TOWARDS AN ALL-HAZARD, ALL-SOURCE, WORLDWIDE DISASTER INFORMATION NETWORK; SURVIVING AN IMPACT

Richard H. Davies*
Western Disaster Center
Moffett Federal Airfield, CA

ABSTRACT

This paper will discuss some of the disaster management issues related to surviving an earth impact of a moderately sized asteroid. In this, the era of the Internet, it is taken for granted that the disaster management community has access to all the data and information they need or desire to perform their mission of mitigation, preparation, response and recovery from natural, environmental and man-made disasters. Unfortunately this is not this case. Even in the United States, the most connected country in the world, the disaster management community is fragmented and not interconnected. Worldwide the situation is even more chaotic. Actionable information following a disaster, especially a mega-disaster such as a Tunguska-class event in a populated area, would be needed to assess damage and loss of life and to coordinate response and recovery activities. An all-hazard, all-source worldwide disaster information network is needed to support this important mission.

Major disasters have a “half-life” of only a few years in our memories and more important in congressional budget cycles. In the mid 1990’s, following a series of costly U.S. disasters including Hurricane Andrew and the Northridge Earthquake a Disaster Information Task Force (DITF) was organized to address if a worldwide disaster information network was needed and how it could be implemented. Because of lack of follow-through, administration changes, a lull in major natural disasters and now an emphasis on addressing the near-term terrorism threat, the recommendations of the DITF to move forward and to form a worldwide disaster information network have gone unheeded while the need and ability to implement an effective disaster information network have continued to evolve.

Addressing a worldwide mega-disaster threat, like that of an earth impact, might be one way to reinvigorate this initiative. One recommended starting point would be to levy a requirement on the evolving U.S. Space Based Infrared System (SBIRS) to openly share near-real-time reporting of bolide events and to develop procedures for reporting on actual impacts. This capability could leverage and build on the capabilities of the National Reconnaissance Office [*]Hazard Support System, a successful demonstration program that used ballistic missile warning satellites, civil weather and environmental satellites and other sensors to continuously monitor the United States and its territories to detect wildland fires and the entire globe for volcanic activity. Utilizing the capabilities of SBIRS and integrating the resources of other nations to establish a worldwide bolide tracking and reporting network would be a dramatic step towards establishing a true all-source, all-hazard worldwide disaster information network.

WHAT IS A DISASTER?

We have all seen the car bumper sticker that makes the observation “S#%T HAPPENS”. This pretty much defines a disaster. The scope of a disaster depends on how many people it affects. If your house burns down that is a disaster for your family. If your neighborhood burns down then it becomes a disaster for your city or county. When multiple neighborhoods burn down or are destroyed in an earthquake it becomes a disaster for the nation.

By and large disasters cannot be prevented from happening since by definition they are unplanned events; unplanned but not necessarily unexpected. In the U.S. disaster management community the disaster management process is divided into four distinct categories:

- Mitigation
- Preparation
- Response
- Recovery

Mitigation is by far the most confusing process. In the U.S., mitigation is considered a process to “reduce the effects” of a disaster not to prevent the disaster. Preventing houses from being built in a known flood plane is considered mitigation not prevention. Internationally it is not uncommon to have five disaster management categories with the mitigation phase expanded to include prevention, but this is not the practice in the U.S.

A potential planetary impact is one of the few situations where there might be a possibility for real

[*] Executive Director

prevention but it is an academic exercise to argue if the diversion of a potential impact is mitigation or prevention.

This paper will address some of the disaster management issues related to what would happen after the impact of small to moderate sized asteroid, something like that which caused the Arizona Meteor Crater or the Tunguska Event.

MEGA DISASTERS

Most disasters only affect a relatively small region of the earth. Even the largest of the great earthquakes rarely exceed regional boundaries and only the largest of hurricanes or typhoons result in severe damage in more than one region of the world. However there are some disasters that in the past have or could in the future affect large regions of the earth. These are mega disasters", and include:

- "Super" Volcanoes
- "Mega" Tsunamis
- Large Scale Methane Hydrate Release
- Contagious Pandemic
- Asteroid/Comet Impact
- Nuclear War

Except for the possibility of a Contagious Pandemic or Nuclear War, the disaster management community has done little to address the possibility of a Mega Disaster. During the Cold War a surprisingly large percentage of FEMA's budget was devoted to the continuity of government after a nuclear war. In this era of terrorism, SARS and the bird flu there is growing consideration of the possibility of a Contagious Pandemic and organizations like the World Health Organization are continually monitoring the possibility of a pandemic.

In terms of natural hazards the Super Volcano seems to have the most in common with a moderate sized asteroid impact. Naturally occurring Mega Tsunamis continue to be somewhat controversial as does the likelihood of a truly catastrophic Methane Hydrate Release.

The Toba Super Volcano eruption in Indonesia, a relatively recent event in geologic time (about 75,000 years ago), exceeded by a few orders of magnitude the energy released by the Tunguska event. Tunguska and the Arizona Meteor Crater impacts are similar in scope to much less violent Mount St. Helens explosive eruption. The eruption from the Yellowstone caldera Huckelberry Ridge Tuff about 2.2 million years ago, which was similar to Toba, has been assessed to cover most of what is now the continental U.S. with about 2.500 cubic kilometers of ejecta compared to the less than 2 cubic kilometers of ejecta for Mount St. Helens.

Below is a range of ejecta volume for selected Super Volcanoes.

- Mt. St. Helens: 1-2 km^3
- California Long Valley Caldera: 600 km^3
- Yellostone Lava Creek Tuff: 1000 km^3
- Yellowstone Huckelberry Ridge Tuff: 2500 km^3
- Toba: 2800 km^3

The point of this discussion is to establish a comparative frame of reference. The damage resulting from the Tunguska and the Arizona Meteor Crater impacts and the Mount St. Helens explosive eruption are similar. The energy released during the formation of the Arizona Meteor Crater impact is considered to be equivalent of a 20-40 megaton nuclear explosion while the Mount St. Helens explosive eruption was estimated to be equivalent to about a 20-30 megaton nuclear explosion.

Although these events are much less dramatic than other mega disasters they are significant and in Cold War parlance would be considered "city killers". For this discussion this is an important observation. An event like the Chicxulub impact or the Tuba Super Volcano really has no relevance in human history and hence no relevance to the disaster management community. However, the implications of a 30 megaton city killer nuclear explosion or the affects of a Mount St. Helens equivalent explosive eruption are easily understand and appreciated.

THE DISASTER MANAGEMENT PROCESS

The disaster management community literally celebrates the anniversary of major disasters. This observation is not a criticism or for that matter a ghoulish character of the disaster management community. Major disaster anniversaries provide a unique opportunity for Mitigation and Preparation, the first phases of disaster management. An event like the recent 10-year anniversary of the Los Angeles basin Northridge earthquake is the perfect opportunity for the disaster management community to encourage the public and politicos to get ready for the "Big One".

Fortunately there is no event in human memory that we can use to raise the public's awareness of a city killer class of impact. If we are ever going to get the public or political funders to take the threat of a comet or asteroid impact seriously we might consider an "anniversary event", maybe a celebration of the natural wonder of the Arizona Meteor Crater combined with the 1994 Comet P/Shoemaker-Levy 9 impacts on Jupiter.

The balance of this discussion is going to focus on the Response and Recovery disaster management steps related to a “city killer” class of impact.

There is no argument that a 30 megaton class impact will result in catastrophic damage. If the event were to occur in a populated area of the earth the loss of life and property damage would be staggering. How the disaster management community could effectively carry out the Response and Recovery missions would be a real challenge.

One of the major misconceptions concerning disaster management in the U.S. is that organizations like the Federal Emergency Management Agency, FEMA, and the respective state emergency management activities are “in charge” following a disaster event. Except for acts of terrorism, disaster events are almost always managed as a local issue. In home-rule states like California, the division of responsibilities is even more clearly defined. For example, if a Tunguska type of detonation were to occur over the Hyatt Regency hotel in Garden Grove where the AIAA Planetary Defense Conference is taking place it would actually be the city of Garden Grove (if it still existed) that would direct the Response and Recovery operations. The County of Orange would work, if requested by Garden Grove, to coordinate mutual aid and to provide any resources that exceed the local community’s efforts. If the resources for Orange County were exceeded the county would call on the State of California and only when the State’s resources were exceeded would the Federal government get involved. Obviously for a disaster of this magnitude this escalation process would be pretty much immediate. What first happens is that the first responder community reacts with little thought of jurisdictional boundaries to begin the process of reducing loss of life and property.

The more complicated matters start occurring in the hours and days after the actual disaster event. For the proposed scenario there would be a great deal of confusion as to whether this was a terrorist event or a naturally disaster. A great deal of the resources would be ultimately be expended to define the scope of the disaster and the costs involved.

Now consider another extreme. What happens if this type of event were to occur in a remote but populated area of the world? There would still be the possibility of large loss of life and property damage but it might take days before the scope of the disaster was recognized and outside help could be provided. As demonstrated in the recent, December 2003, earthquake in Iran the time delays in responding to major disasters in remote areas of the world can result in even more loss of life.

If a “city killer” sized impact were to occur in an unpopulated area of the globe there would still be a great deal of interest in getting to the site as quickly as possible. There are many characteristics of the event that are short-lived and that would be lost to the scientific community if not observed and recorded in the first hours and days following the event.

Even though today’s disaster management community, especially in the U.S., has relatively effective technologies available to support disaster warning and the Response and Recovery missions there is a great deal of room for improvement. In the U.S. beginning in the mid 1990’s a variety of studies and demonstration projects were undertaken to begin to incorporate state-of-the-art computer, communication and information technology capabilities in the disaster management mission.

TOWARDS THE FUTURE

In early 1997 Vice President Gore requested that a Disaster Information Task Force (DITF) be established to evaluate how evolving technologies and changes in U.S. policy to apply previously classified capabilities could improve the disaster management mission. In late 1997 the results of the DITF study were documented in the report: Harnessing Information and Technology for Disaster Management. This report recommended:

- Organization: Build a framework that involves public and private stakeholders in forming a long-term Global Disaster Information Network organizational structure. Begin immediately to solve Federal-level challenges through an Integrated Program Office (IPO) under the auspices of an interagency Executive Committee (EC). Establish a Public/Private Partnership (PPP) to engage all stakeholders.
- Policy: Formulate a policy environment that fosters interagency cooperation through integrated strategic planning and coordination of disaster information budget initiatives and promotes public/ private partnerships. Develop a sustainable plan for timely access to classified data and derived products.
- Information Access: Formulate a logical arrangement of data, information, models, tools, and other resources accessible to users through an integrated information network.
- Connectivity: Develop procedures and policies to ensure the Disaster Information Network is robust

and secure when necessary and that disaster information stored on Federal intranets and on the Internet is available to disaster managers when needed.

- Directed Technology: Develop an approach to integrate new and emerging tools and technologies (models, simulation, and data fusion) for use by disaster managers.
- Demonstration: Conduct formal exercises to demonstrate that enhanced information access, connectivity, and directed technologies have measurable value in reducing disaster costs.
- Global Extension: Begin by building a U.S. Disaster Information Network and construct the appropriate framework to move toward a Global Disaster Information Network.

The recommendations of the DITF were reviewed and validated the National Research Council's Board on Natural Disasters Commission on Geosciences, Environment and Resources in the 1998 report Reducing Disaster Losses Through Better Information. This independent review concluded that there was no justification for continuing in the mode of non-standard disparate resources when available modern technological developments make their linkage into a disaster information network a relatively straightforward matter with obvious potential payoffs in saving lives and reducing losses.

In some respects these two studies established a basis for a short-lived “golden era” in disaster management applied research. Much of the initial effort was made through the U.S. Intelligence Community. The reason for the Intelligence Communities involvement was two-fold, the Clinton administration significantly changed some classification guidelines related to the nation’s space based intelligence capabilities and the Intelligence Community was looking for new missions after the end of the Cold War. Things evolved so far that the CIA established the Director of Central Intelligence (DCI) Environmental Center, the DEC. Within the Intelligence Community the DEC was the focal point in for environmental, including world-wide disaster, issues. On April 27, 2000; President Clinton issued Presidential Executive Order 13151 to define the federal the process to implement the recommendations of the DITF.

One of the most successful and least known applied research initiatives that evolved during this period was the Hazard Support System (HSS). Initially, because its existence was classified, few people knew anything about the Hazard Support System. In 1998 with the declassification of the existence of National Reconnaissance Office (NRO) and some other policy changes the NRO went public with the basic characteristics of the Hazard Support System with a public press release that can still be found on the NRO’s public web site.

This press release states: “The NRO was asked to take the lead in the development of the Hazard Support System because of its expertise in the acquisition, integration and development of satellite-related systems. The Hazard Support System will use ballistic missile warning satellites, civil weather and environmental satellites and other sensors to continuously monitor the United States and its territories to detect wildland fires and the entire globe for volcanic activity. It can also track the movement of volcanic ash clouds which impact aviation.” For an agency that until a few months before could not even admit its existence this open discussion of a previously classified and active project was remarkable. It is unfortunate that the potential of the Hazard Support System was never achieved.

After the start of the Bush administration, most of the activities associated with the recommendations of the DITF were managed by NOAA under PDD 13151 in what was then called the National Hazards Information Strategy (NHIS). NOAA completed a series of successful tests with the Hazard Support System, renamed the Integrated Hazard Information System (IHIS). These tests clearly demonstrated the capability of the system to operate as anticipated and to detect relatively small wildland fires on the surface of the earth, to monitor earthquake activity and to track volcanic airborne ash clouds. By the start of the federal FY2003 all support for the Integrated Hazard Information System ceased and the ground components of the system were moth-balled. Even more significant, NOAA’s support of the National Hazards Information Strategy ceased. To some extent this change in disaster management focus resulted directly from the events on September 11, 2001 and a shift to an emphasis on terrorism related issues.

This type of shift is to be expected as national priorities evolve but what is disheartening is the abandonment of dual use technologies that could effectively be used to save lives and reduce economic losses from a wide range of disasters at little cost.

RECOMMENDATIONS

The Integrated Hazard Information System, if it were operational today, would have immediate application in supporting Response and Recovery activities associated with a survivable but damaging earth impact from an asteroid. The Defense Support Program (DSP) satellite system that comprised the “front end” of the Integrated Hazard Information System is in continuous operation and has been used to track and publicly report on numerous bolides during the past decade. It was unfortunate that the capabilities of the Integrated Hazard Information System were never applied to this mission. This is just another example of “stovepiping” a characteristic of the Intelligence Community and unfortunately the disaster management community.

It is recommended that the capabilities of the Integrated Hazard Information System be resurrected, not only to support its original mission of detecting wildfires and volcano eruptions and tracking volcano ash clouds but for all-hazards including tracking and reporting on bolides and developing the capabilities to detect and report on actual impacts. It is further recommended that the operational requirements of the soon to be deployed U.S. Space Based Infrared System (SBIRS) be evolved to expand on the already demonstrated capabilities of the Integrated Hazard Information System.

It is also recommended that these capabilities be utilized as the foundation of an all-hazard and all-source U.S. Disaster Information Network and a World Wide Disaster Information Network construct. Failure to take advantage of existing capabilities and technologies because of policy considerations or low level budget in-fighting when lives and property are at risk is not only imprudent but morally wrong.