

# Using cyberspace to enhance disaster mitigation, planning and response: opportunities and limitations

**M**uch has been learned about effective mitigation, planning and response to disaster during the past forty years. Those who develop mitigation strategies, plan for and respond to disasters, have learned through first hand experience, through trial-and-error, and through the application of insights gained from various training activities. The source of much of the knowledge has been those in academia who study behavioural and organisational response to disaster. The pioneering work of researchers such as Samuel Prince, Charles Fritz, Allen Barton, E.L. Quarantelli and Russell Dynes has given witness to the proliferation of such research throughout the world. This proliferation is exemplified by the work of Neil Britton, Wolf Dombrowsky, Thomas Drabek, Gary Krepps, Dennis Mileti, David Neal, Joanne Nigg, Walter Peacock, Uriel Rosenthal, Robert Stallings, and Kathleen Tierney. During the last forty years, in particular, we have observed the development of a ever larger body of knowledge which has been shared among disaster researchers through various journals which have emerged during this time period. The International Sociological Association's International Research Committee on Disasters (RC39) has served as a networking link for disaster researchers from around the world. Various international conferences are now regularly held to facilitate the sharing of research findings and practitioner concerns. Research centres with international reputations periodically offer workshops for the same purpose. National government emergency management organisations have created strategies for facilitating the development of emergency management training degree programs at universities (for example, in the USA there is the Federal Emergency Management Agency Higher Education Project).

## Challenge

Despite the wealth of knowledge and experience gained in recent decades, a here-to-fore insurmountable challenge

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Based on the author's presentation at the  
meeting of the International Sociological  
Association in Montreal, July 1998

has been in trying to develop a more effective strategy for researchers and practitioners to share the insights they have gained. Few researchers and practitioners are able to garner the resources necessary to participate in conferences. Often the same cadre of specialists are interacting with one another at such national and international events. How might the educational process be more effectively facilitated to potentially involve all of us? How might we develop a process, which might also enable practitioners to interact with one another and with researchers during emergency time periods to employ the knowledge and experience of others at a critically useful time? The purpose of the current paper is to offer a few suggestions in answer to these questions and to raise a few important issues, which may be useful to keep in mind pursuant to implementing answers to these questions.

## Implications of the information technology

Recent technological advances have resulted in a communications explosion and a levelling of information hierarchies (Burstein & Kline 1995, Davis & Botkin 1994). The revolution that these emerging technologies have created is transforming how we work, live, communicate and learn (Drucker 1993, Gates 1995, Jones 1995). Workers can communicate with the company CEO by email without having to traverse the chain of command. Students are able to access a wealth of information on-line as well as communicate directly with professors at any institution in the world. Any citizen who has access to a computer connected to the Internet can quite easily access holdings of libraries around the world, publications lists at

university research centers, academic articles as well as 'how to' fact sheets outlining how to prepare for and respond to hurricanes (and other disaster agents), and explanations on how hurricanes form—complete with pictures, sound, and video vignettes. Disaster victims have the potential to directly access their national emergency response organisations to complete on-line applications for assistance e.g. in the USA citizens can access the FEMA web site.

## What new technologies?

The information technologies to be currently addressed include CD-ROM, email, web sites and distance learning through web-based university courses. Each of these provide options for enhancing mitigation, planning, response through the use of cyberspace. Each of these technologies also has its limitations. We will first review each of these technologies, and then we will examine illustrative applications for mitigation, planning and response. Finally, we will consider several issues, which one may be wise to keep in mind when pursuing the use of cyberspace to fill to information dissemination void previously noted.

## CD-ROM

The CD-ROM was introduced in 1981, primarily to store high-quality, digitised music (Goldberg 1996). Two companies gave birth to the CD, Sony and Philips (Fischer 1998a). Both saw much greater use for the product. Even without compression a CD can hold up to 650 megabytes of digital data of any kind. CD-ROM drives are now in widespread use among computer users. Libraries could store the equivalent of 250,000 pages of text on a single disc. Companies could store records for an entire year on one disc. A disc for CD-ROM use can be duplicated, depending on volume, for less than a dollar. CD-ROM is also easy to distribute via bookstores, record stores, software stores, mail-order houses, and so forth. And, CD-ROM already has a large user base—over 17 million (for example see Goldberg 1996), and growing rapidly. Desktop, as well as laptop,

computers now being sold usually contain a CD-ROM drive. This feature ensures a sizeable target audience for CD-ROM content. Multimedia materials on CD-ROM continue to flow into the marketplace at an exponential rate. *Encarta* (1997) serves as one early example of how not only text, but also pictures and video can be interactively accessed through the use of CD-ROM.

### Email

Electronic mail, for those who are not familiar with it, is a means by which individuals can communicate with one another by electronically mailing text through cyberspace. Their personal communication is stored in the host computer. Through using email software one individual can correspond with another anywhere on the net. Email addresses are proliferating daily as the rush to connect continues. Connectivity for email is currently most often achieved through desk or laptop computers, modems and telephone access to a commercial service or through one's place of employment. Email is currently most used for personal and business correspondence.

### Web sites

We are only a few steps down a road that promises to lead to readily accessible information and real time communication (Gates 1995). Hundreds, perhaps thousands, of new home pages appear on the World Wide Web daily (Kidder and Harris 1997). This medium is currently proliferated by businesses with an entrepreneurial orientation, government and service agencies, and universities. For those not yet familiar with the web, it is a network of computers with the ability to communicate through the use of software such as 'search engines' or 'browsers'. Information files are stored on host computers. The browsers are used to locate specific cyberspace addresses or to search for all locations with a similar name. The websites are the stored files in the various linked computers, which contain the information accessible through the browsers.

### Distance learning through web courses

'Distance learning' simply refers to the concept that the instructor is in one location while the students are in another—and each student may be in a different location from one another. It is presently often characterised as that which occurs through satellite linkage rather than connectivity through cyberspace. The instructor or trainer is viewed

by trainees at diverse geographical locations throughout a nation or around the world via televised, often closed circuit, broadcasts. With continued proliferation of the new technologies, we will undoubtedly find more learning, training, and conferencing conducted by these means. When the technology is more universally adopted, then resources (time and travel funds) may be saved when the principals do not have to physically relocate in order to meet for instruction.

Distance learning can also be characterised as instruction occurring via connectivity through cyberspace. In this instance the trainee is able to access web sites, digitised video and audio presentations, instructional chat rooms, and communicate via email or digitised video and audio. In the future such distance learning will use the CD-ROM, Web sites, and digitised video far more than it does as of this writing. Early uses of these technologies include the medical practitioner who, while at a location distant from his patient, is interactively providing diagnostic information during real time. Increasingly courses are being developed which students or trainees enrol for and complete through cyberspace. These Web courses (e.g. Fischer 1998b) provide the opportunity for the student to proceed at his or her own pace, to enter the cyberspace classroom at the time and day of his or her choosing, and to increase his or her active participation in the course and with the instructor. Web courses are beginning to include the following in their cyberspace classroom: text material, lecture notes, video vignettes in which the instructor provides instructional snippets (video and audio), links to other materials and sites, links to tutorials, class chat rooms, on-line synchronous and asynchronous interaction with the instructor.

### Examples of applications to enhance mitigation, planning and response

Multimedia CD-ROM, email, Internet web sites, and web courses all comprise a continually emerging array of the new information technologies which are being applied to education and emergency personnel training activities. Most applications to date have been in other fields of endeavour. Market driven, applications in the USA have been aimed at the primary and secondary education markets. How they are *currently* being applied to disaster research, training, and education and how they *may* be applied in the *future* will be addressed.

### CD-ROM

Products currently available are those designed as classroom teaching aids. Multimedia products currently marketed employ CD-ROM technology to provide users with encyclopedic information including text, pictures, audio, and video vignettes. *Encarta* enables the user to access the topic of his or her choice for a multimedia learning experience e.g. how a hurricane forms. The Federal Emergency Management Agency (FEMA) has produced, under contract with Sytel, Inc., field training course materials on CD-ROM which herald the entry of FEMA into the usage of this technology pursuant to enhancing disaster mitigation, planning, response and recovery. There is a paucity of multimedia materials suitable for disaster training or planning purposes are, as of this writing. There is definitely a market vacuum waiting to be filled. If we look into our crystal ball, one can envision state-of-the-art training materials being produced by well-trained, highly skilled teams of curriculum developers for use not only in traditional classrooms of current and future emergency management personnel, but also for use via cyberspace courses. Instructional materials could include dynamic, interactive approaches to disseminating information and providing training in areas such as principles of emergency management, building a disaster resistant community, a survey of natural disaster agents and hazardous materials. The use of such CD-ROM based materials may provide for greater student-centered learning which is highly engaging and interactive. This technology has the potential to move the trainee from passive receptacle to active learner. Since a tremendous amount of text-based, video, and audio information can be stored on such a disc, the potential for an emergency management workforce which is highly trained and very knowledgeable is great.

### Email

An inexpensive, easy, and fast way of communicating between friends, acquaintances, and co-workers, email has proliferated to the point where hundreds, perhaps thousands of new users enter the information highway daily. Disaster researchers primarily use it to interact with one another as well as with practitioners and government agencies. Some emergency management professionals communicate with one another by email during normal time to exchange personal and professional information. They are also increasingly likely to communicate

with disaster researchers. This use of email helps to break down boundaries and hierarchies. One goal of the Natural Hazard Centre's (University of Colorado, Boulder) annual workshop is to facilitate practitioner-researcher interaction—cyberspace interaction eliminates the restrictions of time and place and facilitates ongoing communication throughout the year. Anecdotal information, however, suggests this form of practitioner-researcher (and researcher-practitioner) communication is in the early stages adoption. Its potential is far from being realised. In the future, researchers are likely to regularly invite practitioner input (through email) on research questions the practitioners would like answered. Conversely, practitioners are likely to use email to seek public policy advice from researchers. Email will likely be incorporated, far more than it is now, in the education and training of emergency management personnel (we will return to this theme later when we consider the use of web courses for educating and training emergency managers). Disaster chat rooms (addressing mitigation, planning, response, recovery issues) can be expected to be used more widely, not only for normal time education and training activities but also for consultation during disaster time periods. Direct email consultation during normal and emergency time periods, with one or several specialists, will likely become increasingly common (for additional examples please see Anderson 1995, Birkerts 1994, Botterell 1996, Butler 1994 & 1995, Gant 1996).

### Web sites

A cursory survey of current disaster-related web sites in the academy, government agencies, emergency organisations and businesses suggests that we are in the very early stages of applying *this* technology as well. While variation is observed in the scope and detail found at such sites, they basically appear to have the same goals. Academic sites usually identify personnel, outline current research projects, provide on-line literature search capability, provide mission statements, offer publications lists, and link to other sites. Some also provide miscellaneous information including student opportunities at their research centers, career opportunities in emergency management, alumni accomplishments and so forth.

Disaster relevant government agencies and organisations tend to provide on-line assistance through email capability as well as on-line assistance application forms.

They also often supply mitigation, preparedness, response and recovery information. Some of this information is quite detailed and specific. For example, information can be found on how to prepare one's home for a hurricane or flood. Specifics are even provided down to the level of addressing plumbing needs, complete with a diagram to help the homeowner. Virtually all sites have been created by international or national emergency organisations. Several states have developed such an opportunity. The opportunity also exists for local emergency management organisations to do the same—tailoring the provided information to the needs of their community.

A plethora of increasingly sophisticated Web sites will undoubtedly emerge in the future which will incorporate the use of multimedia materials and email (including chat rooms) in the dissemination of basic knowledge about disaster agents, mitigation needs as well as response and recovery procedures. Linkage with other sites will undoubtedly increase dramatically resulting in an intricate network of educational and training materials produced by the *best* among us for ready access by *any* of us. The ability to build a disaster resistant community should be enhanced in the process.

### Web-based university courses

Distance learning is currently characterised primarily by teleconferencing or satellite connectivity. Future distance learning will encompass much more. Web courses are being designed that will enable emergency management personnel to complete courses, or other types of training, without the necessity of attending class during a certain time period each week for a semester. Web courses will instead provide the opportunity for one to complete the educational experience through cyberspace. The web student is able to access the curriculum materials at his or her leisure, anytime of any day, progress at his or her own rate, and is actively involved in the learning process—not a passive vessel into which information is poured.

Once enrolled, the cyber-student is able to access the secured web course site. What is found there? The cyber-student is welcomed and usually finds a detailed course syllabus. The learning objectives and agenda for each cyber-class are normally encountered next. The required text materials may be found in some combination on-line, in hard copy, via CD-ROM, or through links with other

sites. Sometimes tutorials are also available as well as instructional video and audio digitised vignettes. Interactive, computer corrected quizzes provide rapid feedback. Course chat rooms are often available to provide a cyber-classroom for students to interact with others also in the cyber-course. On-line office hours are posted by the professor enabling the student to interact with their course instructor.

One illustration of this cyberspace approach is the Emergency Management Certificate Program currently under development at various universities. For example, Millersville University of Pennsylvania (USA) is currently pursuing the possibility of developing five multi-disciplinary web-based courses: Sociology of Disaster, Natural Hazards, Hazardous Materials, Issues in Geographic Planning, and Principles of Emergency Management. University credit would be earned as the cyber-student completes each course. An Emergency Management Certificate would be awarded upon completion of the five-course program. Both the university credits and the certificate would be useful to emergency managers in the USA when making application for Certified Emergency Manager status (obtained through application to the International Association of Emergency Managers). Cyberspace holds the potential for facilitating the dispersion of the accumulated knowledge base to all those who access such programs from anywhere in the world.

The new information technologies have the potential to assist emergency management in any number of ways. For example, emergency time consultation could be provided by appropriate university or government personnel as well as those who offer themselves as consultants. Such individuals can be listed and accessed through web sites, rendering them accessible 24-hours-a-day through email, fax, page, or telephone. A rumour control web site and a community advisor could participate in an emergency time chat room for and or respond to email. In addition, information could be provided through cyberspace which provides an all-hazards check list of what the emerging EOC should consider during pre-impact, impact, post-impact periods. *Encarta*-style information sites could be provided which take advantage of multimedia options including pictures, video, animation and sound. 'Students' of any age, grade, or location could access such via search engines whether it be for emergency time



use, normal time education or personal growth.

### Limitations: a few issues to consider

While the information revolution appears to offer a means to redressing earlier limitations in disseminating disaster mitigation, planning and response information, there are problems inherent to the process. Quarantelli (1997: 96–104) has insightfully identified ten issues, which may be problematic with the advent of these new technologies:

- the probability that the ‘rich will become richer’ in dealing with disasters;
- the possibility that technology that is a ‘means’ will be turned into an ‘end’ in itself;
- the inevitable information overload problem;
- the loss of, or outdated, information;
- the greater likelihood of the diffusion of inappropriate disaster relevant information;
- the implications of even further diminution of non-verbal communication;
- intra- and inter-level group communication will be made even more difficult;
- the negative consequences of the probable acceleration of fads and fashions associated with computers;
- the kinds of general social infrastructures and cultures necessary for the adequate functioning of disaster-relevant technology;
- the certainty of computer system-related disasters.

### Will the poor be further disadvantaged?

While the price of computer hardware and software continues a downward trend, the ability to obtain the latest in the new technology is heavily skewed toward those who have the financial resources to make the continual race toward the cutting edge. Those who comprise the lower socio-economic levels within wealthy nations as well as perhaps the majority of citizens in poorer nations are likely to find themselves falling farther and farther behind in the information based global economy i.e. the rich become richer syndrome. The probable outcome of such a scenario is the further solidifying of current world order, rather than the attainment of levelled hierarchies and a greater sharing of resources.

### Will technology be an ‘end’ rather than a ‘mean’?

How many of us have experienced some version of the following? Our office computer becomes increasingly over-

burdened with ever greater volumes of increasingly sophisticated software . . . so much so the memory size must be increased. The cycle continues and the machine must be replaced. If we think about it, most of the software is not even used and most of that which is used has so many functions that are never really used—only to upgrade with greater capacity for non-use. The point? Some of us need massive computer capacity while others need much less. Is having an ever-increasing capability the means to greater productivity or an end in itself—an end pursued primarily to enhance prestige? If so, the process does not help alleviate the problem of the rich getting richer.

### What about information overload?

With the help of any Internet search engine, a practitioner or researcher can gain access to a fair amount of information on, for example, disaster mitigation. In fact, if we conduct such a search today the result may be 45,000 hits! Even if all the located items proved valuable to the searcher—a big if, that is just too much information to digest. Perhaps the Internet is so effective at locating every possible related item on the net that the information consumer actually becomes *less* efficient as a result. The situation is not likely to get better any time soon as every day brings another explosion of more and more web sites.

### Some information will quickly become outdated, others lost

While journal articles and academic books take on a life of their own after publication by remaining on microfilm and in the library stacks for years to come, the information consumer is easily able to determine which these items is outdated. The efficacy of the information available on the Internet is not as readily discernible. Furthermore, anecdotal evidence suggests that many web sites appear only to quickly become obsolete when the site webmaster fails to update the site in a timely manner. Alternately, sites often disappear from the web resulting in the loss of a valuable resource.

### The problem of diffusing inappropriate information

Not all web sources are created equally. The inherent advantage of democratisation provided by the Internet through the levelling of hierarchies also creates at least one unintended consequence. Those who are truly expert may appear equal to those who have no background in the field. An information consumer unfamiliar with the literature would have

no way of distilling one from the other. The outcome? Information may be incorporated into public policy, which leads to ineffective or inappropriate disaster mitigation or response activities. One purpose of bureaucratic hierarchy is provide checks and balances. While the Internet provides the user with quick access to greater volumes of information, a greater burden is placed upon the consumer of such information.

### The limitations of non-verbal communication

Instant, worldwide communication via email and web site access contributes to a more rapid dissemination of needed information. Anecdotal information again suggests email interaction often results in *miscommunication*. When the non-verbal communication clues are lacking, it is more difficult to ascertain the intended meaning. A friendly joke can more easily be misconstrued as sarcasm resulting in a damaged relationship. Some find it easier to be informal and speak more freely via email. Sometimes it would be better to let such thoughts go unsaid.

### Group communications

The problematic aspects of the diminution of non-verbal communication observed between individuals can only be further exacerbated when we multiply their impact in intra- and inter-group communication. The potential is great for an acceleration of misinformation, miscuing, and misinterpretation.

### Fads and fashions

Those of us who author textbooks which encompass a particular version of software, (e.g. Fischer 1996) soon discover *at least* one new version of the software has been released by the time the book is published. Since most textbook publishers would like a three-year run, imagine how far behind such a text becomes by that third year. Computer hardware and software fads move very quickly and are sometimes humorous to observe. The laptop is a wonderful way to write and communicate when away from the home office. It can be humorous to observe all the ‘techno geeks’ in airports, hotel lobbies and beaches checking into the home office. Is productivity enhanced? Often. Is this a fad that brings some of the earlier mentioned electronic prestige? Probably. The use of Power Point in presentations is another example. An emerging pattern is discernible. The computer trendsetter in the organisation makes a Power Point presentation. What happens? Two things: underlings emulate, and the product is

over used sometimes complicating the communication process that it was intended to enhance. For example, some essentially abuse the audio options involving the bells and whistles.

### Computer system failure as a new disaster

Our increased dependence upon computer technology in our individual, group, societal, and global lives sets the stage for a potential new form of disaster: that which may occur with a massive computer system failure. Akin to the blackouts experienced in several urban areas in the United States in recent decades, a massive computer system failure could result in a loss of information on such a scale that serious economic disruptions may result. What mitigation strategies should we employ? How should we prepare to respond to and recover from such an event? To what extent has an infrastructure been developed to address this eventuality?

### Social infrastructure and culture

Sociologically speaking, it is the social structure and culture of a group that guide's behaviour and helps meet human needs. If we apply the sociological perspective to the information highway what do we observe? Throughout human history, technological advances have often out-paced human ability to socially absorb and effectively incorporate new technologies. The problematic aspects of the new information technologies discussed above are arguably the direct result of these technologies outpacing our development of the emerging social structure and culture needed to guide us. We will develop an infrastructure and a guiding culture. The question at this juncture is to what extent will they be dysfunctional, rather than functional, in our individual, societal, and global needs? Quarantelli (1997) admonishes us to proceed with care. In his view 'if we do a good job, the actual future will be different from the [problematic] future'. Current and future uses of the new information technologies may provide great assistance in addressing the information-sharing void, they will not, however, be the panacea that some envision.

### Concluding comments

The new information technologies will, no doubt, be *more* effectively used in the future. The current generation of web sites only hint at their potential. For example, emergency time consultation could be provided by appropriate university or government personnel as well as those who

hire themselves out as consultants. Web sites could list such individuals, along with their email addresses and telephone numbers at which they could be paged 24-hours-a-day. In addition, information could be provided in cyberspace which provides an all-hazards check list of what the emerging EOC should consider during pre-impact, impact, post-impact periods. *Encarta* style information sites could be provided which take advantage of multimedia options including pictures, video, animation and sound. 'Students' of any age, grade, or location could access such via search engines whether it be for emergency time information or normal time education or personal growth—which at the very least has, once again, the potential for contributing to the knowledge base of the larger community and the expected resulting benefits for mitigation, planning and response.

While all of these ideas, both those currently employed as well as those in our future, may actually contribute to information overload, one of Quarantelli's concerns, strategies such as email mentoring will help to educate many as to appropriate sources to turn to for such information. The danger will, of course, be that inaccurate and outdated information *will*, as Quarantelli fears, exist on the net. Of course, these problems have already existed before the advent of these new technologies, though their dissemination was usually not as readily widespread. Our new technologies will still be used by humans—with all their limitations. These problems will continue even in cyberspace (on a brighter note, at least for academics, the continuation, even exacerbation of such problems further justifies the need for those in the academy).

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