DISASTER INFORMATION NETWORKS

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INTRODUCTION

Local communities need disaster information for such purposes as alerting populations to incoming tsunamis or to out-of-control forest fires which are approaching urban areas. A disaster information network may be able to help local communities by coordinating disaster information from a variety of sources and making it available to those communities which might be affected. Local communities can also provide detailed information to the outside world about damage after a disaster in order to make the shipment of humanitarian relief supplies more timely and effective. Vice-President Al Gore became interested in 1997 in the possible use of the Internet for dissemination of information to reduce disaster losses. A task force studied the problem and published a report, "Harnessing Information and Technology for Disaster Management". The report concluded that an international disaster information network using the Internet was technically feasible and that remote sensing from satellites could produce timely information. The report recommended that action be taken to begin international coordination and collaboration to develop a system called the Global Disaster Information Network (GDIN) which will help all countries prepare for and respond to disasters.

The goal of this evolving system is to reduce disaster losses by making timely and accurate information available to emergency managers and to others who need information to make decisions about actions to prepare for, respond to, recover from, and mitigate the effects of disasters. The international network is in early stages of development. A first international conference of experts was held in Washington, DC, July 16-18, 1998 and a second international conference was held in Mexico City, May 11-14, 1999. The third international conference is scheduled to be held in Turkey in April 2000 and the fourth in Canberra, Australia in April 2001.

Some of the organizations which are involved in this initiative and their activities are reviewed here. In particular, organizational and procedural improvements in the State of California's management of disasters and of disaster information are examined to determine whether or not some of these approaches might be appropriate to the development of national and world-wide disaster information networks.

THE CALIFORNIA EXPERIENCE

The Loma Prieta earthquake which occurred at 5:04pm on October 17, 1989 near Santa Cruz, California resulted in the death of 63 people, injury to 3757, the destruction of 1018 homes, and damage to 23,408 homes and 3530 businesses. There was extensive damage to the business districts, homes, and hospitals in the city of Santa Cruz, and in

nearby Watsonville, the other city in Santa Cruz County. Television and radio broadcast stations, however, concentrated their attention on damage in San Francisco and Oakland 60 miles north of the epi-center. The collapse of one span of the San Francisco-Oakland bridge, the collapse of a mile of the upper deck of a major expressway in Oakland which crushed 42 automobiles, and a large spectacular fire which burned blocks of expensive houses and apartments in the Marina District of SanFrancisco monopolized the news broadcasts.

For almost 24 hours, the media barely noticed that earthquake damage to roads and bridges near the epi-center had isolated the city of Santa Cruz where many homes had been damaged. Fortunately, the implementation of pre-disaster local mutual aid agreements resulted in fire engines from other municipalities rushing to Watsonville to help even though the telephone communication systems had been damaged. There were 17 almost simultaneous fires in Watsonville after the earthquake. One of the important lessons learned from this disaster was how vulnerable highway, electrical distribution, gas, and telephone systems are in California. Another lesson learned was that important information about earthquake damage in this disaster did not get to the Governor's Office of Emergency Services in the State capital at Sacramento, 200 miles away, quickly enough.

CALIFORNIA'S SATELLITE COMMUNICATIONS FOR DISASTERS

As a result of this experience, the State of California decided to invest $9 million in a satellite communications system for the Governor's Office of Emergency Services so that disaster information could be exchanged reliably in future earthquakes even though the commercial telephone system might be heavily damaged. There are 58 counties in California, so 58 satellite uplink/downlink stations were purchased, along with four trailer-mounted mobile stations, stations for the Governor's Office and three regional emergency operations centers. This satellite communications system is called OASIS - Operational Area Satellite Information System. Each county with its cities and special districts is now designated as an "operational area" for disaster purposes. Each operational area is responsible for coordination of disaster planning, response, and mutual aid within its area, and for communicating with other operational areas and with the Governor's Office and regional centers. The satellite links permit each operational area to talk to and send data to any or all of the other 57 operational areas, to the three regional emergency operations centers, and to the Governor's State Operations Center. This system is exclusively for disaster-related information.

CALIFORNIA'S DISASTER INFORMATION SYSTEM

The State next developed standardized formats for messages: for reporting information about disasters, for requesting mutual aid, for reporting the status of operations and resources, and for providing information for after-action reports.

This California information system is called the "Response Information Management System" (RIMS). The information can be distributed using the OASIS satellite communication system or by using other communication systems if they are operable after the disaster. RIMS uses off-the-shelf commercial software, Lotus Notes.

Information about RIMS can be found on the State of California's OES web site which has details about all of the formats for the various disaster information reports.

The formats for distributing disaster information have been developed to follow a logical time sequence. After an event such as an earthquake occurs, the local community prepares a basic incident report to tell all the appropriate authorities that something has happened. This is called the Event/Incident Report. Situation Reports are subsequently distributed to provide updated information on the incident.

Mission Request/Tasking messages asking for mutual aid are next sent if the disaster is so large that the resources of the local community are insufficient. The responding agency indicates whether or not it can provide the requested resources.

Status Reports for the Standardized Emergency Management System (SEMS) Reports Databases are prepared and distributed so that everyone will know what has happened, what is happening, and what is planned to happen in a variety of functions such as:

Initial Damage Estimates

Movements

Mass Care and Shelter

Fire and Rescue

Law Enforcement

Hazardous Materials

Medical/Health

The use of standardized formats by the Lotus Notes software makes it possible for all relevant organizations to put their information into the RIMS system and update it so that everyone can receive the information simultaneously. The requests for mutual aid are directed to coordinating authorities, and the information as to whether or not the aid can be provided is available to all, since some other organization might be able to provide assistance.

DEVELOPMENT OF THE STANDARDIZED EMERGENCY MANAGEMENT SYSTEM

The OASIS satellite communications system and the formatted emergency information of RIMS are part of California's new Standardized Emergency Management System (SEMS). This new statewide emergency management system was developed as the direct result of the disastrous East Bay Hills fire in Oakland and Berkeley in October 1991 which resulted in 25 deaths and 150 injuries. There were 3354 houses and 456 apartments destroyed in spite of the efforts of more than 300 mutual aid fire engines brought to the disaster. The estimated cost of the East Bay Hills fire is $1.5 billion and it is the most costly urban fire in the history of the United States.

There were a number of factors which were pertinent to this major disaster according to the official "lessons-learned" report prepared by the East Bay Hills Fire Operations Review Group. The weather made fire fighting almost impossible with temperature of 92 degrees Fahrenheit, relative humidity of only 16 percent, and winds of 30 knots gusting to 50 knots. The fire ignited 790 homes in the first hour. As the fire spread, it was difficult for the police to evacuate people from their homes because the streets were narrow and clogged with burned-out hulks of more than a thousand automobiles. The terrain was hilly with lots of trees. Many houses had wood shingle or wood shake roofs which caught fire easily.

There were also important organizational problems. The Oakland Fire Department did not use the Incident Command System and had few formal mutual aid agreements. The Fire Department moved its field command post to three different locations as the fire spread, which made communications with the Oakland Police Department difficult. The police department had also established its command post in two different locations. When the Governor of California arrived it was difficult for him to find out who was in charge and what was going on.

Furthermore, the Oakland Fire Department had a different size fire hydrant from all other California cities so that the 300 mutual aid engines arriving from other cities needed to use adapters which were in short supply. The Oakland Fire Department's budget had been cut so much in the preceding ten years that about 40% of the firefighting personnel had retired without replacement. There had not been enough money in the budget for training in fighting wildland fires. Because of the small budget for modernization, the fire engines had antiquated four-channel radios for communication instead of modern sixteen-channel radios. This made it difficult to communicate with the 300 mutual aid fire engines which had arrived to try to help.

State Senator Petris, whose home in Oakland had been burned, prepared the draft of Senate Bill 1841 which was quickly approved by the state legislature and signed by the Governor. This law is found in Section 8607 of the Government Code. The intent of the law was to improve the coordination of state and local emergency response in California. The new "Standardized Emergency Management System" (SEMS) became effective December 1, 1996.

BASIC COMPONENTS OF SEMS

The new Standardized Emergency Management System was based on improvements to existing systems and some new concepts. The five basic components are:

1) The Incident Command System (ICS) - The Incident Command System as developed by fire departments in Southern California in the 1970s will be used at the field level by all responders;

2) Multi-Agency Coordination - Multi-agency coordination is the coordination among different agencies within a jurisdiction, such as Fire and Law Enforcement. Inter-agency coordination takes place between different levels, such as city police, county deputy sheriffs, State Police,

and California Highway Patrol officers;

3) A Master Mutual Aid agreement - State, counties, and cities originally signed a master mutual aid agreement in 1950. This has been further developed so that it now covers fire, law enforcement, coroner, emergency medical, and search & rescue systems;

4) Operational Areas - An operational area consists of a county and all political subdivisions within that county's area; and

5) The Operational Area Satellite Information System (OASIS) - A satellite communications system with a high frequency radio backup installed at each of the 58 counties, the regions and the State.

The collection of formatted message reports designed to be transmitted over this satellite system is called the Response Information Management System. Some of these aspects of standardization of disaster information management in California may be of interest to the developers of the Global Disaster Information Network. There would appear to be numerous advantages to using standardized terminology and standardized formats to reduce the possibility of misunderstandings particularly when a truly global system is being designed.

OTHER DISASTER-RELATED ORGANIZATIONS

State and Local Emergency Management Data Users Group

There have been problems after many disasters for outside organizations in providing appropriate humanitarian assistance to local communities. After a hurricane, for example, there may be many damaged houses. There may be a shortage of sheets of plywood and roofing material to make the houses temporarily habitable and keep the rain out. The community should have access to a disaster information network where these needs can be promulgated and read by appropriate organizations which may be able to provide the humanitarian assistance requested. The State and Local Emergency Management Data Users Group (SALEMDUG) developed a "National Donations Information System" some years ago. The goal of this disaster information system was to allow the communities affected by a disaster to specify in detail what sort of assistance they would like to receive, where they needed it, and when. It also contained information from the providers of the equipment or personnel to the recipients as to what was being provided, where it would arrive, and when, so that the recipients could know that their request was being filled and when it would arrive. There had been a number of unfortunate examples after Hurricane Andrew in Florida of donations, which had been sent spontaneously from organizations in northern states, arriving unannounced and causing problems rather than solving problems. The specific things or equipment which arrived had not been requested and were either inappropriate, delivered to the wrong location, or were too late. These well-intended efforts had the unfortunate effect of causing overwhelming problems for the receiving organizations. A disaster information network should address this issue.

Pacific Disaster Center

The Pacific Disaster Center is a Federal information processing center located in Kihei, Maui, Hawaii which is being developed as an organizational and technological model for global, national, and local initiatives in disaster management. The Pacific Disaster Center serves as a nodal model for the Global Disaster Information Network. Federal participants in this development program have included the Federal Emergency Management Agency, US Geological Survey, National Oceanic and Atmospheric Administration, National Reconnaissance Office, and the National Aeronautics and Space Administration. The Pacific Disaster Center uses data from a variety of sources to produce more than 70 different products, such as tsunami travel-time maps, tsunami evacuation maps, flood inundation maps, annotated imagery of damaged areas, and maps of available shelters.

The Pacific Disaster Center held a three-day Users' Conference on April 28-30, 1999. The purpose of the conference was to familiarize users with the Center's capabilities and products and to provide a forum for users. Each user was invited to give a presentation on his organization and its mission, overview of operations, recent activities, suggestions for ways the PDC could assist the user, and description of ways the user might be able to assist the PDC.

The Pacific Disaster Center and the Center of Excellence in Disaster Management and Humanitarian Affairs co-sponsored the Asia-Pacific Disaster Conference '99, September 19-22, 1999 at Lihue, Maui, Hawaii. The conference was designed to identify user needs and enhance collaboration among the participants who included disaster managers and responders from Alaska, Hawaii, North America, Pacific island states, Asia, and international humanitarian organizations. Technologies examined at the conference included remote sensing, image manipulation, information management, medical technology, telemedicine, chemical and biological sensors, decontamination, water, and power.

Western Disaster Center

The Western Disaster Center Inc is a nonprofit public-benefit corporation which has been organized to provide for increased public safety through the enhancement of disaster and emergency management capabilities through the application of advanced technology and research associated with the establishment of the National Disaster Information Network. The Western Disaster Center is proposed as the US western regional component - the Western Disaster Information Network - of the evolving National Disaster Information Network. The mission of the Western Disaster Center is to provide effective and timely dissemination of information to federal, state, and local emergency commanders in the western contiguous United States. The Center is operating under NASA Ames Research Center sponsorship at the WDC Prototype Operations Facility at Moffett Federal Airfield, California.

In Project Quake, the Western Disaster Center has been working with the California Governor's Office of Emergency Services to develop the California Disaster Information Network HAZUS prototype project to demonstrate the value and utility of all-source satellite remote sensing for earthquake damage intelligence. In Project Sanctuary, the Western Disaster Center is working on a pilot project to demonstrate the value of

all-source satellite remote sensing to detect large ocean oil spills in the Monterey Bay National Marine Sanctuary. This will support the US Coast Guard, EPA, the Office of Oil Spill Prevention and Response of the California Department of Fish and Game, and local jurisdictions such as Pacific Grove, Monterey, and Carmel-by-the-Sea.

National Interagency Fire Center

The National Interagency Fire Center in Boise, Idaho needs a near real-time fire monitoring system for the United States. The Center started in 1965 as the joint US Forest Service/Bureau of Land Management Fire Coordination Center. It is now an interagency organization supported by the Department of Agriculture's US Forest Service, the Department of the Interior's Bureau of Land Management, Bureau of Indian Affairs, National Park Service, Office of Aircraft Services, and US Fish and Wildlife Service, NOAA's National Weather Service, and the National Association of State Foresters. The National Interagency Fire Center and the US Geological Survey hosted a conference on GIS and remote sensing technologies, "Crossing the Millenium: Integrating Spacial Technologies and Ecological Principles for a New Age in Fire Management" on June 15-17, 1999 in Boise, Idaho.

Global Fire Monitoring Center

The German Government, Ministry of Foreign Affairs is sponsoring a Global Fire Monitoring Center as a German contribution to the International Decade for Natural Hazard Reduction. This Center is at the Fire Ecology Research Group at Freiburg University, Freiburg. The Center publishes (on the Internet) the UN International Forest Fire News. The Global Fire Monitoring Center's website commented on one of the reasons why the center was established in June 1998.

> ". . . however, it is evident that in many countries of the developing world the state of scientific and technical knowledge is either not known or readily accessible for developing adequate measures in fire policies and management. The fire and smoke episode in 1997-98 in South East Asia was a good example that existing fire information systems or fire management expertise was utilized to a limited extent only. These circumstances led to confusion at national and international decision-making levels and led to the delay of response by a series of national and international projects, some of them even missing the targets. This can be explained by the lack of an information system which is accessible globally. . ."

The Global Fire Monitoring Center has established contact at the working level with the Global Disaster Information Network. One of the goals of the Center's research program is to be able to provide real-time or near real-time information related to fire to the GDIN and similar initiatives.

National Geophysical Data Center

The National Oceanographic and Atmospheric Administration's National Geophysical Data Center in Boulder, Colorado is currently developing a near real-time multi-source active fire monitoring system. The National Geophysical Data Center gets global fire detection data from the US Air Force Defense Meteorological Satellite Program. This

information should be available through the Goddard Space Flight Center.

US Geological Survey's Hazard Support System

The US Geological Survey is establishing a Hazard Support System in Reston, Virginia to receive and coordinate information from satellites, Doppler weather radar, nationwide lighting-strike detection, etc in order to provide detection of fires, volcanic eruptions, and ash clouds to appropriate disaster management organizations. The National Reconnaissance Office has given a two-year $23 million development contract to Raytheon.

HazardNet

HazardNet is a prototype natural and technological hazard information sharing network which has been under development as a demonstration project of the International Decade for Natural Hazard Reduction. The goal is to enhance the timeliness, quality, quantity, specificity, and accessibility of disaster information for persons and organizations worldwide. The prototype development has been led by researchers at Simon Fraser University, Vancouver, Canada and the Canadian Forest Service.

PROGRESS ON THE GLOBAL DISASTER INFORMATION NETWORK

There have already been two GDIN conferences. The first was in Washington, DC, July 16-17, 1998. The second international conference was in Mexico City, May 11-14, 1999 with 130 delegates from 18 countries. The third is scheduled to be held in Ankara, Turkey in April 2000 and the fourth conference will be held in Canberra, Australia in April 2001.

The conference in Mexico City formed five GDIN working groups:

Policy

Outreach / User Need Identification and Partnering

Technology / Systems Engineering

Pilot Projects / Demonstrations / Validations and

Capacity Building.

Individuals and organizations interested in participating in the development of GDIN are invited to contact the US Transition Team at the US State Department.

User Needs

The Global Disaster Information Network should have the potential for providing local communities with timely alerting and warning information on disasters. For example, during the Oakland/Berkeley urban fire, the Oakland Fire Department did not really know where the fire was and where it might be spreading. The Fire Department did not have helicopters for observation and was too disorganized to ask the US Air Force

or NASA for special photographic surveillance of the area of the fire by aircraft or satellite. We might some day have a similar problem in our City. Pacific Grove is adjacent to 5000 acres of the Del Monte Forest. In the area is a golfing and expensive residential area known as "Pebble Beach". There was a 1000 acre fire in the Del Monte Forest in 1901. A fire there in 1987 destroyed 31 homes. This part of California has several State and National forests as well as federal wilderness areas within a few miles of our small cities. The Marble Cone fire in 1976 in nearby Los Padres National Forest burned more than 150,000 acres. Just prior to the rains of the 1998 "El Nino" year, we experienced five years of drought which raised concerns about the possibilities of extensive forest fires in these dry forests and wilderness areas. Anyone interested in user needs of disaster information networks is invited to contact the author who is chairman of GDIN Working Group 2c.

A GDIN system might be able to help us by getting fire information from NASA assets at the Goddard Space Flight Center in Greenbelt, Maryland. Scientists at the Goddard Center and the University of Virginia have recently established a new global fire monitoring Web site which incorporates satellite information from the United States and international partners. NASA's coordination of these various capabilities for detection and monitoring of fires in California could be of tremendous value to our local communities and provide us with alerting information to prevent a repeat here of the Oakland / Berkeley urban fire disaster. Also, the Western Disaster Center might be able to obtain unclassified imagery-derived products on ocean oil spills which could alert the US Coast Guard, California Department of Fish and Game, and our local communities to take prompt response actions.

CONCLUSIONS

Local communities need information on such potential disasters as wildland fires which might get out of control and advance on urban areas or ocean oil spills which may threaten our shoreline. Disaster information networks should have the potential of providing timely fire detection and monitoring information to the affected local cities and providing alerting information on oil spills. Local communities may be able to use the resources of the network to make requests for specific humanitarian supplies after a disaster. Donation information systems in the network would be of value for providing accurate information back to the local communities as to what will be arriving, where, and when.

The Global Disaster Information Network has a tremendous potential for improving the capabilities of local communities to cope with disasters. GDIN should promote more effective collaboration among the providers, disseminators, and users of disaster information by complementing existing networks for sharing disaster information such as ReliefWeb. Some of the developments in management of disaster information by the State of California may be pertinent to evolution of national and global disaster information networks.

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NOTES

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