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CONSIDERATION OF A REGIONAL MULTI-HAZARD NETWORK FOR THE CARIBBEAN AND CENTRAL AMERICA

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EXECUTIVE SUMMARY

The value of interactive real-time telecommunications links between and among meteorologists, volcanologists, epidemiologist and the host of other disciplines within the disaster management community has long been appreciated. The reality of these networks less so. In urban centers of countries with highly developed economies (locations that provide the economic stimulus frequently needed to motivate the development of new technologies) some of these systems can be found operating. But in remote areas of these countries -- and in developing countries in general -- such networks cannot be found.

Though it is difficult to overemphasize the difficulties associated with the lack of access to technology, both developed and developing communities share the (sometimes greater) challenge of working out the regulatory, institutional, and professional protocols for application of those technologies that are available. In short, the challenge in applying technology to disaster management is frequently not a question of the suitability, or even availability, of the technologies themselves, but the development of the relationships among the users.

For example, it could be argued that the reason why a network that could be shared by disaster managers in the region has not been developed is because the potential users have not decided among themselves that such a network should be developed. It could be further argued that the resources that are currently available within the region -- from the governments and private sector of the region's countries, and from international agencies, consortia and donor countries -- is sufficient to cover the expenses associated with such a network if the cost are shared by all.

The Office of US Foreign Disaster Assistance has made the commitment to determine whether the time might be right for a cooperative international effort to implement a shared regional multi-hazard telecommunications network.

As a first step in this exploration, this preliminary report has been commissioned to identify a strategy for proceeding with the planning of the proposed network and to identify short-term "next steps" in the process.

The Author makes an assumption that disaster managers throughout the Caribbean and Central America region perceive a need for this network. Though it is believed to be true, this assumption is made only because the short duration of this initial phase prohibits adequate consultation with regional participants. It is highly recommended -- and integral to the success of the projects -- that subsequent phases of the project involve disaster management experts within the region who will use and manage the network.

During this initial phase, consultations and interviews were conducted with agencies and organizations primarily of the international and/or regional coordinating agencies and US departments having responsibility for hazard warning and coordinating the flow of observational data in the regions. These agencies and organizations include the Office of US Foreign Disaster Assistance, the Office of the Untied Nations Disaster Relief Coordinator (New York and Geneva), Organization of American States, National Oceanic and Atmospheric Administration (National Weather Service and the National Hurricane Center), National Aeronautics and Space Administration's Goddard Space Flight Center, the United States Geological Survey, World Communications Inc., Research Alternatives, Inc., and the Centro de Coordinacion Para la Prevencion de Desastres Naturales en America Central (CEPREDENAC).

Printed material has also been received and reviewed from the World Meteorological Organization, the United Nations Development Programme, the Pan American Health Organization, the Conference of Heads of Government of the Caribbean Community (CARICOM), the Caribbean Meteorological Organization, and the Finnish Meteorological Institute (FINNIDA).

Information about regional projects was also reviewed for this report. This information is referenced throughout the report and project documents can be found in their entirety as appendices to the report.

This report does not address the specific definition of a network that might be developed, rather it attempts to identify the issues that must be addressed in the pursuit of that objective. These issues include identification of potential users and user-needs, inter-institutional and inter-governmental relationships that are likely to be required, and possible funding mechanisms for possible network development and implementation.

Having conducted this study, brief though it was, the author is optimistic about the possibilities for a multi-hazard network. Certainly there is need: though not frequently addressed in terms of a multi-sector international scope, it is commonly perceived by disaster managers specializing in a number of different sectors and phases of disaster management. The technology is available and, arguably, not unaffordable if the burden is shared among a number users (read beneficiaries). Further UNDRO has indicated its willingness to coordinate an international appeal for funding if a project can be developed that meets defined needs and is acceptable to the countries involved.

INTRODUCTION

During the course of recent years the frequency and magnitude of major disasters -- of natural, technological, or ecological origin -- have made the world community dramatically aware of the immense losses of human life and economic resources that are caused regularly by such calamities. Particularly hard hit are developing countries for whom the magnitude of disasters frequently outstrips the ability of the society to cope with them.

Throughout the Caribbean and Central America disasters such as hurricanes, floods, volcanic eruptions and earthquakes have a long and highly destructive history. Though occurring less frequent that other natural phenomenon, tsunamis also represent a threat to the region.

A single hazardous event can destroy social and economic infrastructure that may have taken years to develop and upon whose vitality local and national economies depend. Frequently it is the case in developing countries that the capacities of these infrastructures are strained to manage even the most basic of social and economic development programs in normal times, and a single disaster can severely disrupt the community lifelines that provide food distribution, water supply, health care, waste disposal, and communication locally and with the rest of the world.

The 1972 earthquake that devastated Managua, Nicaragua is an example. It left damages equal to a year's GNP and affected virtually the entire industrial production of Nicaragua.

In order to develop to their fullest potential, countries in the Caribbean and Central America need a sustained period of social and economic development. Major impediments to this development are the disasters which often result in an affected country shifting its economic policies to the supply of basic goods required to cope with disaster response and subsequent reconstruction. These shifts can exhaust scarce resources and intensify a country's financial imbalances.

In many cases this situation can be prevented. Frequently the difference between saving life and property is an effective warning of an impending disaster. Timely warning of a major natural hazard can reduce its consequences: at least, people may have enough time to save their lives; at most, they have an opportunity to relocate or otherwise protect their property.

Further, a disaster-resistant telecommunications network can be vital to mitigation and relief operations for all rapid-onset hazards. Access to real-time information through a regional network would also enhance mitigation efforts for long-term hazards such as drought and insect infestation, and man-made hazards such oil spills and chemical accidents.

THE NETWORK

To be most effective this network should be viewed in a multi-sectorial context. Although it is important to understand respective interests of each sector, funding and political impetus to the programs will likely be stronger if they can be derived from a coalition of broad public and private sector support.

Disaster managers have long envisioned the value of timely communications yet heretofore resources to establish and sustain the requisite infrastructures have been inadequately allocated in comparison with demand for their service. Financing appropriate technology development to serve the needs of countries prone to disaster would be less burdensome if these technologies could be seen as basic infrastructure requirements. Costs could then be shared by all sectors of the nation and region, and protocols developed for shared access to -- and use of -- technology resources. A necessary challenge would then be to design these protocols so that they permit international cooperation during times of need.

Frequently post-disaster analysis shows that the lack of communications links able to provide hazard warnings have resulted in catastrophic loss where such loss might have been avoided with adequate warning. Further, inadequate or nonexistent communications links following a disaster can delay relief efforts and cause confusion and overlap in response.

A network that could serve a number users with differing requirements would have at least four basic components: User workstations (of various sizes and peripheral apparatus), domestic communications links between the user workstations and the satellite earthstation, a satellite earthstation, and the international satellite space segment. This network should also be operational and in use (and tested) frequently to ensure its function when needed.

Workstations

In this case the term workstation refers to the terminus (or origination point) of the information network. In the field, workstations are envisioned (depending on need and funding) as macro- or micro-computer-based decision support systems able to transmit required information as data, voice, fax, and still-frame video. Their primary functions would be to:

- Permit the storage and manipulation of basic information which is routinely collected and maintained concerning availability and location of resources, including fire, police and medical; evacuation routes and transportation routes for emergency vehicles; shelter; supplies such as food, water, medical supplies, cots, and blankets; and medical data, prepared according to agreed upon formats and protocols; and to

- Receive and transmit dynamic, real-time and near-real-time information regarding prediction and detection of a threat and, while the crisis is in progress information regarding emergency medical requirements, treatment and evacuation, requirements for medicines and relief support, detection and warning of secondary (i.e., aftershock) disaster threats, etc.

Domestic telecommunications links between workstations and satellite earthstations

One of the benefits of a shared network is the reduction of cost. This cost savings is realized, in large part, by the sharing the financial burden of purchase, installation, and maintenance of major resources such as satellite earthstations capable of transmitting and receiving information via international satellites.

Of necessity, then, the earthstations in this network would be located at either one user's site, for example the meteorological service of a country, or with other telecommunications facilities that are a part of a country's communications infrastructure. This necessitates the selection of earthstation sites and managers willing and capable of working with other users of different institutions, agencies and disciplines. It also requires the establishment of a link between the earth station and all workstations that are to be a part of the network.

The links that connect these workstations must be resilient to the types of disasters that frequent the area in which they are expected to operate. Ideally they should be redundant and mobile or transportable. And they must also be, by necessity, affordable.

Domestic options, that must be considered on a case-by-case basis, include: HF, UHF and VHF radio, cellular radio, microwave and satellite.

Although each workstation or cluster of workstations will be able to operate using its own software programs, the technical protocols for transmission of information between the satellite earthstations and user workstations must be compatible.

Satellite Earthstations

A form of VSAT (Very Small Aperture Terminal) network capable of carrying, predominately, data and voice (and facsimile) traffic is envisioned for the proposed network. VSAT technology permits use of small earthstations which, in a network consisting of several stations, can result in a system that is lower in cost and easier to maintain than its terrestrial equivalent. Further, and importantly, a VSAT network would be more reliable and resilient to conditions common during severe disasters. For example, if one site is damaged in a terrestrial network, it is typically the case that all

sites in the chain from that point on are out of business too. Whereas in a VSAT network, if one site goes down other sites are not necessarily affected because of that casualty. Another advantage of a VSAT network is the ease with which additional sites can be added at any time.

The flexibility of a VSAT network also permits a "mesh" network configuration where any site within the network can originate and receive transmissions at any time.

With the requirement of multiple and changing origination points within the network, and because of the small size of VSATs, there is a requirement for a "hub" or master earth station in a VSAT network. Transmissions from any user within the network are sent to the satellite and received by the master earth station located anywhere within the foot print of the satellite. The master earthstation then retransmits the information, at greater power, to the satellite for distribution to the other VSAT terminals. This is referred to as a "double hop" and, though the process may sound complex, it is transparent to the user and any transmission delay caused by this double hop is negligible.

Satellite space segment

Because of the size of the region and its geographical diversity, a satellite-based network is envisioned and briefly described earlier. Although the amount of time leased on the satellite will be determined by the amount of traffic between the various users, assuming the selection of one satellite that covers the entire region there is no limitation imposed by the satellite on the number of users. Further assuming that adequate space segment has been leased, any number of ground stations can access system information without additional charge for satellite time. It is also the case that, with sufficient bandwidth and appropriate technical architecture the system can be used by a number of users simultaneously, each without interfering with the other.

As identified in NOAA's proposal for upgrading the ANMET and CEMET networks to a two-way satellite system, the Intelsat and PanAmSat satellite systems are candidates for providing the international space segment. Each organization has developed a working relationship within the telecommunications establishments of the region which may facilitate the technical and regulatory considerations of an international network. These relationships are important and must be explored as part of the scope of activity if there is to be a follow-on phase to this project.

There are also national satellites (principally US and Mexico) that could be considered. Though there are international conventions regulating use of domestic satellites for international traffic if each country in the network agrees a domestic satellite can be employed. This, too, must be investigated in greater detail.

Yet another possibility, the receptiveness of which is difficult to assess, is to approach the collective military establishment of the region, including the United States, to consider what might be termed a "peace dividend" approach. Some of the world's non-civilian disaster management entities have recently given attention to a balancing of the complementary responsibilities of national security and emergency preparedness. It would not be difficult to argue that catastrophic disasters can impact the national security of countries directly affected or of countries dependent upon them. It may be that a request for support from this sector could lead to provision of free or low cost satellite service and associated support.

NETWORK USERS

The number of potential users in the system is virtually limitless. These users could, depending upon their need and availability of funding, participate interactively or receive broadcasts only. User groups within regions, even within individual countries, could use the system for their own application as well as accessing and sharing information with others throughout the region. As stated in the executive summary, the users must define the network and determine its use and management. For the purpose of this study US and international agencies which represent various potential users were interviewed to determine possible applications of a shared system. Summaries of some of these possibilities follow:

National Oceanic and Atmospheric Agency (NOAA)

NOAA's National Hurricane Center in Miami is designated as the Regional/Specialized Meteorological Center (Bob Sheets of the National Hurricane Center is Chair of the Region IV Hurricane Committee). In this context it has the responsibility for providing advisory services on hurricane detection, monitoring, and forecasting to the national meteorological services of the Region IV of the World Meteorological Organization. This region includes North America, the Caribbean, Mexico, Central America and northern South America.

In fulfillment of this responsibility NOAA has a requirement to provide information from the National Weather Service to Caribbean countries participating in the Antilles Meteorological Network (ANMET) and countries in Central America participating in the Central American Meteorological Network (CEMET). NWS in Washington, D.C. is connected to the participating ANMET station in San Juan, Puerto Rico via a multiplexed voice grade satellite circuit. From San Juan the circuit is carried via various terrestrial modes to other participating ANMET sites in the Eastern Caribbean. The current CEMET network circuit is similarly distributed throughout Central America with its satellite connection to Washington, D.C. at the participating CEMET site in Panama.

In March 1991 NWS introduced a proposal for upgrading the ANMET and CEMET networks to a two-way satellite (VSAT) system. NWS's estimate for the cost of the upgrade, at a minimum, is a $945,000 capital (one-time) expenditure (27 sites/$35,000 each) and $535,000 per-year in recurrent system use charges.

In their proposal NWS expects that all nations participating in the new satellite-based ANMET/CEMET system will be responsible for all of their satellite system equipment. It is also expected that each member nation will be responsible for the cost associated with the local site preparation. The NWS is prepared to provide the same level of funding support to the new satellite system that it currently provides in support of the existing ANMET/CEMET networks.

The NWS is currently not in a position to underwrite the cost of the space segment required for the new system. NWS, therefore, expects that all participating member nations will contribute to the overall cost of operating the system and that the collection of annual funds from each member nation will have to be arranged. NWS also has indicted their hope that some donor organization can be found to provide funding for the transition period from the old to the new system of operation.

Tsunami Hazard Mitigation for the Caribbean is also a concern of NOAA (E.N. Bernard). In the past 300 years, at least 10 tsunamigenic earthquakes have occurred in the Puerto Rico-Virgin Islands region, and wave height have been reported from 2.5 to 6 meters. The estimated damage in Puerto Rico due to a 1918 earthquake and accompanying tsunami was a loss of 116 lives and property damage in excess of $4 million (1918).

In addition to tsunamis generated within the region, the islands are also susceptible to tsunamis generated by distant earthquakes. The great Lisbon, Portugal earthquake of 1755 produced a large tsunami that was observed along the Lesser Antilles Islands. Reports of this wave claim heights of 3.5 meters at Antigua and Barbados and 6 meters at Saba.

A recent study of tsunami travel times in the Caribbean (Weissert, 1990) suggests that a tsunami warning system would be effective for the Caribbean because the travel times from a source through the region is about 3 hours.

United States Geological Survey (USGS)

The USGS is involved in at least two programs in the region that might benefit from the availability of a telecommunications network:

The Volcano Early Warning Disaster Assistance Program (VDAP)

Following the disastrous 1985 eruption of Colombia's Nevado del Ruiz volcano, the USGS and AID established a joint program to provide volcano early-warning assistance to Guatemala and Costa Rica (as well as Colombia, Ecuador, Peru, Bolivia, and Chile in South America). The objectives of this program include:

- Maintain a small core team of scientists and technicians with experience in methods of volcano monitoring and hazard evaluation for the purpose of rapid response to volcanic activity.

- Develop and maintain a portable, state-of-the-art inventory of volcano monitoring equipment to deploy during volcano emergencies

- Provide assistance in the interpretation of volcano behavior and in establishing baseline monitors on volcanos

- Create and maintain database file, bibliographic material, and map-photo libraries to track and provide background on currently-active and potentially-active volcanos

-- Develop teaching materials and conduct courses in basic skills or volcano monitoring and hazard evaluation.

The Global Seismographic Network.

The USGS operates two global seismographic networks to provide rapid and accurate information on earthquake occurrence worldwide. The networks are catalog thousands of earthquakes that occur worldwide each year and provide the data needed for earthquake hazards reduction and detailed studies of earthquake mechanisms, deep Earth structure, and tectonic processes.

The Global Digital Seismographic Network (GDSN) is a new satellite-linked seismographic network. It provides very high quality digital seismographic data for seismological research. At this time the Latin American operation of the GDSN are in Colombia, Brazil and Bolivia.

The World-Wide Standardized Seismographic Network (WWSSN) is an analog system and operates in Mexico, Panama, Trinidad (as well as Colombia, Venezuela, Ecuador, Brazil, Peru, Bolivia, Chile and Argentina in South America). the WWSSN was established in the early 1960s. Key elements off the WWSSN are standardized 3-component, long- and short-period, analog seismographs, and the means for distributing seismographs to the earthquake research community. The WWSSN today is comprised of about 100 stations operating in more than 50 countries.

Organization of American States (OAS)

The OAS has a number of programs planned and operating in the region. One of these that can benefit from (and complement) the proposed multi-hazard regional telecommunications network is a technical cooperation program of the Natural Hazards Project. Under the auspices of this project Emergency Information Systems have been implemented in Jamaica, Antigua, Trinidad, St Lucia, Costa Rica and Honduras. Funding is expected from the United Nations Development Programme in the coming year to expand this program.

As an example of the project's scope, the Jamaica EIS network encompasses all key disaster preparedness institutions including: the Ministry of Construction (Housing); Ministry of Construction (Works); Ministry of Education; Ministry of Health; Ministry of Social Security; Ministry of Finance; Jamaica Commodity and Trading Corporation; Urban Development Corporation; Ministry of Development, Planning and Production; Jamaica Public Service; and the National Water Commission.

The Ministry of Development, Planning and Production is the coordination center for information management. The Office of Disaster Preparedness is the coordination center for disaster preparedness information. Each of these institutions can transfer data between each other in three ways: First, via telephone; second, via packet radio; and third via courier.

There are three important implications for EIS in the regional and international disaster preparedness environment.

First, all of the components, from geography to refinement of the disaster preparedness process, are integrated into the design of EIS. With EIS as the information management tool a disaster manager has the opportunity to display, geographically, the relationship between the hazards and capital inventory. The disaster plan ad resource inventory is easily maintained and distributed. Institutions can instantly update others involved in disaster preparedness. In training and education EIS provides full access to the national disaster plan and inventory. When disaster strikes, all information is instantly available. Refinements of the process can be made with minimum effort.

Second, it allows a country to be a part of a regional planning system. Being a part of a regional planning system has value in helping a country identify what resources may be available nearby and also what types of plans and procedures are being put in place in other countries. In the Caribbean and Central American program countries have the capability to exchange any of the information the have entered. Therefore, if Costa Rica has developed a good health sector emergency plan, they can share it with other countries. In turn, the plan can be used as a model or modified for local conditions. Another important consideration is that once a disaster strikes, a regional planning system can help identify personnel with similar languages and experiences in disaster preparedness.

Third, it provides the international donor community an opportunity to be able to see, and therefore assess, what resources are needed, where they are stockpiled, when they can be delivered, and then track the allocation of those resources to the area of need. The communications program of the EIS permits transmission of data from one EIS user to another over a wide range of carriers including satellite.

Office of the United Nations Disaster Relief Coordinator (UNDRO)

UNDRO is the only specialized organizational entity within the United Nations that deals exclusively with disasters and it is the focal point for disaster management in the UN system. UNDRO's task in relation to natural disasters encompasses the complete disaster cycle, from the early warning phase preceding the actual impact or occurrence through the emergency management and response phase to identification of sectors for reconstruction and rehabilitation and, finally, covering the issue of mitigation -- i.e., applied disaster reduction as part of the development process.

In recent years UNDRO has exhibited an increased interest in, and awareness of, the role telecommunications technologies play in disaster management. This understanding has lead to the identification of disaster communications as a significant area of focus in the future. UNDRO also has indicted that it views the Caribbean and Latin America as a region where the benefits of these technologies, applied in preparedness and mitigation phases of disaster planning, can make a significant positive impact in the savings of live and property.

The availability of a multi-hazard network would be of particular value to a new initiative that is being planned by UNDRO in cooperation with the Caribbean Community (CARICOM).

UNDRO believes that in order to ensure that effective disaster mitigation methods are applied systematically at the national level they must capitalize on the trained personnel, communications equipment, contacts and networking developed by the PCDPPP. For this reason, the Caribbean Disaster Mitigation Programme (CDMP) was developed. The CDMP is considered an institution building program with the overall objective to reduce the impact of natural disasters in the Caribbean region. Over a period of 5 years the program is projected to cover the cycle of disaster mitigation activities by a series of parallel workshops. The subjects of these workshops include hazard assessment (hurricanes, volcanoes, etc.), risk mapping and the application of preventive measures. It

also includes a community preparedness component for people living in high risk areas, in conjunction with a public information program on disaster mitigation and preparedness planning. Total estimated cost of the program is US $4,738,516.

At the end of the initial 5 year phase of the CDMP participating countries would be expected to have:

(a) Applied a systematic procedure for hazard and risk assessment as well as disaster mitigation methods;

(b) Carried out community involvement and training activities; and

(c) Established documentation and carried out demonstrations of disaster mitigation activities at the national level for each of the main disaster types.

UNDRO would also be interested in the proposed network as a means to enhance the services of UNINET, the United Nations International Emergency Network. UNINET is a disaster-specific electronic information network providing the international community with access to disaster-related information. UNINET is accessed by telecommunications and connection can be made either from a computer terminal liked to the International Computing Center in Geneva, Switzerland or from any micro-computer equipped with a modem and communications software. Access to UNINET can be provided to any organization or individual involved with disaster management with computer access and telecommunications costs incurred at the user's expense. Services of the system include:

-- Electronic mail for communicating among disaster management organizations

-- Bulletin boards of current disaster emergency situations, international disaster management conferences and meetings, training materials, etc.

-- Databases containing UNDRO situation reports and press releases, descriptions of NGO's dealing with disasters, bibliographies, etc.

-- International disaster emergency contacts

-- Direct access to other United Nations Networks

World Meteorological Organization (WMO)

From notes on the proposed upgrading of the telecommunications and data handling systems for hurricane warnings in the Caribbean and Central America:

The responsibility for provision of hurricane warning services for each country in the region and its territorial waters rests with the national Meteorological Service of that country. The necessary activities are carried out within the framework of WMO's World Weather Watch (WWW) Programme.

Substantial progress has been made in the past decade or two in improving the hurricane warning services for each county through regional cooperation and coordination under the program of the Region IV Hurricane Committee (Bob Sheets/NOAA Chair). The Committee is a regional body of the WMO's Tropical Cyclone Programme and a working group of Regional Association IV for North and Central America whose president is C.E. Berridge.

The Hurricane Committee has annually reviewed the previous hurricane season and upgraded or updated the operational plan. However, while the organizational arrangements have attained a high level and substantial progress has been made in areas such as training of staff of the national services, the rate of progress in implementing or upgrading of facilities has been slow, mainly due to lack of resources. The Committee identified meteorological telecommunications in the southern part of the Region as the weakest link in the chain. It unanimously decided that upgrading of the system using satellite communications and the associated introduction of micro-computer-based data handling in operational services should be the top priority item and a matter of urgency.

There are several factors which make the existing telecommunications system vulnerable. An example is that a disruption at one location will normally result in outages at all other locations downstream. Other examples are the susceptibility of the quality of performance to weather conditions, often deteriorating in bad weather conditions when it is most needed, and complete disruption that may be caused by a hurricane as happened in 1989 while another hurricane threatened the area. Proven modern technology, which

post-dates the installation of the present system, is available. It would circumvent nearly all existing shortcomings. Additionally, it would permit further progress with the introduction, for the first time, of micro-computer (PC) based data handling, continuously updated data base, data recall, processing and graphic display capabilities at each national center to support the fullest use of the available products and forecast and warning services. The modernization of the operational meteorological services would greatly improve not only the seasonal hurricane warning service but also the whole range of meteorological activities. Their services include regularly issued weather forecasts, provision of severe weather and flash flood warnings, inputs to river flood forecasting, services to aviation, marine interests, agriculture, and tourism. At the same time the flow of observational data from all parts of the region to the regional center and to other parts of the world would improve.

To meet these goals the Hurricane Committee has proposed that the existing point-to-point terrestrial communication links be replaced with a satellite-based point-to-multipoint system and associated micro-computer-based data handling facilities at national centers (refer to the section on NOAA for a brief description of the proposal which can be found in its entirety in the appendix to this report).

COORDINATION OF INTERNATIONAL EFFORT

The planning and implementation of a regional multi-hazard network could be coordinated in one of a number of ways, and an early step in the next phase of the project would be to involve the national, regional and international users in a process that would lead to the identification of a network manager or coordinator. NOAA believes that the national meteorological institutions, through the WMO, should act as network hubs because there is a meteorological center in most countries in the region the meteorological applications of the network would require 24 hour-per-day access 365 days per year. It is their further belief that there is enough political clout within the national meteorological services that they are the logical interface with the various national governments involved. In the NOAA scenario the main earth station sites should be co-located at the various national meteorological centers in participating countries. From there the domestic connections to other user-workstations could be made by the most appropriate of a number of transmission modes, including packet radio, HF or UHF radio, cellular radio, domestic VSAT networks and terrestrial land lines as described above.

Though they may be among the principle users, even potentially the most active, the decision of who should manage a system that is designed to serve a number of users must be made with the full participation and consultation of those users.

The coordination of this consultation is a role that UNDRO has agreed in principal to undertake in cooperation with OFDA, NOAA, USGS, OAS and other users and interested parties of the region. UNDRO has also agreed in principal to coordinate the participation of the interested UN Agencies including UNDP and WMO and the International Telecommunication Union (ITU).

SOME ADDITIONAL ISSUES AND NEXT STEPS

As stated earlier, any further planning for a regional multi-hazard network must include regional users. The decision to pursue a next phase of planning must me made with the understanding that the next level of planning will require detailed assessments exactly who the users will be, where they are located, what are their specific needs, and what technology, or technology mix (software and hardware) is required to meet these needs. This will require international travel and regional meetings.

There is also a requirement to assess the ability of potential users to pay for system or otherwise contribute to its operation and maintenance of a network and to obtain commitments from the international donor community for support that cannot be generated by the users themselves.

Additional issues which must be explored, other than those addressed in the body of the report include the following:

-- Although there might be a number of regular users of the system it is not expected that any one of them would "manage" the network for all users. It would seem more reasonable that a "commission" be formed of all major users. It may be that there are two commissions, one for each region. The important thing would be to have a balance of representation among user types and nations.

-- There will be a need to coordinate the network design and operation with telecommunications entities in the region.

International telecommunications entities of a country, frequently referred to at PTTs (Post Telegraph and Telecommunications) typically control the telecommunications in and out of a country, acting as gatekeepers for their respective governments. Sometime these institutions are privately operated, but most frequently they are government agencies. If privatized, there is typically a private and public sector partnership, but this partnership rarely goes beyond 49% private sector ownership. These PTTs are also frequently one of the major generators of hard currency for a country. It is not infrequent that because of these two interests PTTs are reluctant to permit independent operation of telecommunications traffic into or out of a country.

Another telecommunications administration that will be involved in the process is the national telecommunications agency of each country. This is frequently not the same entity as the international administration. These agencies would be responsible for communications within a country and for setting up and maintaining the local (domestic) connections between the end users and the PTT hubs or distribution points.

During this consultation an issues that should be considered is the value in having the system applications identified as being specifically for disaster management. It may be that a lower tariff can be negotiated for this purpose than might not be applied to more administrative applications of the network for which a "second tier" tariff might be negotiated.

In order not to duplicate costly equipment and facilities technical assessments must be made regarding the suitability of VSAT sites and selection of appropriate domestic communication links. This assessment will be require before any accurate system cost can be derived.

As described in the report, there will likely be fewer VSAT earthstations than system users. Each user would not have a earthstation, but would be connected to a shared earth station by whichever was the most appropriate and most reliable mode available. This determination would be made dependent upon geographical location, mode of communications required (data, voice, etc.), disaster type common the location, and available financing. Communications links might include police band radio, landline, cellular, UHF radio, packet radio, etc.

There would need to be assessments by telecommunications engineers who understand the requirements of communications systems that are expected to operate during and after severe disasters. The system of links to the hub communications would, of course, be required to be resilient to disasters and, therefore could not likely rely on the regular national terrestrial telecommunications infrastructure.

NOAA's ANMET and CEMET systems upgrade proposal appears to be based on a dedicated network, where the VSAT earthstations are located at the met centers premisses. This is a reasonable way to that is to design a system that is expected to survive severe hazard conditions. NOAA (and WMO) have indicated that they believe that there is a likelihood that each national meteorological center can convince the national governments that it is reasonable for this dedicated network to, essentially, bypass the PTTs authority (and tariff). Regardless of who coordinates the network (outside of the PTT itself) it will be necessary to obtain this authority in order to establish a dedicated network. PTTs are very protective of their turf and it is difficult, sometimes impossible, to bypass the PTT authority and set up an independent network.

There are, of course advantages and disadvantages in a dedicated network. Operating through the PTT could eliminate many of the difficulties associated with trying network development and upkeep such, facilities installation, regular system maintenance, training of technicians, and not having to deal with multiple points of contact.

Disadvantages include probable added costs, the need to rely on yet another communications system -- HF or packet radio, microwave, satellite -- to connect the main disaster management center facilities (the network VSAT) to the uplink located at the PTT. This connecting systems will be susceptible to the natural phenomenon that typically render terrestrial systems inoperable.

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