

Taiwan earthquake

Situation

On 21 September 1999, at 1.47 a.m. local time, (20 September 1999, 5.47 p.m. GMT) a powerful earthquake hit the central region of Taiwan. The earthquake measured 7.6 on the Richter Scale with the epicentre situated at latitude 23.8 degrees north and longitude 121.1 degrees east, 150km south East of Taichung. Over the following days over 6300 aftershocks hit the region the strongest reached a magnitude 6.8 on Sunday, 26 September 1999.

Taiwan is a densely populated country of approximately 36,000 square kilometres and 22 million inhabitants. The earthquake struck Taiwan's central county of Nantou and affected the neighbouring counties of Yunlin, Changhua and Taichung heavily. Whereas the eastern part of Nantou County is a rural area with mountains of more than 3,000 metres altitude, the western part of the affected region is densely populated urban area.

The settlements in the affected area contain heavily reinforced concrete buildings of up to 15 floors. The quake and subsequent aftershocks caused the destruction of 10,984 structures and the partial collapse of 7563 buildings. Damage occurred mainly through pillar failure causing buildings to lean, topple or collapse into basements. Many of these structures had soft first floor construction used for car parking. The pillars being unsupported laterally are the weakest part of the structure and therefore the first to collapse. Initial investigations suggest this was due to faulty construction and subsequently several builders were either arrested or restricted from leaving Taiwan. Some columns were found to contain empty oil drums and rubble making them extremely susceptible to collapse under earthquake conditions.

The earthquake and subsequent aftershocks caused 2400 deaths, 6190 injuries and 100,000 homeless. Estimates at the cost were US\$6 billion. Residents concerned with further aftershocks refused to go back into their dwellings and therefore camped in tents in any available open spaces. Sporting ovals and vacant blocks of land became tent cities overnight.

In the following days, 35 International Search & Rescue teams from 14 countries arrived in Taiwan to assist with the rescue effort.

Similar to Turkey, this earthquake was very close to the surface. Siesmologists

by Mark O'Connor, Station Officer,
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estimate it to be 1.5km below ground. In 1935 Taiwan had a similar earthquake resulting in the loss of 3000 lives.

Taiwanese response

Taiwanese Emergency Management System

The overall responsibility for dealing with disasters lies with the National Fire Administration (NFA) under the Ministry of Interior. It was officially established in March 1995. NFA's operations fall into three main categories: fire prevention, disaster relief and emergency medical services. It not only deals with damage caused by fires, typhoons, earthquakes and other natural disasters, but is also responsible for dealing with chemical and nuclear emergencies, as well as major traffic accidents.

During times of disaster the administration sets up an emergency response centre, unites rescue teams, controls resources, and helps improve the government and public's ability to respond. The centre is located in Taipei. At provincial level coordination is ensured through county and city governments, which set up regional coordination centres.

Response to the earthquake of 21 September

Rescue and relief efforts responded quickly, aided significantly by a modern seismographic alert system established in 1996. Taiwan has approximately 1000 digital sensors spaced nearly every 3 km in metropolitan areas. This allows rapid calculation of location and magnitude of earthquakes and aftershocks. Once the information is processed it is distributed via email to scientists, emergency services and government agencies. This information also indicates shaking severity and level of damage likely to accompany such a quake.

Early in the morning of 21 September (5.30 a.m.), the Prime Minister of Taiwan released an instruction for disaster assistance and relief measures. According to this instruction ministries and other governmental entities were tasked with taking initial steps to activate the emergency response plan. The Ministry of Interior was tasked with activating the national and county emergency centres



Above, inset: The quake of September 21, and subsequent aftershocks, caused the destruction of 10,984 structures and the partial collapse of 7563 buildings.



On arrival, the Australian team accompanied the UNDAC team on a reconnaissance of the affected areas.

in Nantou, Yunlin, Changhua, and Taichung. The Ministry of Foreign Affairs was assigned to contact and to receive international disaster relief experts. The Taiwanese Ministry of Foreign Affairs had established a reception centre at the Taipei airport.

The first arriving international teams received an initial briefing and logistical support (vehicles). A guide with communications was assigned to accompany each foreign team to the area of operation. This provided a speedy response to the affected regions providing desperately needed assistance.

On 25 September 1999 an emergency order issued by the President of the Republic of China was released. A 6-month state of emergency was also proposed all over the island. The powers allow the government to use troops to conduct evacuations, provide relief and prioritise budgets without regard to existing laws on property, freedom of movement or parliamentary process. The laws have only been used 3 times in Taiwan's history.

The decree is aimed to:

- raise money by issuing Government bonds for reconstruction, irrespective of legal restrictions for these types of bonds
- extend long term loans to people affected by the earthquake
- settle displaced people by reconstructing levelled apartments regardless of current regulations concerning urban planning
- commandeer water resources, private estates, vehicles, aircraft, and vessels for relief purposes to cut down on bureaucratic red tape

- cordon off and evacuate disaster areas, by force if necessary, to speed up the relief effort and prevent the outbreak of disease

The United Nations Disaster and Coordination (UNDAC) team

Team composition

Rudolf Mueller, OCHA Geneva, Team Leader
 Veronique Galeazzi, OCHA Geneva
 Lennart Sorensen, Denmark
 Simo Wecksten, Finland
 Alf Berton Kiil, Norway
 Nils Andreasson, Sweden
 Chuck Mills, USA
 Duey Perks, USA
 Robert Haynes, USA
 Joey Bishop, USA
 Gary Littlewood, Australia
 David Kemp, Australia
 Mark O'Connor, Australia
 Wayne Staples, Australia
 Martin van der Sanden, Australia

Terms of reference

On behalf of the International Search and Rescue Advisory Group (INSARAG), a 6-person United Nations Disaster Assessment and Coordination (UNDAC) team was deployed to Taiwan.

Their role was to assist in setting up a Reception Centre for incoming SAR Teams, assess the level of damage and level of support & aid required, and operate an On-Site Operations and Coordination Centre (OSOCC) for the effective integration and utilisation of international SAR assets.

UNDAC Plan of Action

UNDAC Plan of Action must take into account:

- situation
- mission objectives
- in country counterparts (UN resident coordination)
- team organisation
- program of work
- logistics & resources
- mission support
- communications
- safety & security

Upon arrival at the Taipei international airport on Wednesday 22 September 1999 at 6 p.m., representatives of the Ministry of Foreign Affairs (MOFA) met the UNDAC team.

The MOFA had established a reception centre for international teams at the airport. Therefore it was decided not to create an additional structure. Several international teams arrived in Taiwan and did not report to the reception centre. These teams were operating on their own with no liaison or coordination from the Taiwanese.

To support in the coordination of foreign teams the rest of the UNDAC team were deployed to the affected areas. It was planned to either assign liaison officers to the county emergency response centres or establish sub-OSOCCs. This was not required due to the implementation of the County Emergency Response Centres.

To register all outgoing teams and collect information on lessons learnt, a Departure Centre was established on 25 September 1999 at the VIP Lounge at Taipei airport.

Liaison officers at the Taipei Emergency Response Centre

After a briefing at the Taipei Emergency Response Centre it was decided to assign 2 liaison officers from the UNDAC team to the centre to follow the situation, assist with the coordination of international teams and collect information to be included into the daily UNDAC Field Situation Report.

Reconnaissance/Liaison to County emergency centres

Over several days the UN team visited the worst affected Counties. An initial role was to locate any international teams that had not passed through the reception centre, and obtain details from them. The team also visited several regional command centres, observing their setup and operating structure.

Establishment of a Departure Centre

The Departure Centre was established at the Taipei international airport at the MOFA VIP Lounge on Saturday, 25 September 1999. This was manned by

Australian and American team members. A list of departing teams flight schedules was provided and regular surveillance of the departure lounges was carried out to locate teams not registered. The Departure Centre was to register the outgoing teams, receive data on their accomplishments, level of training and equipment, and comments (lessons learnt) about the mission.

Australia's role

In the days following the earthquake of 21st September, Emergency Management Australia (EMA) requested individual States nominate personnel for possible deployment.

On Thursday 23rd September the following Officers were selected as part of the United Nations Disaster Assessment & Coordination (UNDAC) Team:

Gary Littlewood *Qld Fire & Rescue;*

David Kemp *SA Fire Service;*

Mark O'Connor *Melb. Fire & Emergency Service;*

Wayne Staples *NSW Fire Brigade;*

Martin van der Sanden *ACT Fire Brigade.*

Information was also collected for EMA and the Urban Search and Rescue (USAR) National Steering Committee.

The Australian team met with Mr Rudolf Muller (UNDAC) and his team in Taichung City. Mr Muller conducted the briefing, and gave a situational report consisting of:

- areas affected
- damage sustained
- emergency management arrangements
- international Search & Rescue teams and their locations
- local emergency services
- roles of the UN team

The role of the Australians as part of the UNDAC team was of assessment and coordination, to collect data from the International Search & Rescue teams for the UN's report and to set up a departure lounge. The initial role of setting up On-Site Operational Command Centres (OSOCCs) changed due to the efficiency of Taiwan's National Fire Administration (NFA) in setting up a command structure. Therefore the expected workload assigned to the Australian contingent did not materialise. The Taiwanese Emergency Management arrangements are similar to Australia's however their emergency services lacked the skills and specialised equipment to deal with structure collapse.

Mr. Muller pointed out that previously, (eg Turkey) the UNDAC has been short staffed and they had no intention of being in that situation again. Mr. Muller requested we accompany the UNDAC team on a

reconnaissance of the affected areas and then requested we provide assistance in establishing the departure centre for all outgoing rescue teams. This was scheduled to begin the following days in Taipei.

After the briefing the team traveled to Dingshr in Taichung County where we observed and spoke with the Russian and Japanese teams. An interesting observation while traveling through the streets was the random collapse of structures. Perhaps one or two buildings in a street had suffered major structural damage whilst the others were relatively intact.

We then travelled to Dali in Taichung County and spoke with the Singapore Civil Defence team. The following day the team travelled to Nantou County and visited Nantou City. During our visit we spoke to the combined Swiss, German and Austrian team then proceeded to Nantou Emergency Command Centre and spoke to the Korean team.

Over the 2 days a driver and a represen-

tative accompanied us from the Ministry of Foreign Affairs. Without this support we would not have been able to function due to language problems.

Having completed the reconnaissance we returned to Taipei to assist the United States Team establish and run the departure centre at the Taipei International Airport.

The mission for the Australian contingent was to be of 7-10 days duration. Due to the rescue phase concluding on Saturday 26 September, the International teams began leaving the Country earlier than expected. Once the departure centre was closed the Australian contingent left Taiwan and arrived back in Australia on Thursday 30 September 1999.

The 5 Australians worked closely with the Americans in setting up and running the departure centre. Although the hours were long and sometimes boring, the information obtained will be extremely useful for future UN and USAR deployments.



While traveling through the streets, the teams observed the random collapse of structures. Perhaps one or two buildings in a street had suffered major structural damage whilst the others were relatively intact.

International SAR Teams

International Teams deployed

In total, 35 international SAR and medical detachments were deployed to assist Taiwan in its relief efforts. 681 relief workers with 95 dogs came from abroad. The first team arrived in Taiwan at 19:20 on 21 September 1999.

Teams came from: Japan, Korea, Germany, United Kingdom, Turkey, United States, Canada, Russian Federation, France, Switzerland, Singapore, Czech Republic, Austria, Spain.

The largest team came from Japan. It consisted of 135 Search & Rescue personnel, 19 dogs & 10 medical personnel.

The Swiss, German and Austrian contingents combined their resources and provided a combined team.

The USA was certainly the best funded and equipped team. Their 93-person team arrived on a C5 galaxy at a cost of US\$8000 per hour. Total flying costs, return to Washington US\$288000. Cost of mission US\$2.2 million.

The larger and better-equipped teams brought their own transportation, ranging from 4WD's to semi-trailers. Teams without their own transport relied on hire vehicles

or government provided vehicles.

Several of the teams performed rescues during their mission. These were well documented by the international media. As with most large disasters the majority of injured and lightly trapped victims were rescued by passers-by or local emergency services. Once the mission changed from a rescue role to that of body recovery many of the teams began departing as they consider body recovery not to be one of their roles.

Conclusions

The International response to the Taiwanese earthquake once again proved that support is available for any disaster around the globe. Teams with millions of dollars of equipment and volunteer groups with only hand-tools made themselves available to assist the Taiwanese people.

Australia is fortunate that we haven't yet suffered large losses of life from disasters. Our geographic isolation means that the nearest USAR taskforce outside of Australia is at least 24 hours away. Therefore we must ensure our emergency services are prepared.

From observing the International teams working in Taiwan, Australia currently has

the equipment and skills to deal with a small-scale disaster in Australia. Transportation, logistical support, legislation and funding are the main issues the group highlighted. Should a large-scale disaster hit Australia, then the ability to handle and support several hundred search and rescue personnel arriving on short notice will also need to be addressed.

The Taiwanese were extremely grateful for all the assistance received. Many families lost everything including loved ones yet they still stopped their motor-bikes in the middle of the street to say thank you for coming to help them. It was certainly a humbling experience.

List of Acronyms

UNDAC United Nations Disaster Assessment and Coordination
INSARAG International Search and Rescue Advisory Group
SAR Search & Rescue
OSOCC On-Site Operations and Coordination Centre
NFA National Fire Administration
OCHA Office of Coordination and Humanitarian Affairs Geneva
USAR Urban Search and Rescue

New Books

Natural Disaster Management

A presentation to commemorate the International Decade for Natural Disaster Reduction (IDNDR) 1990-2000

Edited by Jon Ingleton.

Published by Tudor Rose, Leicester 1999

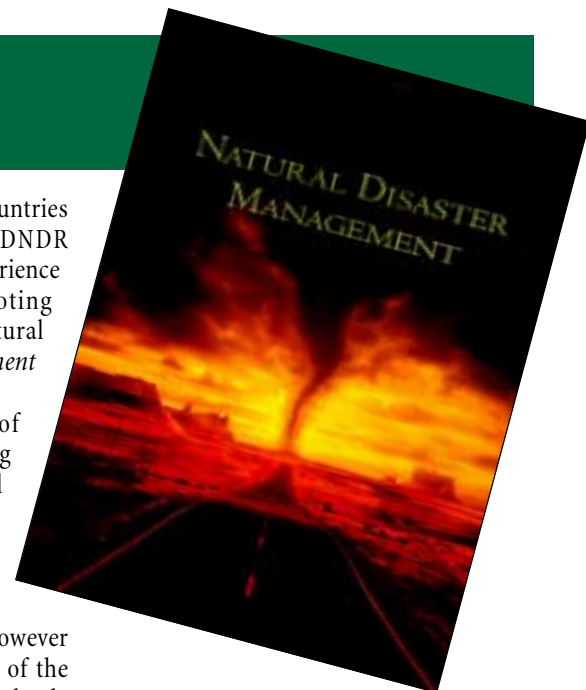
In 1989 the United Nations General Assembly proclaimed the 1990's to be the International Decade for Natural Disaster Reduction (IDNDR). Nations of the world together with UN Agencies such as UNESCO, WMO and the World Bank collectively pledged to combine resources, expertise and skills in pursuit of a greater understanding of natural hazards and their impact on communities and the environments on which these communities depend. Partnerships were forged among scientists, academics, industry and national bureaucracies at all levels, to work cooperatively towards the common goals of sustainable development and management of hazards to ensure a safer world more resilient to the impact of natural hazards and disasters.

As the decade drew to a close researchers,

practitioners and experts from 32 countries who had actively participated in IDNDR collaboratively shared the global experience of understanding and promoting preparedness and mitigation for natural hazards in *Natural Disaster Management* (NDM) edited by Jon Ingleton.

NDM encompasses all aspects of natural disaster management, ranging from an explanation of individual hazards to socio-political consequences of individual events and to some extent future global challenges. The broad focus of this publication means that no one topic is dealt with in depth however it does provide a sweeping overview of the decade and the achievements. NDM is clearly set out in 18 sections and includes 103 individual relatively short and concise contributions. The common thread throughout the diversity of topics is the human perspective this means that the focus remains fixed on the impact of natural hazards on the human populations and the systems that support them. Contributors to NDM are from diverse backgrounds and offer such a broad range of experience and expertise and writing styles that is rarely seen in a single publication.

The welcome dedication for this official



presentation to commemorate IDNDR is provided by Kofi Annan the Secretary General to the United Nations and statements and messages of commitment and support are provided from Bill Clinton, President USA; Godwin Obasi, Secretary General WMO; Frederico Mayor, Director General UNESCO; Fernando Henrique Cardoso, President of the Federative Republic of Brazil; John Howard, Prime Minister of Australia; Jenny Shipley, Prime Minister, New Zealand; P.J. Patterson, Prime

New Books (contd...)

Minister of Jamaica; Paavo Lipponen, Prime Minister Finland; Hubert Ingraham, Prime Minister Commonwealth of the Bahamas; Viktor Klima Federal Chancellor Republic of Austria and Robert Mugabe President Republic of Zimbabwe. All acknowledge the progress and benefits acquired during the decade.

NDM begins with an outline and description of the financial, social and physical impact of disaster. These are considered in the global context and discuss past and likely future trends considering possible impacts of future climates. Terry Jeggle of the IDNDR secretariat then clearly sets out and reflects on the stated goals and aims of the decade as being:

- to improve the capacity of each country to mitigate the effects of natural disasters, in the assessment of disaster damage potential, and in the establishment of early warning systems and disaster resistant capabilities
- to devise appropriate guidelines and strategies for applying existing scientific and technical knowledge
- to disseminate existing and new technical information
- to develop measures for the assessment, production, prevention and mitigation of natural disasters through programs of technical assistance and technology transfer, education and training, and to evaluate the effectiveness of programs.

James Bruce of the IDNDR Scientific and Technical Committee then reflects on the lessons of the decade in terms of the link between disaster loss mitigation and sustainable development. These early chapters effectively set the context and framework for all following chapters.

The full range of hydrometeorological, seismic, geological and physical hazards are detailed and described, affording the reader a good understanding of the parameters of natural phenomena. Papers are short and are not bogged down with technical detail. All are written in the context of impact on human populations and contain interesting examples and illustrations. Environmental and technological hazards are also discussed and an interesting perspective on future hazards, in particular the impact of El Nino, is provided by Michael Glantz of NCAR. Social and community vulnerability to natural hazards is a recurring theme throughout NDM. Several of the papers directly address these issues with examples and case studies being drawn from the Caribbean, the South Pacific Island Nations, Asia and Australia. Ian Davis and Nick Bell of the UK analyse risk perception and offer some thought

provoking insights into community based vulnerability measures. Risk assessment was long considered as the process of simply defining the likelihood of a hazard occurring at a particular time, location and magnitude. In more recent times however quantifying the consequence of such an event and estimating the impact on the population and societal structures has been deemed to be of increasing importance. This paradigm shift is reflected in many of the papers.

One of the aims of IDNDR was to facilitate the development and production of effective forecasting, monitoring and early warning systems and technology transfer. In his keynote paper James Purdom of NOAA outlines the progress toward this end throughout the decade. Other papers demonstrate how the benefits of improved technology is being communicated to human populations in terms of effective warning and hazard response systems.

The need for efficient emergency management strategies to be in place was highlighted throughout IDNDR. Timely, appropriate, well-organised emergency management processes are recognised as being essential in time of hazard impact in order to preserve and maintain infrastructure, the health and well being of the affected population and to minimise the loss of life and enhance recovery processes. The benefits of an informed community participating in the emergency management process are convincingly illustrated in case studies from Jamaica and Turkey and Boris Porfiriev's moving account of Russia's Neftegorsk earthquake explains by example the need for efficient response and communications mechanisms.

Several of the contributions acknowledge an appreciation of the role of traditional mitigation, warning and hazard response practices and systems. Dr Chan Weng describes the effectiveness of traditional housing styles in Malaysia in mitigating against flood loss and traditional rice farming in paddy fields as a flood reduction technique. Joseph Chung of UNDP presents a strong argument for incorporating traditional lifestyle practices at all levels of the disaster management process from mitigation through to coping with recovery.

Information acquisition and sharing is essential for effectively reducing the risk stemming from natural disasters. One of the great achievements of IDNDR has been the raising of hazard awareness this has largely been achieved by the sharing of knowledge and information of past events and experiences at all stages of the disaster management cycle. Juha Uitto of UNU Japan emphasises the importance of delivering appropriate,

timely information at all stages of the disaster cycle to reduce human vulnerability of people and groups and stresses that information is power. Equity and inclusiveness are discussed as key issues in information dissemination and exchange and it is argued that this should encompass relationships between countries as well as between different groups and individuals within a country. The role of journalists is also openly explored, as are the emerging opportunities for taking advantage of the growing global electronic information networks.

A key theme throughout NDM is effective disaster management within the context of sustainable development. IDNDR's aim of ensuring a safer world in the future can only be achieved with commitment at all political and socio-economic levels within a nation this is overwhelmingly acknowledged by NDM contributors. South Africa's Ailsa Holloway presents a persuasive picture of Africa as being always risk prone but not always disaster affected due to chronic problems created by non-sustainable development practices.

Throughout NDM key achievements of the decade are detailed, discussed and assessed and in the final chapters these are summarised. To a lesser extent some future directions—'where to from here'—are explored however the publication is generally reflective. Ingletons aim in producing NDM was to provide the opportunity to share global experiences and promote preparedness and mitigation. By doing this he hoped to improve the ability of individuals, groups and nations to foresee and mitigate the negative effects of natural hazards. I believe he has been successful in this endeavor, he has brought together a richly diverse group of experts who have provided a comprehensive summary of the key issues arising from IDNDR in a single publication that is interesting and very 'readable'. This publication will be useful to anyone interested or involved in emergency and disaster management—including students, practitioners, bureaucrats, politicians, academics, and individuals involved in insurance, telecommunications and remote sensing.

NDM is beautifully presented and is an excellent coffee table book. It will be a valuable resource in both personal and public libraries however at \$US120 for the hard copy version and \$US72 for the soft copy it is very expensive and this may limit its appeal.

Reviewed by Linda Anderson-Berry
JCU Centre for Disaster Studies.

For more information, visit the website at www.ndm.co.uk