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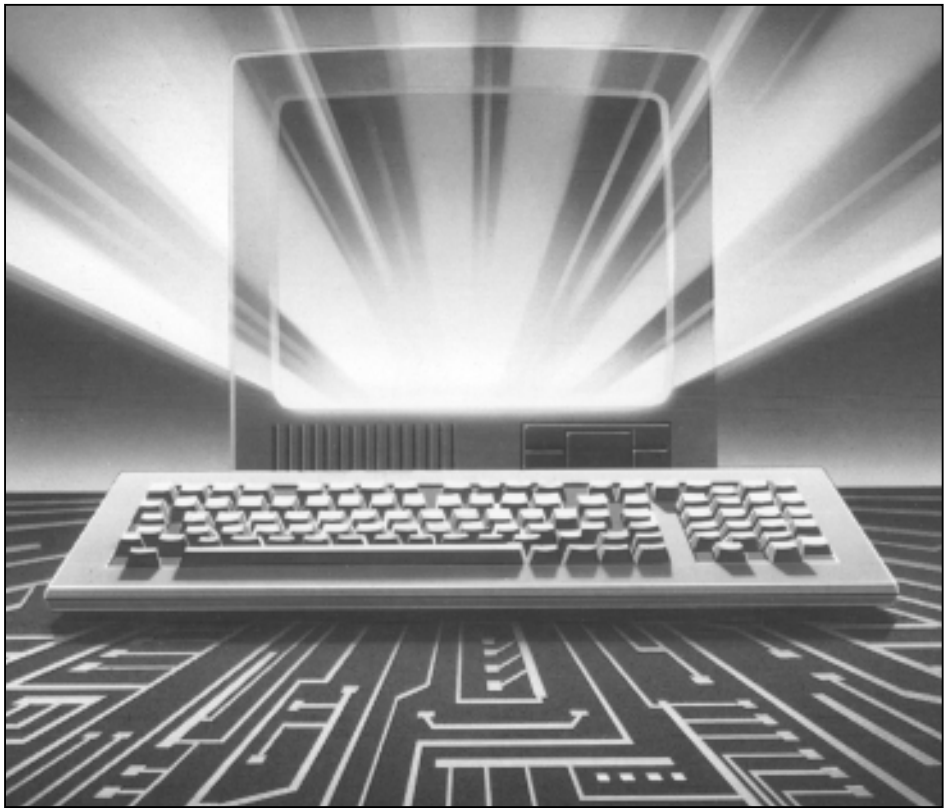
PUTTING RESEARCH INTO PRACTICE:
CHALLENGES AND OPPORTUNITIES

The past decade or so has been witness to a veritable explosion in hazards and disaster research, domestically and globally. The principles and practice of hazards management are increasingly featured in the curriculums of our schools of geography, political science, public administration, sociology, planning, engineering, and economics. In the process, a new generation of researchers has contributed to the hazards knowledge base.

Disasters themselves have yielded valuable knowledge and lessons. Post-disaster studies offer unprecedented opportunities for advances in earthquake engineering, design, construction; emergency preparedness and response; and disaster recovery.

There is a considerable gap, however, between *what we know* about hazards and their effects, and *what has been done* to apply this knowledge to reduce our society's vulnerability to disasters. Risks posed to the public by the built environment are well understood in many earthquake prone communities, yet this knowledge has not necessarily led to the adoption of risk reduction policies. Hazardous areas can be identified, yet this knowledge seldom influences development decisions. Public response to disasters is predictable, yet the lessons from research and experience are not always applied in subsequent disaster operations.

This issue of the *CUSEC Journal* is devoted to the challenges and opportunities of translating hazards research and knowledge into risk reduction practices. A fundamental issue



is examined: what factors contribute to the effective utilization of hazards research? Put another way, what steps can be taken to improve the chances that research will be put into practice?

KEYS TO RESEARCH UTILIZATION

1. *Potential users need to be involved in the identification of research priorities, and the development of risk reduction programs.*

Research has a greater chance of being used when the user is involved in each step of the application process, from identification of problems and issues to be addressed, to the development of strategies for putting the research into practice. While this may seem obvious, until recently there has been relatively little input from users in shaping the national research agenda.

This is changing. User advisory groups are increasingly common; they provide an important "reality check." Hazards research centers (e.g. the Natural Hazards Research and Applications Information Center) and regional consortia (e.g. CUSEC) are among a growing number of organizations that actively promote the application of research.

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2. *Research must be translated into useful materials, techniques, practices, and recommendations.*

We live in an era of information overload. In translating research into useful products, it is important to identify the information needs of specific audiences. Information needs to be provided that can *actually be used*; information that can actually trigger specific sets of actions. For example, design professionals typically need technical information and focused, hands-on training on how to put the information into use.

The products of research must be relevant to user needs and priorities, and be in a user-friendly format (e.g. diskettes with ready to use applications, map-based information and graphics packages, lessons learned, "how to" manuals, etc.). Furthermore, creative approaches can be used to deliver research and information to a broad range of practitioners. These include user workshops, mass media distribution, publication series, and incorporation of materials into ongoing programs of key target groups.

Finally, information dissemination is not implementation. To put research into practice, it is necessary to reach practitioners, educate them on how to use the information, and provide support in developing and implementing projects that incorporate the information.

3. *More emphasis should be given to research that is tailored to local situations.*

As earthquake risk reduction programs begin to mature, it is important to have research that addresses specific local and regional issues. Without accurate, accessible information on local risk, for example, it is difficult for hazards managers to market or "sell" risk reduction strategies to policymakers. Again, practitioners have an important role in identifying research and information priorities.

4. *Potential users must be made aware of hazards research, and the research itself must be made accessible.*

Research will not be used if practitioners - engineers, educators, emergency managers, geographers, seismologists, geologists, etc. - are not aware that the research exists, and cannot access it in a timely manner.

A recurring theme in the FEMA study, ***Earthquake Risk Reduction in the United States: An Assessment of Selected User Needs and Recommendations for the National Earthquake Hazards Reduction Program*** (1994) is that NEHRP research and information is not reaching planners, building officials, hospital and school officials, and other key user groups. Information dissemination appears to be occurring on a hit-or-miss basis.

Among the recommendations: 1) existing "information pathways" need to be examined; changes need to be made (particularly by NEHRP agencies) to ensure that users are better able to identify available research, and to access that information; and 2) greater use needs to be made of professional associations (e.g. American Planning Association, International City Management Association) as *information conduits* in reaching a broad spectrum of practitioners.Greater use should be made of computer based bulletin boards and other information networks to acquire, synthesize, screen, organize, identify, and disseminate useful information (see David Butler's article, *The Information Revolution and Disaster Management).*

> *"Greater use needs to be made of professional associations as information conduits in reaching a broad spectrum of practitioners."*

5. *Greater emphasis needs to be placed on facilitating researcher and practitioner interaction in a long term effort to improve collaboration and improve the chances that research products are used.*

One reason that researchers and practitioners do not work closely with one another is that they operate under different reward systems. A researcher is rewarded by his or her institution when a grant is landed, the study completed, and the results published. Practitioners tend to be action or results oriented; research is often perceived as a means of validating what is already known.

There are many creative ways to foster researcher-practitioner collaboration. Following a disaster, for example, there are unprecedented opportunities for "lessons learned" research and data gathering; emphasis should be given to mixing researchers and practitioners (e.g. emergency managers, building officials, etc.). Researchers can make valuable contributions to State and local emergency management agencies; possibilities for research interns should be explored. Fellowships are another avenue to pursue for research oriented practitioners.

In the long term, there are steps that can be taken to improve researcher-practitioner interaction to implement risk reduction strategies. Researchers, for example, should be required to include an applications component in proposals that are funded under NEHRP. Furthermore, an incentive should be developed to acknowledge and reward researchers when their work is used to advance earthquake risk reduction. In the process, closer collaboration can be achieved, priority problems and issues can be addressed, and scarce resources to support research can be maximized.

6. *An organizational and institutional framework must exist for carrying out sustained research translation and transfer activities.*

The federal government, through the National Earthquake Hazards Reduction Program, can assume a leadership and catalytic role in a new approach to research and information transfer. The bottom line, the lead NEHRP agencies - National Science Foundation (NSF), Federal Emergency Management Agency (FEMA), U.S. Geological Survey (USGS) and the National Institute for Science and Technology (NIST) - must transform the NEHRP from an information dissemination program to a true risk reduction program that is guided by specific goals, objectives, priorities, milestones, and measures of progress.

FEMA, for its part, has a prominent role in a newly focused, re-invigorated research application program. The agency has primary responsibility for implementation. In this capacity, it can serve as an important link, along with regional consortia, between federal agencies and the user community.

CUSEC and other consortia can assume a pivotal role in promoting the use of research and information to shape hazards policy and practice. Advances in computer communications, for example, afford new opportunities to establish information transfer networks among universities, hazards research centers, professional associations, and government agencies. The underlying objectives are to link these "nodes of expertise," to promote increased interaction among these groups, and to integrate hazards information and criteria into the mainstream of community decision making.

NATURAL HAZARDS RESEARCH SYMPOSIUM

Observations and Recommendations

The Natural Hazards Research Symposium, held in Louisville from May 31-June 2, 1994, brought together a diverse audience of hazards researchers, emergency managers, urban planners, engineers, educators, city managers, sociologists, and others: 1) to examine the most recent research that addresses mitigation and public policy; 2) to explore methods and processes for improving the utilization of research findings; and 3) to identify more effective strategies for implementing mitigation policies.

In addressing the issue of *how to improve the utilization of research findings*, the panelists observed:

* Researchers and practitioners live in different subcultures. "Researchers tend to have different paradigms from practitioners or users of research...and there lies part of the problem...further utilization means breaking down the cultural barriers between the two areas." **William Anderson,** National Science Foundation.
* Barriers to improved research utilization include "lack of any strategic communications between researchers and practitioners... resistance to change...poor listening...and no long term commitment to collaboration.." **Walter Hays**, US Geological Survey.
* The transfer of hazards information is not a linear process in which information producers simply inform users. Rather, the process is more interactive, and involves *information networks* of groups with similar concerns or interests (e.g. professional organizations, planners, public officials). Information transfer strategies should acknowledge - and capitalize on - these networks. **David Butler**, Natural Hazards Research and Applications Information Center.

Several recommendations for improving research utilization were offered, including the following:

* Continue to focus research efforts on identifying public expectations of disaster response organizations, and in identifying what motivates people to prepare, as well as factors that serve as disincentives to meaningful action. **Rocky Lopes**, American Red Cross.
* Make greater use of professional associations, such as the American Planning Association, to disseminate research and information. **Jim Schwab,** American Planning Association.
* Pursue a more diligent strategy for developing a capacity for post-disaster investigations in the Central U.S. **Walter Hays**, USGS.

Specific recommendations for CUSEC included:

* CUSEC and other consortia should offer researchers an opportunity to become members of their staffs for a year or two, to "contaminate" one another's organizations and in the process break down cultural barriers. **William Anderson.**
* CUSEC should facilitate "networks of cooperating organizations" to address problems and issues of mutual concern and interest (e.g. integrating mitigation into community decision-making processes); advances in computer communications can propel this approach. **David Butler.**
* CUSEC should work with member States, research institutions and others to coordinate the immediate post-disaster gathering and analysis of research. Acknowledging that scores of researchers will be drawn to disaster sites, there is a valuable **research clearinghouse function**

that needs to take place. Objectives include: 1) to provide a forum for researchers and practitioners - seismologists, engineers, sociologists, emergency response personnel, etc. - to discuss, coordinate and assess initial findings; and 2) to document and chronicle initial research findings, and to share this information with the Disaster Field Office. This approach was used following the Northridge earthquake, and worked well. **Tom Durham,** CUSEC.

Recommendations for improving or strengthening the process of implementing mitigation policies included:

* To communicate effectively with local elected officials and other decision-makers - in clear and understandable terms - the short-term and long-term benefits of mitigation. **James Everett,** Kentucky Disaster and Emergency Services.
* To cultivate mitigation opportunities through *"... a persistent and credible advocate, a local mitigation champion."* **Rob Olshansky,** University of Illinois at Urbana-Champaign.
* To pull together the "building blocks" of mitigation - the myriad groups that traditionally don't work together (e.g. natural resource groups, historical conservation societies, economic and community development organizations, etc.) but who can promote, through their constituencies, mitigation actions. **Cecil Whaley**, Tennessee Emergency Management Agency.

A full report of the findings and recommendations of the Natural Hazards Research Symposium will be released in early 1995.

THE INFORMATION REVOLUTION AND DISASTER MANAGEMENT

This article was contributed by **David Butler**, editor of the *Natural Hazards Observer*, manager of *Disaster Research*, and overall computer networker extraordinaire.

Synopsis

The current communication and information revolution poses immediate and wide-ranging opportunities for disaster management. Computer networks and other high-speed, high-density media can now be used before, during, and after disasters to reduce both property damage and human suffering. These systems can operate on any scale - from office to globe - to improve hazards management. In the Central United States, there are opportunities to use these technologies to improve regional preparedness for earthquakes and other disasters. It is imperative that persons concerned with lessening the impacts of disasters recognize the possibilities for improved hazards management posed by these new technologies and become involved in the worldwide communication/ information revolution.

Minds Uniting

Perhaps without being aware of it, in the past decade we have all been swept up in a major historical, evolutionary event involving the collection, storage, and communication of information. Vast amounts of information are being encoded into storage devices connected to processors (i.e., into computers), and these data bases are supplanting brains and libraries as the principal sources of information in the developed world. Equally important, the connections between these machines are increasing - probably at more than a geometric rate. Computers are more and more sharing information, and through these same links, people all over the globe now have the ability to contact one another and the computer data bases more quickly and cheaply than ever before. In a sense, the minds and the knowledge of the world are merging. Manifestations of this process include the Internet — the world's supernetwork of computer networks - and the NII — the proposed National Information Infrastructure, popularly known as the Information Highway.

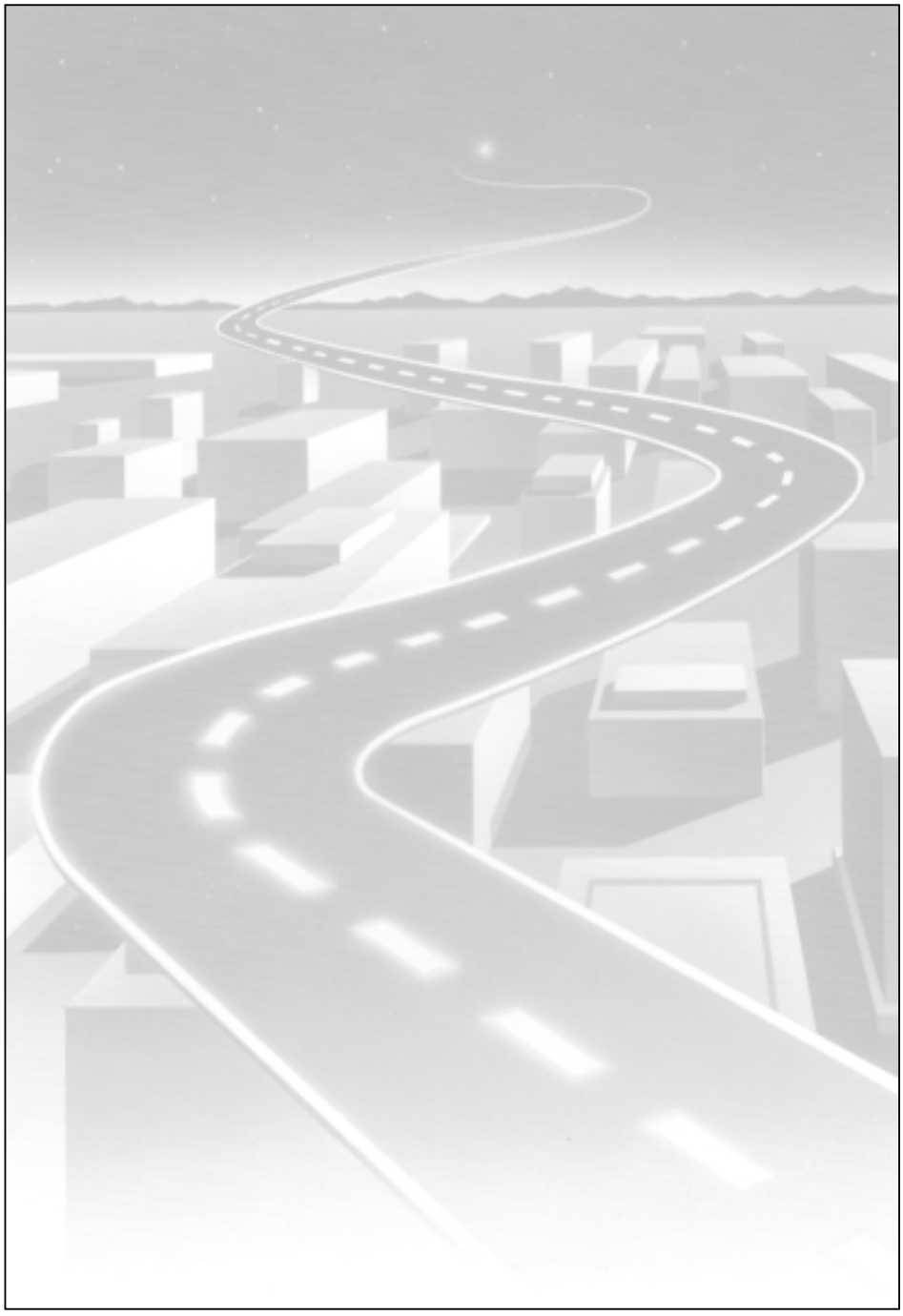
Implications

Although these changes are part of an unprecedented historical change, each of us has the opportunity to determine how the information revolution will proceed and, in particular, how it can be used to minimize the effects of disasters and ultimately improve the quality of human life on this planet. At the practical level, we are faced with a simple question: How can we use the new technologies involving computer-mediated communication to further hazards management?

Network Options Currently Available

The array of computer-mediated communication technologies available to aid disaster management is extensive and constantly increasing. For example, a group of personal computers (and thus their users) within a very limited geographic area can be linked through dedicated (i.e., created and used solely for one purpose) networks of wires; this is a local-area network (LAN). Over larger regions, dedicated lines, telephone lines, or radio links can be used to connect computers. An expansive system of dedicated lines is known as a wide-area network (WAN). Such networks can link either personal computers or larger "mainframe" machines.

Through a device called a modem, data can be first turned into a series of audio sounds and then transmitted via regular phone lines, dedicated phone lines, or other transmission devices. Indeed, computer information can be transmitted using virtually any medium (light, sound, infrared signals, microwave) and any transmitter (phone,



radio, bass drum). Through computer networks, individuals can:

- Exchange written information quickly and cheaply by sending messages to another person's computer, where those messages can reside until read (*e-mail*);
- Share messages with an entire group of people interested in a particular topic (*discussion groups, news groups, or e-mail "lists"*); and
- Obtain computer files (either programs or text) from remote computers (*file transfer - often referred to as "FTP" [file transfer protocol]*);
- Log on to remote computers from their computer and use the remote computer directly (*telnet*);

These media can and do provide both resources and opportunities for improving communication regarding disaster management. Moreover, these are only the current uses of computer networks; there will be more. Computer network communication is in its infancy. Ten years from now these functions will seem archaic, and many of these terms will no longer be used.

The Internet

Going one step further than the networks just described, it is possible to link many smaller networks of computers into a supernetwork, and, in fact, this has been done. The worldwide supernetwork of mainframe computer networks is called the Internet. Through links among both mainframe networks and smaller networks, the Internet reaches millions of people around the globe; it is not unlike the world telephone network. Although originally primarily a means to link government institutions and institutions of higher education, the Internet now spans all kinds of computer networks - including private for-profit services such and Compuserve, America On Line, and MCIMail.[1]

The information accessible on the Internet is incalculable, and there is a considerable amount available on disasters.

Disaster Research

For example, through the Internet and several other national and international networks, the University of Colorado's Natural Hazards Research and Applications Information Center distributes *Disaster Research (DR)*, a moderated electronic newsletter.[2] As needed (usually about every two weeks), *DR* provides information about recent disasters, recent policy decisions, legislative and institutional developments, research-in-progress and proposed research, potential research funding, new information sources, upcoming meetings, and any other pertinent developments in disaster management.

Beyond this, the newsletter allows subscribers to post queries to the entire readership and thus facilitates discussion about disasters among readers and between readers and the Natural Hazards Center. In a very real sense, it extends global access to hazards research findings, researchers, and resources and encourages and supports new investigations.

To cite only one instance of *DR*'s use in disasters, in late 1991, following the eruption of Mt. Hudson in the southern Andes, the Hazards Center received an e-mail request from the University of Patagonia in southern Argentina for information on recovery from volcanic ashfall and methods for studying ashfall effects. Besides sending information from the center's own library, the center also posted the Patagonia request on *DR*. The Argentinean university subsequently received advice and information from around the world, including information from researchers in the U.S. and Canada who had studied ashfall following the Mt. St. Helens eruptions in 1980 and from researchers in the Philippines who were dealing with the eruption of Mt. Pinatubo at the time.

Currently, almost every issue of *DR* contains requests for information from a disaster manager or hazards researcher somewhere around the globe.

Other Internet Lists

A number of other Internet mailing lists and discussion groups carry hazard- and disaster-related information. There is, for example, a Hospital Computer Network Discussion Group (HSPNET-L), which acts as a clearinghouse for information on medical emergencies; as well as QUAKE-L (an earthquake discussion group); VOLCANO LISTSERV; and the Networks in Emergency Management Newsletter (a group devoted to discussions of the use of computers and computer networks in disaster management).[3] Other discussion groups exist, with several new ones appearing annually.

On-line Libraries

The number of libraries - particularly in the U.S., but also elsewhere in the world - whose catalogs are available via the Internet or other on-line means has exploded in recent years. In some cases, entire texts are available on-line. The disaster-related libraries whose resources are accessible include the National Information Service for Earthquake Engineering (NISEE), the National Center for Earthquake Engineering Research (NCEER), the National Oceanic and Atmospheric Administration (NOAA) Central Library, the Australian Emergency Management Institute (AEMI), and others.[4]

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Gophers

Gopher servers are mainframe computers on the Internet that run special software that enables users to navigate among the myriad resources available on the machine and on the Internet generally. (The name *gopher* is a multilayered pun: the software was developed at the University of Minnesota, whose mascot is the gopher; it enables users to "go for" the information they need; and it has been described as a means of "tunneling" - like a gopher - through the Internet.) The software provides a menu and structure that organizes the information and resources available on that computer. Moreover, it enables users elsewhere on the Internet to look for information residing on that or any of hundreds of other gopher machines around the world.

The Earthquake Information (EERC/NISEE) Gopher is an earthquake information gopher server recently developed by the National Information Service for Earthquake Engineering (NISEE) at the Earthquake Engineering Research Center (EERC), University of California at Berkeley. The earthquake information gopher facilitates communication among organizations and individuals in the fields of earthquake engineering, hazard mitigation, disaster response, and related disciplines. NISEE has identified appropriate organizations to be included on this server and has invited them to participate. The various resources appear as options when one first logs on to the computer; when a particular resource is selected, text describing that option, or additional menus, appear. For a given organization, the mission of the organization, publications lists, and other relevant information are provided. The system also links into gophers and computers providing more information at other locations. For example, from the NISEE gopher, one can peruse information on the EPIX gopher at Simon Fraser University, Vancouver, Canada (see below); the Earthquake Engineering Abstracts database at University of California, Berkeley; the National Center for Earthquake Engineering Research (NCEER) anonymous ftp site in Buffalo, New York; and the National Earthquake Information Center's Quick Epicenter Determination (QED) system in Golden, Colorado.[5]

The VITA Gopher was recently established by the Disaster Information Center of Volunteers in Technical Assistance (VITA). The VITA gopher provides disaster situation reports, data on recent disasters and disaster relief operations, and other computer files regarding disasters maintained by the organization.[6]

The "Emergency Preparedness Information Exchange" (EPIX) Gopher is another useful gopher available via the Internet from Simon Fraser University's Centre for Policy Research on Science and Technology in Vancouver, British Columbia, Canada. The purpose of EPIX is to promote and facilitate the exchange of ideas and information among Canadian and international public and private organizations dealing with natural and technological disasters. EPIX is an example of international cooperative networking, since its features include not only locally based information and applications, but also links to services provided by others worldwide via the Internet. Initially, the creators of the EPIX gopher focused on consolidating existing Internet services regarding emergency/disaster management, as well as on building a base of Canadian information (for example, EPIX regularly carries the *Disaster Research* newsletter described above). Current services include: information about emergency and disaster management organizations; topical information (in areas such as emergency communications, training programs, research programs and information

services, natural and sociotechnological hazards); on-line discussion groups, libraries, and data bases (including weather and recent seismic reports), and, of course, connections to other networks.[7]

Other Utilities on the Internet

Gophers were devised to help people deal with the vast amount of information available on the Internet. But they represent just one approach. Indeed, easily searching and sorting the Internet's immense knowledge has more and more been recognized as *the* central problem in using the Internet. The information is there; in fact, *too much* is there. How to find key, pertinent information remains a problem.

Just a few of the newer Internet tools available to deal with this problem include:

Archie - a system for locating appropriate retrievable computer files (based on their names) on remote machines;

WAIS (Wide-Area Information Server) - a system for locating and retrieving appropriate documents (based on their content);

WWW (World Wide Web) - a multimedia, "hypertext" (i.e., cross-indexed text) search tool that also allows users to browse the Internet.

UNIENET

The United Nations International Emergency Network (UNIENET) was created by the United Nations Disaster Relief Office (UNDRO - a department now incorporated into the United Nations Department of Humanitarian Affairs [DHA]) in 1987 to help coordinate the efforts of major international disaster relief organizations. The network consists of a central mainframe computer host located in Maryland with access provided via computer modem through dedicated phone lines locally accessible around the globe. UNIENET provides electronic mail services; reports about current major disaster situations and relief operations; a data base on past disasters; lists of training institutions, national officials, and nongovernment organizations; country profiles; access to information from other major disaster management organizations around the world (including the Natural Hazards Research and Applications Information Center and *Disaster Research*); as well as access to other United Nations networks.[8]

Bulletin Board Systems (BBSs)

A bulletin board system (BBS) consists simply of special software running on a personal computer. That computer (the host machine) is equipped with a modem so that anyone with another computer and modem can call it up. Typically, when a person calls, they receive, from the host machine, a screen of menus telling them that they can upload or download computer files; look at files of related information (bulletin boards); participate in ongoing discussions; send messages to individuals, groups of individuals, or the entire user group; and otherwise search the information available and use the services of the host machine. Many organizations and communities now operate BBS-type facilities, usually allowing anyone to tap the multiplicity of resources available.

> *"Disaster managers in the Central U.S. can begin to shape their future by establishing their own communication network..."*

SALEMDUG

In the U.S., one of the principal BBSs dealing with disaster management is the State and Local Emergency Management Data Users Groups (SALEMDUG) BBS managed by the Federal Emergency Management Agency for the SALEMDUG organization. The SALEMDUG BBS was established to aid state and local emergency management agencies and other interested individuals by providing a simple means of communication and computer file transfer among these users. The system is free (users must pay only the long distance phone charges involved) and open to anyone with an interest in hazards and disaster management. The bulletin board provides a means of electronic messaging among users, includes numerous bulletins on various topics, and contains a host of computer programs and files that users can download.[9]

BBS Communication

As with the larger mainframe networks, many BBSs are linked worldwide so that, in many cases, messages can be sent from BBS to BBS - eventually (and surprisingly quickly) to almost any place in the world. For example, the SALEMDUG BBS is part of a group of BBSs around the world known as EMERGNET - the Emergency Services Telecommunication Network - all of which are bulletin board systems devoted totally or in part to disaster management.

As one might suspect, there are now even links between BBS networks and the Internet, and therefore, BBSs are helping to expand access to information previously available only on mainframe networks. For example, copies of the *DR* newsletter can be obtained from numerous boards in the U.S., Australia, and elsewhere in the world.[10]

As the connections among various types of networks increase, the distinctions among these networks are becoming blurry to the average computer user. (They are usually only hinted at by the e-mail addresses used to reach correspondents.) The trend is clearly toward a synthesis of networks in which users will become relatively unaware of all of the links they are using to reach information and individuals around the world.

The Australian Disaster Management Information Network (ADMIN)

In this regard, one final example of computer networking is particularly instructive. In Australia, several emergency management organizations have cooperated to develop a multi-layered network that integrates many of the means of computer communication described above - from large wide-area mainframe networks to PC-based bulletin board systems to smaller networks at the

local-area level. The Australian Disaster Management Information Network (ADMIN) was established to improve the exchange of disaster management information by building upon the existing resources of participating organizations, while also establishing connections to other networks where appropriate. The system is based on several distributed BBS-type systems around Australia, but also has links to the Internet, UNIENET, and other resources.

ADMIN facilitates the exchange of electronic mail between participants as well as ongoing electronic conferencing on subjects such as emergency communications, research, and disaster prevention/mitigation, preparedness, response, recovery, and reconstruction planning. It also provides numerous data bases, library services, calendars of events, etc. ADMIN is a particularly instructive model because it makes use of all types of computer network technologies to link as many users as possible to the widest possible set of resources. In a sense, it is a harbinger of the future, in which, again, computer network boundaries will become less and less distinct and a person will simply be able to query "the Net" (the super Internet, the Information Highway, or whatever the metamorphosed Internet communication system of the future is called) to find information anywhere in the world.

What This Means for Hazard Managers in the Central United States

A Vision

Non-users of computers or computer networks will probably find all this talk about computer communication and Internet resources daunting ("How can I get involved in this super technology when I can't even program my VCR?") Such a response is certainly understandable. (I still haven't figured out how to program the voice mail options on my telephone). But consider this vision of the not-too-distant future:

No one knows which way we are heading on the information highway; indeed, we cannot know. But if one looks at where we are now, one might gain an intimation of where we will be in, say, ten years. Today, we rely on regular telephones, portable telephones, cellular telephones, fax machines, mail, and e-mail to communicate with friends. We gain information and entertainment from books, radio and television, films, audiotapes, videotapes, cd disks, e-mail lists, and many other means. All of these media are becoming, smaller, increasingly portable, easier to use, and integrated into single systems (for example, it is now possible to send faxes from computers via modem). Young people rollerblade with Walkmans wrapped around their heads; older people drive their cars with cellular phones stuck to their ears. I recently received a solicitation in the mail telling me that if I am willing to pay an extra $5 a month, I can forego dialing my phone and just tell it who I want to talk to (voice recognition) and it will dial for me.

Given these trends, I imagine that in ten years, many people will be walking, riding, skating, driving, or sitting while wearing a designer headset (probably with a mouthpiece and possibly a flip-down viewing screen) through which they will be able to receive radio, TV, films - virtually all of the entertainment now available via the various media we employ. Moreover, they will be able to ask a question or issue a command such as, "What is the situation in Bosnia?" or "What was the closing price of AT&T?" or "I would like to call mom," or "I want to order a pizza," or "What information is available [worldwide] on disabled persons in earthquakes?" and their request will be filled within a matter of seconds. The response could come back as words on the headset, text on the screen, or perhaps as a printout on the printer at home (or the small one strapped to the user's waist).

Is this science fiction? Not at all. All of the functions described above are now available to some degree - at least separately, and their synthesis is only a matter of time. The future will probably not look exactly like this (who knows what new technology lurks around the corner), but it will not be very different either. In any event, a key fact remains: we all have the opportunity to shape that future to our own ends.

A Proposal

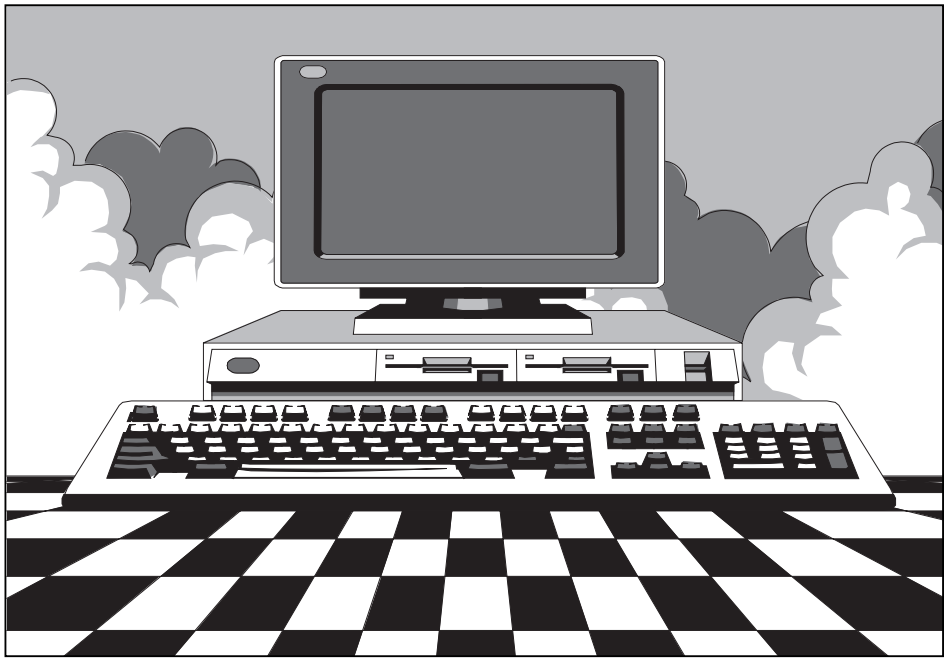
Disaster managers in the Central U.S. can begin to shape their future by establishing their own communication network - perhaps based on a BBS system that is part of the aforementioned EMERGNET or on a commercial network system (preferably one that offers access to the Internet, such as Compuserve or America on Line), or possibly based directly on the Internet itself. The benefits in the long run would be considerable.

Experience has shown that the viability of such a system is dependent on several factors:

- the accessibility of the system,
- the number of people involved,
- the saliency of the issues addressed,
- the involvement of eventual users in the design and installation of the system,
- the active involvement of one or more key participants who, at least initially, promote discussion and use of the system. The role of such persons is similar to that of a discussion leader or workshop facilitator; basically they intercede when the discussion goes awry or wanes and promote system use.

To initiate such a system, an ad hoc group of representatives of potential system users should meet to discuss possibilities and options. Participants might include representatives of state and local emergency management offices, local organizations involved in disaster preparedness or response (the Red Cross, for example), academic institutions involved in disaster research or information dissemination (Memphis State University's Center for Earthquake Research and Information, for example), representatives of major employers in the region, and other interested groups such as CUSEC. That group should invite representatives of other organizations that use such communication facilities to describe how their systems work, and then consider whether such a system - and what kind of system - would be useful in the Central U.S.

Perhaps more importantly than deciding on a physical system, the group should identify local needs, resources,



and *potential users* and begin to determine a process to ensure that such a communication system would not only survive, but thrive. In that respect, the group should begin by realizing that the set of actors with some say in hazard mitigation is large - including everyone from local emergency managers, to local elected officials, to planners, architects, and engineers, and administrators of major institutions such as schools and hospitals. Ideally, any communication system established would provide access to and from all of these groups.

To reach the broader audience involved in the disaster management, it will be important for the developers of the Central U.S. network (CUSNET!) to work with other networks and network developers in order to increase the profile of disaster management within other network communities. It is important not to isolate disaster management as a single discipline on the wide domain of computer communication. Just as disaster awareness and preparedness must become part of almost all aspects of day-to-day life, so disaster information must become commonplace across the wide range of discussion and forums available in the brave new world of the Net.

Notes

1. For a good introduction to the Internet, consult Brendan Kehoe's *Zen and the Art of the Internet*. 1992. New Jersey: Prentice-Hall.
2. For a longer discussion of *Disaster Research*, see my earlier paper: David L. Butler, *Communication to Mitigate Disasters*, Policy Research Paper No. 16.. 1990. Melbourne, Australia: Centre for International Research on Communication and Information Technologies.
   Subscriptions to *Disaster Research* and additional information about this electronic newsletter can be obtained from David Butler, Natural Hazards Information Center, IBS #6, Campus Box 482, University of Colorado, Boulder, CO 80309-0482; (303) 492-6819; fax: (303) 492-2151; e-mail: hazctr@colorado.edu.
3. The e-mail address for HSPNET-L is HSPNET-L@albnydh2.bitnet. To subscribe or gain further information, contact the moderator, Donald F. Parsons, Wadsworth Center, Room C273, New York State Department of Health, Empire State Plaza, Albany, NY 12201-0509; (518) 474-7047, e-mail: dfp10@uacsc2.albany.edu.
   The QUAKE-L coordinator is Marty Hoag, nu021172@ndsuvm1.bitnet or nu021172@ vm1.nodak.edu. To join, send an e-mail message to LISTSERV@vm1.nodak.edu with the one line message "SUBscribe QUAKE-L <your_full_name>."
   For more information about VOLCANO LISTSERV contact Jonathan Fink, Department of Geology, Arizona State University, Tempe, AZ 85387; (602) 965-3195; e-mail: aijhf@asuacad.bitnet. To join, send a one line e-mail message to LISTSERV@asuacad.bitnet asking to "SUBscribe."
   For information about the "Networks in Emergency Management" Newsletter, contact Art Botterell, Telecommunication Division, California Office of Emergency Services, 2800 Meadowview Road, Sacramento, CA 95832; e-mail: acb@oes.ca.gov.
4. The NISEE library data base can be accessed via the gopher server described below.
   The NCEER Quakeline data base can be reached on the Internet by telnetting to ubvm.cc.buffalo.edu, then selecting "BISON," "INDX," and "QKLN."
   The NOAA Library and Information Catalog (NOAA-LINC) can be used to locate materials in NOAA and EPA libraries. The service can be reached from a personal computer via modem by dialing (301) 713-4544 (then pressing <enter> twice, and at the prompt "USER ID," entering "ANSI").
   The AEMI catalog is available through the ADMIN Australian network described in the text.
   To find out about other libraries and resources available on the Internet, send an e-mail message to resource-guide-request@nnsc.nsf.net asking for a copy of the *Internet Resource Guide*.
5. To access NISEE's Earthquake Information Gopher, a person must be using a computer that has gopher client (user) software and, at the prompt, need only type "gopher nisee.ce.berkeley.edu" and select "Earthquake Engineering Abstracts" to begin using the gopher. For further information, contact *Katie Frohmberg, EERC/NISEE, 1301 South 46th Street, Richmond, CA 94804, (510) 231-9401; fax: (510) 231-9471; e-mail: katie@eerc.berkeley.edu*.

6. For information about the VITA gopher, contact *Richard Muffley, Disaster Information Center, VITA, 1600 Wilson Boulevard, Arlington, VA 22209, (703) 276-1800; fax: (703) 243-1865; e-mail: rmuffley@vita.org*.
7. Gopher users can reach EPIX by typing the command:
   gopher disaster.cprost.sfu.ca 5555 or telnetting to disaster.cprost.sfu.ca
   User id is "epix"; no password necessary.
   For more details about the EPIX gopher, contact *Peter Anderson, Department of Communication, Simon Fraser University, Burnaby, British Columbia, Canada V5A 1S6, (604) 291-3687; fax: (604) 291-4024; e-mail: anderson@sfu.ca*.
8. For information on how to gain access to UNIENET, contact the UNIENET System Administrator, Department of Humanitarian Affairs, United Nations, Palais des Nations, CH-1211 Geneva 10, Switzerland; tel: (41-22) 917-2661; fax: (41-22) 917-0023; e-mail: dha.unienet.coor.gva@cgnet.com.
9. For information about the SALEMDUG BBS, contact John Kihl or Diana Wade, SALEMDUG BBS system operators, FEMA, 500 C Street, S.W., Washington, DC 20472, (202) 646-2571.
10. In the U.S., Disaster Research is available via modem on several Bulletin Board Systems (BBSs) including: the State and Local Emergency Management Data Users Group (SALEMDUG) BBS - (202) 646-2887; the VITANET BBS - (703) 527-1086; the Colorado HazardNet BBS - (303) 465-5013.
    In Australia, DR is available on the Australian Disaster Management Information Exchange (ADMIX) - (054) 262-594 or FIDO 3:632/387 - and the Wireless Institute Civil Emergency Network (WICEN) - 03-802-0913 or FIDO 3:632/404.
    All systems operate at 2400 baud, no parity, 8 data bits, 1 stop bit (some systems are accessible at higher speeds).

KNOWLEDGE TRANSFER IN EARTHQUAKE HAZARD MITIGATION:

NCEER'S INFORMATION SERVICE

This article was written by **Dorothy S. Tao**, Information Specialist, and **Patricia Ann Coty**, Manager, Information Services, National Center for Earthquake Engineering Research (NCEER).

The Information Service at NCEER was established to disseminate seismic hazards information to researchers, practitioners, and the general public. To achieve this goal, the Information Service provides reference support and maintains a comprehensive collection of over 20,000 books, journals, reports, and conference proceedings. The Information Service collection also includes audiovisual material, maps, newspaper clippings and a vertical file. In addition, the Information Service publishes a substantial monthly newsletter that is distributed to 600 readers world-wide. Since 1987, the Information Service has produced the QUAKELINE® bibliographic database. Recently, in an endeavor to make its services accessible to a wider audience, the NCEER Information Service established two new Internet-based resources, the NCEER GOPHER and the NCEER Anonymous FTP (file transfer protocol) Site. Improved access to QUAKELINE® was achieved by mounting the database on the Internet in September 1993.

The bibliographic database, which is created and maintained by the NCEER Information Service, contains nearly 26,000 records as of September 1994. Users can quickly locate information on a topic by searching the database. A typical QUAKELINE record refers to a book, journal article, report, or other resources such as slide sets and videotapes. Each record includes such information as author(s), title, date of publication, keywords, broad subject categories, and an abstract. All of the materials indexed and abstracted in the QUAKELINE database are housed in NCEER's collection, so that any materials identified in a search can be easily accessed at our facility. The Information Service can loan or photocopy these materials for off-site users when the materials are otherwise unavailable.

With the QUAKELINE database mounted on the Internet, the user community can perform free online searches. There are several ways to access QUAKELINE on the Internet: via the NCEER GOPHER, via telnet, or by FTP (file transfer protocol). Numerous online help screens are available in the QUAKELINE database, although the menu-assisted design of the *BISON* search software on which the database is mounted is fairly straight forward. Additional manuals and search aids can be requested from the NCEER Information Service. As with most databases, searching is greatly enhanced as the searcher becomes more familiar with the database and its field structure. QUAKELINE users are also encouraged to contact the Information Service for searching assistance.

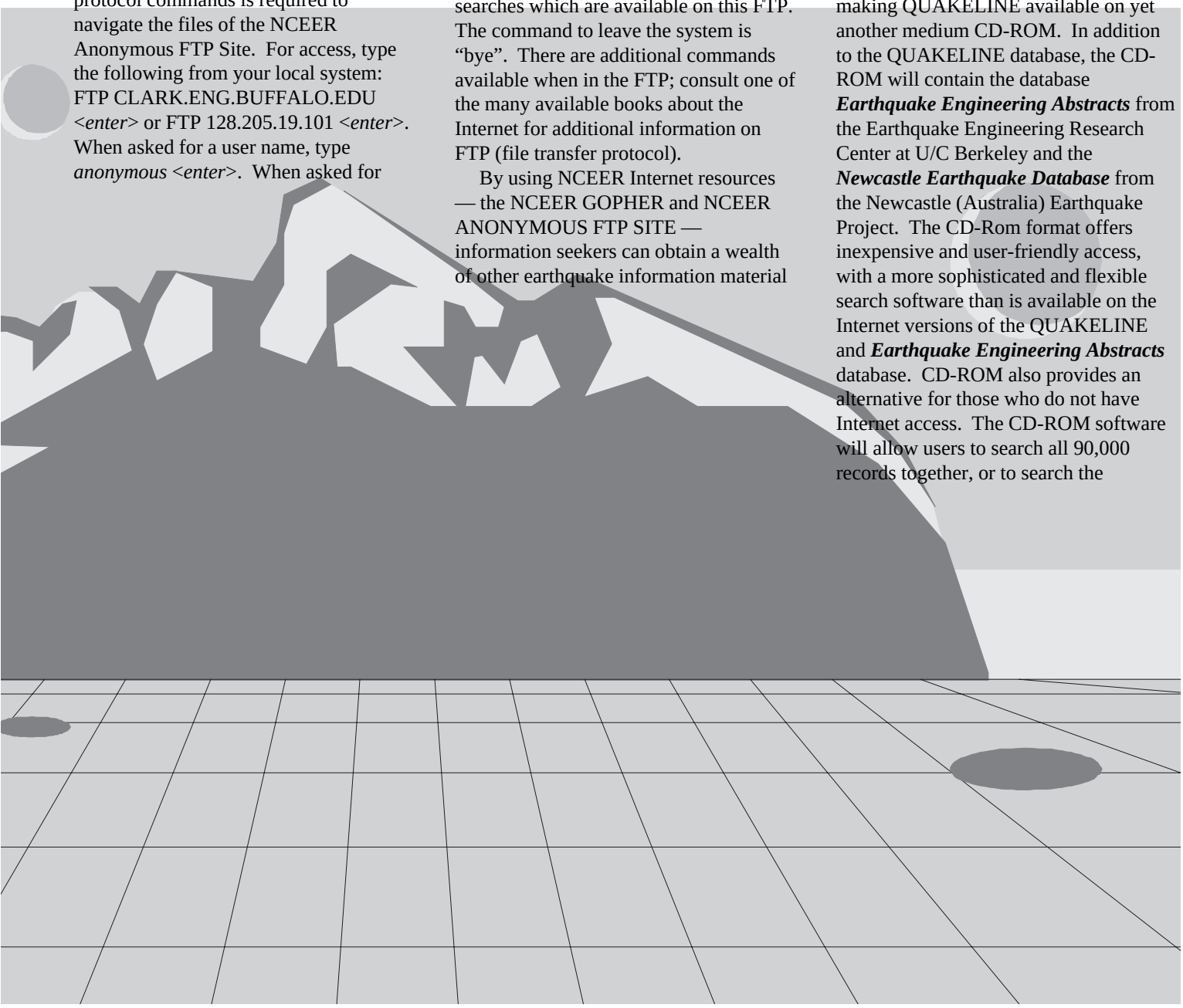
To gain access to QUAKELINE via the NCEER Gopher, a user-friendly, menu-driven system, type GOPHER NCEER.ENG.BUFFALO.EDU <*enter*> or type GOPHER 128.205.19.101 <*enter*>. then make the appropriate menu selection>

To telnet to QUAKELINE from a local system, type *telnet* BISON.CC.BUFFALO.EDU. <*enter*> and when asked for terminal emulation, type the <*enter*> key to get a listing of choices, and enter your response (usually VT100). At the blank screen, type <*enter*>. Once connected to the DATABASE SELECTION MENU, choose the "INDX" menu option by typing INDX and then type QKLN to select the QUAKELINE National Center for Earthquake Engineering Research database label. To exit, type STOP at any screen.

Detailed knowledge of file transfer protocol commands is required to navigate the files of the NCEER Anonymous FTP Site. For access, type the following from your local system: FTP CLARK.ENG.BUFFALO.EDU <*enter*> or FTP 128.205.19.101 <*enter*>. When asked for a user name, type *anonymous* <*enter*>. When asked for your password, type your e-mail address, or type *none* <*enter*>. There are two directories in the FTP: "pub" and "incoming." The "pub" directory contains the information which can be downloaded by users. The "incoming" directory is similar to an empty mailbox, into which users can place messages. To place yourself in the "pub" directory, type *cd pub* <*enter*>. Be sure to use lower case, as the FTP is case-sensitive. To list directory files, type *ls* <*enter*>. To get into the "searches" directory, type *cd searches* <*enter*>. The index file "searchdir" can be downloaded and used as a guide to the numerous computer searches which are available on this FTP. The command to leave the system is "bye". There are additional commands available when in the FTP; consult one of the many available books about the Internet for additional information on FTP (file transfer protocol).

By using NCEER Internet resources — the NCEER GOPHER and NCEER ANONYMOUS FTP SITE — information seekers can obtain a wealth of other earthquake information material at no cost, including about 400 different literature searches on a wide variety of topics (for instance, "Central United States: Seismic Issues 1991-1994"; "Cost of Retrofit, Strengthening, and Repair of Buildings;" "Seismic Retrofitting of Electric Power Facilities"). Also available on these systems is an online listing with ordering information for all published NCEER technical reports, NCEER-produced software and fact sheets, a catalog of earthquakes in the Eastern United States, and guides to obtaining strong motion records and FEMA reports.

In the coming months NCEER will be making QUAKELINE available on yet another medium CD-ROM. In addition to the QUAKELINE database, the CD-ROM will contain the database ***Earthquake Engineering Abstracts*** from the Earthquake Engineering Research Center at U/C Berkeley and the ***Newcastle Earthquake Database*** from the Newcastle (Australia) Earthquake Project. The CD-Rom format offers inexpensive and user-friendly access, with a more sophisticated and flexible search software than is available on the Internet versions of the QUAKELINE and ***Earthquake Engineering Abstracts*** database. CD-ROM also provides an alternative for those who do not have Internet access. The CD-ROM software will allow users to search all 90,000 records together, or to search the



individual databases separately.

In another CD-ROM project, the NCEER Information Service and the Department of Regional Development and Environment of the Organization of American States (OAS) are developing a *Hazards Management Library* to be published on CD-ROM for Latin American and Caribbean hazard management practitioners. The OAS is gathering, selecting and organizing appropriate documents, while NCEER will provide technical expertise for product development. Funding for this project is currently being sought.

By exploring innovative uses of new technologies to enhance knowledge transfer, the NCEER Information Service strives to make seismic hazard knowledge more widely available to the global community of researchers and practitioners. At the same time, the Information Service endeavors to maintain the traditional services that have proved so useful to the earthquake hazards mitigation community—provision of reference, publication of our monthly newsletter, the NCEER *Information Service News*, and production of the QUAKELINE database. For additional information on QUAKELINE, the NCEER GOPHER, the NCEER *Anonymous FTP*, or other information resources in earthquake hazards mitigation, contact the NCEER Information Service, SUNY Buffalo 304 Capen Hall, c/o SEL, Buffalo, NY 14260 (telephone 716-645-3377, telefax 716-645-3379, e-mail NERNCEER@UBVMS.CC.BUFFALO.EDU).

The authors can be e-mailed at NERTAO@UBVMS.CC.BUFFALO.EDU and NERCOTY@UBVMS.CC.BUFFALO.EDU.

SOURCES OF HAZARDS RESEARCH AND INFORMATION

The following is a listing of information sources that can be helpful to earthquake hazard managers and researchers in the Central U.S. A brief description of each organization is provided, including addresses and telephone numbers of principal points of contact.

Federal Government

CENTERS FOR DISEASE CONTROL AND PREVENTION, Disaster Assessment and Epidemiology Section, Health Studies Branch, Division of Environmental Hazards and Health Effects

Mailstop F46, 4770 Buford Highway, N.E., Atlanta, GA 30341-3724.
Eric Noji, Chief, (404) 488-7350; fax: (404) 488-7335.

The CDC has principal responsibility for responding to the public health and medical consequences caused by natural and man-made hazards in the United States. The agency conducts health investigations following natural disasters on a range of health related issues. This research has lead to recommendations for reducing disaster related deaths and injuries, and in improving community based strategies for minimizing health risks associated with disasters.

FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)

500 C Street, S.W., Washington, DC, 20472, (202) 646-2800.
Mitigation Directorate: (202) 646-3860
Response and Recovery Directorate: (202) 646-3692
Preparedness, Training and Exercise Directorate: (202) 646-3487

FEMA Regions:

Region 1	Boston	(617) 223-9579
Region II	New York	(212) 225-7208
Region III	Philadelphia	(215) 931-5513
Region IV	Atlanta	(404) 853-4200
Region V	Chicago	(312) 408-5500
Region VI	Denton	(817) 898-5104
Region VII	Kansas City	(816) 283-7060
Region VIII	Denver	(303) 235-4812
Region IX	San Francisco	(415) 923-7100
Region X	Bothell	(206) 487-4707

FEMA is the lead federal agency under the National Earthquake Hazards Reduction Program, and in that capacity is responsible for interagency coordination, planning, outreach and advocacy. The well known "yellow book series" provides reference material on a broad range of subjects. Since 1993, FEMA's Mitigation Directorate has assumed the lead role in developing, coordinating and distributing manuals and other publications that address Hazard Identification, Risk Assessment, Design Practices, Earthquake Education, and other aspects of earthquake risk reduction. FEMA has the lead role in the implementation of hazard reduction programs, and achieves this in large part through its regional offices, the States, and regional consortia.

NATIONAL SCIENCE FOUNDATION (NSF)

4201 Wilson Blvd.,
Arlington, VA 22230
Earthquake Hazards Mitigation Program, *William Anderson, Program Director*, (703) 306-1362; fax: (703) 306-0312.

The National Science Foundation supports a broad range of natural hazards research programs, including: Fundamental Earthquake Studies (e.g. earthquake processes); Earthquake Effects and Engineering Research (e.g. structural analysis and design, architectural and non-structural components); and Post-Earthquake Studies. In recent years, the NSF has placed greater emphasis on problem focused research and the application of research findings. In May, 1994, the NSF provided funding support for CUSEC's Natural Hazards Research Symposium, in Louisville.

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

Building 226, Room B158,
Gaithersburg, Maryland 20899

Building and Fire Research Laboratory, *Riley Chung,* (301) 975-6062; fax: (301) 869-6275.

The NIST, formerly the National Bureau of Standards, is primarily responsible for conducting problem focused research and development to improve building codes and standards and practices for structures and lifelines. The agency also conducts post-disaster studies, including NIST Special Publication 862, *1994 Northridge Earthquake: Performance of Structures, Lifelines, and Fire Protection Systems (May, 1994).*

U.S. GEOLOGICAL SURVEY (USGS)

Deputy for Research Applications, 905 National Center, Reston, VA 22092. *Walter W. Hays,* (703) 648-6711/6712.

Earth Science Information Center, 507 National Center, Reston, VA 22092. (703) 860-6045.

Earthquake Information Service, MS-967, P.O. Box 25046, Federal Center, Denver, CO 80225. *Waverly Person, Director,* (303) 273-8500.

Library, National Center, MS-950, 12201 Sunrise Valley Drive, Reston, VA 22092. (703) 648-4302.

The USGS supports basic and applied research on the New Madrid Seismic Zone - and 100 others - to increase our understanding of *why, how, and how often* these seismic zones produce damaging earthquakes. As with other NEHRP agencies, the USGS is placing greater emphasis on application of seismic research, including the translation of research and lessons into policy and program options that can be implemented by practitioners. Since 1991, the USGS has supported the seven CUSEC State geologists to enable them to undertake a seismic mapping project, in close coordination with the State Earthquake Program Managers.

State Government

The Earthquake Program Managers and State Geologists are important sources of research and information on earthquakes and other hazards. State emergency management agencies have maps, research, and information that are tailored to the needs of a broad range of users in the CUSEC states. Education and outreach programs have been developed to deliver earthquake preparedness materials to a wide audience.

ARKANSAS OFFICE OF EMERGENCY SERVICES

P.O. Box 758, Conway, AR 72033. *Dan Cicirello,* (501) 329-5601; fax: (501) 327-8047.

ARKANSAS GEOLOGICAL COMMISSION

Vardelle Parham Geology Center, 3818 W. Roosevelt Road, Little Rock, AR 72204. *Bill Bush,* (501) 663-9714; fax: (501) 663-7360.

ILLINOIS EMERGENCY MANAGEMENT AGENCY

110 E. Adams Street, Springfield, IL 62706. *Tom Zimmerman,* (217) 782-4448; fax: (217) 782-2589.

ILLINOIS STATE GEOLOGICAL SURVEY

121 Natural Resources Building, 615 East Peabody Drive, Room 121, Champaign, IL 61820. *Paul DuMontelle,* (217) 333-5111; fax: (217) 244-7004.

INDIANA STATE EMERGENCY MANAGEMENT AGENCY

302 W. Washington Street, E-208, Indianapolis, IN 46204. *R.O. Stanley,* (317) 232-4679; fax: (317) 233-5006.

INDIANA GEOLOGICAL SURVEY

611 N. Walnut Grove, Bloomington, IN 47405. *Norman Hester,* (812) 855-9350; fax: (812) 855-2862.

KENTUCY DISASTER AND EMERGENCY SERVICES

Boone Center, EOC Building, Frankfort, KY 40601. *Mike Lynch,* (502) 564-8628; fax: (502) 564-8614.

KENTUCKY GEOLOGICAL SURVEY

228 Mining and Mineral Resources Building, Lexington, KY 40506-0107. *John D. Kiefer,* (606) 257-5500; fax: (606) 258-1049.

MISSISSIPPI EMERGENCY MANAGEMENT AGENCY

1411 Riverside Drive, Jackson, MS 39296-4501. *Grady Kersh,* (601) 352-9100; fax: (601) 352-8314.

OFFICE OF GEOLOGY

Mississippi Department of Environmental Quality, P.O. Box 20307. *Cragin Knox,* (601) 961-5503; fax: (601) 961-5521.

MISSOURI EMERGENCY MANAGEMENT AGENCY

2302 Militia Drive, Jefferson City, MO 65101. *Ed Gray,* (314) 526-9131; fax: (314) 634-7966.

MISSOURI GEOLOGICAL SURVEY

P.O. Box 250, Rolla, MO 65401, *James Williams,* (314) 368-2101; fax: 368-2111.

TENNESSEE EMERGENCY MANAGEMENT AGENCY

3041 Sidco Drive, Nashville, TN 37204. *Cecil Whaley,* (615) 741-0640; fax: (615) 242-9635.

TENNESSEE DIVISION OF GEOLOGY

Department of Environment and Conservation, 401 Church Street, Life and Casualty Tower, Nashville, TN 37243-0445. *Edward Luther,* (615) 532-1500; fax: (615) 532-0120.

Associate Members

ALABAMA EMERGENCY MANAGEMENT AGENCY

P.O. Drawer 2160, Clanton, AL 35045-5160. *Dave White,* (205) 280-2204; fax: (205) 280-2493.

GEORGIA EMERGENCY MANAGEMENT AGENCY

P.O. Box 18055, Atlanta, GA 30316-0055. *Janie Griffin,* (404) 624-7001; fax: (404) 624-7205.

LOUISIANA OFFICE OF EMERGENCY PREPAREDNESS

P.O. Box 44217, Baton Rouge, LA 70804. *Brett Kriger,* (504) 342-1570; fax: (504) 342-1596.

NEBRASKA CIVIL DEFENSE AGENCY

1300 Military Road, Lincoln, NE 68508. *Dennis Kumm,* (402) 473-2101; fax: (402) 473-1433.

NORTH CAROLINA DIVISION OF EMERGENCY MANAGEMENT

59 Woodfin Place, Ashville, 28801.

Kenneth Taylor, (704) 251-6152; fax: (704) 251-6311.

OHIO EMERGENCY MANAGEMENT AGENCY

2825 W. Granville Road, Columbus, OH 43235-2712. *Candice Sherry*, (614) 889-7172; fax: (614) 791-0018.

OKLAHOMA CIVIL EMERGENCY MANAGEMENT AGENCY

P.O. Box 53365, Oklahoma City, OK 73152. *Larry Brewer*, (405) 521-2481; fax: (405) 521-4053.

SOUTH CAROLINA EMERGENCY PREPAREDNESS DIVISION

1429 Senate Street, Columbia, SC 29201. *Dusty Owens*, (803) 734-8020; fax: (803) 734-8062.

Non-Government Organizations

AMERICAN RED CROSS (ARC)

Disaster Services, National Headquarters, 615 N. Asaph St., Alexandria, VA 22314. *Donald Jones, Director*, (703) 838-7653; fax: (703) 838-7661. CUSEC Liaison, *Elaine Clyburn*, (901) 345-0932; fax: (901) 345-0998.

The ARC develops and distributes public awareness and safety information on disaster preparedness for natural hazards, including thunderstorms, lightening strikes, earthquakes, floods, winter storms, residential fires, and heat waves. The information is generally available in English and Spanish. Many materials have been jointly prepared and published with FEMA, National Weather Service, and other agencies.

CENTER FOR EARTHQUAKE RESEARCH AND INFORMATION (CERI),

University of Memphis, 3890 Central Avenue, Memphis, TN 38152. *James Dorman, Director; Jill Johnston, Manager, Seismic Resource Center* (901) 678-2007.

CERI was established by the Tennessee State Legislature in 1977 to conduct research on the consequences of earthquakes in the Central United States; to study soil and structural response to earthquakes in the geologic environment of the Central United States; to provide accurate, immediate reports and information on the occurrence of regional and worldwide earthquakes; and to provide advice on the methods, means, and feasibility of reducing earthquake damage. New methods of providing information to various groups are being developed at CERI. These include broadcast of seismic data on commercial radio station sub carriers, open computerized access to earthquake information, and production and delivery of automated real-time earthquake bulletins for government agencies, police, fire, emergency response groups and the news media.

CENTRAL U.S. EARTHQUAKE CONSORTIUM (CUSEC)

2630 E. Holmes Road, Memphis, TN 38118. *Tom Durham, Executive Director*, (901) 345-0932; fax: (901) 345-0998.

One of CUSEC's stated goals is to support research and facilitate the information transfer process. The Consortium works closely with researchers and practitioners to: 1) identify research needs and priorities in the Central U.S.; 2) sponsor workshops to disseminate useful publications on disaster preparedness, mitigation, response, and recovery; 3) serve as a "broker" in linking the producers of research, and users. The *CUSEC Journal*, the official publication of the Consortium, covers a spectrum of topics and issues related to earthquake risk reduction.

DISASTER RESEARCH CENTER (DRC), UNIVERSITY OF DELAWARE

Newark, DE 19716. *Joanne Nigg, Director*, (302) 831-6618; fax: (302) 831-2091.

The DRC engages in a variety of social science research projects on group and organizational preparations for, responses to, and recovery from community-wide emergencies, particularly natural and technological disasters. DRC has conducted over 500 field studies since its inception; teams have collected data on earthquakes from all over the world. Recent studies have focused on social and organizational aspects of mental health service delivery in disasters, problems in mass evacuation and sheltering, delivery of emergency medical services in mass care emergencies, mass media reporting of all disasters, and preparations for and responses to major community disasters by lifeline organizations.

EARTHQUAKE ENGINEERING RESEARCH INSTITUTE (EERI)

499 14th Street, Suite 320, Oakland, CA 94612-1902. *Susan Tubbesing, Executive Director*, (510) 451-0905; fax: (510) 451-5411.

EERI is a national nonprofit society of engineers, geoscientists, architects, planners, public officials, and social scientists concerned about earthquakes and their effects. The Institute publishes a wide variety of works on earthquake engineering, including technical monographs, earthquake reports, conference proceedings, seminar notes, educational slide sets, and videotapes. A monthly newsletter is published for members. *Earthquake Spectra*, which is published on a quarterly basis, is intended to serve the informational needs of its diverse audience, specifically as relates to earthquake engineering practice; earthquake code and regulation development; and earthquake public policy formation.

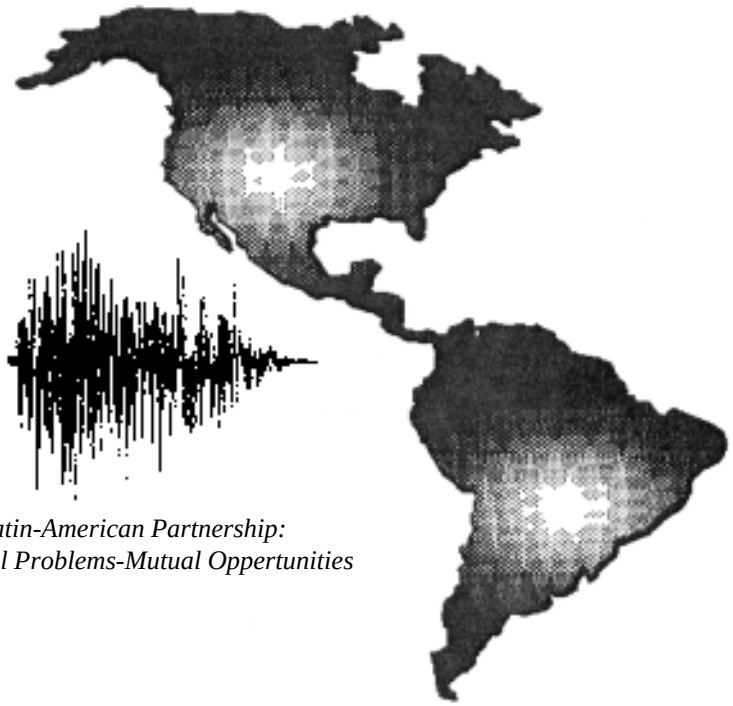
HAZARD REDUCTION AND RECOVERY CENTER (HRRC)

Texas A&M University, College of Architecture, College Station, TX 77843-3137. *Dennis Wenger, Director*, (409) 845-7813; fax: (409) 845-4491.

The HRRC engages in research on hazard mitigation, disaster preparedness, response and recovery in an effort to contribute to the recovery of communities that have been victimized by both natural and technological disasters. Topics of recent research include sheltering, damage assessment, urban search and rescue, the epidemiology of death and injuries, and community preparedness for disasters. The Center distributes research results through various channels, including books, research monographs, reports and articles.

INSURANCE INSTITUTE FOR PROPERTY LOSS REDUCTION

73 Tremont Street, Suite 510, Boston, MA 02108-3910. *Eugene LeComte, President and CEO*, (617) 722-0200; fax: (617) 722-0202.



U.S Latin-American Partnership: Mutual Problems-Mutual Oppertunities

disseminate and diffuse innovative ideas and initiatives. Major areas of focus include Environmental Hazards, Health Care, Public Safety, and Social Issues and Problems. URI provides research services, qualitative evaluation, information dissemination and diffusion, training, and preparation of policy papers.

CREDIT and CREEP: Systems for Information Transfer and Earthquake Preparedness in the Central United States

The Center for Earthquake Research and Information (CERI) and the U.S. Geological Survey are collaborating to institute an electronic database that is provisionally called CREDIT (Central Region Earthquake Data and Information Transfer). Available on Internet or by telephone modem, CREDIT will disseminate scientific information about earthquake hazards within the Central U.S., a focus region of the National Earthquake Hazards Reduction Program. As envisioned, CREDIT will have at least three categories of users: 1) sophisticated users (e.g. engineers and other technical types) and the media; 2) intermediaries, or those with a need to communicate the results of scientific investigations to planners and policy-makers, such as local disaster officials and State geologists; and 3) scientists who require the data produced by publicly funded studies to carry out their own research investigations, who need to communicate to the public, and who will further benefit by the timely exchange of ideas and information. An operational mode of CREDIT, provisionally called CREEP (Central Regional Earthquake Emergency Program), is an effort to coordinate both scientific action and information dissemination to the public, emergency planners, and policy makers during future earthquake emergencies in the region. CREEP will lead to rapid transfer of relevant information in the aftermath of a significant regional earthquake. The relatively low rate of seismicity in the Central U.S. region compared to California highlites the need to obtain the maximum amount of information from events that do occur. In the Central U.S., the seismic hazard is spread among eight or more states, politically complicating earthquake response. For more information on this project, contact Jill Stevens Johnston, Paul Bodin or Eugene S. Schweig at CERI.

One of CUSEC's goals is to promote the application of earthquake hazards research and information in the Central U.S. This section of the *CUSEC Journal* provides a synopsis of current research projects. The second part is a review of useful publications.

CURRENT RESEARCH

Geotechnical Earthquake Hazard Analysis of the Evansville, Indiana Area. *US Geological Survey. Principal Investigators: David Frost, Georgia Institute of Technology; and Don Eggert, Indiana Geological Survey.*

Seismic hazard and risk analyses play a major role in identifying the potential consequences of an earthquake both in relation to existing facilities as well as in the planning and location of new structures. Such analyses must include consideration of several geological and geotechnical hazards and thus of a large number of factors required to describe these hazards. The resulting large databases require an appropriate environment to optimize the evaluation procedures.

Recent advances in computer based Geographic Information Systems (GIS) provide a technology which is ideally suited to fulfill the needs of earthquake hazard analyses. The overall objective of this ongoing research project is to integrate a variety of analytic procedures for identifying and mapping geotechnical hazards and risk through the use of GIS. The work is intended to build on recent efforts initiated by the Indiana Geological Survey, with support from the Department of Fire and Building Services, the City of Evansville, and the State Emergency Management Agency, to study the soils in the Evansville, Indiana area and predict their likely response during seismic activity in the New Madrid Seismic Zone and the Wabash Valley Fault.

Cross-Hazard Mitigation: Residences and Businesses. *Federal Emergency Management Agency. Principal Contact:*

The Institute's Information Center was established in 1989 to serve as the major information resource for IIPLR by developing "information on information." This is accomplished in two ways: 1) the maintenance of a very focused on-site library; and 2) the utilization of technology to identify and access external sources that possess the information sought by the Institute's clients.

Internally, the Information Center contains over 1500 book titles, 122 periodical titles, and 105 videos. Vertical files contain unpublished papers, newspaper clippings, periodical articles, and brochures on a broad range of hazard and insurance related topics. Center services to its membership and others include: a summary of facts and data; a literature compilation; or, a computer search. Most books and videos from the Center's collection may be borrowed.

NATIONAL CENTER FOR EARTHQUAKE ENGINEERING RESEARCH (NCEER)

State University of New York at Buffalo, Red Jacket Quadrangle, Box 610025, Buffalo, NY 14261-0025. *George Lee, Director, Patricia Ann Coty, Manager, Information Services*, (716) 645-3391; fax: (716) 645-3399.

NCEER was established in 1986 at the State University of New York at Buffalo, to coordinate a national research program with the ultimate goal of reducing loss of life and property from earthquakes. In support of this program, NCEER administers and funds basic and applied research at a number of universities and colleges in the United States. The Center also has a program of international collaborative research with organizations in China, Japan and Taiwan. NCEERs activities include the publication of a technical report series and sponsorship of national and international conferences. The Center is also an active participant in the development of building codes and standards, as well as other policy-related activities. Although NCEER focuses primarily on the engineering aspects of earthquake hazards, the Center also explores the socio-economic aspects of earthquakes, earthquake preparedness, catastrophic disaster insurance issues, earthquake education, emergency response, search and rescue, reconstruction, and resettlement. The NCEER Information Service is described in detail in a related article elsewhere in this issue of the CUSEC Journal.

NATURAL HAZARDS RESEARCH AND APPLICATIONS INFORMATION CENTER

University of Colorado, Campus Box 482, Boulder, C0 80309-0482. *Dennis Mileti, Director, David Morton, Librarian*, (303) 492-6818; fax: (303) 492-2151.

The Hazards Center serves as a national clearinghouse for data related to social and economic losses caused by natural and technological disasters, as well as information about methods and programs designed to mitigate those losses. Towards this end, the Center offers several services, including the publication of the ***Natural Hazards Observer*** on a bi-monthly basis, operation of the electronic newsletter, **Disaster Research** which is issued every two weeks via the Internet. In addition, the Center hosts the annual invitational workshop, maintains a hazards library, responds to requests for information from researchers and practitioners, supports small research projects (including "quick response" research following a disaster), and issues a number of new publications each year.

NEW ENGLAND STATES EMERGENCY CONSORTIUM (NESEC)

501 Islington Street, Portsmouth, NH 03801. *Edward Fratto, Executive Director*, (603) 430-9876; fax: (603) 430-9875.

As the first "all-hazards" consortium, NESEC provides a variety of services designed to increase public awareness of the effects of earthquakes, severe weather, and other natural hazards, and measures that can be taken to minimize social and economic losses.

SOUTHERN CALIFORNIA EARTHQUAKE CENTER (SCEC)

University of Southern California, Department of Geological Sciences, University Park, Los Angeles, CA 90089-0740. *Thomas Henyey, Executive Director*, (213) 740-5832; fax: (213) 740-0011.

Established in 1991, SCEC is composed of more than 50 senior researchers whose mission is to promote earthquake hazard mitigation by: defining, through research, when and where future damaging earthquakes will occur in southern California; calculating expected ground motions; and, communicating this information to the public. In addition to funding research, SCEC supports the development and maintenance of an infrastructure, including a seismic network, computer data processing center, and a geographic information system, as well as an education and knowledge transfer program.

URBAN RESEARCH INSTITUTE (URI)

851 South Fourth Avenue, Louisville, KY 40203. *Denise Bryant, Executive Director*, (502) 585-7128; fax: (502) 585-7158.

The Institute collaborates with other organizations to apply collective resources to study, develop, test,

Howard J. Hill, Wiss, Janney, Elstner Associates, Inc., Northbrook, Illinois.

The 1993 Mississippi River Flood drew the nation's attention to flood hazard mitigation opportunities in a region of the country that is also seismically vulnerable. In planning for hazard mitigation, a fundamental question emerged: "What opportunities are there for developing and implementing *cross-hazard mitigation* measures, defined as mitigation techniques that address more than one hazard?"

This research project, funded through FEMA's National Earthquake Technical Assistance Contract (NETAC), examines a wide range of mitigation measures that address floods, earthquakes, and high winds, with the objective of identifying *cross-hazard mitigation techniques* that can be implemented at relatively little cost. The project involved an extensive literature search and a series of interviews with builders and contractors in the flood-prone areas of Missouri and Illinois.

The product of the research is a manual, *Cross-Hazard Mitigation: Residences and Businesses* (August, 1994) that will serve as the basis for training and outreach efforts in the Central U.S. CUSEC will be collaborating with Illinois and Missouri officials to identify appropriate audiences (e.g. insurance underwriters) for the Cross-Hazard Mitigation training.

Cross-Hazard Mitigation: Water Treatment Plants and Electric Power Facilities. *Federal Emergency Management Agency. Principal Contact: Andrew Longinow, Wiss, Janney, Elstner Associates, Inc. (August, 1994).*

A companion to the research project on Residences and Businesses, this research outlines a systematic approach for reviewing the needs of a public utility facility and setting priorities for strengthening (retrofitting) and replacement. Emphasis is placed on cross-hazard techniques, those measures that will reduce vulnerability of utilities to earthquakes, floods, and high winds. Of particular interest is the feasibility of a dual level approach of retrofit and design of structures and equipment to minimize damage, especially in small, rural electric power facilities and water treatment plants.

USEFUL PUBLICATIONS

1994 Northridge Earthquake: Performance of Structures, Lifelines, and Fire Protection Systems (NIST Special Publication 862). *Building and Fire Research Laboratory, National Institute of Standards and Technology (NIST). 1994. 181 pp. Limited copies available from NIST.*

This report is the product of the efforts of a multi-agency team, organized under the auspices of the Interagency Committee on Seismic Safety in Construction and headed by NIST, that documented the effects of the Northridge earthquake on buildings, bridges, lifeline systems, and fire protection systems. Each of these categories of structures was examined in detail by the team. The report contains a thorough description of damages, supplemented by numerous photographs, with a list of suggestions for "improving practice." The final chapter outlines a series of conclusions and recommendations on the performance of buildings, bridges, lifelines and fire protection systems. This document should be on the shelves of those individuals - codes officials, practicing engineers, Federal, State, local officials and others - who have a role and responsibility for promoting the seismic safety of buildings and lifelines.

Practical Lessons from the Loma Prieta Earthquake. *Report from a Symposium Sponsored by the Geotechnical Board and the Board on Natural Disasters of the National Research Council. Washington, D.C.: National Academy Press. 1994. 273 pages.*

These proceedings consist of six keynote papers presented at major sessions of the Symposium on Practical Lessons from the Loma Prieta Earthquake, which took place in San Francisco on March 22-23, 1993. The six keynote sessions addressed Geotechnical, Buildings, Emergency Preparedness and Response, Lifelines, Highway Bridges, and Recovery, Mitigation, and Planning. An Overview chapter is provided by the NRC committee that contains forty principal lessons and recommendations drawn from the presentations that were made and subsequent discussions. An insightful chapter is contributed by T. Thomas Tobin, California Seismic Safety Commission, entitled, *Legacy of the Loma Prieta Earthquake: Challenges to Other Communities*, which concludes that: 1) There is a growing gap between what is used between experts and practitioners; 2) NEHRP should be changed to emphasize implementation, incentives, and actions that reduce and manage risk; and 3) Disaster aid programs and our responses to damage need to accomodate irreversible changes and provide flexibility.

Putting Mitigation Policies to Work: 1994 CUSEC Annual Meeting

Mitigation will be the theme of CUSEC's 1994 Annual Meeting to be held at the Holiday Inn Crowne Plaza in Memphis, November 30–December 1, 1994.

A diverse audience from across the country will convene for a two day, interactive conference that will address the problems, issues, challenges and opportunities associated with reducing the effects of earthquakes and other hazards on our communities.

Annual Meeting topics include:

* *Report on FEMA's Town Meeting Series - Findings and Conclusions;*
* *Role of Consortia in Natural Hazard Risk Reduction;*
* *The Building Code Effectiveness Grading Schedule: A Major Tool for Promoting Building Code Adoption and Enforcement in the U.S.;*
* *Pre-Disaster Versus Post-Disaster Mitigation Programs: Achieving a Balance in Funding Mitigation Measures;*
* *Hazard Mitigation Enterprise Zones: What Are They? Will They Work?*
* *The U.S.-Latin American Partnership: Prospects for Meaningful Inter-American Collaboration, and*
* *Mitigation in 1994 - State-of-the-Art Versus State-of-the-Practice: How Do We Narrow the Gap?*

For more information on the Annual Meeting, including registration materials, please contact CUSEC.

CUSEC LAUNCHES WORKSHOP SERIES FOR ELECTRIC UTILITIES

Electric power utilities are highly vulnerable to the effects of groundshaking and liquefaction. With no warning, hundreds of communities in the New Madrid Seismic Zone could be left without power. The economic and social disruption could be unprecedented. Yet, the good news is that the consequences of earthquake damages to electric power utilities can be anticipated; steps can be taken *before the disaster* to minimize losses and expedite response and recovery.

With this premise, the U.S. Department of Energy has entered into agreement with CUSEC to organize and conduct a series of five workshops for electric utility officials. The objective is straightforward - to provide electric utility managers with the knowledge and tools to reduce the vulnerability of their facilities and systems to earthquakes.

An interdisciplinary team of engineers and seismologists from Pacific Gas and Electric, Tennessee Valley Authority, Southern California Edison, and Tennessee Valley Public Power Association has developed the workshop series, which is guided by four strategic objectives:

1. To raise the awareness of electric utility operations and management personnel about the seismic vulnerabilities of their systems, and what can be practically accomplished to manage the potential effects of earthquakes.
2. To apply state-of-the-art tools and technologies in reducing earthquake risk, while recognizing that the state-of-the-art will continue to change and that utilities must keep up with the changes.
3. To develop and implement a comprehensive, practical, and credible seismic safety program, appropriately structured for each utility, that fits company policies and business realities.
4. To form a working partnership of utilities in the region who have learned ways to share experience and expertise to their mutual benefit in addressing earthquake issues.

The first workshop was held in Nashville on August 8 to 10, and brought together senior electric utility engineers from the CUSEC states and five Latin American countries. Following is a synopsis of key topics and issues that were addressed.

Earthquake Effects on Electric Utility Systems

Electric utility systems are complex, highly integrated networks, and their disruption has a high potential economic impact. In the Central U.S., the vulnerability of electric utilities is compounded by several factors, including: 1) the relative lack of seismic performance criteria in the design and construction of utility systems; 2) the regional, multi-state impact of a New Madrid earthquake, which will impede emergency response and system restoration efforts; and 3) the dependence of other lifelines on the availability of electric power - notably water supply. These and other factors need to be addressed in establishing system performance standards and determining acceptable levels of disruption.

The following conclusions can be drawn from past earthquake damage to electric utility systems:

* Substation components are the most vulnerable components in electric utility systems, and damage to these components generally has been the controlling factor in the length of outages.
* Damage is more predominant in high voltages.
* Adequately anchored and braced lower voltage components (115kV and less) will, in general, suffer little damage.
* Adequately achored and braced equipment in substation control buildings will, in general suffer little damage.
* Transmission towers are very rugged from a structural standpoint, but are susceptible to damages to foundations as a result of groundshaking.
* Liquefaction ("quick sand" effect) is a potentially serious problem for electric utility systems in the Central U.S. Liquefaction is common in floodplains, where many components of an electric utility system are located.

Preparing for Future Earthquakes

A fundamental issue in the workshop series is *how to integrate risk reduction practices into on-going utility policies and programs.* This is difficult in a competitive business environment, in a region that experiences few damaging earthquakes. Furthermore, each utility is different. Customer needs are different, as are abilities to accomodate power service disruption. Against this backdrop, an eight step technological methodology was offered, in two stages.

Scenario Earthquake Analysis

Step 1: Select scenario earthquakes and evaluate their associated hazards, such as ground shaking, liquefaction, and landsliding.

Step 2: Evaluate the expected performance of equipment and facilities when subjected to various levels of ground shaking or other earthquake hazards.

Step 3: Assess the expected consequences of each scenario earthquake in terms of the operability of the utility system and inter-tied systems.

Step 4: Analyze the return-to-service time line based on the expected level of damage and system operability.

Vulnerability Reduction Program

Step 5: Compare the evaluated performance in each scenario earthquake with the desired performance level; note that some damage should be acceptable, provided it does not excessively delay the restoration of customer service.

Step 6: Evaluate the damage mitigation and disruption mitigation alternatives, considering short-term as well as long-term alternatives. Note that emergency response is one of the most important mitigation alternatives.

Step 7: Using cost-benefit analysis and other measures, establish priorities for earthquake mitigation.

Step 8: Implement the mitigation measures in a prioritized, long-term program.

Future workshops will explore each of these steps in detail. Emphasis will be given to: 1) providing technical training to utility personnel to allow them to develop a strategy that is tailored to the needs and capabilities of their utility; and 2) developing a "technical support system or referral network" that will provide on-going technical advice and support to the utility representatives as they develop their own seismic safety program.

Latin American Delegation Participates in Workshop

A unique feature of the electric power workshops is the participation of experienced engineers and utility managers from Latin America. Through the technical agreement beween CUSEC and the Organization of American States (OAS), a team of engineers was assembled, representing: Colombia, Costa Rica, Ecuador, Chile, and Venezuela. Joining the Latin delegation from the OAS was Steve Bender, Project Chief, Natural Hazards Project, and Wayne Parks, Energy Advisor.

The Latin participants enriched the workshops. For starters, their region of the world is among the most seismically active, anywhere. Each representative had practical, hands-on experience in earthquake risk reduction and post-disaster recovery. This experience added an important element to the chemistry of the group, and reinforced the importance of inter-American collaboration on a technical and professional basis.

CUSEC IN TRANSITION

With the departure of **Lacy Suiter** to FEMA, the CUSEC Board of Directors has elected a new chairman, **James E. Maher**, of Mississippi. Joining Jim on the CUSEC Board are two new members: **John White**, director of the Tennessee Emergency Management Agency, a "seasoned" emergency manager with over twenty years of experience with TEMA, most recently as Assistant Director. From Indiana, CUSEC welcomes **Melvin J. Carraway**, who has taken over as the state's new emergency management director, replacing Jerry Hauer. Mel left the Indiana State Police, where he served as commander of the Enforcement Division, to become the director of the State Emergency Management Agency and the Department of Fire and Building Services. Back in Memphis, the CUSEC staff welcomes its newest member, **Gwen Nixon**, Accounting Specialist.

The CUSEC staff and newly constituted Board of Directors will all get together in Gatlinburg, Tennessee this fall for a three day retreat to review policies, programs, priorities, and strategies for 1995 and beyond.

CUSEC TO CO-SPONSOR NDMS CONFERENCE

CUSEC will be co-sponsoring the National Disaster Medical System (NDMS) national conference, March 12-16, 1995 at the Holiday Inn Crowne Plaza in Nashville. This conference will bring leaders in public health emergency response and disaster medicine together to present the latest information and techniques in responding to disasters. Next year's conference will center around a New Madrid Seismic Zone earthquake response theme. The conference will have five workshop tracks presented: Emergency Health and Medical Planning; Health Care Facilities; Disaster Medical Assistance Teams (DMATs); Information Technology; and Disaster Medicine. The conference is accredited for phsysicians, nurses, EMT/paramedics, and other health care professionals. There will be pre-conference training programs available on March 11, 1995. Please contact **Rick Roman,** CDC liaison, for additional conference and registration information at (800) 824-5817 outside Tennessee or (800) 762-4313 inside Tennessee.

CONFERENCES AND TRAINING

EVENT	DATE	LOCATION
* Electric Power Utility Course	Nov. 9–10	Louisville, KY
* CUSEC Annual Meeting	Nov. 30–Dec. 1	Memphis, TN
* Seismic Safety for School Buildings (Missouri Emergency Management Agency)	Dec. 13	Cape Girardeau, MO
Northridge EQ One year later	Jan. 17–20	Los Angeles, CA
* U.S. Natural Hazards Symposium (Earth Resources Association)	Feb. 8–9, 1995	Washington, DC
* National Disaster Medical System National Conference	Mar. 12–16, 1995	Nashville, TN
* Fourth U.S. Conference on Lifeline Earthquake Engineering (Technical Council on Lifeline Earthquake Engineering)	Aug. 10–12, 1995	San Francisco, CA

For more information on training please contact CUSEC Headquarters or the Earthquake Program Manager with your State Emergency Management Agency.

The **Central United States Earthquake Consortium** is a not-for-profit corporation established as a partnership with the Federal government and the seven member states: Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri and Tennessee; and eight associate member states: Alabama, Georgia, Louisiana, South Carolina, North Carolina, Ohio, Oklahoma and Nebraska. The Federal Emergency Management Agency provides the basic funding for the organization.

CUSEC's purpose is to help reduce deaths, injuries, damage to property and economic losses resulting from earthquakes occurring in the central United States. Basic program goals include: improving public awareness and education, mitigating the effects of earthquakes, coordinating multi-state planning for preparedness, response and recovery; and encouraging research in all aspects of earthquake hazard reduction. CUSEC supports the International Decade for Natural Disaster Reduction.

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