

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

**Federated States of Micronesia**



Federated States of Micronesia



**SOPAC**





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

**FEDERATED STATES  
OF MICRONESIA  
14 -17 September 2009**





## Document Control

<b>Approved for release:</b>	Deputy Director Services, Australian Bureau of Meteorology	Date: 27/01/2011
<b>Corrections &amp; comments:</b>	Shannon McNamara Project Officer Australian Bureau of Meteorology GPO Box 1289 Melbourne VIC 3001 E-mail: <a href="mailto:s.mcnamara@bom.gov.au">s.mcnamara@bom.gov.au</a> Phone: +61 (3) 9669 4173 Fax: +61 (3) 9669 4803	
<b>Distribution:</b>	Federated States of Micronesia Tsunami Capacity Assessment Workshop Participants, Australian Bureau of Meteorology, AusAID, SOPAC, National Oceanic and Atmospheric Administration, University of Guam, Disaster Risk Management Partnership Network, UNESCO/IOC, Geoscience Australia, Australian Attorney General's Department	

Version	Date	Author	Comments
0.1	20/04/2010	S. McNamara	Initial draft based on Assessment Team findings and feedback.
0.2	30/06/2010	S. McNamara	Assessment Team members given opportunity to provide further comment and sent to Federate States of Micronesia for review
0.3	30/09/2010	C. Stitz (formally O'Brien)	Final review C. Stitz

**For bibliographic purposes, this document should be cited as follows:**

Australian Government Bureau of Meteorology 2010, *SOPAC Member Countries National Capacity Assessment: Tsunami Warning and Mitigation Systems, Federated States of Micronesia, Pohnpei 14-17 September 2009*, research report compiled by Shannon McNamara, Australian Government Bureau of Meteorology, Melbourne.

**Acknowledgements:**

The Bureau of Meteorology wishes to acknowledge the contribution of all those who participated in the assessment workshop, particularly those who made their time available to help organise the workshop and to deliver presentations. The Bureau also acknowledges the efforts of the Visiting Assessment Team and continued support from partners University of Guam, NOAA and SOPAC and funding body AusAID as well as UNESCO/IOC, the WMO and ISDR for their input into the original questionnaire on which the project was based.

© Copyright Commonwealth of Australia 2010  
Bureau of Meteorology (ABN 92 637 533 532)  
700 Collins St Melbourne  
Phone 03 9669 4000 • Fax 03 9669 4695

(Printed on paper of 50% post consumer waste and 50% FSC certified fibre)



# Table of Contents

<b>1. RESULTS OUTLINE.....</b>	<b>1</b>
1.1. EXECUTIVE SUMMARY .....	1
1.2. RECOMMENDATIONS (INCLUDING PRIORITY AND RESOURCE INTENSITY) .....	4
<b>2. PROJECT BACKGROUND.....</b>	<b>11</b>
2.1. ABOUT THE PROJECT .....	11
2.2. BROAD PROJECT AIM .....	11
2.3. KEY PROJECT OUTPUT.....	11
2.4. PROJECT METHODOLOGY .....	11
2.5. UNDERLYING POLICY OBJECTIVES OF THE AUSTRALIAN TSUNAMI WARNING SYSTEM PROJECT .....	12
2.6. TSUNAMI WARNINGS IN THE PACIFIC .....	12
2.7. INTERNATIONAL TSUNAMI FORUMS.....	12
<b>3. COUNTRY BACKGROUND AND THE TSUNAMI THREAT.....</b>	<b>14</b>
3.1. ABOUT FSM.....	14
3.2. TSUNAMI THREAT SOURCES AND TSUNAMI HISTORY IN FSM .....	17
<b>4. THE FSM TSUNAMI CAPACITY ASSESSMENT .....</b>	<b>21</b>
4.1. DATE AND LOCATION .....	21
4.2. VISITING ASSESSMENT TEAM AND PARTICIPANTS.....	21
4.3. WORKSHOP SUMMARY .....	21
4.3.1. Day 1 (14 September 2009) .....	21
4.3.2. Day 2 (15 September 2009) .....	22
4.3.3. Day 3 (16 September 2009) .....	22
4.3.4. Day 4 (17 September 2009) .....	22
4.4. WORKSHOP PHOTOS (POHNPEI, SEPTEMBER 2009).....	23
<b>5. ASSESSMENT RESULTS.....</b>	<b>25</b>
5.1. STATUS OF KEY SYSTEM COMPONENTS.....	25
5.2. CASE STUDY – TSUNAMI SYSTEM OPERATION IN FSM FOR THE JANUARY 2007 EAST KURIL ISLANDS TSUNAMI EVENT .....	37
5.3. STRENGTHS, OPPORTUNITIES FOR IMPROVEMENT AND RECOMMENDATIONS TO PROGRESS THE TSUNAMI AGENDA IN FSM.....	38
5.3.1. Governance and Coordination.....	38
5.3.2. Regional and International Coordination .....	39
5.3.3. Research Expertise .....	40
5.3.4. Tsunami Monitoring Infrastructure .....	40
5.3.5. Tsunami Warnings.....	41
5.3.6. Communications .....	42
5.3.7. Tsunami Emergency Response (including evacuation) .....	43
5.3.8. Tsunami Hazard, Vulnerability, Risk and Mitigation .....	43
5.3.9. Public and Stakeholder Awareness, Education and Training.....	44
5.4. ADDITIONAL WORKSHOP BENEFITS .....	45
5.5. NEXT STEPS .....	45
<b>6. ANNEXURE.....</b>	<b>46</b>
6.1. ANNEXURE 1: RECORD OF PARTICIPANTS .....	46
6.2. ANNEXURE 2: THE VISITING ASSESSMENT TEAM .....	50
6.3. ANNEXURE 3: AGENDA, FSM TSUNAMI CAPACITY ASSESSMENT WORKSHOP .....	51
6.4. ANNEXURE 4: SUPPORTING DOCUMENTS LOG.....	58
6.5. ANNEXURE 5: DEFINITIONS .....	59
6.6. ANNEXURE 6: REFERENCES .....	63
<b>7. CD ATTACHMENT - SUPPORTING DOCUMENTS.....</b>	<b>65</b>

# Acronyms

ADB	Asian Development Bank
AGD	Australian Attorney-General's Department
AM	Amplitude Modulated
ATWS	Australian Tsunami Warning System
AusAID	Australian Agency for International Development
AWIPS	Automated Weather Interactive Processing System
Bureau	(Australian) Bureau of Meteorology
CFA	Compact of Free Association
CIA	Central Intelligence Agency
CROP	Council for Regional Organisations in the Pacific
D	Document (e.g. Document 39 = D39)
DART Buoy	Deep-Ocean Assessment Real-Time Tsunami Reporting System
DCO	Disaster Coordination Office
DFAT	Australian Department of Foreign Affairs and Trade
DPS	Department of Public Safety
EAS	Emergency Alert System
EMA	Emergency Management Australia
EMWIN	Emergency Managers Weather Information Network
EOC	Emergency Operations Center
ER	Emergency Room
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FM	Frequency Modulated
FSM	Federated States of Micronesia
FSMTC	Federated States of Micronesia Telecommunications Corporation
GA	Geoscience Australia
GIS	Geographic Information System
HF	High Frequency
ICG	Intergovernmental Coordination Group
IOC	Intergovernmental Oceanographic Commission
IOM	International Organization for Migration
ISDR	International Strategy for Disaster Reduction
ITIC	International Tsunami Information Center
ITSU	ICG for the Tsunami Warning System in the Pacific (superseded)
JMA	Japan Meteorological Agency
LiDAR	Light Detection and Ranging
MSMH-MP	Multi State Multi Hazard Mitigation Plan
Mw	Moment Magnitude
NDMO	National Disaster Management Office
NGOs	Non-Government Organisations
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
OEEM	Office of Environment and Emergency Management
PA	Public Address System



## Acronyms (Continued)

PGSP	Pacific Governance Support Program
PICs	Pacific Island Countries
PIFS	Pacific Islands Forum Secretariat
PPA	Pohnpei Port Authority
PTWC	Pacific Tsunami Warning Centre
PTWS	Pacific Tsunami Warning and Mitigation System
RICS	Rural Internet Connectivity System
SMS	Simple Messaging System
SOPAC	Pacific Islands Applied Geoscience Commission
SOPs	Standard Operating Procedures
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Region Environment Programme
SSB	Single Sideband
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA or US	United States of America
USAID	United States Agency for International Development
USGS	United States Geological Survey
UTC	Coordinated Universal Time
VHF	Very High Frequency
WFO	Weather Forecast Office
WMO	World Meteorological Organization
WSO	Weather Service Office





# 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 the Federated States of Micronesia (hereafter referred to as “FSM”) to receive, communicate and effectively respond to tsunami warnings took place in a workshop held from 14-17 September 2009 in Pohnpei, FSM.

The workshop was facilitated by a team of visiting experts and attended by some forty FSM Government agency representatives including participants from each State (Yap, Chuuk, Kosrae and Pohnpei), Non-Government Organisations (NGOs), regional and international organisations to discuss key areas of tsunami warning and mitigation in FSM by completing a comprehensive in session questionnaire, presentations and site visits.

As well as outlining the strengths and opportunities for improvements to the FSM tsunami warning and mitigation system from a National and State perspective, 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 ongoing improvements to the FSM tsunami warning and mitigation system.

FSM is a sovereign island nation which is made up of four States; Yap, Chuuk, Pohnpei and Kosrae. The vastly dispersed nature of FSM's 607 Islands and varied sea-bed characteristics within the archipelago means that exposure to tsunami and possible tsunami impacts are likely to vary from island to island. Tsunami risk modelling and few historical records of tsunami events would suggest that FSM has a moderate tsunami risk relative to other Pacific Islands Countries (PICs) that are in closer proximity to subduction trenches on which earthquakes with the potential to generate tsunami can occur (Thomas and Burbidge 2009). Even so, while the population and Government of FSM have had little direct experience with tsunami impacts, there is an awareness of the susceptibility of low-lying atolls and coastal communities to rising sea levels associated with climate change, the potential for tsunami impact and impact from other hazards such as storm surge resulting from typhoons. This is evident with the inclusion of tsunami as a potential natural hazard for FSM within the country's Multi-State Multi-Hazard Mitigation Plan 2005 (MSMH-MP (D6)).

Studies predict that the main sources of tsunami threat to FSM as a nation are the Philippines and Mariana Trenches, with the New Guinea Trench and the Kuril Trench expected to potentially affect specific FSM states or island groups. In recorded history there have been no significant tsunami impacts on FSM as wave heights and run-up elevations from detected events have fallen below the normal range of damaging high tides and storm surge levels. Information collected from the National Geophysical Data Center for the period between 1950 to 2009 indicates that tsunami generated from the above mentioned sources did not reach amplitudes higher than 10 cm. The highest amplitude recorded for the region at 30 cm was a result of the distant source 1960 Chile earthquake and tsunami (Warne 2009).

FSM has National and State level Disaster Preparedness Plans establishing command and control for managing a range of hazards. However, at the time of the Tsunami Capacity Assessment not all plans formally included agency roles and responsibilities or outlined communication and warning dissemination for the potential tsunami threat. Many of the plans were under review with the intention to incorporate tsunami hazard management

components as required. Documents under review included the MSHM-MP, which while it does include tsunami in the contents, has not been updated since it was endorsed in 2005.

Tsunami warnings form part of the agreement under the Compact of Free Association (CFA) (D11) between the United States of America (USA) and FSM through the provision of services from the United States Weather Service. The Pacific Tsunami Warning Center (PTWC) issue tsunami warnings to in-country FSM Weather Service Offices (WSO) who operate on a 24/7 basis. The Weather Forecast Office in Guam (WFO Guam) place follow-up calls to the Pohnpei, Yap and Chuuk WSOs and the Kosrae Disaster Coordination Office (DCO) to ensure warnings have been received. The WSOs will notify their relevant DCO, with Pohnpei WSO also having responsibility for notifying the Governor. Warning dissemination and evacuations are permitted on authority from the Governor. The National Office of Environment and Emergency Management (OEEM) assist the DCOs in emergency response activities.

Also under the CFA, emergency management support and disaster relief assistance is provided to FSM by the United States Agency for International Development (USAID) and the International Organization for Migration (IOM) in transition from the Federal Emergency Management Agency (FEMA) in accordance with statutory authorities, regulation and policies.

Participants in the workshop identified a number of areas where advancements could be made to the current FSM tsunami warning and mitigation system. Recurring themes included improved emergency response planning, enhancing communications systems and interagency cooperation, introducing community awareness programs about tsunami and strengthening regional and international partnerships. Very high priority recommendations to come out of the Tsunami Capacity Assessment of FSM include:

- The need for National and State agencies to collaborate on joint disaster management including preparedness initiatives from planning stages to implementation. In addition, develop SOPs for the receipt and dissemination of tsunami warning messages from the WSOs to the DCOs and OEEM. Following on from this, review and exercise the FSM National Disaster Preparedness Plan and developed SOPs linking the National and State roles and responsibilities.
- Department of Foreign Affairs submit FSM's membership application to the International Oceanographic Commission (IOC) to ensure continued support and assistance. In addition to this, strengthen cooperation with regional and international support to improve State mitigation, preparedness, response and recovery capabilities.
- Research and document tsunami history including anecdotal evidence and traditional coping strategies that may be incorporated into tsunami awareness, education, preparedness and response activities. Furthermore, train local media about tsunami risk and their role in assisting communities prepare and respond effectively to this hazard.
- Investigate the 'Chatty Beetle' or Rural Internet Communications System (RICS) solution as a backup to the Emergency Management Weather Information Network (EMWIN) and the Federated States of Micronesia Telecommunications Corporation (FSMTC) circuits to receive emergency warnings at the three critical WSO portals and at the Kosrae DCO. Consideration should also be given to establishment of a 24/7 early warning communication link to the remote Outer Islands from the DCOs using fixed solar powered 'Chatty Beetle' (or RICS) earth stations in community centres and controlling units from the DCOs.
- Maintain and upgrade the main island's Very High Frequency (VHF) two-way radio network and consider upgrading to a linked repeater system with full interagency interoperability. A fund to maintain all emergency communication systems should also be considered by the National government. Also identified as a very high priority, was for OEEM and DCOs to purchase backup power systems for communications to support mitigation and response activities.

Workshop participants are encouraged to use the FSM National Tsunami Capacity Assessment report to guide both National and State level projects and aid funded projects to achieve targeted

improvements in the tsunami warning and mitigation system for FSM. In turn, this will assist in improving systems for other high priority natural hazards.

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 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 the recommendations made to improve FSM's tsunami warning 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 to the FSM 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
<b>Very High</b>	<b>Low</b> – Recommendation currently being progressed or could possibly be progressed within the capacity of existing in-country resources (funds and staff).
<b>High</b>	<b>Medium</b> – 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.
<b>Medium</b>	<b>High</b> – Recommendation would require a high level of additional staff and/or expertise and funds. External funding support is likely to be required.
<b>Low</b>	<b>Very High</b> – 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 FSM’s tsunami warning and mitigation system.**

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
<b>Very High</b>	National and State level agencies need to collaborate on joint disaster management including preparedness initiatives from planning to implementation.	Low	Tsunami Emergency Response (including evacuation)	Multi-hazard	21
<b>Very High</b>	Department of Foreign Affairs submit FSM’s membership application to the IOC to ensure continued support and assistance.	Low	Regional and International Coordination	Tsunami specific	5
<b>Very High</b>	Develop Standard Operating Procedures (SOPs) for receipt and dissemination of warning messages for WSO to DCO and OEEM.	Medium	Tsunami Warning	Multi-hazard	8
<b>Very High</b>	Review and test the FSM National Disaster Preparedness Plan and SOPs linking responsibilities from National to State and vice versa	Medium	Governance & Coordination	Multi-hazard	2
<b>Very High</b>	Research and document tsunami history including anecdotal evidence and traditional coping strategies that can be incorporated into tsunami awareness, education, preparedness and response activities.	Medium	Public and Stakeholder Awareness and Education	Tsunami specific	28
<b>Very High</b>	Train local media about tsunami risk and their role in helping communities prepare and respond effectively. This training should focus on educating the media about tsunami alerts/warnings and in turn informing the community on response concepts.	Medium	Public and Stakeholder Awareness and Education	Tsunami specific	30

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
<b>Very High</b>	Look to at 'Chatty Beetle' or RICS solution as a backup to EMWIN and the FSMTC circuits to receive emergency warnings at the three critical WSO portals and at the Kosrae DCO.	High	Communications	Multi-hazard	11
<b>Very High</b>	Establish a 24/7 early warning communication link to the remote Outer Islands from the DCOs. It is recommended solar powered 'Chatty Beetles' (or RICS) are fixed to earth stations at each Outer Island community centre and that they are controlled from each DCO.	High	Communications	Multi-hazard	13
<b>Very High</b>	Maintain and upgrade the main island's VHF two-way radio network. Consider upgrading to a linked repeater system with full interagency interoperability.	High	Communications	Multi-hazard	16
<b>Very High</b>	Strengthen cooperation with regional and international support to improve State mitigation, preparedness, response and recovery capabilities.	High	Regional and International Coordination	Multi-hazard	3
<b>Very High</b>	FSM National government establish a fund to maintain all emergency communication systems.	High	Communications	Multi-hazard	18
<b>Very High</b>	OEEM and DCOs to purchase backup power systems for communications and to support mitigation and response activities.	High/Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Multi-hazard	25

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	FSM explore opportunities by international and regional organisations to build capacity and/or provide expertise for addressing tsunami risk and vulnerability issues.	Low	Research Expertise	Tsunami specific	6
High	Update the National Disaster Preparedness Plan to include tsunami within an all-hazards context.	Low	Tsunami Emergency Response (including evacuation)	Tsunami specific	20
High	USAID and IOM clarify roles, responsibilities, processes and resources to support mitigation, response and recovery initiatives.	Low	Regional and International Coordination	Multi-hazard	4
High	Strengthen community preparedness and response capability using resources available through regional partners such as Weather Forecast Office Guam and National agencies such as OEEM and WSOs.	Low	Public and Stakeholder Awareness and Education	Multi-hazard	32
High	Utilise community-based/non profit organisations such as Red Cross, women's, youth, traditional and religious groups, Chamber of Commerce, Lions and Rotary Clubs to promote local tsunami preparedness and awareness programs.	Low	Public and Stakeholder Awareness and Education	Tsunami specific	33
High	OEEM and DCOs maintain and distribute directory of contacts including satellite phone numbers and designated frequencies for radios, to members of emergency task forces.	Low	Communications	Multi-hazard	10

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Assess and improve existing National and State disaster preparedness and emergency response capabilities based on reviews such as the Pacific Wave 2008 exercise.	Low/Medium	Tsunami Emergency Response (including evacuation)	Multi-hazard	22
High	OEEM to explore possibilities of sending emergency cellular text (Simple Messaging System, SMS) and Emergency Alerting System (EAS) TV text through the FSMTC network to disseminate warnings and emergency information.	Medium	Communications	Multi-hazard	12
High	Encourage international research facilities to install monitoring stations in FSM.	Medium	Tsunami Monitoring Infrastructure	Tsunami specific	7
High	Place an all-hazards display including information on tsunami in a publicly accessible building e.g. the Micronesian Seminar or government offices such as tourism and public libraries.	Medium	Public and Stakeholder Awareness and Education	Multi-hazard	31
High	Develop all-hazards community awareness materials to provide consistent information that can also be adapted and translated for local communities to understand.	Medium	Public and Stakeholder Awareness and Education	Multi-hazard	29
High	a) Assess existing public awareness and community emergency preparedness to tsunami. b) Develop program based on assessment to inform vulnerable communities about tsunami and preparedness options.	High/Medium	Public and Stakeholder Awareness and Education	Tsunami specific	27

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
High	Add Sirens with cellular triggers (with manual back-up) around all State centres.	High	Communications	Multi-hazard	17
High	All States should repair/upgrade and maintain the Amplitude Modulated (AM) broadcast station. AM radio signals can deliver disaster related warnings and updates to the Outer Islands and locations on the main islands that are out of Frequency Modulated (FM) broadcast station range.	High	Communications	Multi-hazard	15
High	Set up permanently mounted 'always on' Iridium handheld in each State Emergency Room (ER) and Emergency Operations Center (EOC).	High	Communications	Multi-hazard	14
High	Develop/upgrade and then exercise State emergency response plans to include details on evacuation routes and locations of shelters.	High	Tsunami Emergency Response (including evacuation)	Multi-hazard	19
High	Review hazard and risk assessments based on new data collected to enhance tsunami preparedness and development planning.	High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	24
High	Conduct tsunami hazard and risk assessments using numerical inundation models based on existing and to be acquired high resolution, near-shore and lagoon bathymetric and topographic data.	High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	23
High	Complete review of FSM's Multi-State Multi-Hazard Mitigation Plan (2005).	High	Governance and Coordination	Multi-Hazard	1

Priority	Recommendation	Resource Intensity	Topic	Multi-hazard or tsunami specific	Recommendation Number In Table 5
<b>High</b>	Develop and enforce National/State building codes/standards incorporating major hazard risks.	High/Very High	Tsunami Hazard, Vulnerability, Risk and Mitigation	Tsunami specific	26
<b>Low</b>	Develop SOPs for DCO's to immediately notify PTWC of a tsunami event.	Low	Tsunami warnings	Tsunami specific	9



Section

2

## 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 receive, communicate and respond effectively to tsunami warnings. The 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 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 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 natural disaster 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 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 Organization (WMO) and the International Strategy for Disaster Reduction (ISDR).

## 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” (Department of Foreign Affairs and Trade (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 Pacific Island nations through the provision of seismic and sea level observations to the 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 USA contribution to the Pacific Tsunami Warning 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/Statement. 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](http://www.prh.noaa.gov/ptwc/about_messages.php)

Particularly in Micronesian countries, tsunami warnings from the Japan Meteorological Agency (JMA) are applicable and sometimes used. Coordination between PTWC and JMA is outlined in the procedures of each centre, For more information refer to [http://www.jma.go.jp/jma/en/Activities/Earthquakes/act\\_Earthquakes.htm](http://www.jma.go.jp/jma/en/Activities/Earthquakes/act_Earthquakes.htm)

## 2.7. International Tsunami Forums

Under the auspices of the IOC, the Intergovernmental Coordination Group (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 FSM

FSM is a sovereign island nation which is made up of four States; Yap, Chuuk, Pohnpei and Kosrae. FSM gained independence on November 3, 1986 under a CFA between FSM and the USA (FSM Gov, 2010).

FSM comprises of 607 small islands which lie just above the equator approximately 2,900 km (1802 miles) north of eastern Australia. Each of the four States surrounds one or more high islands and all States, but Kosrae, are comprised of numerous atolls. Chuuk includes seven major island groups. Pohnpei is the largest island in FSM and includes eight atolls, 25 smaller islands within a barrier reef and 137 widely scattered coral atolls. Yap is made up of four large islands, seven small islands and 134 atolls. Kosrae is essentially comprised of one high island and no outer Islands or atolls (FSM Visitors Center, 2010). The total land area of FSM is quite small amounting to 700 square km (or 270.8 square miles), but spans 2,600,000 square km (over 1,000,000 square miles) of the Pacific Ocean. The incredible variety of the FSM islands and atolls is due to volcanic activity millions of years ago (Wikipedia, 2010).

FSM has a rich history dating back several thousands of years. The islands were originally settled by ancient people sailing east from Asia and north from Polynesia. The first settlers are often described as Austronesian speakers, possessing horticultural skills and highly sophisticated maritime knowledge (FSM Visitors Center, 2010). The most recent Census in the year 2000 indicates that the total FSM population then was 107,008. Between the four States, Chuuk accounted for 53,595 of this total; Pohnpei 34,486; Yap 11,241; and Kosrae 7,686 (FSM Gov, 2010). Approximately 17% of FSM's total population, or 18,000 people live on the outer-islands and atolls (Pretick, 2007)

In FSM the President (currently Emanuel Mori from Chuuk) is both the Chief of State and head of Government. FSM formed its own constitutional government in 1979, the structure consisting of an executive branch, a legislative branch and a judicial branch. Each of the four States has its own constitution, an elected governor, a lieutenant governor and a unicameral legislature (Wikipedia, 2010). The National Congress is also unicameral and consists of 14 members. Four senators (one from each State) serve four-year terms, with the remaining ten members representing single member districts (based on population) serving two year terms. Both the President and the Vice-President are elected by the National Congress amongst its four-year members and both serve a four-year term. An appointed Cabinet supports the President and Vice President. There are no formal political parties in FSM (Central Intelligence Agency, CIA, 2010).

The fisheries sector is regarded as having the greatest economic development potential for FSM with current activities accounting for a significant portion of the regions annual gross domestic product (DFAT, 2010). The islands have few mineral deposits worth exploiting except for high-grade phosphate. The potential for a tourist industry exists particularly in the areas of diving and eco-tourism with some 15,000 tourists visiting the islands each year (DFAT, 2010). However the remote location, a lack of adequate facilities and limited air connections hinder development in this area. Under the original terms of the CFA, the USA provided \$1.3 billion in grant aid during the period 1986 to 2001. However, since then the level of aid has been subsequently reduced (CIA, 2010). FSM's medium-term economic outlook appears fragile due to the reduction of assistance

but also due to the slow growth of the private sector within the country (CIA, 2010). The overarching objectives of the Strategic Development Plan (2004 – 2023) for FSM are to achieve economic growth and self-reliance.

FSM's climate is tropical experiencing heavy rain all year round. The islands are located on the southern edge of the typhoon belt, with typhoon season between June and December (United Nations, UN, 2009). Natural events that are of concern to FSM include typhoons, storms and storm surge, tsunami, drought, landslides and sea level rise.

The future security of the region in relation to the impacts of climate change is outlined in a document from the Permanent Mission of the FSM to the UN to the UN's General Assembly. The document highlights that the widely dispersed population of FSM makes communities vulnerable to sea level rise. Residents of isolated islands are vulnerable due to their proximity to the ocean and their geographic isolation. On the other hand, very densely populated coastal areas in the centres themselves are becoming overdeveloped and crowded, making these populations also vulnerable to sea level rise (UN, 2009).



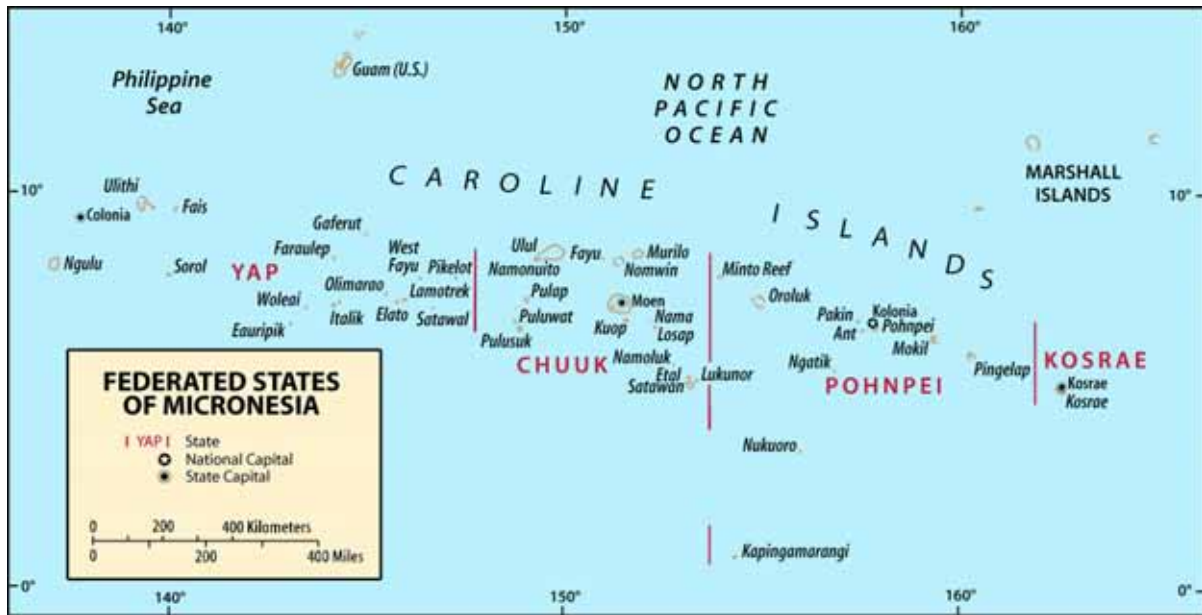


Figure 1: The Federated States of Micronesia Islands (Source:<http://www.fema.gov>)



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

### 3.2. Tsunami Threat Sources and Tsunami History in FSM

An overview of potential tsunami threat sources and the history of tsunami in FSM are outlined below. This information should be treated as general background only and does not attempt to complete a comprehensive picture of tsunami hazard and vulnerability for FSM. Such a study is outside the scope of this project. The vastly dispersed nature of FSM's islands, along with varying features of the sea-bed (or bathymetry) within the archipelago means that exposure to possible tsunami impacts are likely to vary from island to island or island groups. It also means that because of the complex and rapidly altering bathymetry, certain areas of FSM are difficult to model and therefore tsunami amplitudes must be interpreted with caution due to inadequate data sets (Thomas and Burbidge, 2009).

While there are limited official historical records of significant tsunami events for FSM, preliminary risk modelling suggests that there is a medium to high tsunami risk for the region. Initial assessments also indicate that Yap and its surrounding islands and atolls are thought to have the highest risk of tsunami impact out of the four States (Thomas and Burbidge, 2009). Although the FSM population and Government have had little recent experience with tsunami impacts, there is an awareness of the susceptibility of low-lying atolls to rising sea levels associated with climate change, inundation as a result of storms, typhoons and increasingly, the potential of inundation from tsunami impact.

Thomas, Burbidge and Cummins (2007) completed *A Preliminary Study into the Tsunami Hazard faced by Southwest Pacific Nations (D18)*. Scenarios for 8.5 Moment Magnitude (Mw) and 9.0 Mw earthquakes were used to investigate offshore wave amplitudes (at a depth of 50 metres) for tsunami caused by earthquakes along subduction zones (Refer Figure 2 and 3). In this study, FSM's maximum amplitude for all tide gauges for all 9.0 Mw tsunami was 230cm with the most significant source regions being Mariana, Philippines, New Guinea, South Solomons, Aleutians, Nankai and Ryukyu (amplitude greater than 75cm at 50m depth or single most significant source region if no amplitude exceeds 75cm). For an 8.5 Mw tsunami the maximum amplitude reduced to 160cm, with Mariana, New Guinea, Philippines and South Solomons remaining as the most significant threat source regions within this scenario.

A further study completed by Thomas and Burbidge (2009) attempts to answer the question "which Pacific nations might experience offshore amplitudes large enough to potentially result in hazardous inundation, what are the probabilities of experiencing these amplitudes and from which subduction zones might these tsunami originate". The report considers FSM (due to the large east to west extent of the country) as main three regions; Yap, Chuuk and Pohnpei and Kosrae grouped together. The report suggests that the Philippines Trench and the Mariana Trench are significant tsunami threat sources to FSM, while the New Guinea and Kuril Trenches are expected to be more of a threat to specific regions of FSM (Thomas and Burbidge, 2009).

The 2009 report indicates that from all the States, Yap has the highest probabilistic tsunami hazard with a predicted maximum amplitude of 1.8 to 2.6 meters (convert to ft) at the 2000 year return period (Thomas and Burbidge, 2009). Maximum amplitudes for the eastern island States of Pohnpei and Kosrae while lower, still pose a significant threat with predictions of 1.1 to 1.9 meters for a 2000 year return period. The report forecasts that Chuuk also has maximum amplitudes in the order of one to two meters at return periods of 2000 years. However due to the extremely complex bathymetry in this region of FSM, maximum amplitudes calculated for Chuuk and its islands should be treated with caution (Thomas and Burbidge, 2009).

An investigation of the Bureau's deep ocean model-based tsunami prediction system by Dr Jane Warne (2008) reiterates that the main subduction zone threat sources for FSM are the Philippines Trench and the Mariana Trench, as well as the Kuril and the New Guinea Trenches. Warne states that the focus of energy from the Philippines Trench is especially pertinent for the western islands of FSM, with travel time to this area in the order of an hour or less. In large events, Warne predicts a significant threat for communities in the west occupying low-lying population centres. The southern and central sections of the Mariana Trench (particularly the southern) also provide a

significant risk to Yap and its surrounding islands with a predicted travel time of less than 30 minutes.

Warne’s report suggests a similar outcome to Thomas and Burbidge’s assessment in that the New Guinea Trench is most likely to hold the most significant threat for the western region of FSM with lesser effects felt to the east. In relation to the Kuril Trench, Warne also found that this is a significant threat source to the region but due to the proximity of the subduction zone, allows a longer lead time for emergency services and communities to respond to tsunami generated from this trench. Identified as a far lesser tsunami threat to the region were the Ryukyu Trench, the western part of the Aleutians Trench, Nankai Trench, South Solomon Trench and the New Hebrides Trench.

In recorded history there have been no significant tsunami impacts on FSM as wave heights and run-up elevations from detected tsunami have fallen below the normal range of high tide and storm surge levels. Information collected from the National Geophysical Data Center for the period between 1950 to 2009 indicates that tsunami generated from the above mentioned sources did not reach amplitudes higher than 10 cm (refer to Figure 5). The highest amplitude recorded for the region at 30 cm was a result of the distant source 1960 Chile earthquake and subsequent tsunami (Warne, 2009).



Figure 3: The subduction zones (in orange) of the Pacific Ocean



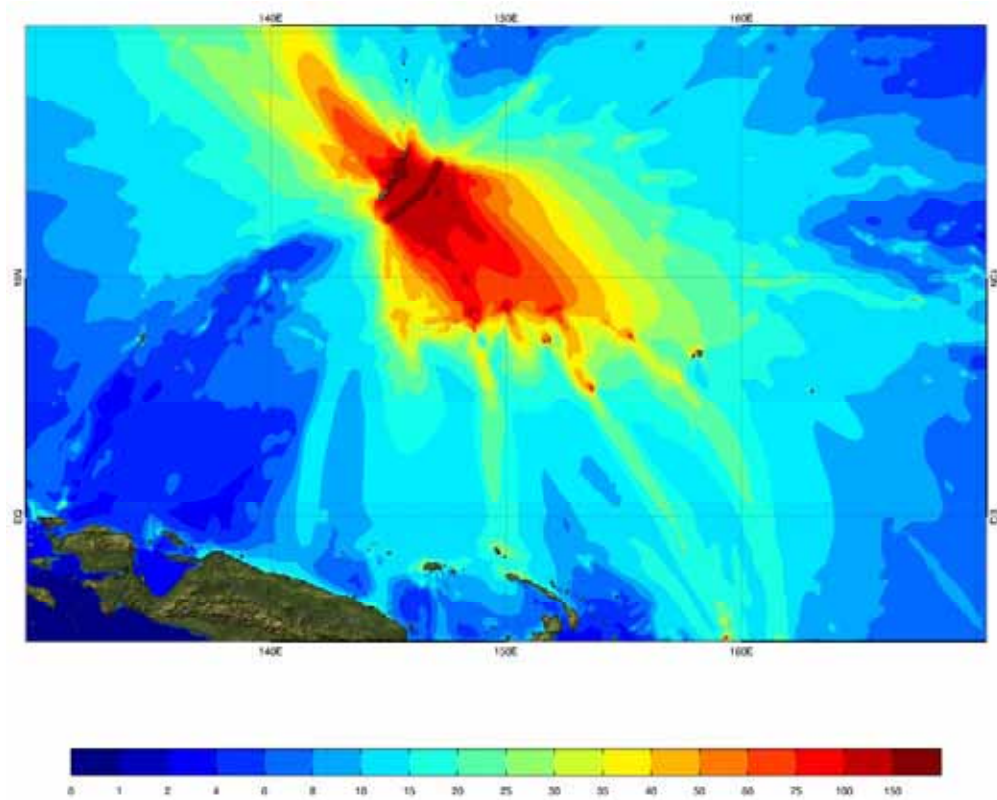


Figure 4a: Maximum amplitude tsunami from Mw 8.5 earthquake scenario on the Mariana Trench showing tsunami energy beamed towards FSM (Source: Scenario 280c of MOST model from T2 database, Greenslade, Simanjuntak and Allen, 2009).

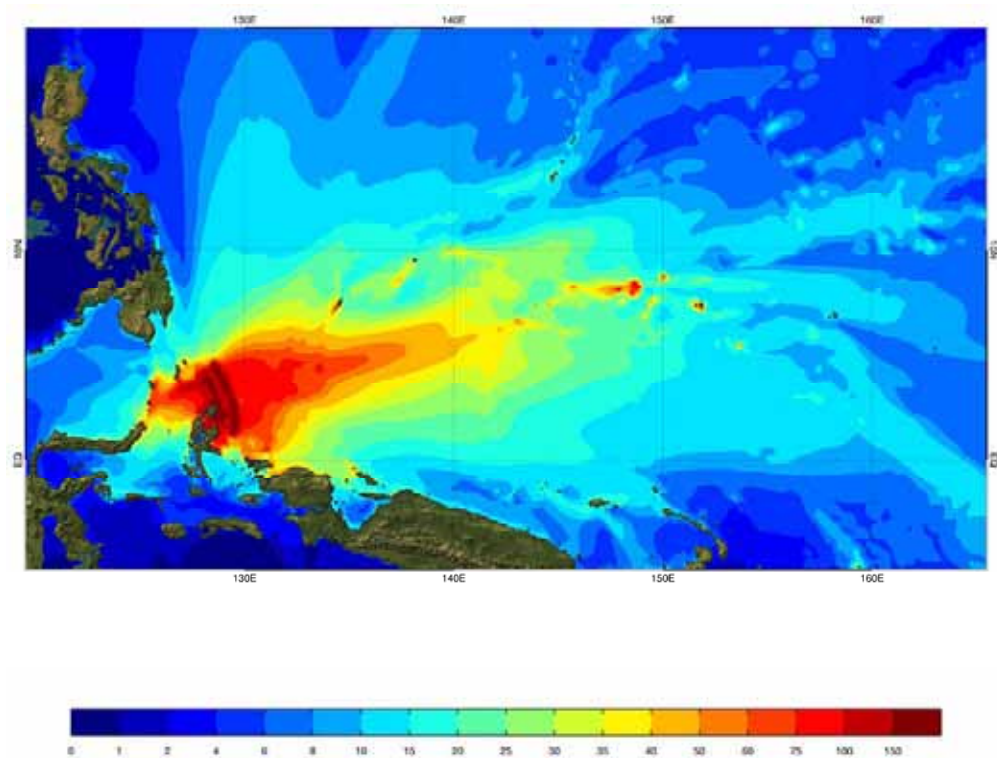


Figure 4b: Maximum amplitude tsunami from Mw 8.5 earthquake scenario on the Philippines showing tsunami energy beamed towards FSM (Source: Scenario 125c of MOST model from T2 database, Greenslade, Simanjuntak and Allen, 2009).

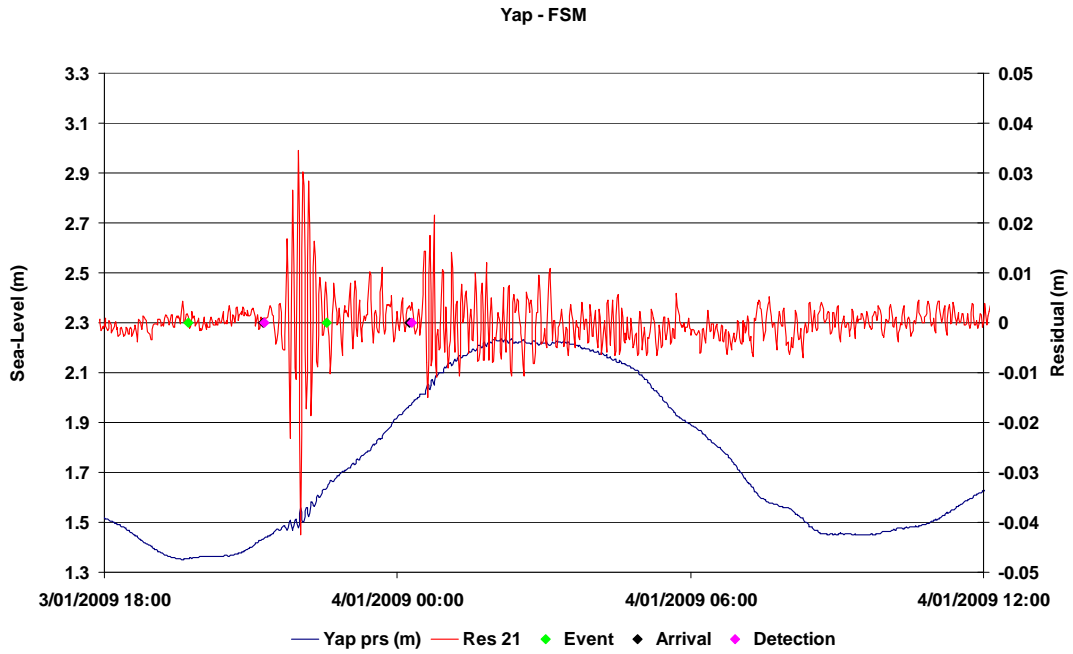


Figure 5: 3 Jan 2009, two small (<10cm amplitude) events at 19:42 (Mw 7.7) and 22:33 (Mw 7.5) event from the New Guinea trench as detected at Yap by the University of Hawaii sea level gauge





## 4. The Federated States of Micronesia Tsunami Capacity Assessment





## 4. The FSM Tsunami Capacity Assessment

### 4.1. Date and Location

The Tsunami Capacity Assessment of the ability of FSM to receive, communicate and effectively respond to tsunami warnings took place from 14 to 17 September 2009, at the Cliff Rainbow Hotel in Pohnpei FSM.

### 4.2. Visiting Assessment Team and Participants

The Visiting Assessment Team was made up of those outlined in Annexure 2. The in-country organising of the workshop was undertaken Andrew Yatilman, Tony Neff and other members of staff from OEEM. A full list of workshop participants can be found in Annexure 1.

### 4.3. Workshop Summary

See Annexure 3 for a copy of the full agenda for the workshop.

#### 4.3.1. *Day 1 (14 September 2009)*

Day one of the FSM Tsunami Capacity Assessment workshop was attended by approximately 40 participants.

Following the opening ceremony, Team Leader Michael Bonte-Grapetin responded to the opening words and provided participants with an overview of the workshop ahead. This was followed by around the table introductions of participants and the assessment team. The opening ceremony was then concluded with a prayer and a morning refreshment break took place.

Presentations took place after the refreshment break by the visiting assessment team which provided an in depth overview about the Tsunami Capacity Assessment project, the tsunami threat to FSM and a summary about some of the current tsunami warning system in place for FSM.

After completion of the presentations, participants were asked to split in to five separate groups to consider priorities to enhance the effectiveness of FSM's tsunami warning and mitigation system. Each group discussed the priorities for various areas including Preparedness and Response, Community Awareness, Communications, Risk Assessment and Mitigation and International Aid Coordination and Recovery. Following this each group took turns to present their answers in relation current activities, gaps and needs, agency responsibilities and priorities.

After lunch, workshop participants' commenced discussions and the recording of answers to sections 2, 5 and 6 of the questionnaire.

#### **4.3.2. Day 2 (15 September 2009)**

Day two of the FSM Tsunami Capacity Assessment workshop was again attended by approximately 40 participants.

The day commenced with presentations by FSM in-country experts, outlining the tsunami warning and mitigation capacity from the National government perspective, as well as that of each State. Presenters included Oleen Poll from OEEM, Philip Raffliyi from Yap DCO, Wilfred Robert from Chuuk DCO, Lawrence Patterson from Pohnpei DCO and Vinson Henry from Kosrae DCO. Sanchez Salle and Kenley Andon spoke on behalf of the Pohnpei and Chuuk WSOs.

Following the morning break, the Tsunami Capacity Assessment Workshop continued as participants discussed and recorded answers to sections 6 and 7 of the questionnaire.

In order to increase their understanding about the capabilities of FSM's tsunami warning and mitigation system, the visiting assessment team conducted site visits in the afternoon and were accompanied by the relevant FSM participants. Visits were made to:

- WSO Pohnpei
- DCO Pohnpei
- National Disaster Management Office (NDMO) Palikir
- New Executive Building
- Micronesia Seminar

#### **4.3.3. Day 3 (16 September 2009)**

Day three of the FSM Tsunami Capacity Assessment was again attended by 40 participants.

Bart Deemer from USAID started the day off with a presentation about Emergency Response and Recovery assistance for FSM. Workshop participants then continued working through sections 8, 9 and 10 of the questionnaire until close of the workshop that day.

#### **4.3.4. Day 4 (17 September 2009)**

The fourth and final day of the workshop was attended by 35 participants.

Following the morning break, the preliminary findings of the visiting assessment team were presented by Litea Biukoto. The FSM participants were then given the opportunity to provide input and feedback against the preliminary findings. The assessment team incorporated the input from this session on the spot.

In the afternoon, Andrew Yatilman led the group in acknowledging the hard work of the participants and the assessment team over the week. Litea Biukoto also provided a few words of appreciation and then closed the workshop.

#### 4.4. Workshop Photos (Pohnpei, September 2009)



**FSM Tsunami Capacity Assessment Workshop participants**



**Chip Guard presents on tsunami risk, monitoring and warnings for FSM**

## Workshop Photos (Continued)



**Bruce Best Speaking about  
FSM Communications  
Systems**



**Andrew Yatilman from the Office of Environment and Emergency  
Management presents on the National emergency management  
arrangements for FSM**



**Litea Biukoto during a visit to the FSMTC in Pohnpei**





## 5. Assessment Results



## 5. Assessment Results

### 5.1. Status of Key System Components

The Tsunami Capacity Assessment Workshop results are summarised below in Table 4 in which the status of key components of FSM's tsunami warning and mitigation system are outlined (as at the date the Tsunami Capacity Assessment Workshop was held in September 2009, updates between then and the publication of this report are as marked).

**Table 4: Summary of current status of key components of FSM's tsunami warning and mitigation system as at September 2009.**

**Rating**

Yes - fully realised
Partially realised
No - not realised

Key Component	Rating	Comment
<b>Authority, Coordination and NGO Role</b>		
Legislation in place for tsunami warnings and response	<b>Yes</b>	<p>The CFA between the USA and FSM outlines in Section 221: Article II (Program Assistance) that services provided to FSM incorporates those undertaken by the United States Weather Service which includes the provision of Tsunami Warnings.</p> <p>Under the same section of the CFA the Department of Homeland Security, and the United States Disaster Preparedness and Response Services (and Related Programs), is responsible for emergency management and disaster relief assistance in accordance with its statutory authorities, regulation and policies.</p> <p>The Robert T. Stafford Disaster Relief and Emergency Assistance Act (D16) also legislates the provision of support to FSM through all facets of emergency management, disaster preparedness and mitigation across all hazards. USAID and IOM provide emergency management and response support for FSM in transition from FEMA.</p>

Key Component	Rating	Comment
<p>Legislation in place for tsunami warnings and response <i>(continued...)</i></p>	<p><b>Yes</b></p>	<p>The legislative responsibilities outlined in the CFA are undertaken in conjunction with National and State plans for tsunami warning and response.</p> <p>The PTWC issue warnings to the WFO Guam who then notify the WSOs in each State (Note: Kosrae DCO is contacted by WFO Guam as there is no WSO based in this State). The Chuuk, Pohnpei and Yap WSOs then notify their relevant DCOs. Pohnpei WSO also notifies the Governor of any tsunami warnings as the authorising body for warning dissemination and evacuations.</p> <p>The National OEEM assist the DCOs in emergency response activities.</p>
<p>Tsunami coordination committee or effort at a National and local level</p>	<p><b>Yes</b></p>	<p>The FSM Cabinet is the committee responsible for tsunami coordination at the National Level. In FSM, the Cabinet comprises of the President, Vice President, Speaker of the Congress, Ambassador to the US, Permanent Representative to the UN and the heads of eight executive departments. The National Disaster Coordination Committee has the authority for decision and policy making.</p> <p>State level disaster coordination committees advise the National committee and also have the authority to make decisions and develop policy. The State of Chuuk has established a committee looking specifically at their tsunami risk. The names of the State based disaster coordination committees are as follows:</p> <ul style="list-style-type: none"> <li>• Chuuk: Tsunami Committee and Disaster Task Force</li> <li>• Pohnpei: Governor's Disaster Task Force</li> <li>• Yap: Disaster Committee</li> <li>• Kosrae: Disaster Committee</li> </ul> <p>Similar coordination mechanisms do not exist at the provincial and community levels, however municipalities form ad hoc committees with their State representatives during emergency events as required.</p>
<p>Agency responsibilities clearly defined</p>	<p><b>Partially</b></p>	<p>Roles and responsibilities are defined verbally and to an extent through National and State disaster management and preparedness plans. However, to maximise the efficiency of the tsunami warning system and account realistically for available capabilities, linking National and State roles and responsibilities through formally drafted SOPs is required.</p>



Key Component	Rating	Comment
<p>NGOs and Red Cross Society have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response</p>	<p><b>Partially</b></p>	<p>The role of NGOs in relation to tsunami warning, dissemination, preparedness, awareness, emergency response and recovery needs to be more clearly defined within reviews of National and State preparedness and response plans.</p> <p>Comment was made during the workshop that there is much opportunity to utilise community based organisations such as women’s, youth, cultural and religious groups, Rotary and Lions Club and Salvation Army in tsunami public education and awareness programs, warning dissemination, emergency response and recovery.</p> <p>While not related directly to tsunami, the assessment revealed that NGO’s do already perform preparedness, warning and recovery functions within the community. Some of these functions include;</p> <ul style="list-style-type: none"> <li>• Red Cross: Community Education, initial disaster assessment, recovery and assisting DCO with warning dissemination for other hazards</li> <li>• Women’s Advisory Council: Community awareness and dissemination of educational materials for programs that are largely health focused</li> <li>• Churches: provide shelter during emergency events and to assist recovery efforts</li> </ul>
<p><b>International and Regional Cooperation</b></p>		
<p>Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts</p>	<p><b>Partially</b></p>	<p>Weather services and support to in-country WSOs are provided to FSM under the CFA. The WSOs pass tsunami warning information to the DCOs with back-up arrangements from the WFO Guam.</p> <p>Under the CFA there is also the provision of technical expertise to WSOs from Honolulu.</p> <p>As mentioned, emergency management support and disaster relief assistance is provided to FSM under the CFA. This assistance goes through National level government and not directly to the States. During the assessment, it was acknowledged that there needs to be strengthen cooperation at the regional and international level to support capacity building of State mitigation, preparedness, response and recovery capabilities.</p> <p>Leading on from this, was the request for USAID and IOM to clarify roles, responsibilities, processes and resources to support mitigation, response and recovery initiatives.</p> <p>Recommendations reflected the need for the Department of Foreign Affairs to submit FSM’s membership application to the IOC to ensure continued support and assistance.</p>

Key Component	Rating	Comment
<b>Priorities</b>		
<p>Priorities established for implementation of tsunami warning and mitigation system at a National and State level</p>	<p><b>Partially</b> (through the tsunami assessment process)</p>	<p>A comprehensive list of priorities was agreed upon throughout the workshop. A detailed overview of the priorities can be found under the Recommendations heading (Table 2). Some of the key priorities included;</p> <ul style="list-style-type: none"> <li>• Closer collaboration between National and State level agencies on disaster management and preparedness initiatives</li> <li>• Develop SOPs for the receipt and dissemination of warning messages from National to State based organisations</li> <li>• Review and exercise the FSM National Disaster Preparedness Plan and SOPs</li> <li>• Multi-State Multi-Hazard Mitigation Plan to complete review</li> <li>• Extract any local FSM knowledge about tsunami that may be incorporated into tsunami awareness, education, preparedness and response activities</li> <li>• Train local media about tsunami risk and the warning system for FSM to assist communities prepare and effectively response during a tsunami event</li> <li>• Investigate potential used of the 'Chatty Beetle' or the RICS as a backup to EMWIN and FSMTC circuits to receive emergency warnings at the three critical WSO portals and at the Kosrae DCO</li> <li>• Establish a 24/7 early warning communications link to the remote Outer Islands from the DCO's. 'Chatty Beetle' (or RICS) earth stations at each of the Outer Island community centres, controlling systems from each State's DCO</li> <li>• Maintain and upgrade the main islands VHF two-way radio network</li> <li>• Strengthen cooperation with regional and international support to improve State mitigation, preparedness, response and recovery capability</li> <li>• National and State organisations to purchase, upgrade and maintain emergency communication systems</li> <li>• Develop community education and awareness programs about tsunami targeting 'at risk' communities including the Outer Islands and coastal communities</li> <li>• More risk assessments and inundation modelling for FSM including the capturing or acquiring sufficient topographical and bathymetrical data</li> </ul>

Key Component	Rating	Comment
<b>Multi-hazard Approach</b>		
Tsunami warning capabilities are being established within a multi-hazard framework	<b>Yes</b>	Existing WSO warning capabilities have been expanded to include tsunami in the all-hazard warnings system for FSM. In addition, improvements to existing communications and warning systems have improved response to hazards in general.  Further tsunami warning capabilities will be incorporated into the all-hazards framework with the review and upgrade of mitigation and response plans on both the National and State levels.
<b>Research Expertise</b>		
Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system	<b>No</b>	There are currently no active researchers or research organisations looking at seismology or tsunami science in FSM.  It is therefore recommended that FSM explore opportunities through international and regional organisations to build capacity and/or provide expertise in addressing tsunami risk and vulnerability issues.
<b>Tsunami monitoring infrastructure</b>		
Existence of seismograph stations and integration of real-time data from these stations into the tsunami warning process	<b>No</b>	FSM does not operate any seismograph stations or networks to monitor either regional or local seismicity.
Existence of sea level stations and integration of real-time data from these stations into the tsunami warning process	<b>Partially</b>	While FSM has real-time sea level gauges that are being monitored and maintained by PTWC, there is currently no in-country technical capability to maintain or budgetary capacity to cover recurrent costs of this equipment.  There are currently sea level gauges in Pohnpei and Yap. These can be viewed via internet through the National Data Buoy Center website. There are plans underway to install sea level gauges in Chuuk and Kosrae. There are also several deep ocean DART buoys in the region that support FSM tsunami monitoring.  There is also an Australian SEAFRAME site in Pohnpei.
Sharing of seismic and sea level data internationally to facilitate improvement of PTWC tsunami messages for the region	<b>Yes</b>	The data from sea level gauges and the buoys are available in real-time and shared internationally, with information sent directly to the PTWC and also through the National Data Buoy Center website.

Key Component	Rating	Comment
<b>Warnings</b>		
Nation receives PTWC messages	<b>Yes</b>	<p>The WSO in Pohnpei, Chuuk, Yap and the Kosrae DCO receive tsunami warnings and bulletins from the PTWC. The messages go simultaneously to the National Weather Service (WFO Guam) who then follow-up with a phone call to each WSO to ensure messages have been received.</p> <p>Warnings are sent via internet to the WSOs and the DCO via the Automated Weather Interactive Processing System (AWIPS). Warnings set off an alarm on the equipment when received by WFO Guam. In addition to calling, WFO Guam are also able to fax information to the WSOs and the DCO.</p> <p>However, it was noted during the workshop that EMWIN is only operational in the Pohnpei WSO and not operational in the Chuuk or Yap WSOs.</p>
24/7 operational staff at warning receipt and dissemination location	<b>Yes</b>	<p>All WSOs are operational 24/7. As previously mentioned the WSO will contact the State based DCOs to inform them of the tsunami warning.</p> <p>In the event that a DCO cannot be reached, the police are called to help locate the DCO officer and deliver the warning message. The DCOs, with assistance from the OEEM, disseminate the tsunami warning.</p>
Disseminate National tsunami warnings as guided by a Standard Operating Procedure	<b>Partially</b>	<p>It was found that while SOPs are in existence, they are largely verbal in nature and therefore, need to be prepared in writing and formalised. The developed of SOPs should reflect receipt and dissemination of tsunami warning messages from WSO to the DCOs and OEEM.</p> <p>Within the SOPs it should be noted that OEEM and DCOs maintain and distribute a directory of contacts including satellite phone numbers and designated frequencies for radios to members of the emergency task forces.</p>
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	<b>Yes</b>	<p>WFO Guam place follow-up calls to WSOs and the Kosrae DCO to ensure they have received the tsunami warning from the PTWC. Alarm capability to alert WSO and DCO staff about the arrival of internet received tsunami warnings is not yet available. In the event that a DCO cannot be reached, the police are called to help locate the DCO officer and deliver the warning message.</p>
Redundant 24/7 methods available for dissemination of warnings to community (e.g. public radio, sirens etc.)	<b>Yes</b>	<p>In the major population centres, the following methods have been employed to disseminate warnings:</p> <ul style="list-style-type: none"> <li>• Pohnpei: Police/Fire sirens and Public Address System (PA). The local media on FM and AM frequencies</li> <li>• Yap: Police cars with PA/siren systems</li> <li>• Chuuk: Police cars with PA/siren systems</li> <li>• Kosrae: Police cars with PA/siren systems</li> </ul> <p>These methods are outlined in each State's response plan and used in an all-hazard warnings context.</p>

Key Component	Rating	Comment
Effective warning dissemination to remote communities	<b>No</b>	<p>There are no early warning systems in place for remote Outer Island communities and presently they have to wait for Single Sideband (SSB)/High Frequency (HF) radios come on in the morning to receive information.</p> <p>The Chatty Beetle was presented to the group and was proposed as an alternative to an early warning system for these remote locations and communities.</p>
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	<b>Partially</b>	<p>FSMTC is a robust local government run telecom system which supports all four States's voice, data, cellular traffic over INTELSAT. The three FSM WSO's have multiple paths for incoming PTWC alerts via the FSM INTELSAT supplied Internet or phone/fax lines (with some Iridium and EMWIN backup).</p> <p>FSMTC also has Broadcast SMS capability and most of the 50 Outer Islands of the FSM are equipped with HF radios. All States have at least one broadcast station.</p> <p>There are many Iridium phones available around Pohnpei and a couple each on Yap, Kosrae and Chuuk. Each State's Department of Public Safety have a local VHF (with retransmitting repeater) two-way radio network.</p> <p>However, FSMTC only covers the main islands (with some Chuuk lagoon coverage). In addition, FSMTC (with direction from National and State DCO's) has not implemented EAS or SMS.</p> <p>EMWIN is re-transmitted on the GOES 7 satellite which is running out of fuel with no backup. Other issues include the fact that HF radios in the Outer Islands are turned off except when passing traffic and also, most Iridium phones in the FSM are not functioning.</p> <p>It was suggested that there is a need to look to at 'Chatty Beetle' or RICS solution as a backup to EMWIN and the FSMTC circuits to receive emergency warnings at the three critical WSO portals and at the Kosrae DCO.</p> <p>The OEEM are exploring possibilities of sending emergency cellular text (SMS) and EAS TV text through the FSMTC network to disseminate warnings and emergency information. There is also talk of setting permanently mounted 'always on' Iridium handheld in each State ER and EOC.</p> <p>It is recommended that all states should repair/upgrade and maintain the AM broadcast station. AM radio signals can deliver disaster related warnings and updates to the Outer Islands and locations on the main islands that are out of FM broadcast station range.</p> <p>Another recommendation was to maintain and upgrade the main island's VHF two-way radio network and consider linking to a repeater system with full interagency interoperability.</p>

Key Component	Rating	Comment
<p>Issue of marine tsunami warnings and guidance for vessels, harbours and ports</p>	<p><b>No</b></p>	<p>The WSO's issue marine forecast and warning to mariners and coastal zone users. However, there are no SOPs in place for issuing marine tsunami warnings for FSM at this stage.</p> <p>There is 24/7 radio capability to contact and warn mariners about tsunami threats through Channel 16/HF available at the Pohnpei Port Authority (PPA). Even so, the success of this current system is dependant on whether the guard wakes up an operator to broadcast the warning.</p> <p>Patrol boats have INMARSAT, NAVTEX communication systems, however these are only manned when crews are out at sea.</p> <p>PA systems located in harbours and ports can be used to warn and instruct berthed boats in or entering PPA. It is unknown if there are PA systems or radio capabilities in the harbours and ports of the other three island States.</p>
<p><b>Emergency Response and Evacuation</b></p>		
<p>Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified</p>	<p><b>Partially</b></p>	<p>While there are National and State Disaster Preparedness Plans in place for FSM, coordination and response to a tsunami event has not been heavily focused upon previously. At the time of this assessment, there were no emergency response and disaster preparedness plans pertaining specifically to tsunami threats.</p> <p>However, at the time of this assessment, many of the plans were under review with intentions to include the tsunami response component. Documents under review include FSM's MSMH-MP, which has not been updated since it was endorsed in 2005.</p> <p>From the assessment workshop, the following recommendations were put forth to address gaps and possible improvements to the current tsunami emergency response system in FSM.</p> <ul style="list-style-type: none"> <li>• Develop, upgrade and then exercise the State emergency response plans. Details about evacuation routes and shelters should be included within the plans.</li> <li>• Update the National Disaster Preparedness Plan to include all aspects of emergency management in relation to tsunami hazards.</li> <li>• National and State level agencies to collaborate on joint disaster management initiatives, including preparedness programs from planning to implementation.</li> <li>• Assess and improve existing National and State disaster preparedness and emergency response capabilities based on reviews of real and simulated events including the Pacific Wave 2008 exercise.</li> </ul>

Key Component	Rating	Comment
Tsunami emergency response, evacuation and recovery plan exists	<b>No</b>	At the time of this assessment there were no emergency plans in place for FSM addressing tsunami specifically.
The designated agency for evacuation is identified and have authority by law	<b>Yes</b>	<p>The Governor authorises public evacuations and grants the responsibility of informing the community and undertaking the task to the DCOs.</p> <p>Evacuations are not forced, however the public is encouraged to act once an advisory is issued. Mayors are tasked with the responsibility of reinforcing evacuation messages to local communities.</p> <p>Note: Kosrae have tested their response plan through an exercise involving the community. Lead time was recorded at approximately 2-3 hours for the community to evacuate the main population areas.</p>
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	<b>No</b>	<p>While emergency shelters have been identified for typhoons, there are no tsunami related evacuation maps, routes and signage in place. Comment was made during the workshop that all of these elements will be considered with the review of State based emergency plans.</p> <p>Note: it was agreed that FSM would consider using tsunami signage already designed and being utilised by other countries if seen as applicable to the evacuation plans and procedures of FSM. It was suggested that tsunami signage could be incorporated into public education tsunami programs for FSM.</p> <p>On the other hand, it was also considered that if signage incorporated images and words that reflected traditional methods of coping with tsunami hazards, it may value-add to community awareness efforts for FSM.</p>
Procedures are tested and exercised to improve the response through better planning and preparedness	<b>Partially</b>	<p>The WSOs and DCOs test SOPs at the airports, for typhoons and other emergency events, but not for tsunami response.</p> <p>In Yap, the United States (US) Forestry Service installed an Incident Command System 400 which is regularly tested.</p> <p>Pohnpei DCO regularly tests capabilities and resources with Federal Aviation Administration (FAA) to maintain accreditation.</p> <p>All Chuukese schools were involved in Pacific Wave 2008.</p> <p>It was noted during the assessment that the Health Department undertakes routine exercises to test their emergency response to health related issues such as dengue fever outbreaks. The Pohnpei Health Department tests its plans every two years which includes the relocation of patients and services to alternate sites during emergency situations.</p>



Key Component	Rating	Comment
<p>Land use policies and building codes are in place to mitigate against the tsunami hazard</p>	<p><b>No</b></p>	<p>Currently, there are no structural mitigations options being implemented to address tsunami risk. However, in the absence of a National building code, Yap State has drafted a State building code as well as land zoning plans to guide the work of construction projects. It was suggested during the assessment that these guidelines could be reviewed to incorporate considerations for tsunami hazards into building codes and plans.</p> <p>It was noted that any hazard and risk assessments undertaken for FSM that generate tsunami inundation models, should be utilised to provide direction on appropriate structural measures.</p> <p>The design and engineering of new facilities and infrastructure in each State use seismic and wind loading criteria which are adapted from US Standards. FSM building, construction guidelines and standards may need to comply with the US under the CFA.</p> <p>The airports of three States are located in close proximity to the coastline.</p>
<p><b>Tsunami hazard, vulnerability and risk</b></p>		
<p>Completion of studies to assess the tsunami hazard in the country or Region</p>	<p><b>Partially</b></p>	<p>The FSM MSMH-MP was based on the hazard and risk assessments of the key natural and man-made hazards for the country. Tsunami is included within this plan. However, tsunami is less frequent than other hazards experienced in region and therefore, there is a lack of awareness about tsunami risk. During the workshop it was found that hazard related risks are not always considered in development planning.</p> <p>At the National level, OEEM has responsibility for identifying tsunami hazard and risk. These assessments were undertaken for all four States when the MSMH-MP was originally drafted by URS Corporation in 2005.</p> <p>Currently, National Oceanic and Atmospheric Administration (NOAA) undertakes typhoon hazard and risk assessments for FSM. These however, are usually response oriented rather than for the purposes of planning. United States Geological Survey (USGS) upon request may be able to carry out hazard mapping and inundation modelling for the region.</p> <p>SOPAC is collating hazard and risk information for most Pacific Island Countries including the FSM States, Chuuk and Pohnpei.</p> <p>GA has also completed preliminary and probabilistic tsunami hazard assessments of PICs, including FSM.</p>



Key Component	Rating	Comment
Local risk assessments have been completed for at risk communities	<b>Partially</b>	<p>The MSMH-MP includes State wide hazard and vulnerability maps. Though these may not be usable for local planning purposes due to the lack of detailed inundation information, they do provide a good starting point.</p> <p>Red Cross Societies in the region have been conducting Vulnerability and Capacity Assessments in the region. However, this process has not yet been undertaken for FSM.</p> <p>In relation to climate change vulnerability, an interagency assessment was due to be undertaken for all four States including the Outer Islands in October 2009.</p> <p>In 2005, the Asian Development Bank (ADB) carried out a climate proofing study in Pohnpei and Kosrae in relation to infrastructure development. Consultations were undertaken with representatives from all four States during the process.</p>
Adequate data exists and local inundation modelling has been completed for population centres	<b>Partially</b>	<p>SOPAC has collated all bathymetric data for Pohnpei. This includes data from the SOPAC swath mapping exercise and LiDAR data flown over Kolonia and Nan Madol. A 10 m grid was produced from this data and has been distributed in FSM to the SOPAC National Representative, Department of Resource and Development and agencies who have requested the data i.e. Statistics, Marine Affairs etc.</p> <p>Some Light Detection and Ranging (LiDAR) data was captured for Kolonia and the Nan Madol mangrove areas on Pohnpei. This data was compiled with the bathymetric data. There was a question raised during the workshop about whose responsibility it is to maintain the LiDAR data.</p> <p>There is also possibly data available from the ADB climate proofing study for Kosrae and Pohnpei.</p>
<b>Public and Stakeholder Awareness, Education and Training</b>		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	<b>No</b>	<p>There have been limited measures taken to date in FSM to ensure sound public understanding about tsunami and the correct actions to take in response to an event.</p> <p>No official National assessment has been undertaken to measure levels of public awareness and preparedness. Nevertheless there are opportunities to carry out a survey off the back of other government initiatives where by teams visit populations in central areas and Outer Islands. Comment was made that assistance to design a survey tool relevant to FSM communities would be required.</p>

Key Component	Rating	Comment
Community level education and preparedness programs exist for tsunami	<b>No</b>	<p>There are no local level programs to educate and prepare communities for tsunami. OEEM have ownership of the community awareness program but have been limited in what they can achieve due to time and resources. OEEM do have a line item in their annual budget for community focused activities.</p> <p>Some of the local resources identified to assist in tsunami awareness raising programs included women's, youth and church groups, print media – the Kasalehlie Press, NGO's, Rotary and Lions Clubs, the Telecom phone book and the Government Public Information Office.</p> <p>At the time of the assessment, a taskforce was being established in Pohnpei to address some of the public awareness issues about natural hazards. The taskforce was to be made up of the DCOs, public affairs and the Departments of Health and Education.</p> <p>One suggested starting point for raising awareness was to utilise existing National Weather Service (NWS) public information sheets and translate these into the four main local languages of the FSM States. It was also identified that education about hazards needed to be looked at for the school curricula.</p> <p>It was noted that Chuuk WSO carries out public awareness on severe weather and related hazards throughout the entire State.</p> <p>Agencies that have allocation for community level education and preparedness program include:</p> <ul style="list-style-type: none"> <li>• The Department of Public Safety (DPS) who obtain some funds for community awareness activities from AusAID; and</li> <li>• The WFO Guam who run annual workshops which the public are welcome to attend.</li> </ul>
Training programs for the National media exist for natural hazard and tsunami	<b>No</b>	<p>There are currently no training programs for the media in FSM about tsunami warnings and preparedness specifically. However, WFO Guam does have a training program for the media on typhoons that could potentially be adapted for tsunami. UNESCO also runs training programs for the media which could also possibly incorporate information about tsunami and tsunami warnings.</p>
Training programs exist for officials involved in tsunami warning and response	<b>Partially</b>	<p>WFO Guam runs training programs for officials involved in tsunami warning and response.</p>

## 5.2. Case Study – Tsunami System Operation in FSM for the January 2007 East Kuril Islands Tsunami Event

Throughout the Tsunami Capacity Assessment, FSM's response to the January 2007 East Kuril Islands earthquake and tsunami event was reviewed. The aim of this review was to gain an understanding of the operation of the tsunami warning system in a real-time event.

### **Event Details:** East Kuril Islands

Magnitude 8.1

Depth 10 km (6.2 miles)

Coordinates 46.272° N, 154.455° E

04:23:20 Coordinated Universal Time (UTC)

Saturday, January 13, 2007 (13 January, 02:23:30 PM at epicentre)

A Tsunami Watch was issued to FSM by the PTWC at 04:34 UTC. However, the Watch was cancelled by the PTWC approximately three hours later in Tsunami Bulletin Number 004 (issued at 07:23 UTC, 13 January 2007). Therefore, FSM did not issue any tsunami warnings to the public for this event as no response was required. No public awareness campaigns were in place at the time this Tsunami Watch was issued.

As per the Standard Operating Procedures, the WFO Guam informed the State WSOs and the Kosrae DCO about the Tsunami Watch at 16:55 local time for Guam, Yap and Chuuk and 17:55 local Pohnpei and Kosrae time. While this account of events was recorded in the WFO Guam log book, related information was not documented for any of the States. At the time of this event, there were no tsunami response plans in place.

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

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 FSM. These are outlined in Table 5.

**Table 5 –Strengths, opportunities for improvement and recommendations under key topics**

<i>5.3.1. Governance and Coordination</i>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• All key organisations and agencies required to establish a comprehensive tsunami warning system for FSM exist.</li> <li>• There are coordination committees in place at the National and State levels of Government who have responsible for decisions and policy making about tsunami warning and mitigation systems.</li> <li>• There are several pieces of legislation in place encapsulating the development and on-going improvements of the FSM tsunami warning system.</li> <li>• Roles and responsibilities of OEEM, WSO, Police, Governor etc. are all clearly defined through National and State Disaster and Emergency Response Plans.</li> </ul>	<ul style="list-style-type: none"> <li>• More interagency coordination is required in order to achieve a fully functioning tsunami warning system.</li> <li>• No in-country expertise exists to research and/or develop technologies generally utilised in tsunami warning and mitigation systems.</li> <li>• Stronger coordination mechanisms at the provincial and community level are required. In addition, input from municipalities needs to be sought proactively.</li> <li>• The National and State Disaster Preparedness arrangements need to be reviewed. A review processes also needs to be undertaken for the MSMH-MP, signed off in 2005.</li> <li>• Tsunami hazard management components need to be incorporated into the National and State plans where required.</li> <li>• SOPs between relevant departments in relation to the emergency management of tsunami hazards need to be formalised and officially recorded.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>1. Review the MSMH-MP for FSM 2005 [D6].</li> <li>2. Review the FSM National Disaster Preparedness Plan and test SOPs linking responsibilities from National to State and vice versa.</li> </ol>	

**5.3.2. Regional and International Coordination**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• CFA authorises weather services and support to WSOs, which pass tsunami information to the DCOs with back-up arrangements from WFO Guam.</li> <li>• Member of the Council for Regional Organisations in the Pacific (CROP) agencies, including SOPAC, Secretariat of the Pacific Community (SPC), Secretariat of the Pacific Region Environment Programme (SPREP), PIFS (Pacific Islands Forum Secretariat).</li> <li>• CFA authorises disaster assistance and support to OEEM by USAID in transition from FEMA.</li> </ul>	<ul style="list-style-type: none"> <li>• Mechanisms for assistance go through National government only.</li> <li>• The roles of USAID and IOM in the space of disaster assistance (as compared to that of FEMA) is not entirely clear to FSM stakeholders.</li> <li>• FSM is not a member of the IOC.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>3. Strengthen cooperation with regional and international support to improve State mitigation, preparedness, response and recovery capabilities.</li> <li>4. USAID and IOM clarify roles, responsibilities, processes and resources to support mitigation, response and recovery initiatives.</li> <li>5. Department of Foreign Affairs submit FSM's membership application to the IOC to ensure continued support and assistance.</li> </ol>	

<b>5.3.3. Research Expertise</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• CFA has provisions for technical expertise to WSO from Honolulu.</li> </ul>	<ul style="list-style-type: none"> <li>• No active in-country researchers or research organisations looking at seismology or tsunami science in FSM.</li> </ul>
<b>Recommendations:</b>	
<p>6. FSM explore opportunities by international and regional organisations to build capacity and/or provide expertise for addressing tsunami risk and vulnerability issues.</p>	

<b>5.3.4. Tsunami Monitoring Infrastructure</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• FSM has real-time sea level gauges that are being monitored and maintained by third parties including PTWC and the University of Hawaii and Australia.</li> </ul>	<ul style="list-style-type: none"> <li>• Sea level gauges are maintained by regional partners.</li> <li>• No in-country capacity to maintain or cover recurrent costs.</li> </ul>
<b>Recommendations:</b>	
<p>7. Encourage international research facilities to install monitoring stations in FSM at Chuuk and Kosrae.</p>	

<b>5.3.5. Tsunami Warnings</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Sound processes in place for receiving tsunami warning messages from PTWC.</li> <li>• All WSOs are 24/7 operational.</li> <li>• Sound working relations and verbal understanding of how to respond to a tsunami between WSO and DCOs.</li> <li>• Dissemination of tsunami warnings to the communities outlined in State level plans.</li> </ul>	<ul style="list-style-type: none"> <li>• No in-country capacity to assess tsunami threats to FSM.</li> <li>• No formalised SOPs between WSO to DCO, the police and OEEM.</li> <li>• Lack of redundancy between National and State offices to ensure warning has been received and actioned.</li> <li>• National and State plans require updating to incorporate tsunami hazard management.</li> <li>• Improvement of tsunami warning dissemination to remote and Outer Islands.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li><b>8.</b> Develop SOPs for receipt and dissemination of warning messages for WSO to DCO and OEEM.</li> <li><b>9.</b> Develop SOPs for DCO's to immediately notify PTWC of a tsunami event.</li> <li><b>10.</b> OEEM and DCOs maintain and distribute directory of contacts including satellite phone numbers and designated frequencies for radios, to members of emergency taskforces.</li> </ol>	

**5.3.6. Communications**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• FSMTC, the robust local government run telecom, supports the voice, data, cellular traffic over Intelsat of all four States.</li> <li>• The three FSM WSO's have multiple paths for incoming PTWC alerts via the FSM INTELSAT supplied Internet or phone/fax lines (with some Iridium and EMWIN backup).</li> <li>• FSMTC has Broadcast SMS capability.</li> <li>• Most of the 50 Outer Islands of the FSM are equipped with HF radios.</li> <li>• All States have at least one broadcast station.</li> <li>• There are many Iridium phones available around Pohnpei and a couple each on Yap, Kosrae and Chuuk.</li> <li>• Each State's DPS has a local VHF (with retransmitting repeater) two-way radio network.</li> </ul>	<ul style="list-style-type: none"> <li>• FSMTC only covers the main islands (with some Chuuk lagoon coverage).</li> <li>• FSMTC (with direction from National and State DCO's ) has not implemented EAS or SMS.</li> <li>• EMWIN is re-transmitted on GOES 7. This satellite is running out of fuel with no backup.</li> <li>• The HF radios in the Outer Islands are turned off except when passing traffic.</li> <li>• Most Iridium phones in the FSM are not functioning.</li> </ul>
<b>Recommendations:</b>	
<ol style="list-style-type: none"> <li>11. Look to at 'Chatty Beetle' or RICS solution as a backup to EMWIN and the FSMTC circuits to receive emergency warnings at the three critical WSO portals and at the Kosrae DCO.</li> <li>12. OEEM to explore possibilities of sending emergency cellular text (SMS) and EAS TV text through the FSMTC network to disseminate warnings and emergency information.</li> <li>13. Establish a 24/7 early warning communication link to the remote Outer Islands from the DCO's. It is recommended solar powered 'Chatty Beetles' (or RICS) are fixed to earth stations at each Outer Island community centre and that they are controlled at each DCO.</li> <li>14. Set up permanently mounted 'always on' Iridium handheld in each State's ER and EOC.</li> <li>15. All states should repair/upgrade and maintain the AM broadcast station. AM radio signals can deliver disaster related warnings and updates to the Outer Islands and locations on the main islands that are out of FM broadcast station range.</li> <li>16. Maintain and upgrade the main island's VHF two-way radio network. Consider upgrading to a linked repeater system with full interagency interoperability.</li> <li>17. Add Sirens with cellular triggers (with manual back-up) around all State centres.</li> <li>18. FSM National government establish a fund to maintain all emergency communication systems.</li> </ol>	



**5.3.7. Tsunami Emergency Response (including evacuation)**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Emergency shelters identified for typhoons.</li> <li>• National and State emergency response plans in place (even though they do not specially address tsunami).</li> <li>• DCO is the agency designated as the agency to carry out public evacuation.</li> </ul>	<ul style="list-style-type: none"> <li>• Emergency response plans to be updated with a tsunami hazard component (to also include details about evacuation routes and shelters).</li> <li>• National and State Preparedness plans need to include tsunami where required.</li> <li>• Exercise plans once reviewed and updated to include tsunami.</li> </ul>
<b>Recommendations:</b>	
<p>19. Develop/upgrade, then exercise State emergency response plans to include locations of evacuation routes and shelters.</p> <p>20. Update the National Disaster Preparedness Plan to include tsunamis in an all-hazards context.</p> <p>21. National and State level agencies need to collaborate on joint disaster management including preparedness initiatives from planning to implementation.</p> <p>22. Assess and improve existing National and State disaster preparedness and emergency response capabilities based on reviews such as the Pacific Wave 2008 exercise.</p>	

**5.3.8. Tsunami Hazard, Vulnerability, Risk and Mitigation**

<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• The FSM MSMH-MP was based on hazard and risk assessments of main hazards impacting FSM (including tsunami).</li> <li>• Work being undertaken by SOPAC collating hazard risk information for PICs including Pohnpei and Chuuk.</li> <li>• Basic hazard and vulnerability maps have been produced and incorporated into the MSMH-MP which, while not detailed, is a good starting point for future work.</li> <li>• US guidelines used for wind and earthquake proofing new constructions in FSM.</li> </ul>	<ul style="list-style-type: none"> <li>• Opportunities exist for raising awareness about tsunami risk for FSM.</li> <li>• Hazard related risks are not always considered in development planning.</li> <li>• Red Cross Society encouraged to undertake their Vulnerability and Capacity Assessment in FSM.</li> <li>• Currently no back-up power available for communication systems to support mitigation and response activities.</li> <li>• Yap building code and land zoning plan policy to be reviewed in relation to tsunami and its potential use as model for the rest of FSM.</li> </ul>
<b>Recommendations:</b>	
<p>23. Conduct tsunami hazard and risk assessments using numerical inundation models based on high resolution near-shore and lagoon bathymetric and topographic data.</p> <p>24. Review hazard and risk assessments based on new data collected to enhance tsunami preparedness and development planning.</p>	

<i>Tsunami Hazard, Vulnerability, Risk and Mitigation (Continued...)</i>	
<b>Recommendations (Continued..):</b>	
<b>25.</b>	OEEM and DCOs to purchase back-up power systems for communications and to support mitigation and response activities.
<b>26.</b>	Develop and enforce National/State building codes/standards incorporating major hazard risks.

<b>5.3.9. Public and Stakeholder Awareness, Education and Training</b>	
<b>Strengths:</b>	<b>Opportunities for Improvement:</b>
<ul style="list-style-type: none"> <li>• Many community and volunteer groups identified to help with the delivery of tsunami education programs including women and youth groups, church groups, print media.</li> <li>• Task force established to address the tsunami and hazard awareness gap including representatives from Health, Education Departments and Public Affairs.</li> <li>• Seemed to be some anecdotal evidence about tsunami history in FSM.</li> <li>• Excellent facilities in FSM to research any existing tsunami history through the Micronesia Seminar.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop programs addressing the gap that exists due to a lack of community awareness and education programs about tsunami and hazards in general.</li> <li>• Tsunami and hazard information added to the school curriculum.</li> <li>• Ascertain the level of understanding about tsunami and other hazards within local communities in FSM (surveys).</li> <li>• Training programs about tsunami for the media (print, radio, TV).</li> </ul>
<b>Recommendations:</b>	
<p><b>27. (a)</b> Assess existing public awareness and community emergency preparedness to tsunami.  <b>(b)</b> Develop program based on assessment to inform vulnerable communities about tsunami and preparedness options.</p> <p><b>28.</b> Research and document tsunami history including anecdotal evidence and traditional coping strategies that can be incorporated into tsunami awareness, education, preparedness and response activities.</p> <p><b>29.</b> Develop all-hazards community awareness materials to provide consistent information that can also be adapted and translated for local communities to understand.</p> <p><b>30.</b> Train local media about tsunami risk and their role in helping communities prepare and respond effectively. This training should focus on educating the media about tsunami alerts/warnings and in turn informing the community on response concepts.</p> <p><b>31.</b> Place an all-hazards display including information on tsunami in a publicly accessible building e.g. Micronesia Seminar or a government offices such as tourism and public libraries.</p> <p><b>32.</b> Strengthen community preparedness and response capability using resources available through regional partners such as WFO Guam and National agencies such as OEEM and WSOs.</p> <p><b>33.</b> Utilise community-based/non profit organisations such as Red Cross, women’s clubs, traditional and religious groups, Chamber of Commerce, Lion’s and Rotary Clubs to promote local tsunami preparedness and awareness programs.</p>	

## 5.4. Additional Workshop Benefits

In addition to this report, benefits of the tsunami capacity assessment workshop in FSM were:

- Improved understanding and documentation of capacity in FSM to receive and respond to tsunami warnings;
- Enhanced working relationships with counterparts and associated agencies and organisations;
- Exchanged information on respective activities and capabilities;
- Open exchange of information on community awareness and preparedness planning as well as implementation and emergency response amongst workshop participants; and
- Enhanced working relationships between the FSM participants and the Bureau.

## 5.5. Next Steps

FSM 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 summarise 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 Bureau 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 in the hope of further capacity development projects being undertaken based on the results of this project.





Section

6

## 6. Annexure



## 6. Annexure

### 6.1. Annexure 1: Record of Participants

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Yap State Police	Police Budget and Technician	Captain	Leo	Yinug	PO Box 207 Colonia Yap	(691) 350 2204	(691) 350 4119	950 2204	<a href="mailto:Ypstechnical@mail.fm">Ypstechnical@mail.fm</a>
OEEM FSM	Director		Andrew	Yatilman	PS – 69	320- 8814/884	320-8936	920 9737	<a href="mailto:diroem@gmail.com">diroem@gmail.com</a>
OEEM FSM	HMO		Oleen	Peter	Palikir, Pohnpei	320- 8814/11 (??)		920 2322	<a href="mailto:Dnpp22@gmail">Dnpp22@gmail</a>
FSM National Police	Police Officer		Grokly	Lipai	PS 10 Palikir	320- 2628/2058		920 1500	<a href="mailto:Nppapq74@yahoo.com">Nppapq74@yahoo.com</a>
Weather Services Pohnpei	Official in Charge		Eden	Silling	PO Box 69, Kolonias, Pohnpei				<a href="mailto:Keenly.andon@noaa.gov">Keenly.andon@noaa.gov</a>
Weather Services Pohnpei	Official in Charge		Kenely	Andon	PO Box PS11	320-2248	320 5787	921 8021	<a href="mailto:Keenly.andon@noaa.gov">Keenly.andon@noaa.gov</a>
FSM National Pohnpei	Base technical officer	Chief Petty Officer	Louis	Malfin	PO BOX PS 11	320 2384	320 5103	920 1994	<a href="mailto:Malfin81@hotmail.com">Malfin81@hotmail.com</a>
FSM National Police	Executive Officer		Kodak	David	PO Box 2369	320 2384	320 5103	920 9015	<a href="mailto:Kodakdavid@yahoo.com">Kodakdavid@yahoo.com</a>
OEEM FSM	Administration Officer		Lorna	Johnny	PO Box PS-69 Palikir, Pohnpei	320- 8814/8815	320- 8936`	920 – 8536	<a href="mailto:lsjohnny@mail.fm">lsjohnny@mail.fm</a> <a href="mailto:lornajohnny@yahoo.com">lornajohnny@yahoo.com</a>

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Nukuoro Municipal Government	Mayor		Gerson	Leka	PO BOX 786 Kolonias PNI FSM	329 1126			
Pohnpei EPA	Specialist		Henry	Susaia	PO Box 927 Pohnpei	320 2208		921 9926	<a href="mailto:Hensusaia@yahoo.com">Hensusaia@yahoo.com</a>
IOM	Project Coordinator	Mr	Ashley	Carl		9222015			<a href="mailto:acalr@iom.int">acalr@iom.int</a>
State Police	Police		Jason	Joseph		922 0332			
PNI POE	Project Coordinator VOCED		Arwelson	Arpona	PO Box 418	320 2184	320 5510	922 2897	<a href="mailto:nanmweiv@yahoo.com">nanmweiv@yahoo.com</a>
FSM National Government , Department of Foreign Affairs	Foreign Service Government	Mr	Robson	Romolon	PO BOX 2074 Kolonias PNI	320 2641	320 2933	922 4606	<a href="mailto:romolon@mail.fm">romolon@mail.fm</a>
FSM OEMM	FSM Public Assistance	Mr	Tony	Neth	PO BOX 69 Palikar	320 8815	320 8936	920 2884	<a href="mailto:Aneth2008@gmail">Aneth2008@gmail</a>
Sokelts Municipal Government	Police Officer	Mr	Ikinio	Roby	PO Box 1678 (?) Kolonias	320 2179	320 2153	921 8595	
Government of Chuuk State	COS/DCO	Mr	Wilfred	Robert	PO Box 189 Weus Chuuk	330 2234	330 2233	930 3387	<a href="mailto:Wrobert227@yahoo.com">Wrobert227@yahoo.com</a>
Weather Services Chuuk	Official in Charge	Mr	Johannes (Joe)	Berdon	PO Box A, Weno, Chuuk FM 96942				
Weather Services Chuuk	Supervisory Weather Service	SWS S	Sanchez	Salle	BOX a Chuuk 96942	330 2548	330 4494	931 2329	<a href="mailto:Sanchez.salle@noaa.gov">Sanchez.salle@noaa.gov</a>
YAP DCO	Chief of Planning	Mr	Philip	Raffilpiy	PO BOX 471 COLONIA YAP 96943	350 2166/2145	350 4430	950 5395	<a href="mailto:Praff_8@yahoo.com">Praff_8@yahoo.com</a> <a href="mailto:Planningchief_opb@mail.fm">Planningchief_opb@mail.fm</a>
Australian Embassy Pohnpei	Consul	Mr	Julian	Parker	PO Box 5, Kolonias, Pohnpei	691 3205448	6913205 449		<a href="mailto:Julian.parker@dfat.gov.au">Julian.parker@dfat.gov.au</a>
Kolonias Town Government	Director of Administration	Mr	John	Nakomaga		320 2420	691 320 8979		



Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
FSM Public Information Officer	Information specialist	Mr	Kester	James	PO Box P-34 Palikir, PNI FSM 96941	320 25 48	320 4356		<a href="mailto:fsmpio@mail.fm">fsmpio@mail.fm</a> <a href="mailto:kester@mail.fm">kester@mail.fm</a>
Department of Transport, Communications and Infrastructure	Assistant Secretary	Mr	Jolden	Johnyboy	PO Box P5 – 2 Palikir Pohnpei	320 2381	320 5853	920 9736	<a href="mailto:transcom@mail.fm">transcom@mail.fm</a>
MRCSS	Acting Deputy PNI Chaptex	Mr	Wayne	Louis	PO Box 1416 PNI	921 1250			
Kosniae DCO	Disaster Coordination	Mr	Vinson	Henry	PO BOX 471 Colonia Yap 96943	370 8090	370 3162	970 1778	<a href="mailto:Vinsonhenry@gmail.com">Vinsonhenry@gmail.com</a>
Sokehs Municipal Government	Police officer	Mr	Konsaka	Kandido	PO BOX 1238 Kolonias, PNI 96941	320 320 7531		9210114	
Pohnpei DCO	Hazard Mitigation	Mr	Patterson	Lawrence	PO BOX 402 PNI 96941	320 3910		921 0114	
FSM National Police	Police Investigator	Mr	Wensper	Raymond	PO BOX 2077 KOLONIA PNI 969 42	320 2628	320 3243	922 0185	<a href="mailto:nph@mail.fm">nph@mail.fm</a>
Pohnpei Port Authority	Safety and Security	Mr	Ron	Reyes	PO BOX 1150	320 6733 320 2793	320 2348	921 8624	<a href="mailto:godlove_getta@yahoo.com">godlove_getta@yahoo.com</a>
Department of Health, Pohnpei	SNS Coordination	Mr	Fisher M	Lorrin	PS 70 Palikir	320 8300	320 8460	920 4704	<a href="mailto:florin@fsmhealth.fm">florin@fsmhealth.fm</a>
Pohnpei Police	Police officer	Mr	Loston	Loyale	PO BOX 941	320 3592			
Department of Public Safety		Mr	Tony	Pernet					
Department of Education	Education Specialist	Ms	Rihna	Jimmy	Box 1032	2105			<a href="mailto:ohwede5738@yahoo.com">ohwede5738@yahoo.com</a>
Office of Environment and Emergency Management	Climate Change	Mr	Ben	Namakin	PO BOX 65			921 8814	<a href="mailto:ben.mihne@gmail.com">ben.mihne@gmail.com</a>

Organisation	Position	Title	First Name	Last Name	Postal Address	Phone	Fax	Mobile	E-mail
Office of Environment and Emergency Management	National Capacity Self Assessment Consultant	Ms	Jane	Gallen		320 8814/5	320 8936		<a href="mailto:anejayallenengaye@yahoo.com">anejayallenengaye@yahoo.com</a>
Australian Embassy Pohnpei	Consul	Mr	Julian	Parker	PO Box 5, Kolonia, Pohnpei	691 3205448	6913205 449		<a href="mailto:Julian.parker@dfat.gov.au">Julian.parker@dfat.gov.au</a>
Kolonia Town Government	Director of Administration	Mr	John	Nakomaga		320 2420	691 320 8979		
Weather Service Yap	Meteorologist in Charge	Mr	David	Aranug	PO Box 10, Colonia, Yap 96943				
Australian Embassy Pohnpei	Consul	Mr	Julian	Parker	PO Box 5, Kolonia, Pohnpei	691 3205448	6913205 449		<a href="mailto:Julian.parker@dfat.gov.au">Julian.parker@dfat.gov.au</a>

## 6.2. Annexure 2: The Visiting Assessment Team

Team Position	Name	Position within Organisation	Organisation	Contact Details
Risk Assessment and Regional Expert & Team Leader 1	Michael Bonte-Grapentin	Risk Assessment Specialist	Pacific Islands Applied Geoscience Commission (SOPAC)	<a href="mailto:Michael@sopac.org">Michael@sopac.org</a> Ph. +679 (338) 1377 Fax. +679 (337) 0040
Disaster Risk Management and Regional Expert & Team Leader 2	Litea Biukoto	Advisor – Hazard Assessment	Pacific Islands Applied Geoscience Commission (SOPAC)	<a href="mailto:litea@sopac.org">litea@sopac.org</a> Ph. +679 338 1377 Fax. +679 337 0040
Data Communications Expert	Bruce Best	Research Associate and Station Manager for the Pacific PEACESAT Project & Telecommunications and Distance Education Operation (TADEO)	University of Guam	<a href="mailto:bbest@guam.net">bbest@guam.net</a> Ph. +1-671 735 2620 Mob. +1-671 688 5301
Natural Hazard Warning Expert	Chip Guard	Warning Coordination Meteorologist	National Weather Service Forecast Office Guam (NOAA)	<a href="mailto:Chip.Guard@noaa.gov">Chip.Guard@noaa.gov</a> Ph. +1-671 472 0946 Fax. +1-671 472 0980
Public Awareness Expert & Logistics	Shannon McNamara	Project Officer Disaster Mitigation Policy	Bureau of Meteorology (Bureau)	<a href="mailto:S.McNamara@bom.gov.au">S.McNamara@bom.gov.au</a> Ph. (03) 9669 4173 Fax: (03) 9669 4803
Disaster Assistance Coordinator	Bart Deemer	Disaster Assistance Coordinator	United States Agency for International Development	<a href="mailto:bdeemer@usaid.gov">bdeemer@usaid.gov</a> Ph. +692 247 4011 Fax. +692 247 4012

## 6.3. Annexure 3: Agenda, FSM Tsunami Capacity Assessment Workshop

## National Capacity Assessment of FSM's Tsunami Warning and Mitigation System

## WORKSHOP AGENDA 14 to 17 September 2009

DAY 1: Monday 14 September 2009				
SESSION 1: OPENING CEREMONY AND INTRODUCTORY PRESENTATIONS				
LOCATION: The Cliff Rainbow Hotel Conference Room				
Time	Item	Questionnaire Reference	Duration	Participation
9.00 – 10:00 am	<b>Welcome Address</b> <ul style="list-style-type: none"> <li>• <i>FSM Representative</i></li> <li>• <i>Michael Bonte-Grapentin, Pacific Island Applied Geoscience Commission (SOPAC)</i></li> <li>• <i>Introduction of Participants</i></li> </ul>	NA	1hrs	Open
10.00 – 10.30am	<b>Workshop Group Photo and Opening Morning Tea</b>	NA	0.5hrs	Open
10.30 – 11.15am	<b>CHAIR: Michael Bonte-Grapentin (SOPAC)</b> <b>Housekeeping Presentation –</b> <ul style="list-style-type: none"> <li>• <i>Introduction to the tsunami capacity assessment project</i>  <b>Presenter:</b> <i>Shannon McNamara, Australian Bureau of Meteorology</i></li> <li>• <i>Tsunami hazard &amp; warning systems in relation to FSM</i>  <b>Presenter:</b> <i>Chip Guard National Weather Service Guam</i></li> </ul>	NA	0.75hrs	Open

Time	Item	Questionnaire Reference	Duration	Participation
11.15 – 12.00pm	<b>Focus Groups</b> <i>FSM's priorities for implementing an effective tsunami warning system</i>	Section 4	0.75hrs	Open
12.00 – 1.00pm	<b>Lunch</b>	NA	1hrs	Open
<b>SESSION 2:</b>	<b>ORGANISATIONS, COMMITTEES, LEGISLATION, STRATEGY AND COOPERATION</b>			
<b>LOCATION: The Cliff Rainbow Hotel Conference Room</b>		<b>CHAIR: Michael Bonte-Grapentin, SOPAC</b>		
1.00 – 1.30pm	<b>Capacity Assessment – Organisations, Committees and Legislation</b>			
	<ul style="list-style-type: none"> <li>Organisations involved in tsunami warning and mitigation in FSM</li> </ul>	Section 2, Part A	0.5hrs	Open
	<ul style="list-style-type: none"> <li>Tsunami warning and mitigation coordination committees at Village, State and National levels in FSM</li> </ul>	Section 2, Part B		
	<ul style="list-style-type: none"> <li>Legislation relevant to tsunami warnings and emergency response</li> </ul>	Section 2, Part C		
1.30 – 2.30pm	<b>Capacity Assessment – Strategy, International and Regional Cooperation, All Hazards Approach</b>			
	<ul style="list-style-type: none"> <li>Disaster risk reduction strategy in FSM</li> </ul>	Section 2, Part D	1.0hrs	Open
	<ul style="list-style-type: none"> <li>International and Regional cooperation for tsunami warning and mitigation in FSM</li> </ul>	Section 2, Part E & F		
	<ul style="list-style-type: none"> <li>All-hazards approach</li> </ul>	Section 3		
2.30-3.00pm	<b>Afternoon Tea</b>			
	<b>Capacity Assessment – Research, Monitoring, Warning and Emergency Response</b>			
3.00-4.00pm	<ul style="list-style-type: none"> <li>Research and development expertise</li> </ul>	Section 5	1hrs	Open
	<ul style="list-style-type: none"> <li>Tsunami monitoring including: <i>Tsunami monitoring infrastructure (seismic network, sea level network)</i></li> </ul>	Section 6, Part A, B		
4-4.30pm	<ul style="list-style-type: none"> <li>Components of a Tsunami Warning System &amp; Communicating <i>Tsunami Warnings to the community</i></li> </ul> <p><b>Presenters:</b> Bruce Best (University of Guam)</p>		0.5hrs	Open
4.30pm	<b>Close</b>			

<b>DAY 2: Tuesday 15 September 2009</b>				
<b>SESSION 3: RESEARCH, MONITORING AND WARNING</b>				
<b>LOCATION: The Cliff Rainbow Hotel Conference Room</b>				
<b>CHAIR: Litea Biukoto, SOPAC</b>				
<b>Time</b>	<b>Item</b>	<b>Questionnaire Reference</b>	<b>Duration</b>	<b>Participation</b>
<b>8.30 – 9.30am</b>	<b>Opening Presentation:</b> <b>Presentations:</b> <ul style="list-style-type: none"> <li>• <i>Tsunami warning and mitigation systems in FSM:</i> <ul style="list-style-type: none"> <li>○ <i>Federal Perspective (Oleen Poll)</i></li> <li>○ <i>State Perspective DCO (Phillip Rafflipiy, Wilfred Robert, Lawrence Patterson, Vinson Henry)</i></li> <li>○ <i>State Perspective WSO (Sanchez Salle &amp; Kenely Andon)</i></li> </ul> </li> </ul>	<b>NA</b>	<b>1hrs</b>	<b>Open</b>
<b>09.30 – 10.00am</b>	<b>Capacity Assessment – Research, Monitoring, Warning and Emergency Response – cont'd</b>			
	<b>Tsunami monitoring including:</b> <ul style="list-style-type: none"> <li>• <i>Tsunami monitoring infrastructure (utilisation of satellites for data communication)</i></li> <li><i>Case Study – 13 Jan 2007 Kuril Islands East Earthquake &amp; Tsunami</i></li> </ul>	<i>Section 6, Part C &amp; Case Study – Monitoring Systems</i>	<b>0.5hrs</b>	<b>Open</b>
<b>10.00 - 10.30am</b>	<b>Morning Tea</b>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>10.30 – 12.00pm</b>	<b>Tsunami warning system in FSM including:</b> <ul style="list-style-type: none"> <li>• <i>International communication cooperation</i></li> <li>• <i>National tsunami warning center</i></li> <li>• <i>Receipt of advisories from PTWS</i></li> <li>• <i>Procedures for dissemination of tsunami warnings Nationally, once received from PTWS</i></li> </ul>	<i>Section 7, Part A, B, C, D, E, F, G, Case Study – Tsunami Advisory Messages and Warnings &amp; Part H</i>	<b>1.5hrs</b>	<b>Open</b>

Time	Item	Questionnaire Reference	Duration	Participation
	<b>Tsunami warning system in FSM <u>continued</u> including:</b> <ul style="list-style-type: none"> <li>• <i>Issuing warnings for marine vessels, harbours and ports</i></li> <li>• <i>Case Study – 13 Jan 2007 Kuril Islands East Earthquake &amp; Tsunami</i></li> <li>• <i>Conclusion – Strengths and weaknesses of tsunami warnings</i></li> </ul>	<i>As above</i>	<i>As above</i>	<i>As above</i>
<b>12.00 – 1.00pm</b>	<b>Lunch</b>	<b>NA</b>	<b>1.0hr</b>	<b>Open</b>
<b>SESSION 4: SITE TOURS</b>				
<b>LOCATION: To be confirmed</b>				
<b>1:30 – 4.00pm</b>		<b>NA</b>	<b>2.5hrs</b>	<b>Relevant Agencies &amp; Assessment Team</b>

<b>DAY 3: Wednesday 16 September 2009</b>				
<b>SESSION 5: TSUNAMI EMERGENCY RESPONSE, MITIGATION AND PREPAREDNESS</b>				
<b>LOCATION: The Cliff Rainbow Hotel Conference Room</b>			<b>CHAIR: Litea Biukoto, SOPAC</b>	
<b>Time</b>	<b>Item</b>	<b>Questionnaire Reference</b>	<b>Duration</b>	<b>Participation</b>
<b>8.30 – 9.00am</b>	<p><b>Opening Presentation:</b></p> <ul style="list-style-type: none"> <li>Emergency Preparedness &amp; Response, Community &amp; Stakeholder Awareness</li> </ul> <p><b>Presenter:</b> Bart Deemer (USAID)</p>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>9.00 – 10.00am</b>	<p><b>Emergency response to tsunami in FSM</b></p> <ul style="list-style-type: none"> <li>Assessing the capacity of the disaster management system in FSM and identifying training needs</li> <li>Emergency response and recovery plans</li> <li>Evacuation (including evacuation legislation)</li> </ul>	Section 8, Part A, B & C	<b>1hr</b>	<b>Open</b>
<b>10.00 – 10:30am</b>	<b>Morning Tea</b>	<b>NA</b>	<b>0.5hrs</b>	<b>Open</b>
<b>10:30 – 12.00pm</b>	<p><b>Emergency response to tsunami in FSM <u>continued</u> including:</b></p> <ul style="list-style-type: none"> <li>GIS use for emergency response</li> <li>Testing and exercising</li> <li>Consideration of critical infrastructure</li> <li>Tsunami mitigation efforts</li> <li>The role of NGOs in tsunami warning and mitigation</li> <li>Case Study – 13 Jan 2007 Kuril Islands East Earthquake &amp; Tsunami</li> </ul>	Section 8, Part D, E, F, G, H & Case Study – Preparedness and Response	<b>1.5hrs</b>	<b>Open</b>
<b>12.00 – 1.00pm</b>	<b>Lunch</b>	<b>NA</b>	<b>1hr</b>	<b>Open</b>



Time	Item	Questionnaire Reference	Duration	Participation
<b>SESSION 6: TSUNAMI HAZARD, VULNERABILITY, RISK AND COMMUNITY AWARENESS</b>				
<b>1.00 – 4:30pm</b>	<b>Capacity Assessment – Hazard, Vulnerability, Risk and Community Awareness</b>			
<b>1.00 – 2.00pm</b>	<b>Tsunami hazard, vulnerability and risk studies in FSM:</b> <ul style="list-style-type: none"> <li>• <i>Post tsunami surveys</i></li> <li>• <i>Tsunami hazard, vulnerability and numerical modelling studies</i></li> <li>• <i>Community participation in assessing the tsunami risk</i></li> </ul>	Section 9, Part A, B, C, D, E, F	1hr	Open
<b>2.00 – 3.00pm</b>	<b>Public and stakeholder awareness and education regarding tsunami in FSM including:</b> <ul style="list-style-type: none"> <li>• <i>Assessment of public awareness</i></li> <li>• <i>The role of public awareness in understanding warnings and taking action</i></li> <li>• <i>Public awareness and education programs</i></li> <li>• <i>Media education programs</i></li> <li>• <i>Tsunami memorials and museums</i></li> </ul>	Section 10, Part A, B, C, D	1hrs	Open
<b>2.30 – 3.00pm</b>	<b>Afternoon Tea</b>	NA	0.5hrs	Open
<b>3:30 – 4.00pm</b>	<b>Public and stakeholder awareness and education in FSM:</b> <ul style="list-style-type: none"> <li>• <i>Assessment of public awareness</i></li> <li>• <i>The role of public awareness in understanding warnings and taking action</i></li> <li>• <i>Public awareness and education programs</i></li> <li>• <i>Media education programs</i></li> <li>• <i>Tsunami memorials and museums</i></li> </ul>	Section 10, Part A, B, C, D	1hrs	Open
<b>4.00pm</b>	<b>CLOSE</b>			

**DAY 4: Thursday 17 September 2009****SESSION 6: PRESENTATION OF PRELIMINARY ASSESSMENT FINDINGS****LOCATION: The Cliff Rainbow Hotel Conference Room****CHAIR: Litea Biukoto, SOPAC**

Time	Item	Questionnaire Reference	Duration	Participation
10:30 – 11:00	<b>MORNING TEA</b>		0.5hrs	
11.00 – 12.00pm	<p><b>Preliminary summary presentation</b></p> <ul style="list-style-type: none"> <li>FSM's strengths, opportunities for improvement, preliminary recommendations, priority review and next steps</li> </ul> <p><b>Presenter:</b> Litea Biukoto, SOPAC</p> <p><b>Questions and Feedback:</b> From FSM participants on preliminary summary presentation and the assessment process in general</p>	NA	1hrs	Open
12.00 - 12.15pm	<p><b>ACKNOWLEDGEMENTS AND CLOSE</b></p> <ul style="list-style-type: none"> <li>FSM Representative TBC</li> <li>Litea Biukoto, SOPAC</li> </ul>	NA	0.25hrs	Open
12:15/12:30pm	<b>CLOSING LUNCH</b>	NA	1hr	Open

## 6.4. Annexure 4: Supporting Documents Log

Ref.	Document Name	Copy Obtained (Y/N)	Format (H = Hard Copy) (E = Electronic)
D1	National Disaster Preparedness Plan	N	
D2	State of Pohnpei – Disaster Preparedness Plan: Jan 2006	N	
D3	State of Chuuk – Disaster Preparedness Plan	N	
D4	State of Yap – Disaster Preparedness Plan	N	
D5	State of Kosrae – Disaster Preparedness Plan	N	
D6	Multi State Multi Hazard Mitigation Plan: 2005	Y	E
D7	Constitution of Pohnpei	Y	E – Online
D8	Constitution of Chuuk	Y	E – Online
D9	Constitution of Yap	Y	E – Online
D10	Constitution of Kosrae	Y	E – Online
D11	Compact of Free Association	Y	E
D12	Exercise Pacific Wave 08 Brief from Chuuk	N	
D13	Smith and Kumar (2007) FSM, Pohnpei, Multibeam and Seismic survey SOPAC Preliminary Technical Report LR 146	N	
D14	ADB (2005) Climate Proofing: A Risk-based Approach to Adaptation.	Y	E
D15	Letter from the Permanent Mission of the Federated states of Micronesia to the UN.	Y	E
D16	Robert T.Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities	Y	E
D17	Tsunami Threat Source for Federated States of Micronesia – Summary: Dr Jane Warne.	Y	E
D18	A Preliminary Study into the Tsunami Hazard faced by southwest pacific Nations: David Burbidge and Phil Cummins.	Y	E
D19	A probabilistic Tsunami Hazard Assessment of the Southwest Pacific Nations: Christopher Thomas and David Burbidge	Y	E
D20	Communications and Infrastructure FSM-EWS Assessment and Recommendation Project	Y	H

## 6.5. 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 organisation 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 organisation 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 organisation 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 programs 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.

## 6.6. Annexure 6: 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.

Central Intelligence Agency, The World Factbook, Federated States of Micronesia, viewed May, 2010 <https://www.cia.gov/library/publications/the-world-factbook/>

Department of Foreign Affairs and Trade, Federated States of Micronesia, viewed May, 2010 <http://www.dfat.gov.au/geo/fsm/>

Federated States of Micronesia Visitors Center, viewed May, 2010, <<http://www.visit-fsm.org/>>

*Federated States of Micronesia Strategic Development Plan (2004 – 2023), Achieving Economic Growth & Self Reliance, Vol II: Strategic Planning Matrices and Appendices*, viewed May, 2010  
<<http://uscompact.org/files/FSM%20Publications/Background%20Documents/Strategic%20Development%20Plan/FSM%20SDP%20Vol%202.pdf>>

Federated States of Micronesia Wiki, viewed May, 2010  
<[http://en.wikipedia.org/wiki/Federated\\_States\\_of\\_Micronesia](http://en.wikipedia.org/wiki/Federated_States_of_Micronesia)>

Government of the Federated States of Micronesia, viewed May, 2010, <<http://www.fsmgov.org/>>

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://www.ioc-tsunami.org/index.php?Itemid=978&id=275&option=com\\_content&task=view](http://www.ioc-tsunami.org/index.php?Itemid=978&id=275&option=com_content&task=view)>

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

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

Permanent Mission of the Federated States of Micronesia to the United Nations 2009, *Views on the Possible Security Implications of Climate Change to be included in the report of the Secretary-General to the 64th Session of the United Nations General Assembly*, viewed May, 2010 <[www.un.org/esa/dsd/resources/res\\_pdfs/.../Micronesia CCIS.pdf](http://www.un.org/esa/dsd/resources/res_pdfs/.../Micronesia_CCIS.pdf) >



Pretick, M.E., 2007. *Health Impacts of Climate Variability and Change in the Federated States of Micronesia*, viewed May 2010, <<http://www.wpro.who.int/NR/rdonlyres/372E1B54-F276-4842-8280-F591DCAADE44/0/Micronesia.pdf>>

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>>

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.

Warne, J., 2009. *Summary - Tsunami Threat Source for Federated States of Micronesia*, Australian Government Bureau of Meteorology.





## 7. CD Attachment



## 7. CD Attachment - Supporting Documents

- a. Assessment Questionnaire
- b. Supporting Documents
- c. Presentations

