



Improving Emergency Planning and Response with Geographic Information Systems

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Improving Emergency Planning and Response with Geographic Information Systems

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Introduction

This paper describes the importance of providing appropriate information and data to first responders. The future success of first responder agencies (public safety, law enforcement, and medical and public health) will depend on emphasizing risk assessment and comprehensive preparedness to achieve effective response. The requirements to prepare for and respond to large-scale catastrophic emergencies will also be reviewed. The need for technologies that integrate disparate data from multiple agencies with different missions will also be reviewed in the context of planning for and responding to complex emergencies.

GIS for First Responders

Traditionally, first responders have relied on experience, practiced skills, good equipment, and teamwork for effective and successful emergency response. Similarly, the focus of public safety in law enforcement, fire service, and medical response has been to strengthen response capabilities across the board. An example of a fire emergency was chosen to illustrate the challenges.

Fire Service Example

As the population densities surge and community economic development create greater concentrations of residential and commercial risks, the role of fire service has become more demanding and complex. Fire service continues to require better response capability (more personnel, stations, and equipment) to manage this increased demand. As fire service expands, rebalancing between response-related investments must be weighed against the need to invest in better planning, evaluation, and data communication tools and technologies such as geographic information system (GIS) technology. A more balanced approach to better allocation of existing resources will ensure better risk prevention and consequence reduction that will support and expand required response resources.

Effective planning for response involves understanding how to prevent or minimize consequences of emergencies and acquire the information and data necessary to respond. Achieving these goals requires the identification of critical infrastructure and resources as well as a sound understanding of how emergencies unfold. Effective response is realized when planning and preparedness investments are sufficient to ensure continuity of effort.

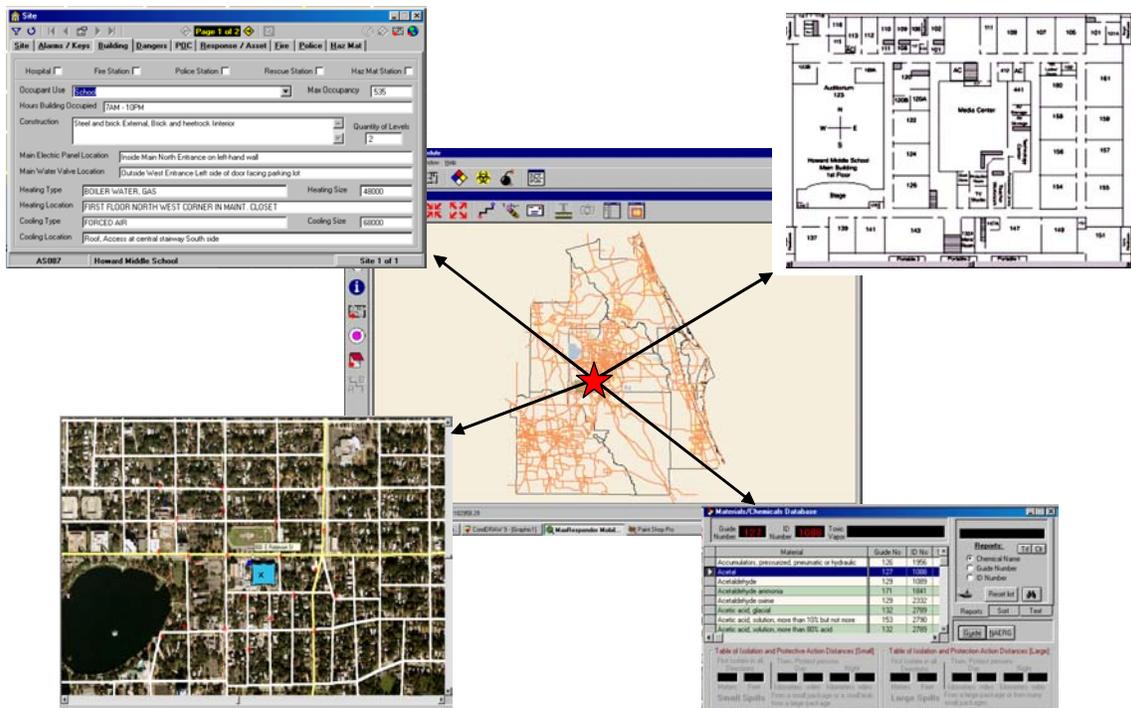
There is little argument that, depending on the nature of the emergency, every first responder requires certain equipment and personal protection gear. Increasingly, first

responders will also require the best data and information relevant to the risks to which they are exposed. Knowing where critical assets are located and having first access to key data and information necessary for optimal response can be addressed through the purposeful implementation of GIS—digital (or geospatial) data creating spatial intelligence. Geospatial information is required from the moment an emergency call is received; it would answer the following questions:

- Where is the emergency?
- What is the best route?
- Where are the closest hydrants?
- What is the layout of the facility?
- What is the occupancy type, and how many people may need rescue or evacuation?

Beyond maps, other information and data requirements may include

- Photographs of the facility
- Floor plans and main utility control panels
- Existing fire protection systems
- Inventory of the facility (hazardous materials)
- Preincident plan (a preinspection and fire protection plan)
- Previous call history



Providing First Responders Access to Critical Information During Response

Putting critical information in the hands of first responders can mean faster, safer informed deployment. Without easy access to data, first responders must often obtain it at the scene; data is often contained in multiple notebooks carried in the fire apparatus or derived by a thorough physical inspection of the facility upon arrival.

From the moment a chief officer or incident commander is present on the scene, he or she is responsible to manage the incident rather than become part of the tactical response. The chief officer requires complete information to perform the command mission. Depending on the complexity and scope of the incident, data and information must support rapid decision making including the following:

- What additional exposures or facilities are threatened by this event?
- Where should incoming units be positioned to access critical hydrants that will effectively support the mission?
- If an equipment staging area or incident command post is required, where are parking lots, schools, churches, malls, or other suitable facilities located?
- If helicopter evacuation of victims is required, where are suitable landing sites?
- If medical triage or decontamination is required, what facilities are closest and available?
- If hazardous materials are involved or a chemical plume is being generated, in what direction will it drift, what is likely to be threatened, and what is required in protecting and evacuating the public?
- If an explosion has occurred or is eminent, who needs to be evacuated and where are the closest evacuation facilities and resources?

All of these decisions require geospatial information (maps, directions, building layouts, etc.), and most will be in different places and digital formats. The challenge is to provide first responders the right information, at the right time, and in the most relevant place—easy to access and use. The vast collection of digital information from which a first responder can draw is often inaccessible because of the lack of data interoperability. Data interoperability is one of the greatest values of a GIS, since GIS can integrate disparate information and provide useful visual information quickly to first responders. GIS can also create various scenarios through spatial modeling that produce visualization that can more accurately and realistically describe the direction and extent of explosions, plumes, fire behavior, or disease outbreak. For example, instead of guessing or estimating evacuation requirements, transportation network delays, or blockages, GIS can provide an actual prediction of the scale of the event and visually display potential consequences.

GIS for Emergency Management

Since the events of September 11, 2001, the threat of terrorism and the realities of catastrophic emergencies are a new reality. Terrorist events are intended to create mass

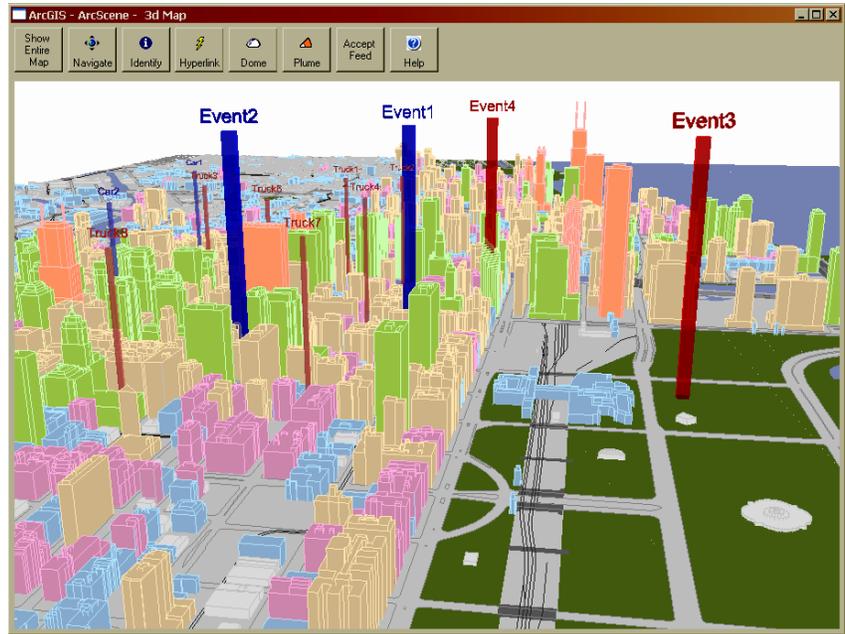
fear through either extensive destruction of property or loss of life. These events are complex, difficult to manage, and require the involvement of many agencies, many of which seldom work together outside a particular emergency. Preparing for such events requires uncommon levels of collaboration, preparedness, and timely ability to create a common vision of the "what," "where," and "how" that will guide effective response.

Of all the emergency events that remain most illusive to the first responder community, bioterrorism is likely one of the most difficult to prepare for, protect against, and respond to effectively. A bioterrorism event, whether a confirmed threat or an actual release, will require a high level of coordinated preparedness and response across a wide swath of the first responder community. An example of the type of organizations that are likely to be involved includes

- Hospital emergency departments
- Law enforcement departments
- Transportation services
- Fire services
- Medical and surgical facilities
- Pharmacies
- Public works departments
- Public health agencies
- Federal health and law enforcement agencies
- State public health agencies

Immediate response requirements will include

- Protecting first responders from contamination and unintended exposures
- Protecting medical facilities from contamination and exposures
- Safeguarding drug stockpiles
- Maintaining safe transportation networks
- Enforcement of health quarantine areas
- Determining drug dissemination sites
- Establishing field surveillance data collection
- Accelerating laboratory testing



Creating Situational Awareness through a GIS-Based Common Operating Picture

Chemical or biological toxin in any form will cause panic and disrupt the usual flow of people and activities within a community. It is a complex emergency management problem that requires a high level of coordination. All first responders, as well as the agencies that support them, must mobilize with a common understanding of the situation (view) and collaborate to produce a common operating picture required for response. The response to a bioterrorist event requires precise information about person, place, and time and compels all first responders to react based on the same information. The information (map) must reflect continuous updates and be capable of immediate viewing by all responsible agencies and responders. A dynamic map, complete with relevant details depicting changes to unfolding events and responses, is possible through a network of Web-based GIS, linking all of the appropriate responding and supporting agencies and organizations—providing the common picture for decision making, action taking, and evaluation of response.

One of the strongest benefits of a GIS in a bioterrorist threat or release is in its ability to accelerate the flow of relevant spatial information across a large and diverse response community.

The ability to keep the public informed is a by-product of the comprehensive approach to linking various information sources and data collection technologies. Geospatial information in the form of maps can easily be used to share critical information with the public as well as illustrate affected or safe areas, thus reducing confusion and panic. GIS enables community leadership to take a proactive stance to providing up-to-date information and engage the public quickly in an efficient and effective manner during the onset of an event and in the public's recovery.

Summary First responders require effective physical tools, as well as intangible information tools, to evaluate and manage risk and, at the same time, increase their overall capacity for effective response. Grants and assistance to first responders, including firefighters, should require the adoption of information technologies, such as GIS, that both increase capacity and leverage existing informational resources toward prevention and preparedness. Complex incidents involving multiple agencies and private organizations require the ability to create common operational pictures that are capable of guiding both preparedness and response.

To properly prepare for and ultimately manage all the possible threats that a community might face, sound information technologies, as well as uncommon diligence to ensure that collaboration produces useful and relevant information, are required. First responders, whether fire service, law enforcement, or medical emergency, are essentially at the risk of their information and the systems designed to produce it. To respond intelligently requires significant levels of spatial awareness only attainable through the use of a GIS.

If a picture is worth a thousand words, then certainly an intelligent map is worth much more. Today's GIS produces intelligent, relevant, and useful spatial information that achieves critical response missions. First responders deserve nothing less.



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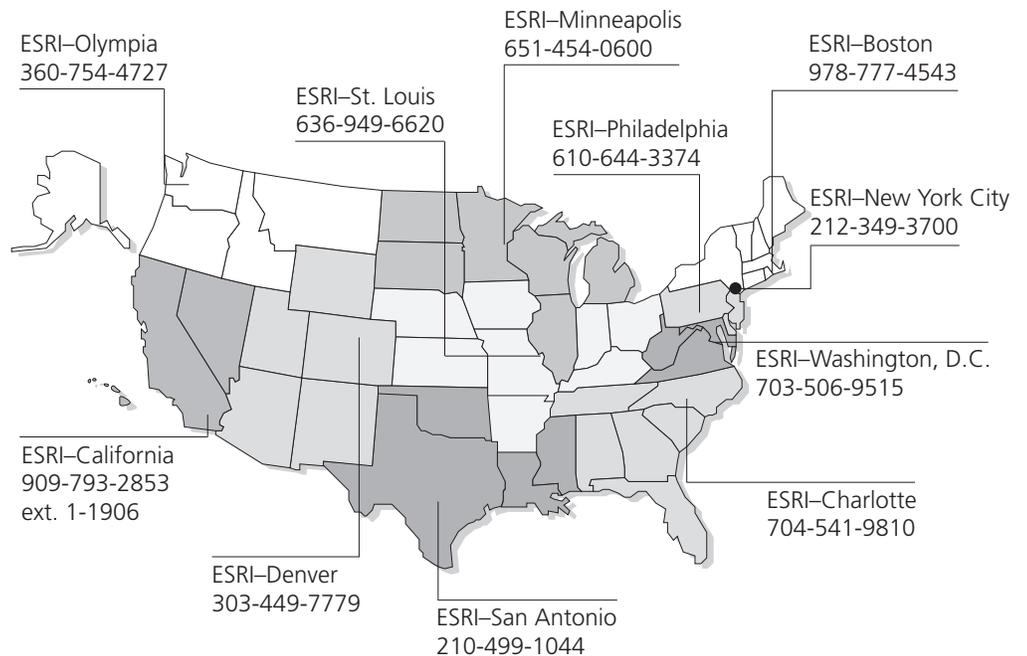
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