SOPAC Member Countries National Capacity Assessments:

Tsunami Warning and Mitigation Systems

Federated States of Micronesia

Federated States of Micronesia

AUSTRALIA

SOPAC

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
Authority, Coordination and NGO Role		
Legislation in place for tsunami warnings and response	**Yes**	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. Under the same section of the CFA the Department of Homeland Security, and the Untied 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. 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.

Key Component	Rating	Comment
Legislation in place for tsunami warnings and response *(continued…)*	**Yes**	The legislative responsibilities outlined in the CFA are undertaken in conjunction with National and State plans for tsunami warning and response. 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. The National OEEM assist the DCOs in emergency response activities.
Tsunami coordination committee or effort at a National and local level	**Yes**	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. 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: • Chuuk: Tsunami Committee and Disaster Task Force • Pohnpei: Governor's Disaster Task Force • Yap: Disaster Committee • Kosrae: Disaster Committee 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.
Agency responsibilities clearly defined	**Partially**	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.

Key Component	Rating	Comment
NGOs and Red Cross Society have a defined role in tsunami warning dissemination, preparedness and awareness and emergency response	**Partially**	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. 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. 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; • Red Cross: Community Education, initial disaster assessment, recovery and assisting DCO with warning dissemination for other hazards • Women's Advisory Council: Community awareness and dissemination of educational materials for programs that are largely health focused • Churches: provide shelter during emergency events and to assist recovery efforts
International and Regional Cooperation		
Country represented at an international and regional level to aid cooperation in tsunami warning and mitigation efforts	**Partially**	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. Under the CFA there is also the provision of technical expertise to WSOs from Honolulu. 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. 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. 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.

Key Component	Rating	Comment
Priorities		
Priorities established for implementation of tsunami warning and mitigation system at a National and State level	**Partially** (through the tsunami assessment process)	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; • Closer collaboration between National and State level agencies on disaster management and preparedness initiatives • Develop SOPs for the receipt and dissemination of warning messages from National to State based organisations • Review and exercise the FSM National Disaster Preparedness Plan and SOPs • Multi-State Multi-Hazard Mitigation Plan to complete review • Extract any local FSM knowledge about tsunami that may be incorporated into tsunami awareness, education, preparedness and response activities • Train local media about tsunami risk and the warning system for FSM to assist communities prepare and effectively response during a tsunami event • 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 • Establish a 24/7 early warning communications link to the remote Outer Islands from the DCO's. 'Chatty Bettle' (or RICS) earth stations at each of the Outer Island community centres, controlling systems from each State's DCO • Maintain and upgrade the main islands VHF two-way radio network • Strengthen cooperation with regional and international support to improve State mitigation, preparedness, response and recovery capability • National and State organisations to purchase, upgrade and maintain emergency communication systems • Develop community education and awareness programs about tsunami targeting 'at risk' communities including the Outer Islands and coastal communities • More risk assessments and inundation modelling for FSM including the capturing or acquiring sufficient topographical and bathymetrical data

Key Component	Rating	Comment
Multi-hazard Approach		
Tsunami warning capabilities are being established within a multi-hazard framework	**Yes**	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.
Research Expertise		
Active research is being undertaken within the country for seismology and tsunami to strengthen the tsunami warning and mitigation system	**No**	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.
Tsunami monitoring infrastructure		
Existence of seismograph stations and integration of real-time data from these stations into the tsunami warning process	**No**	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	**Partially**	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	**Yes**	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
Warnings		
Nation receives PTWC messages	**Yes**	The WSO in Pohnpei, Chuuk, Yap and the Korsae 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. 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. 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.
24/7 operational staff at warning receipt and dissemination location	**Yes**	All WSOs are operational 24/7. As previously mentioned the WSO will contact the State based DCOs to inform them of the tsunami warning. 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.
Disseminate National tsunami warnings as guided by a Standard Operating Procedure	**Partially**	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. 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.
System redundancies in place for receipt of PTWC messages and dissemination of National warnings	**Yes**	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 research, the police are called to help locate the DCO officer and deliver the warning message.
Redundant 24/7 methods available for dissemination of warnings to community (e.g. public radio, sirens etc.)	**Yes**	In the major population centres, the following methods have been employed to disseminate warnings: • Pohnpei: Police/Fire sirens and Public Address System (PA). The local media on FM and AM frequencies • Yap: Police cars with PA/siren systems • Chuuk: Police cars with PA/siren systems • Kosrae: Police cars with PA/siren systems These methods are outlined in each State's response plan and used in an all-hazard warnings context.

Key Component	Rating	Comment
Effective warning dissemination to remote communities	**No**	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. 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.
Communications coverage of whole country that is effectively utilised for the dissemination of tsunami warning messages	**Partially**	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). 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. 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. 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. 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. 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. 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. 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. 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.

Key Component	Rating	Comment
Issue of marine tsunami warnings and guidance for vessels, harbours and ports	**No**	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. 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. Patrol boats have INMARSAT, NAVTEX communication systems, however these are only manned when crews are out at sea. 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.
Emergency Response and Evacuation		
Disaster preparedness and emergency response system has been reviewed and opportunities for improvement and training identified	**Partially**	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. 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. 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. • Develop, upgrade and then exercise the State emergency response plans. Details about evacuation routes and shelters should be included within the plans. • Update the National Disaster Preparedness Plan to include all aspects of emergency management in relation to tsunami hazards. • National and State level agencies to collaborate on joint disaster management initiatives, including preparedness programs from planning to implementation. • 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.

Key Component	Rating	Comment
Tsunami emergency response, evacuation and recovery plan exists	**No**	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	**Yes**	The Governor authorises public evacuations and grants the responsibility of informing the community and undertaking the task to the DCOs. 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. 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.
Plans have been made for safe evacuation of population centres including aspects such as maps, routes and signage	**No**	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. 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. 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.
Procedures are tested and exercised to improve the response through better planning and preparedness	**Partially**	The WSOs and DCOs test SOPs at the airports, for typhoons and other emergency events, but not for tsunami response. In Yap, the United States (US) Forestry Service installed an Incident Command System 400 which is regularly tested. Pohnpei DCO regularly tests capabilities and resources with Federal Aviation Administration (FAA) to maintain accreditation. All Chuukese schools were involved in Pacific Wave 2008. 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.

Key Component	Rating	Comment
Land use policies and building codes are in place to mitigate against the tsunami hazard	**No**	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. 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. 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. The airports of three States are located in close proximity to the coastline.
Tsunami hazard, vulnerability and risk		
Completion of studies to assess the tsunami hazard in the country or Region	**Partially**	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. 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. 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. SOPAC is collating hazard and risk information for most Pacific Island Countries including the FSM States, Chuuk and Pohnpei. GA has also completed preliminary and probabilistic tsunami hazard assessments of PICs, including FSM.

Key Component	Rating	Comment
Local risk assessments have been completed for at risk communities	**Partially**	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. 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. 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. 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.
Adequate data exists and local inundation modelling has been completed for population centres	**Partially**	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. 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. There is also possibly data available from the ADB climate proofing study for Kosrae and Pohnpei.
Public and Stakeholder Awareness, Education and Training		
Measures have been taken to ensure the public understand and take action in the event of a tsunami warning being issued	**No**	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. 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.

Key Component	Rating	Comment
Community level education and preparedness programs exist for tsunami	**No**	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. 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. 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. 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. It was noted that Chuuk WSO carries out public awareness on severe weather and related hazards throughout the entire State. Agencies that have allocation for community level education and preparedness program include: • The Department of Public Safety (DPS) who obtain some funds for community awareness activities from AusAID; and • The WFO Guam who run annual workshops which the public are welcome to attend.
Training programs for the National media exist for natural hazard and tsunami	**No**	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.
Training programs exist for officials involved in tsunami warning and response	**Partially**	WFO Guam runs training programs for officials involved in tsunami warning and response.