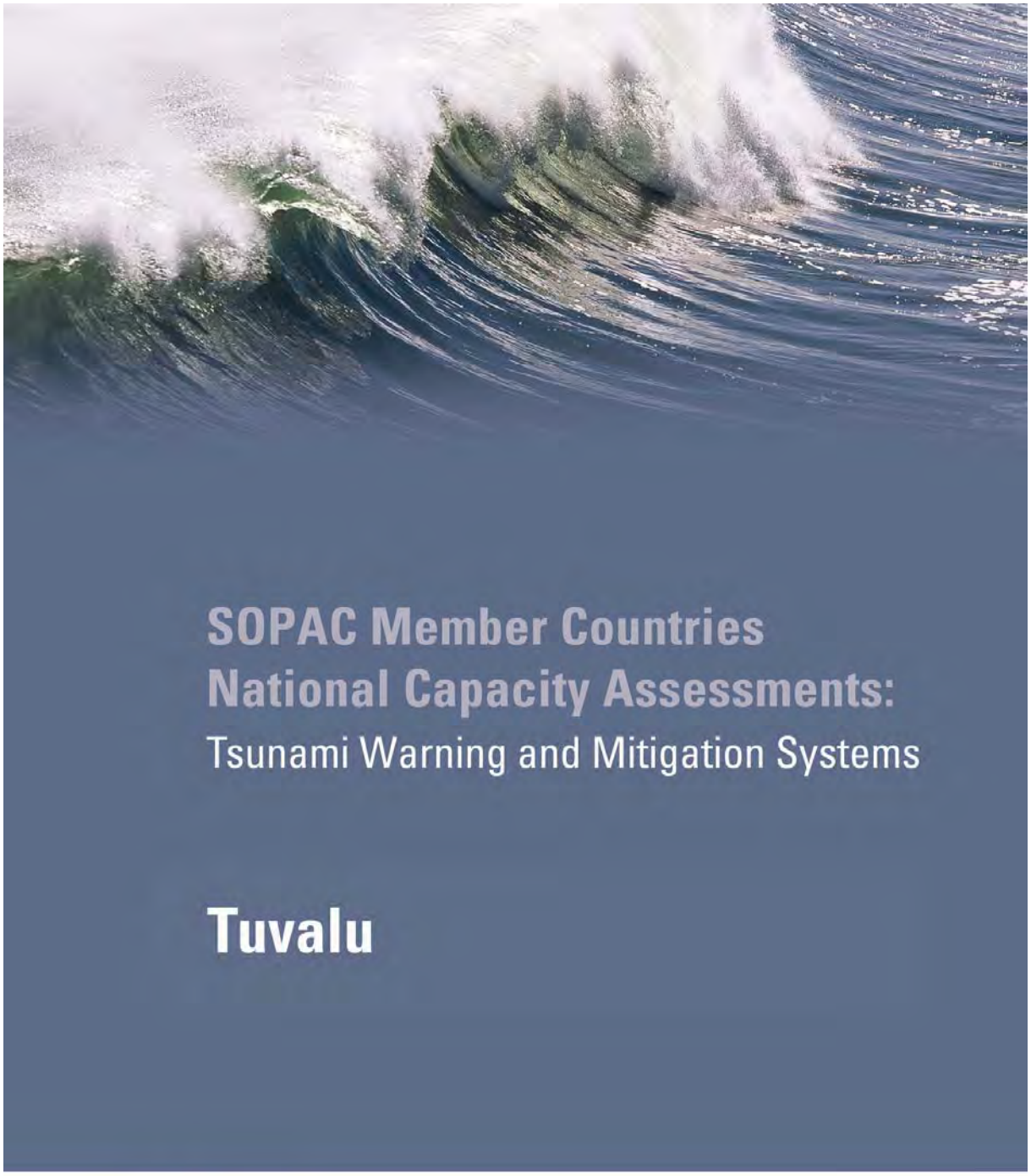


SOPAC Member Countries National Capacity Assessments:

Tsunami Warning and Mitigation Systems

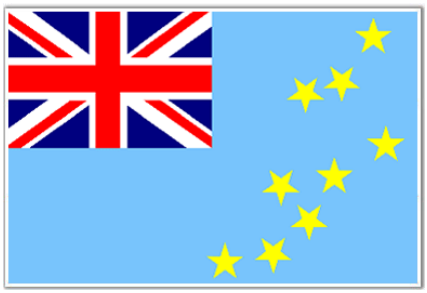
Tuvalu

Tuvalu

AUSTRALIA

SOPAC

SOPAC Member Countries National Capacity Assessments: Tsunami Warning and Mitigation Systems



Tuvalu, Funafuti,

26 June - 01 July 2009

Australian Government
AusAID

Australian Government
Bureau of Meteorology

Australian Government
Attorney-General's Department

SOPAC

Document Control

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Table of Contents

Acronyms

Acronym	Meaning
ATWS	Australian Tsunami Warning System
AusAID	Australian Agency for International Development
Bureau	Australian Bureau of Meteorology
CAEP	Community Awareness and Education Programme (Tuvalu)
cGPS	Continuous Global Positioning System
D	Document (e.g. Document 39 = D39)
DFAT	Australian Department of Foreign Affairs and Trade
DPMA	Disaster Preparedness & Mitigation Assessment (US army)
DREF	Disaster Relief Emergency Fund
EMA	Emergency Management Australia (now defunct)
EMWIN	Emergency Managers Weather Information Network
ERT	Emergency Response Team
FM	Frequency Modulated
FSPI	Foundation for the people of the South Pacific International
GA	Geoscience Australia
GAO	Government Administrative Orders (Tuvalu)
GEMS	Global Environmental Modelling Systems Pty Ltd (Australia)
GMDSS	Global Maritime Distress and Safety System
GTS	Global Telecommunications System
GSN	Global Seismic Network
HF	High Frequency
ICG	Intergovernmental Coordination Group
IDC	Island Disaster Committee (Tuvalu)
IFRC	International Federation of Red Cross
IOC#	Intergovernmental Oceanographic Commission#
IOC	Island Operations Centre (Tuvalu)
ISDR	International Strategy for Disaster Reduction
ISO	International Organisation for Standardisation
ITIC	International Tsunami Information Centre
ITSU	ICG for the Tsunami Warning System in the Pacific
MET	Meteorological Services (Tuvalu)
MoU	Memorandum of Understanding
NCC	National Coordination Centre (Tuvalu)
NDA	National Disaster Act 2008 (Tuvalu)
NDC	National Disaster Committee (Tuvalu)
NDMO	National Disaster Management Office (Tuvalu)
NDMP	National Disaster Management Plan (Tuvalu)
NDP	National Disaster Plan
NDPWG	National Disaster Preparedness Working Group (Tuvalu)
NGO	Non-Government Organisations
NTC	National Tidal Centre (BOM)
OPM	Office of Prime Minister
PDC	Pacific Disaster Centre
PGSP	Pacific Governance Support Programme

Acronyms (Continued)

Acronym	Meaning
PICs	Pacific Island Countries
PTWC	Pacific Tsunami Warning Centre
PTWS	Pacific Tsunami Warning and Mitigation System
PWD	Public Works Department
RANET	Radio and Internet for the Communication of Hydro-Meteorological Information for Rural Development
SAR	Search and Rescue
SG	Secretary to Government (Tuvalu)
SMS	Short Message Service
SOPAC	Pacific Islands Applied Geoscience Commission
SOPs	Standard Operating Procedures
SPDRP	South Pacific Disaster Reduction Programme
SPSLCMP	South Pacific Sea Level and Climate Monitoring Project
TANGO	Tuvalu Association of Non Government Organisations
TNCW	Tuvalu National Council of Women
TMS	Tuvalu Meteorology Service
TNTP	Tuvalu National Tsunami Plan
TRC	Tuvalu Red Cross
TTC	Tuvalu Telecommunications Corporation
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
USP	University of the South Pacific
USGS	United States Geological Survey
UTC	Coordinated Universal Time
VHF	Very High Frequency
VSAT	Very Small Aperture Terminal
WMO	World Meteorological Organisation

1. Results Outline

1. Results Outline

1.1. Executive Summary

The National Capacity Assessment of Pacific Islands Applied Geoscience Commission (SOPAC) Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to receive, communicate and respond effectively to tsunami warnings. The Tsunami Capacity Assessment of the ability of Tuvalu to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 26 June – 01 July 2009 in Funafuti, Tuvalu.

The workshop was facilitated by a team of visiting experts and attended by some 28 Tuvalu Government agency representatives, Non-Government Organisations (NGOs), international organisations and the private sector to discuss key areas of tsunami warning and mitigation in Tuvalu by completing a comprehensive questionnaire in session, presentations and site visits.

As well as outlining Tuvalu's current status, strengths and opportunities for improvement with regard to tsunami warning and mitigation, a list of recommendations were formulated by the visiting assessment team in consultation with national participants. The aim of these recommendations is to guide further capacity development programs to target improvements in Tuvalu's tsunami warning and mitigation system.

The local threat sources for the Tuvalu are the South Solomon's Trench, New Hebrides, Tonga, Papua, Philippine and Mariana Trenches . Long distance sources including the Kiril Islands and the South American trenches, Peru and Chile can also impact these Islands.

Warne (2009), notes that the sea-level gauge at Funafuti has been installed on the inside of the atoll and that this can result in some damping of the signal from any tsunami. The islands are regularly subject to inundation during King Tides and these have devastating effects on the densely populated (Approximately 420 person/km^2) nation.

Warne (2009) also notes that there are reports that a surge possibly seismically generated, but more likely a King Tide or meteorological event, occurred at 3:00 on the 17th April 2007. While the event may have been highly localised it raises the question of the sensitivity of the measurement, and the damaging sea-level events by the enclosed atoll. All observations of tsunami have been <10cm, despite variability in the observed amplitude at nearby sites like Majuro. This would indicate that while most events will be detected, the information from this site cannot be correlated directly with impact on humans or infrastructure.

The Tuvalu National Disaster Act 2008 (NDA) covers the issue of tsunami warnings and the draft National Tsunami Plan (NDP) that identifies the Tuvalu Meteorological Service as the lead agency for issuing of tsunami warnings. These all provide a sound foundation for the enhancement of the tsunami warning and disaster management system.

The visiting team and workshop participants concluded that there were a large number of very high priority tasks to be addressed. However, the highest priority and a significant first step towards enhancing the tsunami warning and disaster management system, is to review and finalise the National Disaster Plan (NDP) as required under the National Disaster Act (2008).

The visiting team also noted that Tuvalu should be congratulated on their proactive and committed approach to improving disaster management arrangements.

Participants in the workshop stated a number of urgent priority areas that need to be addressed and these are presented in Table 2 below.

The Tuvalu workshop participants are encouraged to use this National Tsunami Capacity Assessment report to guide both national projects and aid funded projects to achieve targeted improvements on the Tuvalu tsunami warning and mitigation system. In turn, this will assist in improving systems for other natural hazards such as earthquakes and cyclones.

Contingent on the availability of human and financial resources, the Australian Bureau of Meteorology (Bureau) and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done in the hope of further capacity development projects being undertaken.

1.2. Recommendations (including priority and resource intensity)

Table 2 outlines the priority and resource intensity for recommendations made to improve Tuvalu's tsunami and mitigation system. Both the priority and resource intensity are based on the consensus of the visiting Tsunami Capacity Assessment team after discussions held within the Tsunami Capacity Assessment Workshop. It is recognised that these rankings may not reflect the opinions of all individuals involved in the workshop as priorities vary depending on personal responsibilities and areas of interest. Each recommendation is important in its own right to achieve holistic improvements in Tuvalu's tsunami warning and mitigation system.

The priority ranking and resource intensity scale used as a basis for allocating a priority and resource intensity to each recommendation is explained in Table 1. The Very High priority recommendations should be seriously considered as requiring urgent completion. Low resource intensity recommendations are considered the 'low-hanging fruit' that are achievable with very few additional resources.

Table 1: Priority ranking and resource intensity scale

PRIORITY	RESOURCE INTENSITY
Very High	**Low –** Recommendation currently being progressed or could possibly be progressed within the capacity of existing in-country resources (funds and staff).
High	**Medium –** Recommendation could be progressed by existing staff or with a low to moderate number of additional staff and/or expertise and a moderate level of additional in-country funds. May or may not require external funding.
Medium	**High –** Recommendation would require a high level of additional staff and/or expertise and funds. External funding support is likely to be required.
Low	**Very High –** Recommendation would require a very high level of additional staff and funds. External funding support will be required.

Table 2: Priority and anticipated resource intensity for completion of recommendations made for improving Tuvalu's tsunami warning and mitigation system.

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Review and finalise the National Disaster Plan. Include as annexes, the completed Tuvalu National Tsunami Plan and the plans of the member agencies of the National Disaster Preparedness Working Group, as required under the National Disaster Act (2008).	Low	Governance and Coordination	Multi-hazard	1
Very High	Widely distribute and promote the National Disaster Plan through the National Disaster Preparedness Working Group and the Island Disaster Committees to key stakeholders.	Low	Governance and Coordination	Multi-hazard	2
Very High	Review the current arrangements between Pacific Tsunami Weather Centre (PTWC) and Tuvalu Meteorological Services to ascertain and clarify the services that are available.	Low	Regional and International Coordination	Tsunami specific	5
Very High	Integration of community-based warning systems into island tsunami plan using existing infrastructure such as church bells	Low	Communications	Multi-hazard	13
Very High	PTWC send SMS warnings to Director (or designate), Tuvalu Meteorological Service and the Disaster Coordinator, National Disaster Management Office (NDMO)	Low	Communications	Multi-hazard	14
Very High	NDMO give due consideration for the receipt of tsunami watch and warning alerts to be sent from the proposed re-commissioned NCC EMWIN, into the 24/7 Police office	Low	Communications	Tsunami specific	15

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Rapid adoption of the mobile network for the receipt of tsunami warnings provided by the PTWC – Director (or designate), Tuvalu Meteorological Service and the Disaster Coordinator, National Disaster Management Office (NDMO)	Medium	Tsunami Warning	Tsunami specific	10
Very High	Enhance the community-based awareness and education programs to ensure the appropriate response of the community to tsunami warnings.	Medium	Tsunami Emergency Response	Tsunami specific	18
Very High	Consolidate and coordinate under the National Disaster Preparedness Working Group (NDPWG), the education and awareness programs delivered by the education system, NGOs and Red Cross.	Medium	Public and Stakeholder Awareness and Education	Multi-hazard	24
Very High	Implement ongoing scheduled assessments (gap analysis), that establish the levels of community awareness. Use findings from the gap analysis to enhance program content and delivery.	Medium	Public and Stakeholder Awareness and Education	Multi-hazard	25
Very High	Provide additional staffing (Deputy Disaster Co-ordinator) and an appropriate resourcing level to meet the responsibilities articulated under the National Disaster Act (2008) and the National Disaster Plan.	High	Governance and Coordination	Multi-hazard	3
Very High	Develop, implement and exercise (desktop and field-based) the outer island response plans including Standard Operating Procedures (SOPs).	High	Tsunami Emergency Response	Multi-hazard	19
Very High	Obtain, catalogue and appropriately archive all research data to current standards that has been undertaken by international and regional agencies/organisations.	High	Tsunami Hazard	Tsunami specific	21

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
Very High	Re-commission the EMWIN system in the National Coordination Centre to ensure a redundancy for receipt of warnings.	Very High	Tsunami Warning	Multi-hazard	11
Very High	Undertake risk assessments for all government development projects to the ISO 31000:2009 Risk Management Standard to mitigate identified risks.	Very High	Tsunami Hazard	Multi-hazard	23
High	To maximise the opportunities through current international and regional partnerships to strengthen Tuvalu's monitoring, warning, preparedness and response capabilities in relation to tsunami events.	Low	Regional and International Coordination	Tsunami specific	4
High	Relevant partners to provide appropriate training to the Tuvalu Meteorological Service that will enhance the maintenance and operational activities associated with monitoring equipment.	Low	Tsunami Monitoring Infrastructure	Multi-hazard	7
High	USGS to be approached to review and upgrade as required equipment and infrastructure for the seismic station.	Low	Tsunami Monitoring Infrastructure	Tsunami specific	8
High	BoM to be approached to review and upgrade as required equipment and infrastructure for the sea-level gauge.	Low	Tsunami Monitoring Infrastructure	Tsunami specific	9
High	Seek admission to UNESCO training programmes for media staff that have a multi-hazard focus on disaster preparedness and response.	Low	Tsunami Emergency Response	Multi-hazard	20
High	Develop a full set of Standard Operating Procedures (SOPs) for all agencies identified in the NDP and involved in disaster response.	Medium	Tsunami Emergency Response	Multi-hazard	16

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 4
High	Develop and implement a schedule of exercises (desktop and field-based) to evaluate and improve the response phases of National Disaster Plan.	High	Tsunami Emergency Response	Multi-hazard	17
Medium	TTC to formalise with Fiji TV an agreement to provide warnings through this media.	Low	Tsunami Warning	Multi-hazard	12
Medium	To request the international and regional organisations to improve current tsunami modelling using available research resources.	Low	Tsunami Hazard	Tsunami specific	22
Low	To identify current and relevant research in respect to tsunami modelling and pursue an active role contributing to this research.	Medium	Research Expertise	Tsunami specific	6

2. Project Background

2. Project Background

2.1. About the Project

The National Capacity Assessment of SOPAC Member Countries: Tsunami Warning and Mitigation Systems project aims to work in collaboration with the member countries of SOPAC to assess their capacity to prepare for, receive, communicate and respond effectively to tsunami warnings. The Australian Bureau is the lead implementing agency, in partnership with the Australian Attorney-General's Department (AGD), (formerly Emergency Management Australia (EMA)), SOPAC, and with the assistance of the Intergovernmental Oceanographic Commission (IOC) a division of the United Nations Educational, Scientific and Cultural Organization (UNESCO). The project is funded by the Australian Agency for International Development (AusAID) under the Pacific Governance Support Programme (PGSP). It is implemented under an agreement (Schedule 5 to the Record of Understanding 14304, June 2006) between AusAID and the Australian Bureau). The fourteen SOPAC member countries participating in the project are the Cook Islands, the Federated States of Micronesia, Fiji, Kiribati, the Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, the Solomon Islands, Tonga, Tuvalu and Vanuatu.

2.2. Broad Project Aim

By undertaking an assessment of the capacity of individual nations to manage tsunami events, the project aims to better guide donor funding towards achieving targeted improvements in the tsunami warning and mitigation systems in the respective countries.

2.3. Key Project Output

The key deliverable of the project is a comprehensive set of reports, including one National Report specific to each country, detailing the strengths and opportunities for improvement of the country with regard to tsunami warning and mitigation. The National Report for each country also includes recommendations to address priority issues. These reports will then feed into a consolidated Regional Report that will aim to identify common issues across the Region with regard to tsunami warnings and mitigation.

2.4. Project Methodology

National assessments in each SOPAC member country are conducted by visiting teams including experts in the fields of tsunami warnings, emergency management, disaster risk reduction and data and warning communications. The visiting team meets with in-country experts during a four-day workshop involving government agencies, the private sector, NGOs and regional and international organisations involved in tsunami and disaster risk management.
The workshop aims to complete a questionnaire covering all aspects of tsunami warning and mitigation and gather information to support questionnaire responses. This information then

feeds into the National Report. Consultation with individual countries before completion of the report is an integral part of the report writing process.

The questionnaire for the Pacific Island Countries (PICs) is a modified version of that used for the Indian Ocean equivalent project. The Indian Ocean questionnaire was jointly developed by UNESCO/IOC, SOPAC, the World Meteorological Organisation (WMO) and the International Strategy for Disaster Reduction (ISDR). Details of the Indian Ocean equivalent project can be found at http://ioc3.unesco.org/indotsunami/nationalassessments.htm

2.5. Underlying Policy Objectives of the Australian Tsunami Warning System Project

The Bureau in partnership with Geoscience Australia (GA) and AGD, has recently completed a four-year project to establish the Australian Tsunami Warning System (ATWS). One of the three policy objectives of the ATWS project was "To contribute to the facilitation of tsunami warnings for the South West Pacific" (DFAT, 2006). The Tsunami Capacity Assessment project and this report, contributes to the achievement of this policy objective. Also, as part of the implementation of the ATWS, Australia has and will continue to contribute to the facilitation of more effective tsunami advisory bulletins to PICs through the provision of seismic and sea level observations to the Pacific Tsunami Warning Centre (PTWC) in Hawaii.

2.6. Tsunami warnings in the Pacific

Tsunami messages for the Pacific Ocean are issued by the PTWC in Hawaii as the United States of America (USA) contribution to the Pacific Tsunami Warning and Mitigation System (PTWS). Individual countries are then responsible for using this advice to distribute national tsunami warnings to their communities. PTWC messages can be Tsunami Warnings, Tsunami Watches, Tsunami Advisories and Tsunami Information Bulletin/Statements. For the purpose of this report, products from the PTWC will be referred to generically as 'tsunami messages'.

A full definition of each PTWC product can be found at:
http://www.prh.noaa.gov/ptwc/about_messages.php

2.7. International Tsunami Forums

Under the auspices of the IOC, the ICG/PTWS (formerly known as ICG for the Tsunami Warning System in the Pacific (ITSU)) was first convened in 1968 (IOC, 2009). This is an international cooperative effort involving many IOC Member States of the Pacific Region. The ICG/PTWS meets regularly to review progress and coordinate activities resulting in improvements of the service (IOC, 2009).

The Working Group on Tsunami Warning and Mitigation in the Southwest Pacific Ocean was formed at the ICG/PTWS-XXI meeting in Melbourne in early May 2006 with the aim of enhancing tsunami warning and mitigation in the Southwest Pacific Ocean. The membership of the working group is composed of representatives from IOC Member States and other countries in the region (as members and observers). SOPAC provides secretariat support.

The Working Group is currently chaired by a representative of New Zealand, with vice-chairs from Fiji and Samoa.

The Working Group has a number of Terms of Reference and this project is directly relevant to the following Terms of Reference:

- To evaluate capabilities of countries in the Southwest Pacific Region for providing end-to-end tsunami warning and mitigation services;
- To ascertain requirements from countries in the Southwest Pacific Region for the tsunami warning and mitigation services;
- To facilitate capacity building and the sharing of tsunami information in the region;
- To support the further development of the virtual centre of expertise in a multi-hazards context within SOPAC in line with the Regional Early Warning Strategy; and
- To facilitate the inclusion of tsunami hazard and response information into curricula, and development and dissemination of education materials.

3. Country Background and the Tsunami Threat

3. Country Background and the Tsunami Threat

3.1. About Tuvalu

The following information has been extracted from the official Tuvalu website (http://www.tuvaluislands.com).

Tuvalu, pronounced "too-VAH-loo", (see Figs 1 and 2) is an independent constitutional monarchy in the southwest Pacific Ocean between latitudes 5 degrees and 11 degrees south and longitudes 176 degrees and 180 degrees east. Formerly known as the Ellice Islands, they separated from the Gilbert Islands after a referendum in 1975, and achieved independence from Great Britain on October 1, 1978. The population of 11,636 (est 2005) live on Tuvalu's nine atolls, which have a total land area of 10 square miles, or 27 square kilometres. This ranks Tuvalu as the fourth smallest country in the world, in terms of land area.

Funafuti, pronounced "foo-NAH-footi", is the capital of Tuvalu. Most administration offices are all located in Vaiaku Village on Fogafale (formerly spelled Fongafale) Islet, Funafuti atoll.

Ethnic Tuvaluans are Polynesian, and account for 94% of the population.

The flat islands seldom rise higher than 15 feet above sea level. Five of the islands, Funafuti, Nukufetau, Nukulaelae, Nui, and Nanumea are atolls. Large lagoons are enclosed within the coral reef. Many "artificial" lagoons are on the various islets of Funafuti, as the results of extracting material for the runway built during World War II. The remaining four islands are pinnacles of land rising up solid from the sea bed. Some have salt-water ponds on them, while Nanumea has a fresh-water pond, a rarity for atolls. Coconut palms cover most of the land

Tuvalu's small size and almost total lack of exploitable resources suggest that most of the population will remain dependent on subsistence activities for the foreseeable future. Subsistence farming and fishing are the primary economic activities. Subsistence crops are coconuts, taro, pandanus fruit, and bananas. Tuvaluan business is predominantly co-operative or communal, with each island having a co-operative store.

Tuvalu exports small quantities of copra, sells licenses to foreign ships wishing to fish for tuna in it 200 mile exclusive economic zone, and has a philatelic bureau for stamp collectors. The islands are too remote for development of a large-scale tourist industry and depends on remittances from expatriate Tuvaluans and external aid funds.

Most employment is in the government sector, but in recent years there has been an increasing number of private businesses developing, especially on Funafuti.

Imports consist mainly of food, petroleum products, construction materials and manufactured goods. Most imports are sourced from Fiji and Australia. The Australian dollar is legal tender in Tuvalu.

Radio Tuvalu is the only local radio station. It broadcasts 40 hours per week, in English and Tuvaluan. The government publishes the only newspaper, *Tuvalu Echoes*.

Funafuti Atoll has a regular telephone service, and there are connections to all the outer islands through the Post Offices. Communications with the outer islands is also available by radiophone. Full Internet services have been available since late 1999. The main roads of Funafuti are the only paved ones in Tuvalu, done in the late 1990's. The most popular

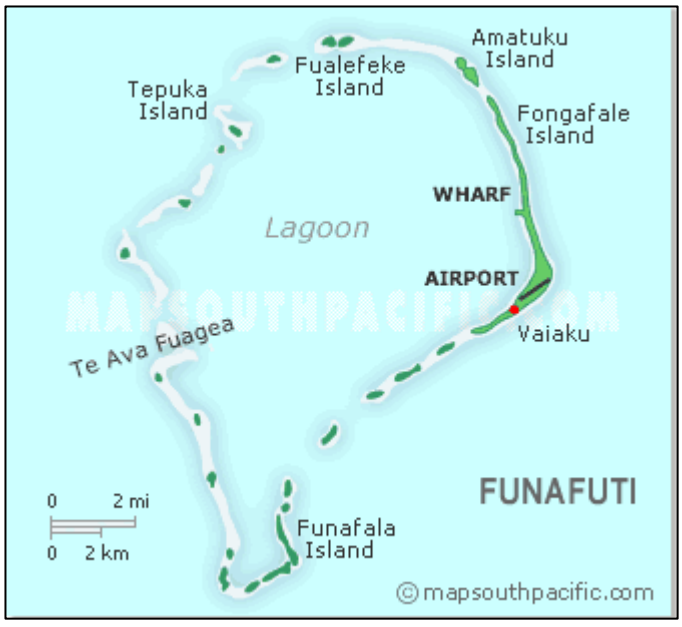
method of individual transport is the bicycle, followed by small motorcycles. There is one passenger/cargo vessel based at Funafuti, the M. V. Nivaga. It provides inter-island transport throughout the island group.

There are regular air services from Funafuti International Airport to Tarawa, Kiribati and Suva, Fiji.

Hot, tropical climate with very little seasonal variation; average temperature 30 degrees Celsius; heavy rainfall, averaging approximately 353.5 centimetres per year; and, very occasionally subject to hurricanes - severe cyclones struck in 1894, 1972 and 1990. The wettest season is November to February.

Fig 1a: Tuvalu (Source: www.maps-pacific.com)

Fig 1b: Funafuti Capital of Tuvalu (Source: www.mapsouthpacific.com)



3.2. Tsunami Threat Sources and Tsunami History in Tuvalu

An overview of potential tsunami threat sources in Tuvalu is outlined below. This information should be treated as general background and does not attempt to provide a comprehensive picture of tsunami hazard and vulnerability and associated risk for Tuvalu. Such a study is outside the scope of this project.

Thomas, Burbidge and Cummings, 2007 completed *A Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations*. Simulated scenarios for an 8.5 moment magnitude (Mw) and 9.0 Mw earthquakes were used to investigate normalised offshore (to a notional depth of 50 metres) wave amplitudes for tsunami caused by earthquakes along subduction zones (Refer to Figures 2a & b). For Mw 8.5 events Tuvalu was placed in Category 2 (normalised amplitude 25-75 cm) and for Mw 9.0 events Tuvalu was placed in Category 3 (normalised amplitude of 75-150 cm). In this study, Tuvalu's maximum amplitude for all Mw 9 tsunami would be 88cm with the most significant source region being New Hebrides (amplitude greater than 75cm at 50m depth or single most significant source region if no amplitude exceeds 75cm). For a Mw 8.5 tsunami Tuvalu's maximum amplitude would be 57cm with the most significant source region being the New Hebrides Trench to the south-west.

A further study completed by Thomas and Burbidge (2009) attempts to answer the question "which Pacific nations might experience offshore amplitudes large enough to potential result in hazardous inundation, what are the probabilities of experiencing these amplitudes and from which subduction zones might these tsunami originate". The hazard is greater in the southern islands of Tuvalu, with maximum amplitudes (2000 year return period) of up to 1.6 metres in Nukulaelae and around 1.0 to 1.2 metres in Nukufetau and Funafuti. At a return period of 100 years maximum amplitudes of 0.2 to 0.3 metres can be expected at all model output points in the region. The major source of hazard, the New Hebrides Trench, is oriented so as to direct most of the energy from a tsunami originating there toward the southern islands.

Investigation of the Bureau's deep ocean model-based tsunami prediction system conducted by Dr. Jane Warne in 2009 (ATWS Project Network Design Manager) demonstrated that the local threat source (Figure 2b) for Tuvalu is the New Hebrides Trench (see figure 3) to the south-west.

Warne (2009) also notes that other local threat sources are from the South Solomon's Trench (see figure 4), Tonga (see figure 5), New Guinea, Philippine and Mariana Trenches.

Travel times for tsunami from these sources vary but are typically between

- 2.5 to 3 hours from the New Hebrides Trench,
- 2 to 3.5 hours from the Tonga Trench
- 3 to 4.5 hours from the Solomon Trench,
- 6 to 10 hours from the New Guinea Trench
- 5.5 to 6 hours from the Mariana Trench
- 6 to 7 hours from the Philippine Trench

The times will vary to individual islands because of the distributed nature of the islands and atolls and the complexity of the sea-bed within the archipelagos.

The SOPAC/GA Tsunami Hazard & Risk Assessment Project, Inventory of Geospatial Data and Options for Tsunami Inundation & Risk Modelling, Tuvalu (Pearce 2008) notes that 'there are no active volcanos in Tuvalu, however the bathymetry does show areas where large landslides have occurred in the geological past that may have generated local tsunami. The period of records available is short compared to the recurrence interval of large events on the nearby trenches. More work could be done to collect paleo-seismic, paleo-tsunami information and oral history of tsunami in the region, e.g. Tonga, Kermadec and New Hebrides and Solomon Islands Trenches. This could assist with estimates of probabilities of tsunami events associated with critical regional sources for Tuvalu'.

Pearce (2008) also notes that 'the largest tsunami event recorded by the Funafuti sea level gauge was 10 cm from an event in 1997 with a source near Santa Cruz Islands in the Solomon Islands ... Even with the gauge in the lagoon at Funafuti, readings for small tsunami will be difficult to distinguish from background wave activity and seiching in the lagoon.

Since all the nine islands of Tuvalu are low lying atolls and reef islands, the lack of any high ground may appear to make these islands especially vulnerable to tsunami. On the other hand, because such atolls often have steep drop-offs in which ocean depths increase very rapidly with distance from the fringing reef, there may not be a pronounced shoaling effect (Thomas *et al*. 2007). However, even relatively small tsunami, when timed with high tides may have a significant impact on communities on low lying atolls.

Figure 2a: The subduction zones (in orange) of the Pacific Ocean

Figure 2b: The location of Tuvalu and other Pacific Island Countries in relation to regional and local subduction zones (in orange)

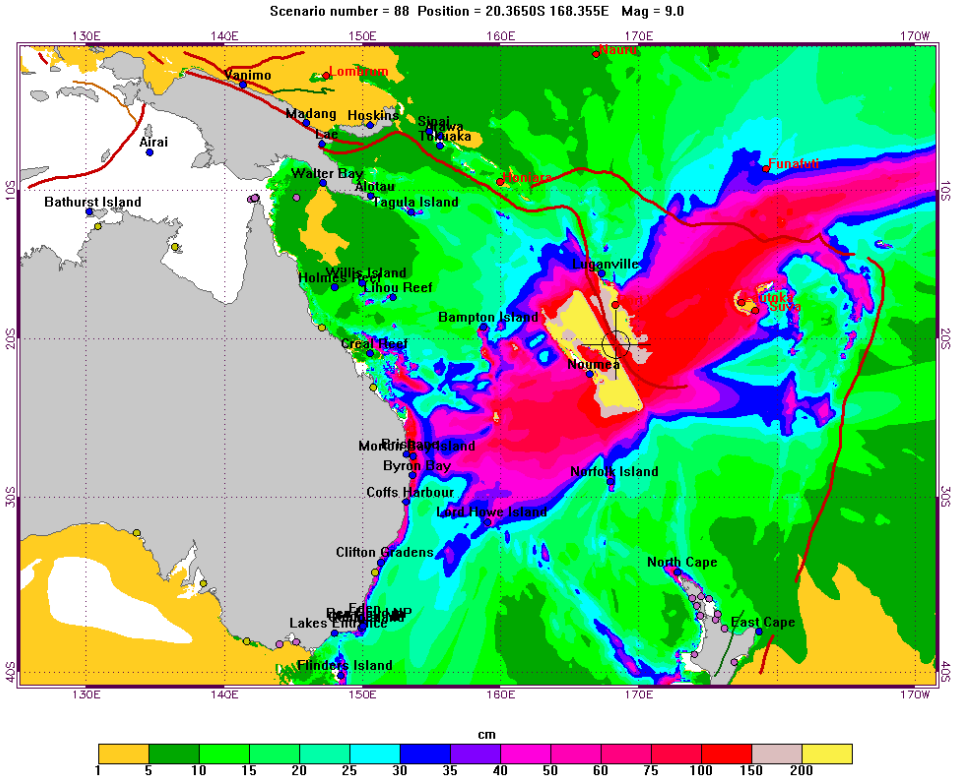


Figure 3: Threat to Tuvalu from the New Hebrides Trench

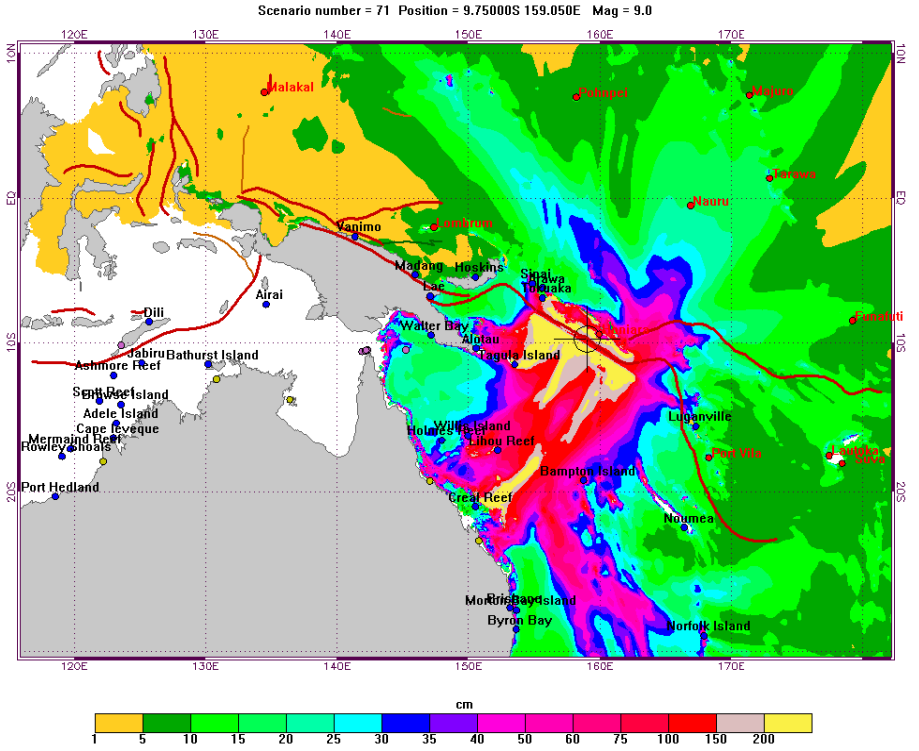


Figure 4: Threat to Tuvalu from the South Solomon's Trench

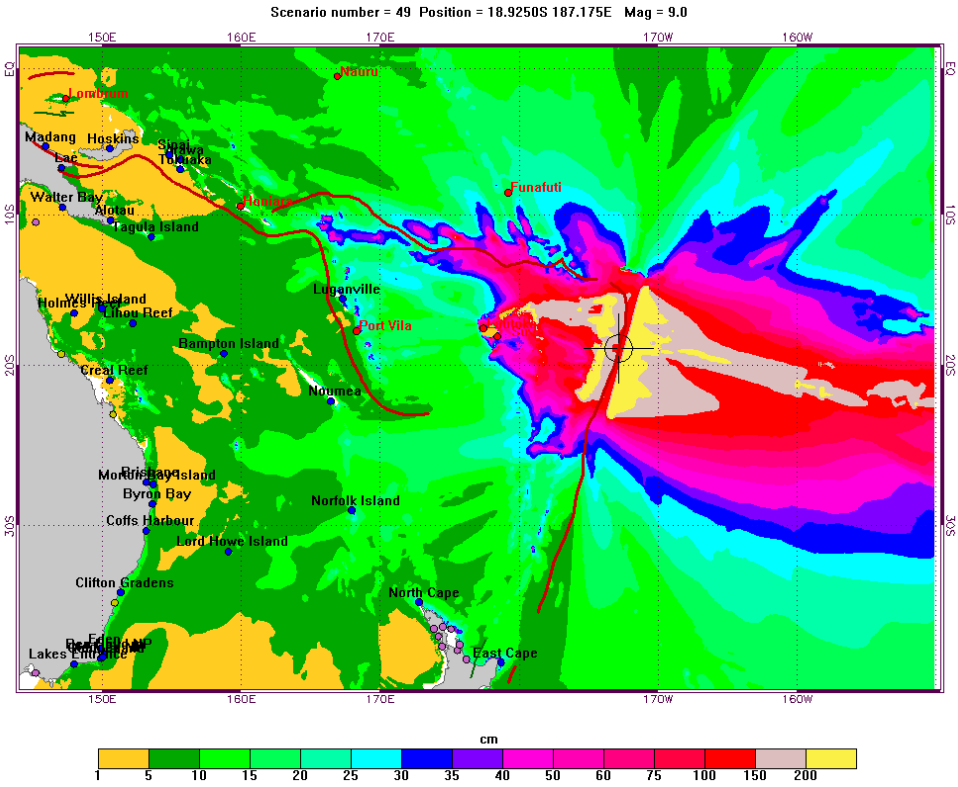


Figure 5: Threat to Tuvalu from the Tonga Trench

4. The Tuvalu Tsunami Capacity Assessment

4. The Tuvalu Tsunami Capacity Assessment

4.1. Date and Location

The tsunami capacity assessment of the ability of Tuvalu to receive, communicate and effectively respond to tsunami warnings took place from 26 June – 1 July 2009 in Funafuti, Tuvalu.

4.2. Visiting Assessment Team and Participants

The visiting assessment team was made up of those outlined in Annexure 2. The focal point in Tuvalu for the completion of this project was Ms Hilia Vavae, Chief Meteorological Officer, Tuvalu Meteorological Service. A full list of workshop participants can be found in Annexure 1.

4.3. Workshop Summary

For a copy of the full agenda for the workshop see Annexure 3.

4.3.1. Day 1 (26 June 2009)

09:00am – 12:00pm

Opening Ceremony Welcome address provided by Ms Hilia Vavae, Chief Meteorological Officer

Response - Visiting Assessment Team Leader Bryan Boase

Overview of the meeting breaks for morning/afternoon teas and lunch was provided by Helen Tseros

Presentations:

Bryan Boase – Introduction to the tsunami capacity assessment project

Litea Biukoto – Tsunami science and the tsunami hazard in relation to Tuvalu

Hilia Vavae, Tinapa Faleiute and Tataua Pese - Tsunami warning and mitigation systems in Tuvalu

1:30pm – 2:30pm

Focus groups were formed to look at Tuvalu's priorities for implementing an effective tsunami warning and mitigation system.

2:35pm – 3:00pm

The capacity assessment questionnaire was commenced on Organisations, Committees and Legislation Section and good progress was made addressing the issues pertaining to the:

- Organisations involved in tsunami warning and mitigation in Tuvalu.
- Tsunami warning and mitigation coordination committees at National, and village level in Tuvalu
- Legislation relevant to tsunami warnings and emergency response

3:30pm – 4:30pm

The capacity assessment questionnaire was commenced on Strategy, International and Regional Cooperation and All-Hazards Approach and good progress was made addressing the issues pertaining to the:

- Disaster risk reduction strategy in Tuvalu
- International and Regional cooperation for tsunami warning and mitigation in Tuvalu
- All-hazards approach

4.3.2. Day 2 (29 June 2009)

08:30am – 09:00am

Peter Rowswell provided a presentation on Data Communications for Tsunami Warnings

09:00am – 12:00pm

Work on the capacity assessment questionnaire recommenced and the Section on Research, Monitoring, Warning and Emergency Response was addressed in terms of:

- Research and development expertise
- Tsunami monitoring including infrastructure (seismic network, sea-level network and utilisation of satellites for data communication)
- Case Study – 1st April 2007 Solomon Islands Earthquake and Tsunami event
- Tsunami warning system in Tuvalu including, international communication cooperation, national tsunami warning centre, receipt of advisories from PTWS, procedures for dissemination of tsunami warnings Nationally, once received from PTWS, issuing warnings for marine vessels, harbours and ports
- Case Study – Receipt of international advisories and dissemination of warnings nationally for the 1st April 2007 Solomon Islands event.

- Strengths and weaknesses of tsunami warnings

1:30pm – 4:00pm

The assessment team were provided with a conducted tour of the following sites:

- Tuvalu Meteorological Service
- Tuvalu Media Centre
- Police Headquarters
- Telecom
- National Disaster Management Office
- Seal-level gauge located at Old Main Wharf

4.3.3. Day 3 (30 June 2009)

08:30 – 09:00am

Anne Marie Drummond provided a presentation on Emergency Coordination, Planning and Community Awareness

09:00 – 12:00pm

The capacity assessment questionnaire recommenced and the section on Emergency response to tsunami in Tuvalu addressing the issues pertaining to:

- Assessing the capacity of the disaster management system in Tuvalu and identifying training needs
- Emergency response and recovery plans
- Evacuation (including evacuation legislation)
- GIS use for emergency response
- Testing and exercising
- Consideration of critical infrastructure
- Tsunami mitigation efforts
- The role of NGOs in tsunami warning and mitigation
- Case Study – Preparedness and response for the 1st April 2007 Solomon Islands event.

13:00 – 16:00

The capacity assessment questionnaire recommenced and the Section on Capacity Assessment – Hazard, Vulnerability, Risk and Community Awareness addressing the issues pertaining to:

- Tsunami hazard, vulnerability and risk studies in Tuvalu:
  - Post tsunami surveys

- Tsunami hazard, vulnerability and numerical modelling studies
- Community participation in assessing the tsunami risk

- Public and stakeholder awareness and education regarding tsunami in Tuvalu including:

  - Assessment of public awareness
  - The role of public awareness in understanding warnings and taking action
  - Public awareness and education programs
  - Media education programs
  - Tsunami memorials and museums

4.3.4. Day 4 (01 July 2009)

17:00 – 18:00

Preliminary summary presentation was provided to the workshop participants by Bryan Boase on Tuvalu's strengths, needs, preliminary recommendations, priority review and next steps. This was followed by questions and feedback from the participants.

The formal closing of the Workshop was performed by the Acting Senior Assistant Secretary from the Office of the Prime Minister, Mr Kelesoma Saloa and this was followed by a response from the Team Leader Bryan Boase. The closing ceremony was followed by an informal dinner at the Vaiaku Lagi Hotel.

4.4. Workshop Photos (Tuvalu June 2009)

Workshop Participants

5. Assessment Results

5. Assessment Results

5.1. Status of Key System Components

The Tsunami Capacity Assessment Workshop results are summarised below in Table 3 in which the status of key components of Tuvalu's tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in June/July 2009, updates between then and the publication of this report are as marked).

Table 3: Summary of current status of key components of the Tuvalu tsunami warning and mitigation system as at June/July 2009.

Rating

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Comment
Authority, Coordination and NGO Role		
Legislation in place for tsunami warnings and response	**Yes**	The National Disaster Act 2008 (NDA) covers the issue of tsunami warnings and the draft Tuvalu National Tsunami Plan (NDP) that identifies the Tuvalu Meteorological Service as the lead agency for issuing of tsunami warnings.
Tsunami coordination committee or effort at a National and local level	**Partially realised**	The National Disaster Act 2008 covers the formation of the National Disaster Committee (NDC) and National Disaster Preparedness Working Group (NDPWG) the functions and responsibilities of which are identified in the National Disaster Plan (D1). It has been noted that the NDP has recently been reviewed.
Agency responsibilities clearly defined	**Partially realised**	The agency responsibilities are defined within the NDP but only in very broad terms.
NGOs have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response	**Partially realised**	This is a secondary role for TANGO and the Churches as they only provide an informal warning dissemination role. However, TANGO in particular provides preparedness and awareness training as well as risk management. The Churches play a significant role in the provision of counselling disaster victims and their families.

Key Component	Rating	Comment
International and Regional Cooperation		
Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts	**Partially realised**	Tuvalu is a member of the IOC and the sea level and seismic data contributes to the international provision of tsunami warnings. The Tuvalu Red Cross (TRC) also provides regional assistance when and as appropriate – e.g: the Solomon Islands.
Priorities		
Priorities established for implementation of tsunami warning and mitigation system at a National level	**Partially realised**	This was addressed during the workshop in Question 12 (see annexure, where participants identified current and planned activities required to establish an effective warning system. These have been captured in the recommendations.
Multi-hazard Approach		
Tsunami warning capabilities are being established within a multi-hazard framework	**Partially realised**	The Tuvalu Meteorological Service has an established tropical cyclone warning system that does provide the framework to incorporate tsunami warning. This has been captured in the draft Tuvalu National Tsunami Plan.
Research Expertise		
Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system	**No**	Not at this time.
Tsunami monitoring infrastructure		
Existence of seismograph stations and integration of real time data from these stations into the tsunami warning process	**Yes**	The FUNA seismic station is part of the Global Seismic Network array which feeds into the regional warning system provided by PTWC
Existence of sea-level stations and integration of real time data from these stations into the tsunami warning process	**Yes**	The Tuvalu sea-level gauge located on the Old Main Wharf is part of the Pacific Sea-level Climate Monitoring Project which includes installed gauges in the region. This data feeds into the regional monitoring system and provides some input into the warning system provided by PTWC.

Key Component	Rating	Comment
Sharing of seismic and sea-level data internationally to facilitate improvement of PTWC tsunami messages for the region	**Yes**	As per above. All data is available via the web.
Warnings		
Nation receives PTWC messages	**Yes**	The Tuvalu Meteorological Service is the primary recipient of warnings issued by PTWC
24x7 operational staff at warning receipt and dissemination location	**No**	Recommendations as a result of this workshop have been provided to address this issue
Disseminate national tsunami warnings as guided by a Standard Operating Procedure	**Partially realised**	The Tuvalu National Tsunami Plan outlines key agencies in the warning process however, a greater depth of detail including SOPs is required as indicated in the recommendations of the workshop
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	**No**	Recommendations as a result of this workshop have been provided to address this issue
Redundant 24x7 methods available for dissemination of warnings to community (e.g. public radio, sirens etc.)	**No**	Recommendations as a result of this workshop have been provided to address this issue
Effective warning dissemination to remote communities	**Partially realised**	Recommendations as a result of this workshop have been provided to address this issue
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	**Partially realised**	Due to the limitations of the existing communication system, recommendations have been provided to address this issue
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	**Partially realised**	There is no formal process for issuing warnings to mariners. SOPs need to be developed to address this as per recommendations

Key Component	Rating	Comment
Emergency Response and Evacuation		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	**Partially realised**	Review of the National Disaster Plan and the draft National Tsunami Preparedness Plan should address this. This issue has been highlighted in the recommendations.
Tsunami emergency response, evacuation and recovery plan exists	**Partially realised**	The draft National Tsunami Preparedness Plan needs to be reviewed by the National Disaster Preparedness Working Group and tested as indicated in the recommendations.
The designated agency for evacuation is identified and have authority by law	**Yes**	As per the National Disaster Act (2008) and the National Disaster Plan (1997)
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	**No**	The draft National Tsunami Preparedness Plan identifies this as a responsibility. This has been highlighted in the recommendations.
Procedures are tested and exercised to improve the response through better planning and preparedness	**No**	The National Disaster Plan and the draft National Tsunami Preparedness Plan both need to be reviewed and tested. This has been highlighted in the recommendations.
Land use policies and building codes are in place to mitigate against the tsunami hazard	**Partially realised**	There is a building code developed for Tuvalu though not passed by Cabinet.
Tsunami hazard, vulnerability and risk		
Completion of studies to assess the tsunami hazard in the country or Region	**No**	This has been addressed in the recommendations from this meeting.
Local risk assessments have been completed for at risk communities	**No**	This has been addressed in the recommendations from this meeting.

Key Component	Rating	Comment
Adequate data exists and local inundation modelling has been completed for population centres	**No**	This has been addressed in the recommendations from this meeting.
Public and stakeholder awareness and education		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	**Partially realised**	This has been addressed in the recommendations from this meeting.
Community level education and preparedness programs exist on tsunami	**Partially realised**	This has been addressed in the recommendations from this meeting.
Training programs for the National media exist for natural hazard and tsunami	**No**	This has been addressed in the recommendations from this meeting.

5.2. Case Study – Response to the Solomon Islands Earthquake and Tsunami

Throughout the tsunami Capacity Assessment Questionnaire completed in Tuvalu, the country's response to the Solomon Island's event that occurred on the 01 April 2007 was reviewed. The aim of this review was to gain an understanding of the operation of the system in a real time event.

The details of the event are as follows;

Origin Time	- 20:39:56 UTC, Sunday 01 April 2007
Local Time in Tuvalu	- 08:39am, Monday 02 April 2007
Coordinates	- 8.481 SOUTH 156.978 EAST
Location	- Solomon Islands
	- 2331 km (1449 miles) WSW of Tuvalu
Magnitude	- 8.1
Depth	- 10km (6.2 miles)

The warning was received via the Australian Maritime Surveillance centre and it was then passed to the Secretary to Government. The Secretary to Government then passed the warning onto the community via Radio Tuvalu. The warning was also broadcast on Fiji TV. The first warning was sent by the PTWC at 08:55 (Local) and the second by 09:32 (Local) which advised the ETA of the tsunami in Tuvalu was predicated for 1159 (Local). It appears that there was a warning received from the PTWC on the first issue but Tuvalu was not mentioned on subsequent issues. At the time of the event the EMWIN System was unserviceable.

There was a response plan – refer NDP (D1) but this is Tropical Cyclone specific. It was not used during this event. However, the development of a specific draft tsunami plan was as a result of the Solomon Islands event.

The response of the community to the warning was that the older members of the population were concerned but the younger generation were somewhat excited at the prospect of experiencing a tsunami. There was some panic buying at the shops and there was concern expressed by parents whose children did not come home straight after school. The event occurred at 08:39 (local time) and the first warning was sent by the PTWC at 08:55 (Local) and the second by 09:32 (Local) which advised the ETA in Tuvalu was 1159 (Local). Disturbingly however, the announcement was only made on Tuvalu Radio at about 12:00 (local). This meant there was approximately a gap of 2.5 hours that was lost and could have been utilised preparing the community. Fortunately, no impact from the tsunami was experienced.

As well, there was no feedback loop from the PTWC to confirm the advice had been received as at that time Tuvalu was not a member of the IOC. Tuvalu is now a member and confirmation of receipt of any advice is a standard practice.

The unserviceability of the EMWIN System highlights the need for a backup as well as the need to investigate the use of an alternative system on which to receive warnings if the TMS EMWIN is unserviceable. Part of this investigation should take into account recommissioning the EMWIN located at the NCC.

5.3. Strengths, Opportunities for Improvement and Recommendations to Progress the Tsunami Agenda in Tuvalu

Based on the discussions during the workshop with in-country participants and the supporting documentation collected during the visit, the visiting team, in consultation with Tsunami Capacity Assessment workshop participants formulated the following strengths, opportunities for improvement and recommendations under key topics which they believe will progress the tsunami agenda in Tuvalu. These are outlined in Table 4.

Table 4 – Strengths, opportunities for improvement and recommendations under key topics

5.3.1. Governance and Coordination

Strengths:	**Opportunities for Improvement:**
• There is a National Disaster Act (2008)	• Finalise the review of the NDP • Finalise the Tuvalu National Tsunami Plan

Recommendations:

1. Review and finalise the National Disaster Plan. Include as annexes, the completed Tuvalu National Tsunami Plan and the plans of the member agencies of the National Disaster Preparedness Working Group, as required under the National Disaster Act (2008).
2. Widely distribute and promote the National Disaster Plan through the National Disaster Preparedness Working Group and the Island Disaster Committees to key stakeholders.
3. Provide additional staffing (Deputy Disaster Co-ordinator) and an appropriate resourcing level to meet the responsibilities articulated under the National Disaster Act (2008) and the National Disaster Plan.

5.3.2. Regional and International Coordination

Strengths:	**Opportunities for Improvement:**
Support from the development partners	Strengthen the relationship with development partners.

Recommendations:

4. To maximise the opportunities through current international and regional partnerships to strengthen Tuvalu's monitoring, warning, preparedness and response capabilities in relation to tsunami events.
5. Review the current arrangements between Pacific Tsunami Weather Centre (PTWC) and Tuvalu Meteorological Services to ascertain and clarify the services that are available.

5.3.3. Research Expertise

Strengths:	Opportunities for Improvement:
None at this time	To enhance the current research in respect to tsunami modelling through active participation.

Recommendations:

6. To identify current and relevant research in respect to tsunami modelling and pursue an active role contributing to this research.

5.3.4. Tsunami Monitoring Infrastructure

Strengths:	Opportunities for Improvement:
Sea-level gauge and seismic station Installed	Improve return to service times of these equipment BoM and USGS to enhance skill levels of Tuvalu Meteorological Service technical staff.

Recommendations:

7. To provide appropriate training to the Tuvalu Meteorological Service that will enhance the maintenance and operational activities associated with monitoring equipment.

8. USGS to be approached to review and upgrade as required equipment and infrastructure for the seismic station.

9. BoM to be approached to review and upgrade as required equipment and infrastructure for the sea-level gauge.

5.3.5. Tsunami warnings

Strengths:	Opportunities for Improvement:
The current levels or equipment to receive warnings is maintained or enhanced The desire of the community to have a strong tsunami warning system	The implementation of the mobile network The reactivation of the NCC EMWIN that is operational 24/7 that could be monitored by the duty Police officer A formal review of the NDP and ensure all agencies plans are in line with the NDP

Recommendations:

10. Rapid adoption of the mobile network for the receipt of tsunami warnings provided by the PTWC – Director (or designate), Tuvalu Meteorological Service and the Disaster Coordinator, National Disaster Management Office (NDMO).

11. Recommission the EMWIN system in the National Coordination Centre to ensure a redundancy for receipt of warnings.

12. TTC to formalise with Fiji TV an agreement to provide warnings through this media.

5.3.6. Communications

Strengths:	Opportunities for Improvement:
Planned reintroduction of the mobile network Communities have identified church bells for warning systems	Mobile network will allow SMS (text messages on phones) direct to key government officials

Recommendations:

13. Integration of community-based warning systems into island tsunami plan using existing infrastructure such as church bells

14. PTWC send SMS warnings to Director (or designate), Tuvalu Meteorological Service and the Disaster Coordinator, National Disaster Management Office (NDMO)

15. NDMO give due consideration for the receipt of tsunami watch and warning alerts to be sent from the proposed re-commissioned NCC EMWIN, into the 24/7 Police office

5.3.7. Tsunami Emergency Response (including evacuation)

Strengths:	Opportunities for Improvement:
The review of the NDP and planned review of the National Tuvalu Tsunami Plan The community-based organisations (Red Cross and TANGO) already conduct community preparedness activities. Red Cross has identified officers on the outer islands who can enhance community-based response activities in coordination with the Police.	Undertake regular exercises of the National Disaster Plan The development of outer island response plans The provision of training for media staff on tsunami hazards.

Recommendations:

16. Develop a full set of Standard Operating Procedures (SOPs) for all agencies identified in the NDP and involved in disaster response.

17. Develop and implement a schedule of exercises (desktop and field-based) to evaluate and improve the response phases of National Disaster Plan.

18. Enhance the community-based awareness and education programs to ensure the appropriate response of the community to tsunami warnings.

19. Develop, implement and exercise (desktop and field-based) the outer island response plans including Standard Operating Procedures (SOPs).

20. Seek admission to UNESCO training programmes for media staff that have a multi-hazard focus on disaster preparedness and response.

5.3.8. Tsunami Hazard, Vulnerability, Risk and Mitigation

Strengths:	Opportunities for Improvement:
The geographical position in terms of tsunami threat provides additional lead time	Using the identified threat scenarios to refine the response plans Improve the current tsunami models through the addition of known bathymetry for the islands of Tuvalu.

Recommendations:

21. Obtain, catalogue and appropriately archive all research data to current standards, that has been undertaken by international and regional agencies/organisations.

22. To request the international and regional organisations to improve current tsunami modelling using available research resources.

23. Undertake risk assessments for all government development projects to the ISO 31000:2009 Risk Management Standard to mitigate identified risks.

5.3.9. Public and Stakeholder Awareness and Education

Strengths:	Opportunities for Improvement:
There are education and awareness programs being delivered by the education department, Red Cross and TANGO.	Undertake formal ongoing assessments of community awareness. To consolidate and coordinate under the National Disaster Preparedness Working Group (NDPWG), the education and awareness programs delivered by the education system, NGOs and Red Cross to maximise available resources.

Recommendations:

24. Consolidate and coordinate under the National Disaster Preparedness Working Group (NDPWG), the education and awareness programs delivered by the education system, NGOs and Red Cross.

25. Implement ongoing scheduled assessments (gap analysis), that establish the levels of community awareness. Use findings from the gap analysis to enhance program content and delivery.

5.4. Additional Workshop Benefits

In addition to this report, additional benefits of the Tsunami Capacity Assessment Workshop in Tuvalu were:

- Facilitation of working relationships between agencies and organisations involved in tsunami warning and mitigation within Tuvalu;
- Exchange of information on National activities and capabilities within Tuvalu;
- Enhanced working relationships between the Tuvalu participants, the Australian Bureau, AGD and SOPAC; and
- Enhanced understanding and appreciation by the assessment team and Project of the challenges faced by the Tuvalu communities.

5.5. Next Steps

Tuvalu will receive three key material outcomes from the Tsunami Capacity Assessment project:

1. The completed questionnaire in electronic format with scanned copies of all supporting documentation collected in-country:
2. A comprehensive National Report in a standard format which aims to summarse information collected from the visits and is consumable for non-technically minded recipients (this document); and
3. A copy of the final Regional Report which will outline common themes across the region.

At the agreement of the country project results will be posted on websites such as the Australian Bureau, SOPAC and Pacific Disaster Net.

Once approved by the country the Bureau will facilitate dissemination of reports to regional and international donors and other stakeholders to ensure maximum exposure of results. Contingent on the availability of human and financial resources, the Bureau and project partners will aim to work with potential donors to bring the findings of this project to their attention on a country and regional scale. This will be done to facilitate further capacity development projects being undertaken based on the results of this project.

6. Annexure

6. Annexure

6.1. Annexure 1: Record of Participants

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	E-mail
Tuvalu Meteorology Service	Scientific Officer	Mr	Tauala	Katea	Meteorological Service, Private Mail Bag, Funafuti, Tuvalu	20736	20090	Tauala.k@gmail.com tkatea@gov.tv
Tuvalu Meteorology Service	Chief Meteorological Officer	Ms	Hilia	Vavae	Meteorological Service, Private Mail Bag, Funafuti, Tuvalu	20736	20090	hiliavavae@yahoo.com
Tuvalu Meteorology Service	Technical Officer	Mr	Tinapa	Faletiute	Meteorological Service, Private Mail Bag, Funafuti, Tuvalu	20736	20090	tfaletiute@gov.tv faletiute@yahoo.com faletiute@gmail.com
Tuvalu Media Department	Chief Engineer	Mr	Stanley	Manao	Tuvalu Media Department, Private Mail Bag, Office of the Prime Minister, Funafuti, Tuvalu	20138		ssmanao@gov.tv stanmanoa@gmail.com
Tuvalu Media Department	News Reporter	Mr	Semi	Malaki	Tuvalu Media Department, Private Mail Bag, Office of the Prime Minister, Funafuti Tuvalu	20176		smalaki@gov.tv
Funafuti Kaupule	Secretary	Mrs	Hellani	Tumua	Funafuti, Kaupule-Luapou, Funafuti, Tuvalu	20422	20486	bkaitu@yahoo.com.au

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	E-mail
SDA Primary School	Church Member		Motulu	Pedro	Funafuti, Tuvalu			Rosemary9554@yahoo.com.au
Foreign Affairs	CEO		Aunexe	Simati	Funafuti Tuvalu			asimati@gov.tv
Tuvalu National Council of Women	Accounts Officer		Suia	Pesega	Women's Centre Vaiaku Funafuti, Tuvalu	20822	20643	suiapesega@gmail.com
Lands and Surveys Department	Director		Faatasi	Malologa	Funafuti Tuvalu	20170	20167	fmalologa@gov.tv
Nauti Primary School	Assistant Head Teacher		Fanoiga	Falasa	Funafuti Tuvalu			ffalasa@yahoo.com
TD Police Department	Commissioner (Acting)		Tipelu	Kauani	Funafuti Tuvalu	20728		tp_kauani@yahoo.com
Tuvalu Red Cross	Disaster Management Officer	Mr	Tataua	Pese	PO Box 14 Funafuti Tuvalu	20740		tatauap@hotmail.com
Civil Aviation	Civil Aviation Officer	Mr	Vitoli F.	Iosefa	Funafuti Tuvalu	20153	20722	viosefa@gov.tv
Energy Department	Energy Officer	Mr	Kapuafe	Lifuka	Energy Department, PU1, Vaiaku	20056	20207	klifuke@gov.tv
Tango	Coordinator	Mrs	Annie	Homasi	PO Box 136 Funafuti Tuvalu	20758 20759		anniehomasi@yahoo.com.au
Telala D Noa	EKT Assistant (Witness & Corporation)							EKT Office
Fetuvalu Secondaty School	Principal		Penehuro	Hauma	Fetuvalu Secondary School	20717	20755	penehuroh@yahoo.com.au
Ministry Home Affairs	Rural Development Planning		Malofu	Auina		20175		mauina@gov.tv
Ministry of Health	Medical Superintendent, Princess Margaret Hospital	Mr	Puakena	Boreham	Princess Margaret Hospital, Funafuti, Tuvalu	20480		puakena@yahoo.co.uk

Organisation	Position	Title	First Name	Last Name	Postal Address	Telephone	Fax	E-mail
Ministry of Transport	Director of Marine	Mr	Turiekalu	Italea		20055	20722	titaleli@gov.tv
Ekalesia Kelisiano Tuvalu Church	Pastor	Rev	Telala	D Noa	EKT Office Tuvalu	20755	20755	
Office of the Prime Minister	Acting Senior Assistant Secretary		Kelesoma	Saloa	Office of the Prime Mimister, Funafuti, Tuvalu	20100	20113	ksaloa@gov.tv
Tuvalu Met Service	Opu Acting Senior Observer		Elifaleti	Ene	Tuvalu Met Service, Vaiaku Funafuti, Tuvalu	20736	20090	eneearl@gmail.com
Tuvalu Met Service	Observer		Kilima	Kilima	Tuvalu Met Service, Vaiaku Funafuti, Tuvalu	20736	20090	kk.kilima@yahoo.com.hz
Tuvalu Met Service	Observer		Hina	Taape	Tuvalu Met Service, Vaiaku Funafuti, Tuvalu	20736	20090	Hina.taape@gmail.com
Tuvalu Telecom Corporation	Chief Operation Officer		Anisi	Penitusi	Tuvalu Telecom Centre PMB 14	20019	2000	anisi@tuvalutelecom.tv

6.2. Annexure 2 – The visiting assessment team

Team Position	Name	Position within Organisation	Organisation	Contact Details
Natural Hazard Warning Expert and Team Leader	Bryan Boase	National Manager Weather Services Quality	Australian Bureau of Meteorology	b.boase@bom.gov.au Ph. +61 3 9669 4719 Fax. +61 3 9669 4695 Mobile. +61 4 0853 4234
Logistics Coordinator	Helen Tseros	Project Officer Weather Services Branch	Australian Bureau of Meteorology	h.tseros@bom.gov.au Ph. +61 3 9669 4541 Fax. +61 3 9669 4695 Mobile +61 4 2584 7644
Emergency Management Expert	Anne Marie Drummond	Manager Education – Education Planning and Coordination	Attorney-General's Department	annemarie.drummond@ag.gov.au Ph: +61 3 54215268 Fax: +61 3 54215272 Mob: +61 4 58724094
Data Communications Expert	Peter Rowswell	Regional Engineering Services Manager, WA	Australian Bureau of Meteorology	p.rowswell@bom.gov.au Ph. +61 8 9263 2203 Mob. +61 4 0802 0564
Advisor, Hazard Assessment	Litea Biukoto	Advisor Hazard Assessment Pacific Islands Applied Geoscience Commission	Pacific Islands Applied Geoscience Commission (SOPAC)	litea@sopac.org Ph. +679 338 1377 Fax. +679 337 0040 Mob. +679 9213741

6.3. Annexure 3 – Agenda, Tuvalu Tsunami Capacity Assessment Workshop

DAY 1: Friday 26th June 2009

SESSION 1: OPENING CEREMONY AND INTRODUCTORY PRESENTATIONS

LOCATION: Government Offices

Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 9.30am	**Welcome Address** • *Hilia Vavae – Director, Tuvalu Meteorological Service* • *Bryan Boase – Team Leader, Visiting Assessment Team*	**NA**	**0.5hrs**	**Open**
10.00 – 10.30am	**Workshop Group Photo and Opening Morning Tea**	**NA**	**0.5hrs**	**Open**
10.35 – 11.00am	**CHAIR: Bryan Boase** **Housekeeping – Helen Tseros** **Presentation –** • *Introduction to the tsunami capacity assessment project and, tsunami science* ***Presenter:*** *Bryan Boase – Team Leader, Visiting Assessment Team*	**NA**	**0.5hrs**	**Open**
11.00 – 11.30am	**Presentation –** • *The tsunami hazard in relation to Tuvalu* ***Presenter:*** *Litea Biukoto - Risk Assessment Specialist, SOPAC*	**NA**	**0.5hrs**	**Open**

Time	Item	Questionnaire Reference	Duration	Participation
11.30 – 12.00pm	**Presentations –** • *Tsunami warning and mitigation systems in Tuvalu (including questions from participants)* • *Presenters: Tataua Pese – Red Cross Disaster Coordinator, Hilia Vavae & Tinapa Faletiute, Tuvalu Meteorological Service*	**NA**	**0.5hrs**	**Open**
12.00 – 1.30pm	**Lunch**	**NA**	**1.5hrs**	**Open**
SESSION 2:	**ORGANISATIONS, COMMITTEES, LEGISLATION, STRATEGY AND COOPERATION**			
LOCATION: Government Offices				
CHAIR: Bryan Boase Team Leader, Visiting Assessment Team				
1.30 – 2.30pm	***Focus Groups*** • *Tuvalu's priorities for implementing an effective tsunami warning and mitigation system*	*Section 4*	**1.0hrs**	**Open**
2.30 – 3.00pm	**Capacity Assessment – Organisations, Committees and Legislation**			
	• *Organisations involved in tsunami warning and mitigation in Tuvalu*	*Section 2, Part A*	**0.5hrs**	**Open**
	• *Tsunami warning and mitigation coordination committees at National, and village level in Tuvalu*	*Section 2, Part B*		
	• *Legislation relevant to tsunami warnings and emergency response*	*Section 2, Part C*		
3.00 – 3.30pm	**Afternoon tea**	**NA**	**0.5hrs**	**Open**
3.30 – 4.30pm	**Capacity Assessment – Strategy, International and Regional Cooperation, All Hazards Approach**			
	• *Disaster risk reduction strategy in Tuvalu*	*Section 2, Part D*		
	• *International and Regional cooperation for tsunami warning and mitigation in Tuvalu*	*Section 2, Part E & F*	**1.0hrs**	**Open**
	• *All-hazards approach*	*Section 2, Part E & F*		
4.30pm	**CLOSE**	*Section 3*		

DAY 2: Monday 29th June 2009

SESSION 3: RESEARCH, MONITORING AND WARNING

LOCATION: Government Offices

CHAIR: Bryan Boase, Team Leader, Visiting Assessment Team

Time	Item	Questionnaire Reference	Duration	Participation
8.30 – 9.00am	**Opening Presentation:** • *Data Communications for Tsunami Warnings (including questions from the participants)* ***Presenters:*** *Peter Rowswell*	**NA**	**0.5hrs**	**Open**
09:00 – 09:30am	**Capacity Assessment – Research, Monitoring, Warning and Emergency Response**			
09:30 – 10:00am	***Research and development expertise***	*Section 5*	**0.5hrs**	**Open**
10.00 - 10.30am	**Morning Tea**	**NA**	**0.5hrs**	**Open**
10:30 – 11.00am	***Tsunami monitoring including:*** • *Tsunami monitoring infrastructure (seismic network, sea-level network and utilisation of satellites for data communication)* • *Case Study – 1st April 2007 Solomon Islands Earthquake &Tsunami*	*Section 6, Part A, B, C & Case Study – Monitoring Systems*	**0.5hrs**	**Open**
11.00 – 12:00pm	***Tsunami warning system in Tuvalu including:*** • *International communication cooperation* • *National tsunami warning centre* • *Receipt of advisories from PTWS* • *Procedures for dissemination of tsunami warnings Nationally, once received from PTWS*	*Section 7, Part A, B, C, D, E, F, G, Case Study – Tsunami Advisory Messages and Warnings & Part H*	**1.0hrs**	**Open**

Time	Item	Questionnaire Reference	Duration	Participation
	Tsunami warning system in Tuvalu <u>continued</u> including: • *Issuing warnings for marine vessels, harbours and ports* • *Case Study – Receipt of international advisories and dissemination of warnings nationally for the 1st April 2007 Solomon Islands Earthquake &Tsunami* • *CONCLUSION – Strengths and weaknesses of tsunami warnings*	*As above*	*As above*	*As above*
12.00 – 1.00pm	**Lunch**	**NA**	**1.0hr**	**Open**
SESSION 4: SITE TOURS				
LOCATION: Tuvalu Meteorological Service, National Disaster Management Office & Others				
1:30 – 4.00pm	• *Tuvalu Meteorological Service* • *Tuvalu Media Centre* • *Police Headquarters* • *Telecom* • *National Disaster Management Office*	**NA**	**2.5hrs**	**Relevant Agencies & Assessment Team**

DAY 3: Tuesday 30th June 2009

SESSION 5: TSUNAMI EMERGENCY RESPONSE, MITIGATION AND PREPAREDNESS

LOCATION: Government Offices

CHAIR: Bryan Boase, Team Leader, Visiting Assessment Team

Time	Item	Questionnaire Reference	Duration	Participation
8.30 – 9.00am	**Opening Presentation:** • *Emergency Coordination, Planning, Community Awareness (including questions from participants)* ***Presenter:*** *Anne Marie Drummond, Australian Attorney-General's Department*	**NA**	**0.5hrs**	**Open**
9.00 – 10.00am	**Emergency response to tsunami in TUVALU** • *Assessing the capacity of the disaster management system in Tuvalu and identifying training needs* • *Emergency response and recovery plans* • *Evacuation (including evacuation legislation)*	*Section 8, Part A, B & C*	**1hr**	**Open**
10.00 – 10:30am	**Morning Tea**	**NA**	**0.5hrs**	**Open**
10:30 – 12.00pm	**Emergency response to tsunami in Tuvalu <u>continued</u> including:** • *GIS use for emergency response* • *Testing and exercising* • *Consideration of critical infrastructure* • *Tsunami mitigation efforts* • *The role of NGOs in tsunami warning and mitigation* • *Case Study – Preparedness and response for the 1st April 2007 Solomon Islands Earthquake &Tsunami*	*Section 8, Part D, E, F, G, H & Case Study – Preparedness and Response*	**1.5hrs**	**Open**
12.00 – 1.00pm	**Lunch**	**NA**	**1hr**	**Open**

Time	Item	Questionnaire Reference	Duration	Participation
SESSION 6: TSUNAMI HAZARD, VULNERABILITY, RISK AND COMMUNITY AWARENESS				
1.00 – 4:30pm	**Capacity Assessment – Hazard, Vulnerability, Risk and Community Awareness**			
1.00 – 2.00pm	***Tsunami hazard, vulnerability and risk studies in Tuvalu:*** • *Post tsunami surveys* • *Tsunami hazard, vulnerability and numerical modelling studies* • *Community participation in assessing the tsunami risk*	*Section 9, Part A, B, C, D, E, F*	**1hr**	**Open**
2.00 – 3.00pm	***Public and stakeholder awareness and education regarding tsunami in Tuvalu including:*** • *Assessment of public awareness* • *The role of public awareness in understanding warnings and taking action* • *Public awareness and education programs* • *Media education programs* • *Tsunami memorials and museums*	*Section 10, Part A, B, C, D*	**1hrs**	**Open**
2.30 – 3.00pm	**Afternoon Tea**	**NA**	**0.5hrs**	**Open**
3:30 – 4.00pm	***Public and stakeholder awareness and education regarding tsunami in Tuvalu including:*** • *Assessment of public awareness* • *The role of public awareness in understanding warnings and taking action* • *Public awareness and education programs* • *Media education programs* • *Tsunami memorials and museums*	*Section 10, Part A, B, C, D*	**1hrs**	**Open**
4.00pm	**CLOSE**			

DAY 4: Wednesday 1st July 2009

SESSION 6: PRESENTATION OF PRELIMINARY ASSESSMENT FINDINGS

LOCATION: Government Offices

CHAIR: Bryan Boase, Team Leader, Visiting Assessment Team

Time	Item	Questionnaire Reference	Duration	Participation
17:00 – 18:00			**0.5hrs**	
	Preliminary summary presentation • *Tuvalu's strengths, needs, preliminary recommendations, priority review and next steps* ***Presenter:*** *Bryan Boase – Team Leader* **Questions and Feedback** *From Tuvalu participants on preliminary summary presentation and the assessment process in general*	**NA**	**1hrs**	**Open**
	ACKNOWLEDGEMENTS AND CLOSE • *TBA* • *Bryan Boase –Team Leader, Visiting Assessment Team*	**NA**	**0.25hrs**	**Open**
	Dinner			

Annexure 4 – Supporting Documents Log

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D1	National Disaster Plan (1997)	Y	E
D2	National Disaster Act (2008)	N	
D3	Police Act	N	
D4	National Sustainable Development Strategy (2005-2015)	Y	Y
D5	Progress report of implementation	N	
D6	Government Administrative Orders	N	
D7	Tuvalu National Tsunami Plan (Draft)	Y	
D8	MoU - BoM Tsunami Warning System (Sea Level Gauge)	Y	Y
D9	National Building Code - Tuvalu	N	
D10	Home Building Manual	N	
D11	SOPAC Miscellaneous Report 656 - Tuvalu	Y	Y
D12	Bathymetric Data of Tuvalu	N	

6.4. Annexure 5 – Definitions

Used in reports for SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems

Source: United Nations, International Strategy for Disaster Reduction, 2009

Capacity

A combination of all the strengths and resources available within a community, society or organization that can reduce the level of risk, or the effects of a disaster.

Capacity may include physical, institutional, social or economic means as well as skilled personal or collective attributes such as leadership and management. Capacity may also be described as capability.

Capacity building

Efforts aimed to develop human skills or societal infrastructures within a community or organization needed to reduce the level of risk.

In extended understanding, capacity building also includes development of institutional, financial, political and other resources, such as technology at different levels and sectors of the society.

Disaster

A serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources.

A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

Disaster risk management

The systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards.

Disaster risk reduction (disaster reduction)

The reduction of disaster risks and adverse impacts of natural hazards, through systematic efforts to analyse and manage the causes of disasters, including through avoidance of hazards, reduced social and economic vulnerability to hazards, and improved preparedness for adverse events

Early warning

The provision of timely and effective information, through identified institutions, that allow individuals exposed to a hazard, to take action to avoid or reduce their risk and prepare for effective response.

Early warning systems include of three primary elements: (i) forecasting of impending events; (ii) processing and dissemination of warnings to political authorities and population; and (iii) undertaking appropriate and timely actions.

Emergency management

The organization and management of resources and responsibilities for dealing with all aspects of emergencies, in particularly preparedness, response and rehabilitation.

Emergency management involves plans, structures and arrangements established to engage the normal endeavours of government, voluntary and private agencies in a comprehensive and coordinated way to respond to the whole spectrum of emergency needs. This is also known as disaster management.

Geographic information systems (GIS)

Analysis that combine relational databases with spatial interpretation and outputs often in form of maps. A more elaborate definition is that of computer programmes for capturing, storing, checking, integrating, analysing and displaying data about the earth that is spatially referenced.
Geographical information systems are increasingly being utilised for hazard and vulnerability mapping and analysis, as well as for the application of disaster risk management measures.

Hazard

A potentially damaging physical event, phenomenon and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can include latent conditions that may represent future threats and can have different origins: natural (geological, hydrometeorological and biological) and/or induced by human processes (environmental degradation and technological hazards). Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterised by its location, intensity, frequency and probability.

Land-use planning

Branch of physical and socio-economic planning that determines the means and assesses the values or limitations of various options in which land is to be utilized, with the corresponding effects on different segments of the population or interests of a community taken into account in resulting decisions.

Land-use planning involves studies and mapping, analysis of environmental and hazard data, formulation of alternative land-use decisions and design of a long-range plan for different geographical and administrative scales.

Land-use planning can help to mitigate disasters and reduce risks by discouraging high-density settlements and construction of key installations in hazard-prone areas, control of population density and expansion, and in the siting of service routes for transport, power, water, sewage and other critical facilities.

Mitigation

Structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Natural hazards

Natural processes or phenomena occurring in the biosphere that may constitute a damaging event.

Natural hazards can be classified by origin namely: geological, hydrometeorological or biological. Hazardous events can vary in magnitude or intensity, frequency, duration, area of extent, speed of onset, spatial dispersion and temporal spacing.

Preparedness

Activities and measures taken in advance to ensure effective response to the impact of hazards, including the issuance of timely and effective early warnings and the temporary removal of people and property from a threatened location.

Prevention

Activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.

Depending on social and technical feasibility and cost/benefit considerations, investing in preventive measures is justified in areas frequently affected by disasters. In the context of public awareness and education, related to disaster risk reduction changing attitudes and behaviour contribute to promoting a "culture of prevention".

Public awareness

The processes of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives and property in the event of a disaster.

Public awareness activities support changes in behaviour leading towards a culture of prevention. This involves public information, dissemination, education, radio or television broadcasts and the use of printed media, as well as, the establishment of information centres and networks and community and participation actions.

Recovery

Decisions and actions taken after a disaster with a view to restoring or improving the pre-disaster living conditions of the stricken community, while encouraging and facilitating necessary adjustments to reduce disaster risk.

Recovery (rehabilitation and reconstruction) affords an opportunity to develop and apply disaster risk reduction measures.

Relief / response

The provision of assistance or intervention during or immediately after a disaster to meet the life preservation and basic subsistence needs of those people affected. It can be of an immediate, short-term, or protracted duration.

Resilience / resilient

The capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures.

Risk

The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

Conventionally risk is expressed by the notation
Risk = Hazards x Vulnerability
Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Beyond expressing a possibility of physical harm, it is crucial to recognize that risks are inherent or can be created or exist within social systems. It is important to consider the social contexts in which risks occur and that people therefore do not necessarily share the same perceptions of risk and their underlying causes.

Risk assessment/analysis

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that could pose a potential threat or harm to people, property, livelihoods and the environment on which they depend.

The process of conducting a risk assessment is based on a review of both the technical features of hazards such as their location, intensity, frequency and probability; and also the analysis of the physical, social, economic and environmental dimensions of vulnerability and exposure, while taking particular account of the coping capabilities pertinent to the risk scenarios.

Structural / non-structural measures

Structural measures refer to any physical construction to reduce or avoid possible impacts of hazards, which include engineering measures and construction of hazard-resistant and protective structures and infrastructure.

Non-structural measures refer to policies, awareness, knowledge development, public commitment, and methods and operating practices, including participatory mechanisms and the provision of information, which can reduce risk and related impacts.

Vulnerability

A set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards.

6.5. Annexure 6 – Priorities for implementation of an effective tsunami warning and mitigation system

The following table provides a summary of the priorities established by the Tuvalu Workshop participants to achieve an effective tsunami warning and mitigation system. The priorities were established under the following four areas of activity:

- Prevention
- Preparedness
- Response
- Recovery

A brief definition of each is also provided to ensure clarity of understanding.

Prevention Actions considered long before an emergency occurs and includes any activity aimed at reducing the probability of damage from a disaster. Prevention strengthens the structure of your home to protect it from tropical cyclones, floods, and other natural disasters. Prevention helps business and industry avoid damages to their facilities and remain operational in the face of catastrophe.	**Preparedness** Actions taken to save lives before and during a natural disaster. It ensures people are ready for a disaster and respond to it effectively. Preparedness requires figuring out what you'll do if essential services break down, developing a disaster plan, and practicing the plan. Preparedness activities include forecasting and warning systems, stocking an emergency preparedness kit with supplies, and knowing where your nearest emergency shelter is.

• Relocation of communities, government assets out of high risk areas
• Empowering our faith
• Building seawalls, reclaiming land, building up islands – importation of aggregates
• Enforcement of building code
• Backup systems
• Finances and resources
• Setup a taskforce
• Awareness Programs
• Educational Program – use the media (radio)
• Need resources – financial, human
• Issues: education on tsunami, impacts and preparedness
• Formulate and enforce laws and regulations that empower the taskforce to carry our their mandate
• Complete the National Tsunami Plan
	• Establish national disaster committees to coordinate and deliver preparedness activities
	  ○ Disaster management office
	  ○ Disaster committee
	  ○ Actual involvement of NGOs, community based agencies, Red Cross
	• Public awareness and education including individual and family preparedness
	• Villages identify boats to safely evacuate communities given sufficient lead time
	• Early warning systems in place
	• Incorporating traditional knowledge and practices into preparedness planning
	• Improved coordination with stakeholders – meeting of disaster committee
	• Build capacity of responsible agencies to respond appropriately, in the case of Met. To analyse warnings to be communicated to public.
	• Tuvalu National Tsunami Plan taskforce – list key people
	• Warning system - establish an effective communications system (Telecom) Media – radio
	• Disaster Office to maintain emergency communications system
	• Test the plan
	• Departmental plans – to improve the response plan
	• Stock of emergency supplies
	• Shelter

Response Occurs after the onset of a disaster. Response is intended to provide emergency assistance for casualties, including search and rescue, shelters, and medical care, to reduce the probability or extent of secondary damage. E.g: sandbagging against floodwaters.	**Recovery** Activities continue immediately following a disaster. The purpose of recovery activities is to return all systems and services back to normal. Funds are used to rebuild homes, businesses and public facilities, to clear debris and repair roads and bridges, and to restore water, sewer and other essential services.

• Response team responsibilities be outlined
• Necessities of life, livelihood to priorities response and reallocation of resources
• Response and evacuation plans are being used with roles, responsibilities and SOPs.
  o Communication facilities working
  o satellite phones, RANET
  o Evacuation
  o Cutting of trees
  o Securing houses
  o Continuous warnings
• Safety and security
• Establish a response plan
• Formulate response teams
• Assess the damage – water supply, electricity and other critical infrastructure
• Prioritise the response to the degree of damage
• Alert contacts for assistance – “shout for help”
	• Activate recovery plan
	• Restore basic lifelines and critical facilities and services they provide
	• Rebuilding of infrastructure
	• Re-evaluate/ reassess response plans and guidelines
	• Anti-corruption
	• Activate recovery plan
	• Disaster Office to direct/co-ordinate
	• Assessment of damage
	• Determine resource allocations
	• Request/establish means of getting external support
	• Lessons learnt – to be compiled and noted for improvement of the current plan for future disasters

6.6. Annexure 7 - References

- Australian Agency for International Development (AusAID) and Australian Bureau of Meteorology 2006, *Schedule 5 to the Record of Understanding 14304 in relation to cooperation between the Australian Bureau of Meteorology and AusAID for SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems,* AusAID, Canberra.

- Intergovernmental Oceanographic Commission, a division of the United Nations Educational, Scientific and Cultural Organisation, *Assessment of Capacity Building Requirements or an Effective and Durable Tsunami Warning and Mitigation System in the Indian Ocean, Consolidated Report for Countries Affected by the 26 December 2004 Tsunami,* viewed 2008, <http://ioc3.unesco.org/indotsunami/nationalassessments.htm>

- IOC's Tsunami Program, Intergovernmental Coordination Group for the Pacific Tsunami Warning System (ICG/PTWS), International Tsunami Information Centre October, viewed January 2009, <http://ioc3.unesco.org/itic/contents.php?id=179>

- Pacific Tsunami Warning Centre 2008, National Oceanographic and Atmospheric Administration (NOAA), U.S.A, viewed January, 2009, <http://www.prh.noaa.gov/ptwc>

- Pearce, H. SOPAC/GA Tsunami Hazard & Risk Assessment Project : inventory of geospatial data available and options for tsunami inundation & risk modelling.

- Thomas, C. and Burbidge, D. 2009. A Probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations. *Geoscience Australia Professional Opinion No. 2009/02.*

- Thomas, C., Burbidge, D., Cummings, P., 2007. *A Preliminary study into the Tsunami Hazard faced by Southwest Pacific Nations*. Risk and Impact Analysis Group, Geoscience Australia.

- Terminology: Basic terms of disaster risk reduction March 2004, United Nations, International Strategy for Disaster Reduction, viewed January, 2007, <http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm>

7. CD Attachment

7. CD Attachment - Supporting Documents

a. Assessment Questionnaire
b. Supporting Documents
c. Presentations