° 6°
N
Sittwe
Mawlamyaine
Diamond Island
Present Tide Gauge Stations
kilometer
0 200 400
M
-4500 -3000 -1500 0 1500 3000 4500 6000
GMT 2010 Jan 08 14:06:22
By_ZawMin(Naypyidaw)

Figure (25) Tide Gauge stations in Myanmar

Tide Gauges Monitoring

The Department of Meteorology and Hydrology (DMH) start to observe the sea level after the Great Sumatra Earthquake of 2004. The DMH was installed two sea level tide gauges at Myanmar coastal area, Mawlamyine and Sittwe during July 2006 which were donated by Asian Disaster Preparedness Center (ADPC). Installation at two stations was completed, as shown in Figure (26).

(a) **(b)**

Figure (26) (a)Sea Level Tide Gauge at Sittwe and (b)Sea Level Tide Gauge at Mawlamyine

3.4.6 Information Dissemination earthquake & Tsunami

Warning and information issued by DMH is immediate dissemination to the public through the disaster management authorities, local governments and mass media, such as TV and radio, Fax and Telephone (see in Figure (27)). But Myanmar Television and Radio are not available broadcasting for 24 hours, so we have established our own communication warning system to the public by Single Side Band (S.S.B), transmitting system. These systems have been installed in Myanmar coastal area, as shown in Figure (28) (a). We are also in the process of establishing FM Radio transmitting station as can be seen from the plan in Figure (28) (b).

The disaster management authorities and local governments take actions for mitigating disasters based on such warning and information. When an earthquake occurs, DMH issues seismic intensity information in 15-30min, subsequently information on the hypocenter and magnitude of the earthquake and cities, towns and villages where a strong shake has been felt is issued. After the Great Sumatra Earthquake of 2004, DMH established the tsunami warning & information system. DMH tsunami warning system is not advance, so DMH obtained the tsunami warning & information by e-mail or fax from Japan Meteorological Agency (JMA) and Pacific Tsunami Warning Center (PTWC). After that DMH issues the tsunami warning & information for the public through the disaster management authorities, local governments and mass media in Myanmar coastal area.

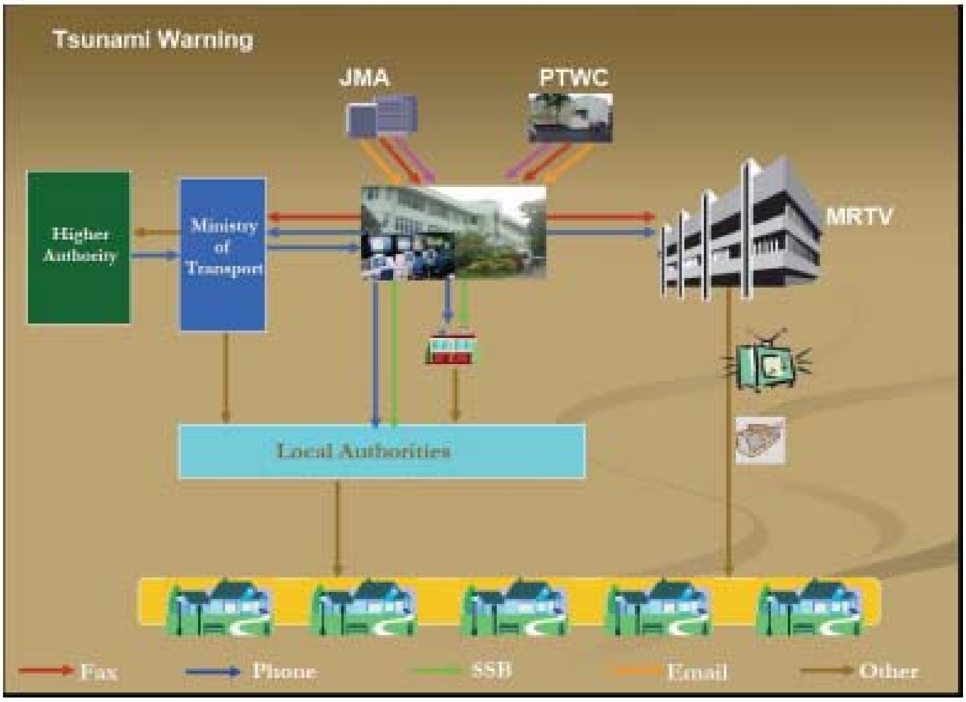
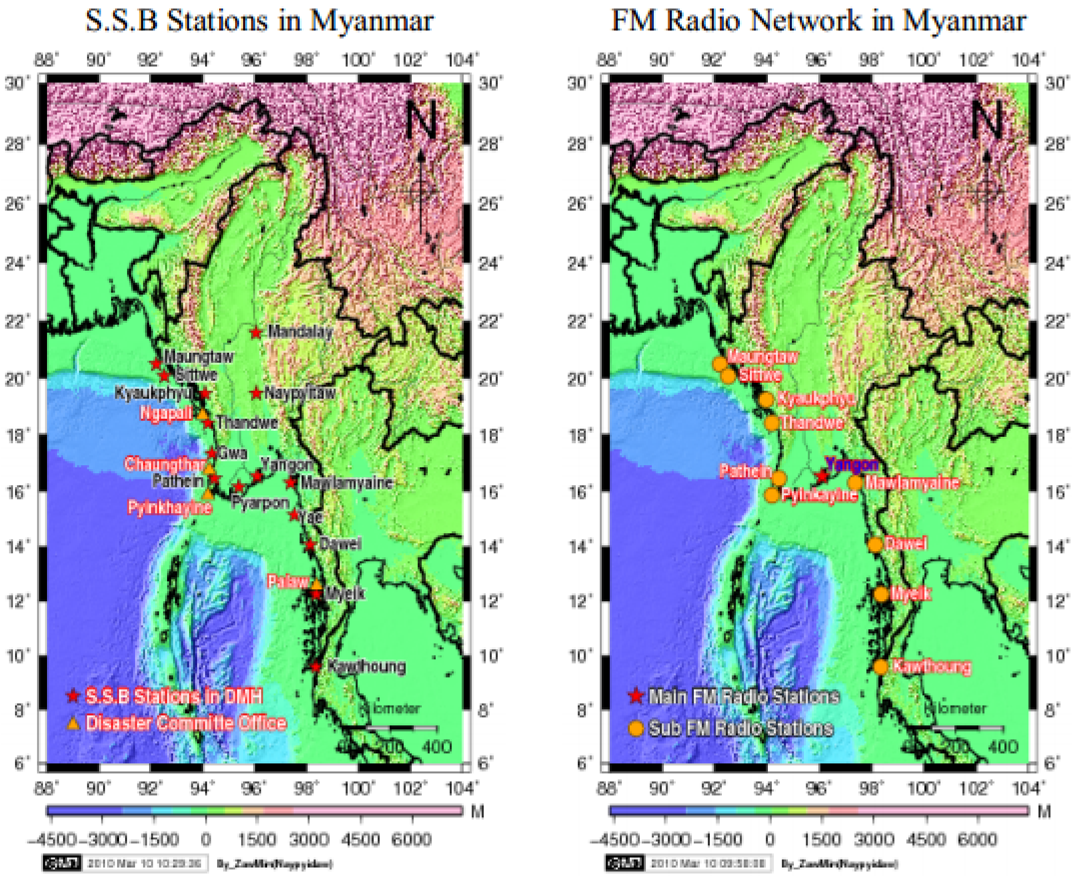


Figure (27) Tsunami Warning Network


S.S.B Stations in Myanmar
FM Radio Network in Myanmar
Mandalay
Maungtaw
Sittwe
Kyaukphyu
Naypyitaw
Ngapali
Thandwe
Gwa
Chaungthar
Yangon
Pathein
Mawlamyaine
Pyarpon
Pyinkhayine
Yae
Dawei
Palaw
Myeik
Kawthoung
S.S.B Stations in DMH
Disaster Committe Office
Main FM Radio Stations
Sub FM Radio Stations
Kilometer
0 200 400
N
-4500 -3000 -1500 0 1500 3000 4500 6000
M

(a)

(b)

Figure (28) (a) Present S.S.B Stations and (b) Planning of FM Radio Stations

3.4.7 Tsunami Warning Response and Emergency Preparedness

As Myanmar is closely located to potential epicenters of large submarine earthquakes tsunamis may reach coastal areas within a period of one hour from the time of occurrence of large submarine earthquakes. Thus requires that warning message should reach the people near the coastal as quickly as possible to protect lives. Every sector, not only DMH but also all others in the early warning chain need to make efforts to convey the warning messages to the people as fast as possible. Another challenge is that tsunami may hit during night hours when people are asleep. The use of laud-speakers for transmitting tsunami warnings by Red Cross volunteers at the community level is very effective, but it needs a well organized plan, as tsunami is very different from storm surges or other common disasters in the country. The plan should be categorized in a manner that each community has a coordinator. Nevertheless, the warning information may not reach people living in isolated area such as remote islands rural areas. TV and Radio are effective means of disseminating tsunami warning to the public; however there are limitations in that, some people living in the rural area may not have access to these media. Moreover, national radio and TV do not broadcast 24 hours a day. Considering the fact that other areas outside Yangon are not connected to telephone and other important communication means, one effective way for warning transmission is via amateur radio. It is cost effective and easy to operate between the local authorities and community leaders. This would also help in transmitting the observed tsunami information by coastal communities to DMH. As soon as the tsunami warning system is established, the government should conduct tsunami drills including evacuation. Disaster managers should evaluate the drill based on several factors, like how long it takes for people to receive the warning at each municipality and community and also to evacuate to safe places. It is recommended to designate safe places such as higher ground or tsunami evacuation centers and train community leaders to educate the public on tsunami awareness. Additional communication system with the police force, fire volunteers, and Red Cross volunteers should be established.

3.4.8 Tsunami Public Awareness, Preparedness and Community Level Activities

Tsunami was completely unknown to the public as well as most of the government 6 officials before 26 December 2004. Many of the victims were killed due to lack of knowledge on Tsunami; some of them went to see the sea, some of them tried to catch fish when the sea level dropped. Sustaining the public awareness and preparedness would be most important to minimized losses from any other tsunami events. As the central government and relevant departments have strong initiative for tsunami disaster management, some structural measures against tsunami and activities to raise public awareness have been already carried out. Evacuation routes have been designed in severely affected islands and tsunami memorial posts were erected on the coast area. High Level government officials have sufficient knowledge on tsunami disaster management; however, other staffs including local government staff need training on tsunami response and preparedness. Training for tsunami early warning for local government officials in the coastal area is highly recommended. For the general public, community-level education and preparedness programmes for tsunami should be continued. Brochures and pamphlets have already been published and distributed to the affected area. This might be reinforced through community-level education seminars or workshops when distributing these brochures and pamphlets. Non-governmental people centered, community-based organizations such as the local Red Cross, with a large number of volunteers, play a major role in early warnings and preparedness for all natural disasters including tsunami. Training programs can be conducted jointly by the government and these organizations. Training for trainers is also urgently required. Radio broadcasting plays a critical role in Myanmar, as many houses do have radio in rural and coastal areas. Training for the media, especially for the radio presenters on tsunami information dissemination, as well as public education on tsunami, would be an effective way for tsunami warning dissemination.

3.5 CASE STUDY ON NARGIS CYCLONE

On 2 and 3 May 2008, Cyclone Nargis (category 3) swept in from the Bay of Bengal and struck Myanmar’s Yangon and Ayeyarwady Divisions, resulting in unprecedented large-scale loss of life and destruction of infrastructure, property and livelihoods. Approximately 140,000 people were killed or unaccounted for following the cyclone. 2.4 million people – one third of the population of Ayeyarwady and Yangon Divisions – were affected by the cyclone in 37 townships covering an area of 23,500 square kilometres.

3.5.1 Fast Facts

- The 8th deadliest cyclone ever recorded and by far the worst natural disaster in the history of Myanmar.
- It hit both urban and rural areas, the Ayeyarwady and Yangon Divisions. The townships of Labutta, Pyapon and Bogale were the hardest hit.
- Winds during the cyclone reached up to estimated at up to 200 kilometres per hour, which destroyed houses, tore down trees, power cables and severed communication systems including land line and mobile phone service.

- It had a significant, long-term impact on people's livelihoods and resulted in enormous physical losses, including the destruction of homes and critical infrastructure such as roads, jetties, electricity, water and fuel supplies and sanitation systems
- A large proportion of water supplies were contaminated and food stocks damaged or destroyed. This damage was most severe in the Delta region, often referred to as the country's rice bowl, where the effects of extreme winds were compounded by a 3-4 metre storm surge, which inundated broad areas of the fertile land and submerged countless villages.
- Nargis struck just as the Delta's paddy farmers were at the very last stage of harvesting the so-called "dry season" crop, which accounts for 25 per cent of the annual production in the affected areas, and destroyed several rice warehouses and their stocks. The total damage and losses estimated for the agricultural sector ranged from K 570,000 million to almost K700,000 million.

Overview of loss and damage resulting from Cyclone Nargis, based on the Post-Nargis Joint Assessment (PONJA)
- Damage from the cyclone was estimated at USD 4 billion, with USD 1 billion needed for recovery until 2012.
- Total economic losses amounted to approximately 2.7 per cent of Myanmar's projected GDP in 2008.
- Affected households were extremely vulnerable – 55 per cent reported having only one day of food stocks or less. Reliance on the steady flow of relief supplies was widespread.
- The scale of the impact was similar to that inflicted on Indonesia following the Indian Ocean Tsunami in 2004.
- Over 90 per cent of needs were at the community level and could be addressed through community based approaches.

3.5.2 Emergency Warnings and Dissemination Before and During Nargis

Department of Meteorology and Hydrology (DMH) were disseminated emergency warnings to Prime Minister Office; Secretary of State Office; National Disaster Management Committee; National Disaster Risk Committee; Ministry of Defence (Central Headquarters); Ministry of Transport; Ministry of Home Affairs; Ministry of Social Welfare, Relief and Resettlement; and other relevant Ministries (34 Ministries in total); Naval Headquarters; Air Force Headquarters; Chairman Offices in Rakhine State and Ayeyarwady and Yangon Divisions; Naval Commander Office at Heingyi; Local Authorities (in Rakhine, Ayeyarwady, Yangon); NGOs, UN Offices, other relevant organizations; national media (Newspapers, TVs (4 channels), Radios (MRTV and City FM)); and four phone line services for public information. All the authorities/organizations immediately carried out necessary actions (e.g., rerouting flights, relocation of UN workers in the field to safer places, closing ports, etc.) were taken based on warnings and information provided by DMH.

The frequent power shortage disrupted the operational services of DMH and the blackout after the landfall of Nargis significantly affected its services. All communications were broken down in Yangon from 20:00 MST on 2 May to 17:00 MST on 3 May 2008. During that silent period, storm centres were determined by the NayPiyTaw Meteorological Centre, where satellite images were received from FengYunCAST. The Internet was unavailable for more than one day over the country. Only the communication between NMC Yangon and coastline observing stations were made by SSBs. DMH continued to provide warnings to the relevant authorities from NayPiyTaw.

People's lack of knowledge on the necessary actions for preparedness (many local people were aware of the warning 48 hours in advance, but they thought that staying at home and not going out was enough for storm preparedness), planning and what people would do with the warning was not quite understood at community level. Myanmar had not experienced such a cyclone (moving along the coast) for a long time.

Although much of the communities had received some sort of warning at their communal levels, both local authorities and people's lack of knowledge, public awareness towards the warning, limited shelters and high ground, and poor mobility (only waterways along small canals by boats are available) made them vulnerable in a large way.

3.5.3 Emergency Response Activities during Nargis

3.5.3.1 Government Response

In order to fulfill the need to carry out emergency search and rescue and provide assistance and carry without delay in townships and rural areas in Ayeyarwady Division and Yangon Division that suffered extensive damages due to the cyclone Nargis, in accordance with the instruction of the State, the National Disaster Preparedness Committee headed by the Prime Minister beginning from 3 May 2008 based the committee in Yangon, and cabinet ministers were assigned separate responsibilities. Rear, mid-point and forward relief camps were set up systematically and the strength of the Government, the public and the Tatmadaw were combined and cyclone relief and assistance activities were carried out in harmony enthusiastically.

In doing so relief, rehabilitation and development and prevention of natural disasters in the long run are being carried out in three phases in accordance with the guidance of the Head of State.

a. First Phase: Emergency relief activities which consist of meeting immediate food, clothing and medical needs of the cyclone victims and getting them under shelter speedily.
b. Second Phase: Resettlement activities which consist of the reconstruction of ravaged town and villages, regeneration of livelihood mechanism and restoration of road and communication links.
c. Third Phase: Prevention of disasters in future by establishing windbreakers and constructing shelters.

3.5.3.2 Response from the Myanmar Public and Civil Society

The grave adversity and the immense challenge posed by the cyclone also brought the best out of the Myanmar people. Known for their humanity, charity, generosity, kinship and neighborliness, they shared not only their wealth but in many cases, whatever little they possess. Many people of Myanmar throughout the country gave generously to their less fortunate storm affected compatriots in cash and in kind. In the days following the storm, the roads leading out of Yangon and other big towns to the affected townships were filled with motorcades of people carrying with them cash, food and household supplies. Many of them ventured further a field by boats to difficult to access villages, spurred on by a humanitarian urges to help. Similarly, many Buddhist monks from all over the country also went to the affected difficult to access areas and disbursed substantial quantities of cash and relief materials to the villagers using the local monastery as base. Likewise, religious leaders and members of all other faiths in the country contributed substantially to the relief efforts. The large Myanmar diaspora outside the country also responded generously. Many of them returned home to help in ways big and small. Others organized collections of mainly cash in favor of the affected population. Such spontaneous help from the public, religious leaders and civil society in general, reached the needy population, in a timely manner. The recorded contributions in cash and kind from Myanmar nationals reached a total of 13,040,881,369 Kyats or about USD11.86 million by 24 June. This figure does not tell the whole story as many donations and contributions have been made anonymously and without registration anywhere. The unrecorded portion is quite possibly as large as, if not larger than the recorded figure. It is therefore quite impossible to put a precise value to the entire massive outpouring of generosity by the people of Myanmar. Nevertheless, the fact that starvation and disease that was originally feared and voiced in some quarters was avoided, is due in no small measure, to the unstinting, if not completely recorded generosity of the people.

3.5.3.3 Response from the Tatmadaw (Myanmar Armed Forces)

In the immediate aftermath of the cyclone the Tatmadaw provided substantial assistance in the overall relief and early recovery effort. Senior military officials accompanied the Prime Minister in his first tour of the affected regions in the Ayeyarwady Division on 3 May. Two divisions of infantry servicemen were also deployed in the region to ensure the continued maintenance of peace, security and tranquility during the turbulent days in the wake of the cyclone. In addition, they undertook a myriad of tasks ranging from search and rescue, evacuation of the injured, setting up of camps for the displaced, collection, identification and burial of the dead, clearing of roads, removal of debris, loading and unloading of relief goods, and generally to help in the distribution of relief assistance to the distressed. Doctors and nurses from the Defense Services Medical Corps also provided emergency medical care in the affected areas. Fleets of military trucks were used to transport relief goods, oil and fuel, seeds, agricultural machinery and implements. Water buffaloes were transported from up country to the lower delta region in time for the planting season. The Air Force has placed its helicopters at the disposal of the relief operation for ferrying and evacuating to and from the affected areas. On its part the Myanmar Navy deployed a number of its boats and crew at a number of locations in the lower delta region to generally help in the relief effort.

To summarize, in an atmosphere of shock, dismay, grief and uncertainty that prevailed in the immediate aftermath of the cyclone, the Tatmadaw made a valuable contribution by calming fears, providing security, and maintaining peace and harmony in the affected areas. Further, the armed forces provided services that assisted the government, the private sector, civil society organizations, local community and international aid workers for more effective and timely delivery of aid supplies and services to the victims of the cyclone.

3.5.3.4 Response from Myanmar Business Community

The Myanmar business community, consisting both of large enterprises and small and medium firms, responded in a timely and effective manner to the crisis. They contributed substantially in cash, kind, and essential services to the relief and reconstruction tasks. Many of them made a special effort to provide assistance in areas of their competence. In this regard, the large construction and engineering firms, with their considerable capacity in equipment, technical know-how, manpower, and financial muscle were well suited to repair and rebuild the physical infrastructure damaged by the storm. These large firms, in close cooperation with the government authorities and village and township elders, gave priority to the renovation and rebuilding of hospitals and schools and the construction of relief camps. The Government provided construction materials including timber, zinc sheets and nails either free of charge, or at heavily subsidized prices. Some construction materials were also permitted to be imported from abroad free of tax or duty. These companies were also tasked to reconstruct entire villages to replace those that were completely swept away by the cyclone. Many villages have either been completed or are already in various stages of completion in the Ayeyarwady Division. The total value of their initial inputs and contributions of these companies to date is USD 68.13 million.

For the next phase, the government intends to build more than 50,000 houses in various villages to replace those lost in the cyclone. These would be durable houses superior in quality to those that were lost, with cement post shoes, zinc roofing, and wood. They would measure 16’ x 20’, self standing in individual plots of land measuring 40’ x 60’. To ensure that cost are kept down, the State will provide corrugated zinc sheets, roofing nails, nails, cement and other construction materials. Many of these houses, which are of a uniform design and specification are already completed and are available for donation at a low cost of Kyats 600,000 or USD 545.45 each. Provided there is good support and cooperation from donors, the government expects the construction of these houses to be completed within a short time.

4. MODEL EMERGENCY RESPONSE SYSTEM FOR MYANMAR

In current Emergency Response System in Myanmar, gaps are identified and a Model Emergency Response System for Myanmar with different headlines depends on the case study of Great East Japan Earthquake (GEJE) is proposed as follow:

4.1 Legal and Institutional Framework

(i) In Myanmar, there is an absence of a policy directive for allocation of funds for specifically for DRR. Plans have been drafted at all administrative levels, but need for more detailed activities and implementation. To ensure the DRR budget allocation, State budget should have separately allocate/mention DRR component and the consolidation efforts among ministries and capacity development / institutional strengthening should be reinforced. The same needs to be ensured at the ministerial levels.

(ii) There is a lack of clarity on how to integrate DRR into each ministry as well as the focal ministry to support other ministries. The integration of technical research works into policy making and implementation in practical problem solving. Data providing and information sharing from respective organizations are necessary. More coordination and cooperation among relevant ministries and academia is needed. Cost benefit analysis for disaster risk reduction has not been conducted yet. Therefore, coordination and cooperation with other relevant ministries and academia needs to be strengthened. In addition, the integration of technical research works into policy making and implementation in practical problem solving should be made. Establishment of a Disaster Management Institute is also needed.

(iii)The system for monitoring, maintaining the data of departments concerned is equipped with aging and obsolete equipment. Therefore, need to change with effective modern equipments. Financial and technical support as well as coordination among different stakeholders is lacking which impedes in improving the existing system. So Financial and technical support as well as coordination among different stakeholders need to be improved.

(iv) A specific institution or department needs to be established for better coordination and standardization.

(v) Need to add effective facts of Disaster Countermeasures Basic Act among 7 basic acts in Japan into legal system in Myanmar

4.2 Effective Early Warning System and Information Dissemination

(i) The dissemination of early warning is unable to reach remotest sections of community. This is also due to the difficult geographical terrain of the country. Particularly, the linkages and communication system between township level to village and community levels is still weak so needs to be strengthen by providing communication facilities as well as capacity building for the stakeholders at community level.

(ii) The mobile service for hazard and early warning information is needed for the public. In addition, dissemination framework for early warning should be restructured or redefined by bringing in wider participation of stakeholders, horizontally and vertically. The message of early warning needs to be understandable and simplified for community. Warning signals is also not standardized. Local level preparedness plans is yet to integrate early warning along with necessary response measures.

(iii) Department of Meteorology and Hydrology (DMH) is the focal department for monitoring, archiving, disseminating data on some key hazards: cyclone, flood and storm surge. Through their 102 sub-stations they are able to monitor; record and disseminate information to higher levels. Irrigation Department is also monitoring river water level of major rivers. The national seismological data has been recorded and compiled by DMH and Myanmar Earthquake Committee to a certain extent and the information is available for the concerned departments, agencies and research purposes. Fire and forest fire data are systematically compiled and recorded at Fire Services Department (FSD) for several years. Dry Zone (covers Central Myanmar) Greening Department is the agency responsible for data on drought. However, the system to monitor, archive and disseminate data on landslide is needed to improve.

(iv) The system for vulnerability data is lacking. Only vulnerability data of very few communities are compiled in some CBDRM programmes of humanitarian agencies in delta during the Nargis recovery period. However, the system for the country as a whole for vulnerability is lacking. Therefore, the system for vulnerability data for whole country needs to be compiled.

(v) Data dissemination to public and stakeholders is present but weak for all the hazards. The early warning and emergency warning dissemination system should be carried out by using radio network system for emergency situations like Japan.

(vi) Due to lack of internet access throughout country, web-based information system is not effective. Firstly, government must made to get internet access throughout country and then Myanmar version websites for information on disasters needs to be created on the Internet.

(vii) Different ministries, organizations and stakeholders are providing DRR information and building capacity at different levels but more co-ordination is needed to reach public in a regular and sustainable way. Many printed reports are too technical for public to understand and difficult to apply in life for building a culture of safety and resilience. Weather news is not able to reach remote areas in time due to limited communication and information systems as well as geographical terrain. So, Documents and reports needs to be made user friendly for general public and easily available; More TV and radio programmes on weather news and DRR needs to be created, for example, use of prime time on different TV channels by interviewing different ministries' experienced personnel, information sharing or airing TV spots that focus on safety during emergencies; Good articles on DRR needs to be collected from newspapers and journals and put in a monthly Village Library Magazine which can reach the remote village libraries and the community. In addition, other magazines that are read by different age groups at village level are identified.

4.3 Public Awareness Raising

(i) There is an absence of a National countrywide strategy to raise awareness and preparedness that could build a culture of safety and resilience at all levels as well as a coordinate strategy among various actors. It is difficult to access some targeted areas to conduct risk assessments, which limits available data and programme reach, greater access to vulnerable communities. Various techniques and methods should be developed to deliver messages to different target groups or communities.

(ii) In education; Due to the tight school routine, there is a little time to practice DRR in schools. Insufficient DRR related teaching aids to stimulate students' interest and participation is also a challenge. The three-month summer holiday limits DRR programme implementation. Regarding DRR in higher education, there are limitations in human resources and facilities to offer courses, carry out research studies and apply findings in DRR activities. So we must be carried out more effective coordination among associated organizations, use pay days as an opportunity to put DRR on the meeting agenda (Note: Township Education Officers and school principals usually have a meeting at the township education offices on pay days.), conduct monitoring visits to foster the use of tools and mechanisms, provide supervision and necessary support to schools, Incorporate DRR and recovery concepts and practices in the higher education curriculum and provides professional DRR education programmes, develop degree, diploma and certificate courses on DRR.

(iii) In media; Radio, TV, and other channels should be showed disaster movies and On-Air programs to improve disaster awareness among public. In addition, disaster drills should be held cooperation with other agencies and then projects like earth manual project in Kaeru Caravan, Sannomiya should be carried out.

(iv) National and local governments can create and publicize earthquake disaster prevention maps that are detailed enough to allow people to identify individual neighborhoods. This is one means of raising awareness of disaster management among residential and other property owners, and it is an effective method for making the public better understands the necessity of disaster-proofing. Need to enhance "soft measures," such as community awareness and effective risk communications because of a more decisive role in saving lives.

4.3 Emergency Services

(i) As described in the foregoing paragraphs the fire services in the country isn't effective shape. Fire services haven't enough firemen for making emergency functions. So organization of fire services needs to strengthen to get more firemen. And also Myanmar Red Cross Society need to have enough RCVs like Fire services.

(ii) There is also urgent need to convert and equip the fire services all over the country as multi-hazard response force by strengthening, revamping, training and equipping.

(iii) The Home Guards should also be trained in fire-fighting besides training them in other aspects of emergency response such as search and rescue, medical first aid, management of relief, etc.

4.5 IASC (Inter-Agency Standing Committee) Contingency Plan and EOC

(i) IASC including UN organizations, INGO, NGOs and various government agencies as a platform for coordination should be set-up and strengthened. It would strengthen the existing systems. It is required for effective planning, coordination and execution over the issues pertaining to DRR, disaster preparedness and response. IASC would also promote sharing of best practices, tools & techniques and different types of resources among the stakeholder organizations for enhance solution exchange among stakeholders.

(ii) The goal of EOC is to strengthen the region's capacity for disaster management through the adaption and integration of the Incident Command System (ICS) and other components of the U.S National Incident Management System (NIMS) into national and regional disaster system. Establishment of EOC in March 2013, by the support of Japan ASEAN Integration Fund (JAIF). Technical assistances are providing from four pilot countries (Brunei, Indonesia, Philippines and Thailand) as well as support to the ASEAN Coordination Centre for Humanitarian Assistance on disaster management (AHA Centre).

(iii)To become more effective EOC, we have many challenges like these: GIS technology, more detailed country information for making country map, video conferencing system for coordination mechanism. In addition, Emergency Relief Headquarter Control Room needs and should equip with Phoenix System which provides the latest information on disaster damage. And also need a cooperative organization staff room which is used by staff who deals with Defence Forces, the police, fire-fighting authorities, lifeline companies and other entities involved in damage prevention when a disaster occurs.

5. CONCLUSION

The Republic of the Union of Myanmar is striving for peaceful, modern and developed nation. Although current status of Emergency Response System in Myanmar has some weakness by viewing foregoing discussions, national government is carried out to improve disaster management for disaster risk reduction by revising Myanmar Action Plan on Disaster Risk Reduction (MAPDRR) and by re-enacting Disaster Management Law. But these plans are needed to carry out practically by cooperating national government and other non-government organizations. If we must add and apply the best facts from numerous effective models and system on the world like Japan and other disaster leader countries to improve our disaster management system, Disaster Management Mechanism of Myanmar must more and more enhance in future. If so, we must create a system which saves lives and reduces losses at the minimum possible cost.

REFERENCES

1. United Nations, International Strategy of Disaster Reduction, UN ISDR's Terminology Disaster Risk Reduction, 2009.

2. Cabinet Office in Japan: Disaster Management System in Japan, February 2011

3. KAZUSA, Shuhei : Director for Disaster Management, Cabinet office, Government of Japan: Disaster Management System of Japan

4. www.jma.go.jp: Earthquake Early Warning System and Tsunami Advisory/ Warning, Weather Forecasting and Warning System

5. Rajaram Panda*, Vol 6. No.1, January 2012: Japan's Disaster Response Management: Lessons for the world.

6. Emin NAZAROV, Crisis Management Center, Ministry of Emergency Situations of the Republic of Azerbaijan: Asian Disaster Reduction Center (ADRC), Visiting Researcher Program FY2011A, EMERGENCY RESPONSE MANAGEMENT IN JAPAN

7. Hyogo Disaster Management Center, Disaster Response Bureau, Disaster Management and Planning Bureau, Civil Policy Planning and Administration Department, Hyogo Prefectural Government, Japan.

8. Phoenix Disaster Management System, Disaster Management communication Office, Disaster Response Bureau, Disaster Management and Planning Bureau, Civil Policy Planning and Administration Department Hyogo Prefectural Government, Japan.

9. http://www.kantei.go.jp

10. www.familylinks.icrc.org

11. http://www.heritage.org/research/reports/2011/05/the-great-eastern-japan-earthquake-assessing-disaster-response-and-lessons-for-the-us

12. http://en.wikipedia.org/wiki/Aftermath_of_the_2011_T%C5%8Dhoku_earthquake_and_tsunami

13. http://www.city.natori.miyagi.jp/soshiki/soumu/311kiroku/index/gazou/tsunami

14. http://mceer.buffalo.edu/infoservice/disasters/Honshu-Japan-Earthquake-Tsunami-2011.asp

15. Arnold M. Howitt, Ph.D, Executive Director, The Roy and Lila Ash Center for Democratic Government and Innovation, and Faculty Co-Director, Program on Crisis leadership: The Tohoku Disaster: Responding to Japan's 3/11 Earthquake, Tsunami and Nuclear Accident

16. Upgrading of seismic network and Tsunami simulation for myanmar region By Zaw min, Department of meteorology and hydrology, Ministry of transport, Nay pyi taw- Myanmar

17. www.dmh.gov.mm Department of Meteorology and Hydrology in Myanmar

18. Myanmar Action Plan on Disaster Risk Reduction (MAPDRR) 2012: Relief and Resettlement Department, Ministry of Social Welfare, Relief and Resettlement

19. Disaster Management System in Myanmar: Relief and Resettlement Department, Ministry of Social Welfare, Relief and Resettlement

20. Disaster Management Law in Myanmar

21. http://www.aseanpostnargiskm.org/knowledge-base/lessons-learned/key-to-successful disaster-response

22. http://www.fsd.gov.mm/?view=firefightrecord

23. https://www.e-education.psu.edu/geog588/node/2139

24. http://www.myanmarredcrosssociety.org

25. Post Nargis Joint Assessment (PONJA) in Myanmar

26. Mission Report, World Meteorological organization (WMO) Fact Finding Mission to Myanmar, Yangon and Nay Pyi Taw, 13-9 February 2009.