SUPPORT EMERGENCY MANAGEMENT COMMUNICATIONS IN THE NORTH, CENTRAL AND WESTERN PACIFIC


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1. ABSTRACT

This paper provides an overview of various U.S. organizations involved in disaster planning and relief efforts in the North, Central and Western Pacific. It also describes the nature of environmental threats in the Pacific which illustrates the grave necessity of communication networks to support emergency management efforts. Although there are numerous players involved in operating and maintaining such communication networks, this paper focuses on two specific examples: the Hawaii State Voluntary Organizations Active in Disaster (HSVOAD) and the Emergency Management Network via PEACESAT.

1.0. INTRODUCTION

The importance of disaster planning and communication is often underplayed until a disaster occurs. Information gained from past disasters play an important role in improving the organization of existing and developing infrastructures to better support emergency communication. These networks must be operable in the absence of conventional infrastructures, such as electricity and telephone lines. Redundant networks are relied upon even when conventional infrastructures are in tact because telephone lines are often overloaded by the general public. Accurate and timely information distribution is also critical in times of disaster. In addition to being reliable and viable systems, cost effectiveness is key. Today, collaborative efforts among emergency management organizations, communication network managers and technicians are combining forces to address the emergency communication needs in disaster preparation and response.

2.0. BACKGROUND

The Federal Emergency Management Agency, or FEMA is the governmental agency tasked with coordinating the federal disaster response and recovery process. It also implements the
President's Disaster Assistance Program which is designed to supplement the efforts of the state and local government, voluntary agencies and others in providing assistance during emergencies.

The Pacific Islands served by FEMA Region IX Pacific Area Office include the American Flag Pacific Islands which are the State of Hawaii, the Territories of American Samoa and Guam, and the Commonwealth of the Northern Mariana Islands, and the Freely Associated States which are comprised of the Republic of the Marshall Islands, the Federated States of Micronesia (Kosrae, Pohnpei, Chuuk and Yap), and the Republic of Palau.

FEMA Region IX services an enormous Pacific region which extends from 134 degrees east longitude to 155 degrees west longitude and 14 degrees south latitude to 22 degrees north latitude (See Figure A).

The combined Exclusive Economic Zone (EEZ) is about 4.3 million square miles of water. The total land area is 7,562 square miles, less than 0.2 percent of the combined EEZ. Approximately 85 percent of the total land area is in the State of Hawaii. (See Table 1)

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<th>Table 1: Pacific Area Data</th>
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<td>The region is lightly populated, although specific islands may have a high density (e.g. Majuro with 5,244 persons per square mile). The total population is 1.484 million, and the population density is 196 persons per square mile of land and 0.3 persons per square mile of EEZ. About 75 percent of the population, or 1.1 million, is in the State of Hawaii. (See Table 1).</td>
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Several natural hazards are common to the region, including tropical cyclones (called hurricanes in the eastern Pacific, and typhoons in the western and central Pacific), flash floods, flooding due to high waves, tsunamis, earthquakes, volcanic eruptions, drought and storm surge. These can cause enormous damage, some of which are severe enough to warrant assistance from the federal government. Since 1982 there have been 30 federally declared disasters which generated $531 million in total obligations for FEMA assistance. (See Table 2). The total damage of these disasters was in excess of $2.2 billion.

The primary threat in the region is tropical cyclones. Twenty-five of the declared disasters since 1982 and 96 percent of the FEMA obligations were the result of cyclones. The six events causing the most obligations were cyclones (Iniki - $229 million, Val - $77 million, Omar - $63 million, Ofa - $66 million, Owen - $17 million and Nina - $16 million). Four of the cyclones (Roy, Russ, Yuri and Axel) caused substantial damage in multiple jurisdictions.

The severity of these natural hazards have been costly in the resiliency of both the people and economy. This emphasizes the importance of disaster planning and response in the Pacific. Communication is the critical vehicle for the organization and collaboration of relief efforts needed to provide health care, food, water, shelter and the rebuilding of communities.

Damage to inter- and intra- island communication systems is an important effect of the tropical storms. Given their relative isolation and geographic make-up, the communication system within a jurisdiction and with the outside world is vitally important. A cyclone's high wind and rain may cause damage to power and telephone lines, communication satellite dishes and electronic equipment. It is not uncommon for phone communications to be out during and for several days after the storm, hampering the response and recovery function of local, state and federal agencies. The development of a reliable, survivable combination of communication systems for emergency management would be a large step toward solving this repetitive problem in the region. The many players involved in emergency management including policy makers, managers and technicians are working together towards merging resources to build redundancy and organization in emergency management communication.

3.0. EMERGENCY MANAGEMENT ORGANIZATIONS
The role of government and voluntary agencies like the American Red Cross in disaster response and recovery activities can best be described as an integrated collaborative effort. Governments at all levels--local, state and federal share in the responsibility of mitigating against, preparing for and responding to disasters and emergencies within their jurisdictions. However, for many years, governments have relied on the expertise and resources of voluntary agencies to augment their efforts in disaster planning and response.

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<th>Table 2: Pacific Area Disasters</th>
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<td>Roles in disaster preparedness and planning can best be described as a pyramid of</td>
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Increasing severity. At the base of the pyramid is local government and community organizations.

Local government provides the first line of response and is the level of government that is closest to the situation. Fire, law enforcement, search and rescue, and emergency medical services are provided by the local government to ensure life and property. Community voluntary agencies work in concert with the government to provide feeding, sheltering and basic needs of both individuals and families affected by the disasters. Additionally, private and government agencies work together to restore vital municipal resources, such as power, transportation and communications systems. If an emergency is so great that it overwhelms or exhausts local resources, assistance may be sought from the next level of the pyramid, state government.

State government has a duty to prepare for and respond to emergencies within their jurisdictions. State government serves as the liaison between affected populations and federal assistance programs. Should the disaster be so severe that it is beyond the capabilities of both the local and state government to respond, the governor, (or in the case of the Pacific Jurisdictions which has one level of government, the senior government official), may request a major declaration from the President of the United States. When such a declaration is made, a wide range of federal resources and assistance programs are made available to the affected state or jurisdiction. The federal response to an emergency represents the final tier of the pyramid.

The Federal Emergency Management Agency, or FEMA as described earlier, is the governmental agency which is responsible for coordinating response efforts when local and state resources are too heavily taxed.

The American Red Cross is the leading voluntary agency involved in disaster preparedness and response in America. Though not a government agency, the American Red Cross has a legal and moral mandate to provide disaster relief to the American people. American Red Cross' authority to respond to disasters is derived directly from its Congressional Charter of 1905.

The American Red Cross disaster services program involves the provision of a planning, preparedness, education and relief program throughout the United States and its Territories and Possessions. American Red Cross disaster relief assistance involves the operation of shelters, the provision of feeding services, providing for individual and family assistance to meet immediate needs, such as the replacement of food, clothing and household items. American Red Cross assistance also involves medical health support, the handling of inquiries from concerned family members outside the area, and the coordination of relief activities with other voluntary agencies, businesses, labor and government. All American Red Cross disaster relief is provided free of charge and are a result of donations from the American public.

When responding to disasters, voluntary agencies provide resources to support the government’s response efforts. For example, the American Red Cross supports government's efforts in mass care, by managing government identified congregate care shelters. Another voluntary agency, the American Amateur Radio Relay League (ARRL), provides emergency communications between government and voluntary agencies during disaster. Additionally, voluntary agencies like the American Red Cross coordinate the service delivery of other voluntary agencies involved in the response effort. Through a coordinated, collaborative effort government and the voluntary sector work together to address the disaster caused needs of their communities. Communication is a vital element of this coordination.

4.0. COMMUNICATIONS IN THE PACIFIC ISLANDS (REGION IX)

4.1. Telephone, Radio, Television
There are substantial telephone, radio and television frameworks in the major cities of the Pacific Island region served by FEMA. However, these infrastructures can not be depended on during an emergency due to frequent damage of telephone and electrical lines from the harsh weather conditions. High winds, flying debris and heavy rain have caused damage to overhead telephone and/or electrical lines. If the public telephone system remains operational, it is also first to become overwhelmed.

4.2. Amateur Radio
Amateur radio communication is commonly used for communication in rural areas. Amateur radio communication is highly prevalent in the Pacific Islands. According the Federal
Communication Commission, there are approximately 570 licensed amateur radio operators in Guam alone and another 500 total in the other U.S. territories and possessions in the Pacific. Amateur radio communication is used for voice and data applications. Due to the ease of installation and mobility of amateur radio equipment, amateur radio operation has historically been instrumental in providing communications in an emergency. Amateur radio communication infrastructures have often provided redundancy or replacement of conventional telephone communication. However it is evident, from past experience in both real time emergencies and unannounced drills, that there are factors, other than technical systems, to be considered. For example, there is a need for operators to be trained for emergency situations. There is a need for structure and organization of the voluntary groups to be able to actively and effectively support disaster relief efforts from the local to the federal level. Section 5.2. of this paper identifies how the Hawaii State Voluntary Organizations Active in Disaster, or HSVOAD, was formed in order to address these issues in Hawaii.

A high frequency radio costs approximately $1,500 U.S., with no recurring transmission costs. In the event of risk or loss of life or property, all local communication frequencies are made available for emergency communication.

4.3. PEACESAT

44 PEACESAT stations are located in 22 Pacific Island countries. As described in following sections of this paper, nine additional PEACESAT stations will be installed in each Emergency Management Office of the Pacific Island jurisdictions of Region IX establishing an Emergency Management Network. Additionally, in September of 1995, PEACESAT and the National American Red Cross entered into a Memorandum of Understanding confirming the commitment by each organization to work collaboratively in disaster relief efforts.

The PEACESAT system utilizes a decommissioned meteorological satellite, GOES-2, of the National Oceanic Atmospheric Administration (NOAA). Current PEACESAT services include voice, data and facsimile. A PEACESAT Services Improvement Plan is being implemented which will provide a digital overlay to the existing analog system. New services will include higher speed data, concurrent voice and data communication and compressed digitized video.

PEACESAT provides public service communication for distance education, training, research and economic development. Providing communication to support emergencies is also a primary mission of PEACESAT. In the case of an emergency, all scheduled programs are preempted to support the country in need of communication.

A standard PEACESAT station costs approximately $30,000 U.S. There are no recurring user fees in terms of transmission costs.

4.4 Inmarsat

Inmarsat-A systems are deployed for emergency response by American Red Cross. Inmarsat-A stations are portable systems which provide voice, data and fax transmissions via an Inmarsat satellite and Land Earth Stations. Inmarsat-A terminals provide a wide range of mobile coverage in all four ocean regions.

Currently there are two Inmarsat-A stations based in Hawaii, one in Guam and one in the Commonwealth of the Northern Mariana Islands. If an emergency occurs in other parts of the region, Inmarsat-A systems are brought in from either Hawaii, Guam, Saipan or the U.S. Mainland.

An Inmarsat-A terminal costs approximately $30,000 - $40,000 U.S. Transmission costs are approximately $10 U.S. per minute.

4.5. Military Communications

There are military communication networks in place which are primarily used to provide service to the armed forces of the government. These networks, understandably, cannot be readily depended on for dedicated civilian use. The military plays a major role in providing relief efforts during emergencies and require communication for their own needs. Security restrictions are also a concern for military communication networks.

5.0. EXAMPLES OF NETWORKS SUPPORTING EMERGENCY COMMUNICATION

Emergency Communication
The Emergency Management Network utilizing PEACESAT and the Hawaii State Voluntary Organizations Active in Disaster (HSVOAD) has been formed in order to address the issues in Hawaii.
Organizations Active in Disaster (HSVOAD) are specific examples of emergency managers and communication network managers acting jointly to address the issues of establishing overlays of communication infrastructures to support emergency communications.

5.1. PEACESAT

The Pacific islands served by FEMA's Pacific Area Office correspond to the member States of the National Emergency Management Association's Pacific Caucus. The Pacific Caucus and the Governors of the AFPI, who also make up the Board of the Pacific Basin Development Council (PBDC), proposed to establish an Emergency Management Network (EMN) using the Pan Pacific Education and Communication Experiments by Satellite (PEACESAT) program. The EMN will strengthen emergency management planning, programming and response communication throughout the region.

The Department of the Interior (DOI) and FEMA are jointly funding the EMN through a cooperative agreement with the PBDC and PEACESAT.

The EMN will be made up of the Pacific Caucus Emergency Management Offices (EMO) in: American Samoa, Guam, Saipan in the Northern Mariana Islands, Majuro in the Marshall Islands, Kosrae, Pohnpei, Chuuk and Yap in the Federated States of Micronesia, and Koror in Palau. The Hawaii Civil Defense and the Pacific Area Office will be able to access the PEACESAT network via a phone-patch to the PEACESAT Headquarters located at the University of Hawaii.

Each earthstation will consist of an analog transceiver, a 3.5 meter satellite dish, and a radome. PEACESAT earthstations share the use of nine analog simplex channels that support voice teleconferencing and three full-duplex point-to-point channels for voice, fax or data transmission. One full-duplex and one simplex circuit will be dedicated to the EMN.

The full-duplex channels support 9.6 Kbps data communication for data transfers or access to information services such as Internet. PEACESAT headquarters in Honolulu provides Internet access to the Pacific via GOES-2. The PEACESAT standard terminal can be upgraded to support higher data rates up to 32 Kbps.

All standard PEACESAT stations are equipped with a telephone patch which can connect calls from the public switched telephone network to the PEACESAT network. This would be practical for a location outside of the GOES-2 footprint, Washington D.C. for example, to be in direct contact with the EMO facing the crisis. If Saipan was completely devastated without telephone communication, electricity, etc. the EMO would contact another PEACESAT station, Honolulu, for example, who would then "phone-patch" the appropriate federal office for a current status of the situation and needed resources.

PEACESAT systems have withstood environmental disasters in the Pacific. Recent examples include Hurricane Iniki and Typhoon Omar. Historically, PEACESAT has provided communication to devastated areas when telephone lines were either completely disabled or overloaded. However the EMN intent is to combine several integral components that will provide the basic structure to better orchestrate disaster planning and relief assistance.

The EMN calls for the PEACESAT antenna to be housed in protective radome coverings for an added level of protection and will allow communication during the storm. Theses PEACESAT stations will be equipped with back-up power, sturdy facilities and personnel who are readily available and trained to operate under emergency situations.

The EMN will be instrumental in assisting FEMA to fulfill its response and recovery, preparedness and training, and mitigation roles in the Pacific. The EMN will provide a reliable, survivable communication system during and after a disaster. This will allow FEMA to respond to a disaster quicker and more appropriately, to overcome the large distances and high cost of travel that impede staff training and education, and to provide information on a timely basis.

5.2 HSVOAD

In the wake of Hurricane Iniki, which in 1992 devastated Hawaii's Northernmost island of Kauai, it was clear that a collaborative and cooperative disaster response effort on the part of government and voluntary agencies was required. However, the desire to coordinate the various disaster relief programs became an almost impossible task as conventional communication systems were disrupted, over taxed or destroyed along with approximately half of Kauai's 20,000 homes and most of its 70 hotels. Over 7,000 of Kauai's 52,000 people...
were left homeless.

In retrospect of the Iniki experience voluntary agencies, realized that a more coordinated effort among Hawaii's communities must be developed to insure a more efficient disaster response effort in the future. As a result, on July 27, 1993, the Hawaii State Voluntary Organizations Active in Disaster, or HSVOAD was formed.

The mission of the HSVOAD is to "facilitate the provision of comprehensive services to the People of Hawaii in disaster preparedness, response, and recovery by fostering coordination among private, non-profit and government agencies". The emergency management objective of HSVOAD is to "ensure a collaborative, effective, and timely disaster response among volunteer organizations". In an emergency situation, when the State of Hawaii Civil Defense Emergency Operations Center (EOC) is activated, a member of the HSVOAD is assigned to the EOC team. The HSVOAD representative within the State EOC will respond to operating requirements of the State Director of Civil Defense, State and County government requests for coordination and disaster assistance, as well as from HSVOAD member agencies. With such an important role to play, the HSVOAD realized early on in its formation that a reliable cost-effective communication system was needed to insure continuity of communications during and after a disaster.

Training and practice is essential in forming an effective emergency operations routine. In March of 1995, an initial emergency test using volunteer amateur radio operators and CB stations was conducted specifically to aid the HSVOAD organization. Communication links were set up by amateur radio operators and CB operators at the HSVOAD member agency offices.

The emergency communications test operated within a pre-determined scenario that called for a near miss hurricane that left wind and major flood damage in West Maui and the Southern Region of Hawaii County. There were ensuing problems related to food, shelters, and mass care. The emergency communications network, or HSVOAD-NET, was activated to address these various concerns.

In all, ten HSVOAD sites on four islands came on-line. The test proved without a doubt that a designated voluntary agency emergency communications system was an absolute necessity and completely feasible. To further validate the existence of a voluntary agency emergency communications system, the HSVOAD-NET was activated during the State of Hawaii 1995 Hurricane Exercise. During the May exercise, all twenty-five HSVOAD member agencies expressed interest to participate. Unfortunately there were not enough CB and Amateur radio operators available to support their involvement. To address this issue, the HSVOAD made arrangement to phone patch or CB patch voluntary agencies into the emergency communications net, via the MARS communications systems. Thus, HSVOAD agencies that did not have an on-site amateur radio operator were able to participate and communicate. Those voluntary agencies that actively participated were serviced by amateur radio operators equipped with hand-held portable radios. Additionally, voluntary agencies located in areas not conducive to VHF transmission, (high rise buildings), were serviced by CB operators. During the hurricane exercise, HSVOAD member agencies and the local governments were successful in using the given scenario and resources to create a workable communication solution. From this exercise, the HSVOAD and related players will be in a better position to respond proactively rather than reactively, in the event of an actual hurricane.

The beauty of the HSVOAD-NET is that the system utilizes existing training systems and volunteer structures. The system is not complicated and is "user-friendly", with the option of transmitting voice or data information. Also, in the event that a voluntary agency would like to transmit and receive its own communications, a portable-hand held VHF radio can be purchased for $300 or less. Voluntary Agency staff can train themselves to be systems operators by completing the ARRL home study course and applying for a Ham Radio License. The ability to "self-train" and procure affordable equipment makes HSVOAD-NET very cost effective. Supporting the HSVOAD-NET are existing "repeaters" operated and owned by private radio clubs and state government, providing instant state-wide coverage.

It should be noted that HSVOAD intends to work with member agencies like the ARRL, the American Red Cross and PEACESAT to further develop redundant communication systems that can enhance the HSVOAD-NET. A few desirable developments would include interfacing HF and VHF networks to satellite communication for extended coverage, portable satellite systems and packet data communications via HF or VHF radio to be interface to satellite
terminals for data communication from rural areas.

HSVOAD is dedicated to the continued development and utilization of redundant methods of communication during times of disaster.

6.0. CONCLUSION

Emergency management communication for planning, response and relief efforts, are currently being addressed by emergency managers and organizations, who are joining forces with various communication networks with the intent of providing redundant, reliable and survivable communication in the Pacific areas.

It is evident that there is a need to identify communication systems that are in place and identify innovative means of strengthening these infrastructures by considering alternative power (solar power repeaters, generators, etc.), overlapping system applications with redundancy, organizing the information flow and management of the networks to best serve the emergency communication needs.

With systems and networks in place, it is critical to provide operators with proper training and practice. Routine emergency communication network drills involving all parties likely to be involved will do many things: It will verify the operational condition of the communication equipment if not used on a regular basis exercise operational procedures and maintain collaborative relationships.

There are numerous efforts working parallel to these which are not mentioned in this paper. They include information delivery systems to reach the masses specifically for disaster preparedness. For example, systems which can transfer and distribute weather images and information for advanced warning and proper preparation. An example is the Radio Activated Alarm System (RAAS) developed by the Scientific and Commercial Systems Corporation. It is a hand-held system which receives warning alarms indicating danger. It is intended to provide wide range of coverage with various types of repeater systems attending specifically to rural areas. There are many innovative applications for a system such as the RAAS.

Communication technology is ever changing and developing. Emergency managers must push communications technology to the limit. It is a challenge we can ill afford to ignore and that requires organizations to work together and join resources.

ACRONYMS

AFPI American Flag Pacific Island
ARC American Red Cross
ARRL American Amateur Radio Relay League
CB Citizen Band
DOI Department of the Interior
EEZ Exclusive Economic Zone
EMN Emergency Management Network
EMO Emergency Management Offices
EOC Emergency Operations Center
FEMA Federal Emergency Management Agency
FSM Federated States of Micronesia
GOES-2 Geostationary Operating Environmental Satellite
HF High Frequency
HSVOAD Hawaii State Voluntary Organizations
Active in Disaster
MARS Military Amateur Radio System
NMI Commonwealth of the Northern Mariana Islands
NOAA National Oceanic Atmospheric Administration
PBDC Pacific Basin Development Council
PEACESAT Pan Pacific Education and Communication Experiments by Satellite
RMI Republic of the Marshall Islands
RAAS Radio Activated Alarm System
VHF Very High Frequency