Needed: The Right Information at the Right Time

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Ninety-nine years ago, a young engineer inspecting the Connenmaugh River Dam upriver from Johnstown, Pennsylvania, realized that the dam was about to collapse. He jumped onto his horse and raced to the nearest railroad station to telegraph a warning to communities in the valley below. His message never got through. The Johnstown Flood of 1899 is part of the lore of American disasters. Even though the engineer was using state-of-the-art communications, he could not deliver the right message at the right time. More than 2,200 people drowned.

In 1977, Johnstown suffered another flood, its third, and again there was a failure to deliver the right messages at the right time, although communications technology was, obviously, much further advanced. Again, the message didn't get through in a timely way, but this time it was because of human failure, not technology's—a combination of an overly cautious river forecaster who did not sound an alarm, and such corollary failures as a Red Cross answering service in Pittsburgh that told the Johnstown Red Cross chapter to call back in the morning. Fortunately, the residential areas of the city—or most of them—had long since been relocated on higher ground and flood control works, built after earlier flooding, added to the safety margin. The death toll was 58.

Some years ago, on the occasion of his 20th anniversary with the Red Cross Disaster Services, the late Robert Edson was asked by an interviewer what he thought were the three most important advances in disaster preparedness and response during his tenure. One of the three, he said, was great advances in communications technology. (If he had been alive at the time of the 1977 Johnstown flood, he'd have seen the Red Cross using an experimental satellite uplink to reestablish communications when the city's telephone company building blew up.)

Yet despite technological progress, the basic need of 1899 still remains—getting the right information at the right time. The tools now available to gather and deliver that information range from small, hand-held shortwave radio units to complex satellite systems, but, unfortunately, they are not always in the right place when disaster threatens or strikes and, even if they are, they don't necessarily deliver the right information.

Communications breakdowns are a continuing problem to those who rely on receiving the right information—the potential or actual disaster victim, the relief agencies, and government decision-makers who must quickly mount a response and recovery effort. What they need, essentially, is "people information"—warnings ahead of the disaster and then, in its aftermath, data on casualties, damage, the supplies and skills that are needed, the best ways to bring in these resources, the help that is available and is being provided, and so on. And, of course, there is the pressure on communications systems to provide information for anxious families concerned about loved ones believed to be in the disaster area. This pressure may come from a nearby village or from relatives half a world away.

Radio is the communications mode of choice for emergency managers, although at some point in the total communications system what comes in via radio is moved further along the chain of command by telephone, facsimile, teleprinter, or other sophisticated systems. Radio has the advantages of portability, availability, and versatility. Battery-powered radios are not susceptible to downed wires, loss of power, damage to switching stations, or inundation of switchboards. An Illinois Bell System fire knocked out phone service to tens of thousands of Chicago-area customers for weeks, and a similar problem occurred in New York City several years before. The U.S. Army Corps of Engineers in 1959 projected that a high-tide hurricane affecting New York harbor would curtail telephone service in much of Manhattan for well over a month. These are all indicators of telephone vulnerability.

A look at the communications plans for a catastrophic earthquake in California provides an insight into communications organization for a major disaster. The state's plan anticipates "that terrestrial-based telephone service will be disrupted for a period of time within the affected areas," adding, "because of this factor, radio communications will provide most—if not all—communications . . . during the first 24 to 36 hours of the emergency operations period." Primary communications support will come from the Telecommunications Division of the California Department of General Services, aided by the Highway Patrol, National Guard, State Police, Fish and Game Division and other state agencies, augmented by the California Wing of the Civil Air Patrol, and the California Conservation Corps. In addition, support will come from such specialized systems as the California Emergency Services Radio System, the State Emergency Communications Using Radio Effectively (SECURE), a high-frequency system used primarily for long range communications; the California Law Enforcement System and its Mutual Aid Radio System; the Office of Emergency Services Fire Radio System, the State Radio Amateur Civil Emergency Service (RACES); and the Applied Technology Satellite (ATS), which can be made available through NASA-Ames Laboratory.

In addition to the foregoing state radio resources and any existing telephone service, the American Red Cross radio system and federally controlled radios will be made available through the National Communications System.

How well the communications system will work depends upon how it interlinks. During the Mount St. Helens operation (and in many foreign disasters), a major problem was the inability of different systems to communicate with one another. The Washington State Police, for example, could not talk to the National Guard. In foreign disasters, military radio often cannot communicate with civilian shortwave communicators.

The Protocols contained in the Geneva Conventions that pertain to radio communications in times of armed conflict could perhaps solve this problem. Protocol I permits special agreements about using similar electronic systems to identify medical vehicles, ships and aircraft. While this protocol applies to conflict situations, a similar agreement applying to disaster relief operations could be drafted.

The Protocol's chapter on communications provides, for instance, that medical units use codes and signals laid down by the International Telecommunication Union, the International Civil Aviation Organization, and the Inter-Governmental Maritime Consultative Organization (IGMCO). The provisions also require that the codes and signals be used in accordance with those organizations' standards, practices, and procedures. Further, the Protocol says that when two-way radio communications are not possible, the signals provided for in the International Code of Signals be used. These signals were adopted by the IGMCO and in the December 7,1944 Annex to the Chicago Convention on International Civil Aviation.

The purpose of this paper, however, is not to focus on the technical problems but on communications content: After a catastrophic California earthquake, what will the emergency response crews be communicating about?

First, they will be trying to determine what has happened. How many people are injured or dead? How many need medical help or transportation to medical facilities? Where will temporary medical facilities be established? What kinds of medical personnel and equipment are needed? Where are people trapped in damaged buildings? Where are search and rescue teams needed? What's happened to the uninjured? Where are they? How many? Where should shelters be opened, and how can people get to them? What's on fire? Where are gas leaks, downed power lines, broken sewer and water lines? (It is estimated there could be as many as 1,750,000 lifeline breaks in a major Los Angeles-area earthquake). Are there blocked roads, damaged highway bridges? What has happened, physically, to the hospitals, food supply sources, and blood banks?

This information will have to be processed and resources deployed. Arrangements must be made for locally available resources to be supplemented in an organized way by the federal government, by the national Red Cross, other voluntary agencies, and by available help from nearby communities and adjacent states. The information relayed through such networks should be available quickly, so that the response can be truly organized. Confusion often results when the first publicly available information is fragmentary and disseminated mainly by the news media and ham radio operators scattered around the landscape.

Within the disaster area, the Red Cross needs to establish communications between emergency vehicles and shelters, shelters and headquarters, supply depots and the community's medical response teams. The Red Cross also must deal with literally millions of welfare inquiries from outside the disaster area. The Red Cross should establish a predesignated communications center outside the earthquake area, with 800-number lines, to handle casualty and relocation information.

Information can be funneled to the center and computerized so that the inquiries can be diverted away from the disaster area's already overloaded communications capacity. Unless this is done, phone circuits that are jammed but otherwise still functioning will be worthless. The emergency communications pattern must include a system for reaching the victims to give them information and instructions as to what to do.

In foreign disasters, the need for such information exchange can be even more acute. In developing nations or remote areas such as the Andes or the Pakistani delta, the communications and emergency response infrastructure may not suit our needs. Problems result when relief agencies from a score of nations add their shortwave radios and different languages to the airwaves. They may also interpret what they hear in ways that differ from common cultural understandings. For example, there have been situations in which medical teams sent in by individual nations or their Red Cross societies could not communicate in the language of the host country. This language barrier made it difficult to monitor what was going on or to initiate actions by local officials who had to do what was being requested. This same problem applies to labels on medicines and other supplies and to written instructions for their use. Additionally, a local radioman who is trying to communicate with a foreign relief agency may not understand what the agency's people are saying or asking.

The Federation of Red Cross and Red Crescent Societies and the International Committee of the Red Cross use their own system or the system of the national Red Cross society in the affected country. The Federation sends in its radios and, where allowed, telex machines. In some cases, the Federation has been able to use an independent satellite uplink unit, which includes its own generator, heating, air conditioning, telex, telefax, telephone and telegraph systems. The unit—which was donated to the Federation by the EP Corporation of Scandinavia—can operate 24 hours a day anywhere in the world. The unit worked well during a test in Rio de Janeiro in 1987.

Despite the advantages of this system, some governments may object to this satellite ground link equipment being brought in. On several occasions in recent years, the Federation has been prevented from installing its own telefaxes because outgoing messages could not be monitored by the host country. The Red Cross has initiated negotiations with some disaster-prone countries to establish prior agreements concerning permission to bring in the emergency satellite link.

Eventually, the Federation hopes that a pro forma agreement can be developed. According to George Reid, director of public affairs for the Federation, such an agreement would have to:

◆ *list the equipment and its parts by serial number;*

◆ *describe how the equipment works in both technical and laymen's language;*

◆ *guarantee that the equipment will be used exclusively for humanitarian purposes in the event of disaster;*

◆ *ensure that it will be open to surveillance by the local (national) authorities;*

◆ *guarantee that it will be shipped out of the country when the relief effort is over, and*

◆ *state that no import or export duties will be charged.*

The satellite ground link unit, which was brought in by the American Red Cross after the Mexico City earthquake, could be flown to the scene of another large-scale disaster and set up as a 24-hour-a-day link. Whether it could be used effectively for communications from operational sites more remote than a headquarters in a nation's capital remains to be seen. In fact, the unit's value in establishing vital two-way communications might well be limited if those in the field have no comparable uplink capacity.

While there may be problems getting permission to bring this particular piece of equipment into a country, the same problems apply to all kinds of communications equipment. Foreign relief agencies may also run into refusals or bureaucratic resistance to their bringing in specialized equipment or use of in-country systems, unless they were already present in the country for ongoing programs.

Finding out what happened in remote areas can be a time-consuming, frustrating effort, especially if there is no way to get to the disaster area and helicopter landings are made difficult by terrain or weather conditions. Fly-overs (including those by satellites with photographic or radar devices) can provide some information about what happened but not enough. Aerial photography requires not only interpretation but also comparison with predisaster conditions. The survivors may be hidden from view in forests or surviving buildings, or someplace else entirely, giving a mistaken impression that everyone has been killed or is missing.

The poisonous gas cloud at Lake Nios in the Cameroon in 1986 is a classic example of what happens when misinformation is spread worldwide by news coverage. Word of the incident came from a Dutch priest a few miles away from the scene who reported that the scene was "like a neutron bomb . . . all the buildings are still standing but all the people are dead." What had actually happened was that those who survived the gas cloud had moved a few miles down the road from Lake Nios, leaving no one to answer the telephone in the village. Also, the telex and phone were out at the Cameroon Red Cross, so Red Cross officials in Geneva had no way of finding out what had happened. During the two to three days it took to get accurate information from Lake Nios, all kinds of reports were broadcast, some putting the evacuation total at 20,000 people. Experts and medical supplies poured into the country from around the world. What was actually needed, it turned out, was some salve for those who had suffered minor burns from the gas and cash for evacuees camping out or with relatives to use in purchasing food at local markets. If there had been adequate communications systems in place and working, a lot of unneeded response efforts and international concern could have been avoided.

The content of emergency communications falls into the following four categories:

Warnings

Warning information is aimed at protecting life and property. It is most effective when linked to information about what to do—evacuation instructions, boarding up, taping glass windows, cutting off utilities, and so forth. In the United States, such warning systems include step-by-step hurricane forecasts, tornado and flood warnings, and instructions for related evacuations. Hurricane watches from the National Weather Service are widely disseminated by the news media. They may be broadcast as long as two or three days before actual impact. Hurricane warnings that attempt to pinpoint actual landfall 24 hours beforehand activate civil defense and public safety preparations for an actual evacuation and the establishment of Red Cross mass care facilities. The Weather Service also issues probabilities—the likelihood of a specific area being impacted—as a guide for emergency response preparations.

Tornado watches and warnings are generally related to specific protective actions, such as advising people to go to the basement. Often, a local tornado warning is nothing more than a community siren, sounding a take-cover message. Flash flood warnings simply urge people to be alert and move to high ground as fast as they can. Other flood warnings may provide time for orderly evacuation of people and removal or flood-proofing of household or business equipment and furnishings. Blizzard and thunderstorm warnings are also accompanied by protective information. Because earthquakes are currently unpredictable, no warning system is possible.

Where there are no warnings or the warnings are not linked to pre-provided precautionary planning and education, the results are often tragic. In 1970, a tropical cyclone hit Pakistan's low-lying coastal areas on the Bay of Bengal without warning, drowning 200,000 people. Not only was there no warning, but there was no safe place for them to go if they had heard storm forecasts. Since then, shelter areas have been designated and a rudimentary warning system has been installed and linked to weather forecasts. This was done under a cooperative project involving the World Meteorological Organization, the International Federation of Red Cross and Red Crescent Societies, and the United States and Pakistani governments.

Other technological systems, now in use, could be adapted for various parts of the world. In some U.S. watersheds, a combination of radar and telemetry activates siren warnings and other systems in affected communities when rainfall and river heights reach certain levels. Such a warning system might have saved lives in the Big Thompson Canyon in Colorado when radio and TV stations carrying programs from Denver did not telecast weather information. In fact, cable TV is a problem. In some areas, local emergency agencies cannot override the cable signal in an emergency. Systems similar to the flash-flood warning system are now used to protect areas near volcanoes, including the Nevado del Ruiz volcano in Colombia.

Remote sensing has an important role to play in warnings. It can be used effectively to establish evacuation routes and to set up emergency plans based on an ongoing knowledge of what is happening—if the information is available immediately to the public officials and if they know what to do with the information. Information from remote sensing devices may include weather patterns, movement of lava and other natural phenomena, as well as downed bridges, obstructed roads, and so on. Real-time availability of understandable remote-sensing information is not always possible, and many countries may object to information gathered by another country's satellite as it passes overhead. It may be diplomatically undesirable to even offer to provide such data.

Other information sources can also help provide warnings. A broadcast meteorologist in Mississippi predicted a tornado's path using a utility company's reports of power lines downed as the storm moved through the grid of transmission lines. Movement of animals is often a precursor to disaster. In the Sudan, for example, one long-accepted sign of impending drought is the crowding of marketplaces with livestock for sale. There is an earthquake-related animal behavior monitoring network in California, and the Chinese have long watched for signs of unusual animal behavior in advance of earthquakes.

But what of chemical and nuclear emergencies? In light of Three Mile Island, Chernobyl, and Bhopal, there has been a renewed interest in warning systems related to accidents involving chemical spills or nuclear power plants.

Could warning technology have saved lives in the Indian town of Bhopal, where a middle-of-the-night chemical leak killed more than 2,000 people? If a siren had sounded automatically when the accident occurred, perhaps some lives would have been saved. But the people would have had to know in advance what they should do if any particular chemical exploded into the air around them. That's a big "if." In the United States, Title III of the Superfund Amendments and Reauthorization Act of 1986 addresses this problem in its Community-Right-to-Know provisions. These provisions mandate that chemical manufacturers or companies using chemicals inform local fire chiefs, emergency planning authorities, and community organizations about the chemicals they have on hand and how to deal with exposure to dangerous chemicals. Much of this information is already being built into emergency management computer systems for use by civil defense and public safety agencies.

Successful warning systems can and have been established. In 1962, a chlorine barge that contained as much potential poison gas as was used in all of World War I was salvaged from the Mississippi River below Natchez. Components of the warning system developed for that incident involved sirens (all other use of sirens was barred during the month-long salvage operation), small planes and helicopters with public address systems, and National Guardsmen with radios and whistles stationed on every Natchez street corner around the clock. Again, the warning system was tied into widely known evacuation plans.

It remains to be seen how the mass of information about hundreds of different chemicals will translate into public knowledge of what to do if a siren goes off behind a chemical company's chain link fence. Certainly some kind of communications technology will be required.

The state of New Jersey is conducting one unusual effort using existing technology to monitor hazardous materials transportation. Special monitoring and communications equipment will be placed on all trucks and tankers carrying hazardous chemicals into or within the state. The monitors will inform public safety officials of what is being transported and where it is going—over what roads and so on. In the event of an accident, the place of the occurrence will be instantly communicated to emergency agencies.

Chernobyl focused attention on a persistently troublesome problem—how to warn people about a nuclear power plant accident and what to tell them to do. In the United States, plant operators are supposed to notify public officials if an accident reaches a certain danger level; the public agencies issue the warning. After Three Mile Island, the first information to reach the residents of the area accurately reported the danger level, which was low. But then sensational reporting in national media and confusing information from government agencies caused more than 140,000 people to evacuate—without any official recommendation that they do so.

In congressional hearings about nuclear planning, a civil defense director from a rural North Carolina area testified that his warning plan was to send volunteers out, Paul Revere style, to sound the alarm if there was an accident at a plant in his jurisdiction. Is this a state-of-the-art warning system? What kind should there be? And what should its message be? The initial warning could simply mean "stay indoors until further notice," or "leave permanently!"

The Chernobyl disaster pointed out the need for an international warning network to collect the wide variety of radiation tracking information available in different parts of Europe. In the United States, the national Environmental Protection Agency monitoring network reported radiation levels in air, water, milk, and soil daily through its headquarters in Washington. For all chemical and nuclear emergencies, warnings need to be made immediately and linked to public knowledge of what to do.

What Is Happening? What Is Needed?

In order to implement an effective emergency response, public authorities need to know what has happened and what is happening if the disaster is a continuing situation. At the simplest level, a fire official or policeman at the scene of an incident reports on the nature of the event and how many people are hurt or homeless. That information is given immediately to those responsible for providing medical and social services. In more complex situations, the information is much harder to acquire. Surveys to determine the extent of destruction and casualties take time, and the area may be impossible to reach. In some countries, the rescuers may not speak the same language or dialect as the people they are trying to reach, and the immediate demands on their services may preclude taking the time to get the information together and pass it on. Some disaster areas may be isolated for extended periods of time, or disasters may remain undetected for days.

In such situations, radios, either airborne or air-dropped into the community, have been of inestimable help. The information they pass along is more reliable than second-hand reports and speculation, but it must be as specific as possible. Authorities and relief agencies need to know *exactly* what supplies are needed. It does no good to send in medical teams and equipment to treat large numbers of casualties if the casualties are all dead, if the injured have only minor injuries, or if the people unexpectedly require immunization or vermin-control teams. If the main effort is search and rescue, then heavy duty equipment and experts in such activities should be sent instead of field hospitals. Those in charge need to know whether local supplies of food are adequate or more has to be brought in. In the latter case, they have to determine if food can be acquired and brought in. Housing needs must also be quickly detailed.

Unfortunately, the news media cannot provide relief agencies with concrete information on casualties, injuries, or damage. Generally, media reports are sketchy and tend to concentrate on the sensational—deaths and destruction. They provide little timely, comprehensive information, needed by relief agencies, on the number of survivors or areas untouched by the disaster. How many times did television show the same buildings ruined by the Mexico City earthquake, without reporting that most of the city was relatively undisturbed?

Whether aerial and satellite photography can quickly help define the needs of relief operations still requires a good deal of study. Will the technology be acceptable to the nations or people involved? And if a community has been buried or washed away, can a photo interpreter unfamiliar with the area tell what was there before?

Operational Needs and Problems

The more specific the information transmitted, the more helpful it is. Details enable the authorities to respond precisely instead of sending scattershot aid. Details about particular pesticides in danger of release, for example, can be valuable in determining the proper response.

Of primary importance is information about access to the disaster area. Remote sensing can help here, as emergency officials seek to determine whether bridges and roads are passable. Are area bridges and roads passable by four-wheel-drive vehicles only, or can heavy-duty trucks and ambulances get through? Is there electric power, water, fuel? Are body bags or vermin-control chemicals required? Is there a need for baby formula or specialized foods to meet cultural predilections? It is not unusual for well-meaning but misguided groups to fly in foods that the local populations just will not eat.

Relief agencies also need to know about survivors—where they are, who they are, whether they are injured. This information helps in assessing housing needs and in informing anxious relatives.

Transmitted information, unfortunately, does not automatically become usable information. Technical information, names of medicines, names of survivors that are passed along by radio or over the telephone must be transcribed by someone at the receiving end. The job is not only tedious, but can, especially if language is a problem, lead to many inaccuracies. Each emergency communications system, whether permanently installed or trucked in, should have a radio-teletype or facsimile machine to allow lists to be transmitted in hard copy. This means, of course, that at least one member of the communications team should be able to type or that typists fluent in the native tongue should be located.

While facsimile machines are private (and some governments object to this), voice radio presents the opposite problem. Voice radio is not very private, especially on bands that can be monitored by ham-radio operators or owners of citizens-band transceivers. One humorous result of this open exposure to relief agency messages occurred in Idaho after the Teton Dam collapse. A Red Cross shelter nurse radioed to headquarters that her shelter needed a supply of diapers—a routine message, but one that was overheard by every truck driver in the general area. All day and into the night, trucks kept pulling up at the shelter to offload boxes of disposable and regular diapers. Concerned truckers had cleaned out every supermarket and drugstore for miles around! While the incident was relatively harmless, consider the possibility that a routine report of one or two casualties could lead to the unnecessary diversion of rescue squads and medical teams.

Informing Victims and Public Officials

Emergency information systems often overlook the need to communicate with the disaster victims themselves and their public officials, especially in remote areas and low-income neighborhoods. These areas normally have little access to more formal community information networks. In smaller communities, public officials often have little real knowledge of emergency response and relief programs beyond their own fire departments and rescue squads.

Victims may have to receive information in a number of languages, and in simple, direct words and graphics. While the news media provide much of this communication, not everyone reads the newspaper or listens to radio. Relief agencies may need to turn to sound trucks or small planes with public address systems, special leaflets or posters, and broadcast public service announcements in a number of languages. Where illiteracy is common, face-to-face contact through clergymen or missionaries, village elders, officials, storekeepers, and other central figures needs to be encouraged.

No matter which means of communication is used, high priority should be given to reassuring victims that they are not forgotten and that help is on its way, telling them where and how to get it, and advising them of precautions that would protect family and belongings.

More formal communications may be necessary to reach public officials, especially since they are responsible for the well-being of the victims in their communities. They need to know immediately what help is available, from whom, and how their constituents can take advantage of these recovery resources. Otherwise, the officials may say with great emotion, "My people need everything—they have no food, no clothes, no place to stay" and set off a reaction of well-meant donations and unofficial relief efforts. Public officials or one of the emergency agencies in their community need to be quickly tied into whatever emergency communications network is established for the disaster.

Communication with public officials also means informing foreign governments, embassies in the affected country and abroad, national government emergency organizations, and the headquarters of voluntary relief groups. These organizations must have the same understanding of the nature of the disaster, the needs of the victims, the resources available, and what additional resources are needed from outside. With this information, these agencies can begin to coordinate an orderly, appropriate response. Embassies can inform inquiring nationals or their governments about what is needed, accept appropriate donations, and forward inquiries about people who may have been affected or reassure callers that their families have not been affected.

In international disasters, other nations need to know quickly what the affected government will accept in the way of help, emergency communications systems and equipment, overflight policies, customs routines and the like. Because disaster can be highly politicized, early warning of political or bureaucratic encumbrances can avert a lot of heartache and wasted effort.

In the United States a system has been established through which a designated person in each of the 50 governors' offices is quickly informed of the assistance needed in foreign disasters. This system was intended to ward off campaigns for used clothing and other donations that were inappropriate, unneeded, and costly to transport overseas in a timely manner. The system itself is used now and then; there are those who want it more formally organized.

Pleas by local officials, picked up by the media, can often compound an already difficult information problem. Similarly, ham radio operators relaying information to official agencies or the news media may provide the first information from an overseas disaster area, but it may be completely out of context. The same kind of misinformation may come out of domestic disaster areas in the United States, with the media focusing day after day on the same few damaged houses, giving the impression an entire town has been destroyed.

Overzealous news reporting does not mean the media should be censored; rather, it means they need to be linked more closely to sources of accurate information, and to be encouraged to double-check their information rather than settle for stark but inaccurate bad news. Furthermore, if reporters have access to satellite time, telephone or teleprinter circuits, they must be made to understand that they cannot expect to use them to the exclusion of relief workers.

Another media-related problem that is generally overlooked in emergency response planning is the rubbernecking crowds that gather after disaster news is reported on the air. After reports of two incidents in New York City—an expected difficult landing at Kennedy Airport and an explosion on a Brooklyn pier—so many sightseers responded that emergency vehicles could not get through. At the airport, spectators overflowed onto the runways while they waited for the airliner to try its emergency landing. New York City police later tried to get the media to agree to a 30-minute delay in reporting, which would give the police time to secure emergency routes and take other necessary steps. No agreement was reached, and the problem remains.

A final major problem is information overload. Computerized technology can absorb masses of information and disgorge it on command, but can emergency managers deal with the information onslaught? Do they really need to? Does information technology need to be tailored to actual information needs instead of answering the technologists' desire for more and more capacity?

In 1977, a storm named Doria moved up the East Coast of the United States. The Weather Service's state meteorologist for New Jersey worked around the clock putting information about the storm's progress, rainfall amounts, and other information on to the teletype circuits going from the state capital to emergency operations centers throughout the state. Then he went to sleep, exhausted. The next day he decided to visit a number of emergency operations centers to see how his output had been used. In center after center, he found the floor littered with paper that had rolled off the machine, apparently unread. He realized that once the storm had hit, emergency managers could respond directly to the amount of water in their streets. They did not need more data from him. He had overloaded them. Similarly, broadcast weather information that repeatedly says "stay tuned for further information" at some point becomes irrelevant to listeners who should have already taken shelter or other protective steps.

The current overload classic is Title III's requirements for chemical reporting. The Act requires that communities invest in a wide variety of systems to absorb the information on thousands of Material Safety Data Sheets and other paperwork, and then make the information instantly available when fire crews respond to a chemical spill, or when victims of the spill reach a hospital.

Each new development in data technology makes even more disaster information available to emergency managers, but its real usefulness is rarely assessed. Quality, not quantity, should be the key.

Comprehensive, accurate, timely information gets help for the victims in a coordinated, effective manner. Without it, relief teams may waste time, effort, specialists, supplies and equipment, or send in the wrong kind of help. At times, the best information will be action-oriented—get out of the way, fast, before impending disaster. At other times, it may not only expedite needed help, but do so without provoking well-intentioned excesses or wasted effort.

One of the worst examples of unneeded help was the occasion when the U.S. government sent vast food supplies to Guatemala earthquake victims. Unfortunately, arrival of the American supplies coincided with Guatemala's own harvest, creating a secondary disaster by usurping the local farmers' markets. This was worse, in its way, than other slip-ups—medicines with labels in a language that could not be read by local doctors, and mountains of unneeded clothing that had to be trucked, at great cost, out of the Hurricane Camille landfall after that relief operation.

Good information helps. Bad information hurts. Both are disseminated through the same technologies.

While this paper has focused on information content, emergency relief agencies have worked to acquire useful information technology. The American Red Cross, for example, was the first to experiment with the use of small, portable satellite uplinks that could be carried or dropped into disaster areas where communication was a problem. In several exercises, information from hand-held and mobile radios was relayed by a truck-mounted satellite dish to national Red Cross headquarters. In another project, x-ray pictures of a patient were transmitted from the jungle to the hospital ship *Hope* and from the ship to a radiologist in New York City for diagnosis.

While satellite communication is not always needed, portable suitcase-sized units should be available in many major domestic or foreign disasters. Satellite capability might be most useful in situations like post-earthquake Mexico City, where live pictures of rescue operations could be viewed instantly by rescue experts in other countries. The experts could serve as "remote consultants," advising by voice transmission as the rescue mission goes on. Part of an ideal system would be some kind of teleprinter or facsimile transmission unit that can be linked to the satellite or other lines or radios; where language problems exist, some kind of limited desktop-publishing capability would help in printing information for victims in a variety of translations.

Developers of high-tech emergency communications systems must keep in mind the cost of equipment and the time required to get it in place. Especially those relief agencies that depend on public contributions must pay attention to cost-effectiveness. If, for example, it takes 24 hours—including truck or helicopter transportation—to get a satellite uplink into place and set up, is the uplink cost justified? This question is critical, especially if less sophisticated systems could handle the immediate emergency. For many Red Cross societies, existing links are adequate. Bringing in new systems would be redundant, especially where only a few messages are sent in a week. Of course, the bottom line is that any communications system must be up and running very quickly if all who need it are to get the right information at the right time.