Geographic Information Systems: A Powerful New Tool for Fire and Emergency Services

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Contents **Page**

Introduction 1

What GIS Can Do 2
- Station Location Planning 2
- Creation of Response Performance Zones 2
- Pin Mapping and Response Analysis 2
- Mobile Data Computers 3
- Large Incident Management 3

Recommendations for Fire and Emergency Medical Service Agencies 3
- Existing Municipal Resources 3
- Multiagency Partnerships 4

New Specialized Applications 4
- FireView 4
- MaxResponder 4
- CATS 4
- eteam.com 5

Conclusion 5
- E-fire 5
- Future Considerations 5

Geographic Information Systems: A Powerful New Tool for Fire and Emergency Services

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ESRI

Introduction

Why should fire departments utilize geographic information system (GIS) technology? Fire departments have the responsibility to protect lives and property but have a limited amount of resources. It is critically important that the deployment of resources is effective, efficient, and based on the best information possible. Effective deployment is based on numerous complex issues: fire demand, effective fire fighting force, occupancy, historical occurrence, response time, and others. Traditional planning methods require the use of numerous maps, reports, tables, and historical records. This data is often found in a variety of different locations and formats, and requires a great deal of time to acquire, prepare, and formulate into a useful format. Resultant deployment plans are often completed, implemented, and shelved. Deployment planning in the traditional sense is more of an event than an ongoing process.

GIS allows fire officers to view all of the necessary deployment data in place. Data can be added, subtracted, or modified with computer mouse operations. Alternative plans can be created, analyzed, and modeled by a group or staff of fire officers using GIS. Once a GIS database has been created, deployment analysis can be reviewed and updated at any time with little effort. GIS allows deployment analysis to become a process rather than a periodic event.

Although computerized mapping systems have been around for many years, recent improvements have made GIS software available on the desktop and on laptops. GIS applications developed specifically for fire departments provide tremendous functionality through a user-friendly interface. GIS software can now be used by nonspecialists to improve planning, analysis, and response. These tools offer managers the ability to eliminate much of the guesswork that has been the norm in tasks such as siting stations or deploying apparatus.

What GIS Can Do

Station Location Planning

Siting fire stations is a challenging task that is often oversimplified. In its most basic form, many stations are sited using a simple radius coverage scheme that is believed to relate back to the time of horse-drawn fire apparatus. Other formulas presume that fire departments protect only real property, that travel speed is constant at all hours of the day, and that emergency events occur randomly with respect to time. In truth, fire department response workload involves nonfire (medical and service) responses, travel time changes at various times of the day, and emergency events are not randomly distributed but are predictable within certain limits.

Because of the constant changes in street networks, the ability to test potential fire station locations for area coverage is very important. Historically, this testing was accomplished by sending a fire vehicle equipped with a stopwatch to drive an area and mark travel times over the street network. This approach is limited by the varying speeds, distances, and the availability of crew time in the face of competing duties. It is also not possible to test areas where streets have not been completed or where the street network is subject to change.

The ArcView® GIS package from ESRI and the ArcView Network Analyst extension to that program can assist in station location siting. ArcView GIS and its extensions run on desktop PCs running Windows 95 or later, or Windows NT. ArcView Network Analyst allows an organization to test station locations using average travel speeds to determine coverage capabilities within specified times.

Creation of Response Performance Zones

In developing standards for coverage, it is necessary to examine areas and perform statistical analyses of response performance within those areas.

Using GIS, calls can be geocoded to their specific locations, creating a very busy pin map supported by all of the data pertaining to each call. Groups of calls can then be captured using the GIS and exported to a statistical analysis program for evaluation. Response zones can be created based on workload, fire demand, and response times rather than traditional response time criteria.

Pin Mapping and Response Analysis

One of the most powerful tools provided by a GIS is the ability to geocode individual incidents and display those incidents on jurisdictional basemaps. Fire agencies can use geocoded data to make decisions about the need to purchase and assign additional extrication tools and to strategically position brush fire fighting units or other specialized units for optimal response. Fire prevention requirements and other mitigation strategies can be determined through GIS incident analysis.

Incident data can be readily examined via GIS and deployment adjusted accordingly. GIS provides the ability to quickly query the database and perform what-if scenarios. The tools have eliminated the need to wait while paper maps are produced, allowing real-time problem solving by staff officers and others.

Mobile Data Computers

Dynamic GIS in the cab of emergency response apparatus is rapidly expanding. This exciting development will eliminate many of the difficulties associated with too many three-ring binders, outdated map books, transfer of personnel, and rapidly developing communities. Firefighters will be able to obtain maps, travel directions, prefire plans, and a variety of other information from their vehicular computers.

Large Incident Management

Large-scale incident management can be greatly enhanced through timely application of GIS technology. Incident commanders faced with wildfires, floods, earthquakes, or other events impacting large numbers of people, the municipal infrastructure, or large geographic areas will be better able to manage events and resources if timely and accurate map data is available to an incident command system (ICS) and other members of the incident management team.

GIS has proven so valuable to California's fire service that *FIRESCOPE* (the State-wide all-incident mutual aid program) has GIS specialists assigned to its overhead incident management teams, utilizing common basemaps, map symbology, and fire planning data. When large numbers of resources must be mobilized and accounted for as the event progresses, GIS can prove an invaluable asset.

Recommendations for Fire and Emergency Medical Service Agencies

Every fire service executive should be thinking about implementing GIS into the management and incident management process. One of the primary challenges for implementing GIS is obtaining geographic data. If reasonably accurate digital basemaps are already available in the community (and the fire department has access), the biggest obstacle has been overcome. If data is not available from other departments, street data can be purchased reasonably from commercial sources. State-of-the-art desktop GIS software, such as ESRI's ArcView GIS 3.2, can be acquired for less than $1,200.00. ArcView GIS runs on a desktop PC (you will need at least 64 MB, and preferably 128 MB, of RAM) with Windows 95, 98, or NT. A reasonably computer-literate staff member with an interest can begin doing useful GIS work after a two-day training course (available from ESRI or through many community colleges). Geocoding of incidents will require that incident data (location, times, types, etc.) be entered into a database (and you will be pleased at how much can be accomplished with basic National Fire Incident Reporting System [NFIRS] data). For a while, a basic letter-sized printer, such as one of the Hewlett–Packard DeskJets, will produce useful 8½ 11-inch maps.

After that, the sky is the limit. Large-scale plotters make beautiful wall maps. Liquid crystal display (LCD) computer projectors allow real-time what-if testing of scenarios projected on the wall. The application of GIS technology to your daily business activities is limited only by imagination.

Existing Municipal Resources

In most communities, some level of GIS resources already exists. Municipal utilities, surveyors, tax assessors, transportation providers, and others utilize GIS data to plan, analyze, and record geographic data.

Another resource that should not be overlooked is law enforcement agencies' crime analysts. Most medium- and large-size police and sheriff's departments have special units, often comprised of detectives and specialized support personnel, who use GIS to map crime patterns and recommend resource deployment strategies for street patrol

officers. Many strategies and techniques employed by crime analysts are readily adaptable to the analysis of fire and EMS responses.

Multiagency Partnerships

If your agency is too small to support its own GIS specialists, resources can be shared between agencies. One agency could do the work, another fund the cost of basic data, and a third might perform the legwork to locate some important resources (hydrants, for example). Developing a lot of GIS capability is relatively straightforward and not terribly costly, but it never hurts to share the costs as well as the benefits.

New Specialized Applications

FireView

FireView is a geographic analysis product designed to meet the planning and analysis requirements of fire departments. As a suite of integrated analysis tools designed for use in the ArcView GIS environment running under Windows, FireView facilitates the accomplishment of both simple and complex fire analysis tasks.

By:
The Omega Group
12707 High Bluff Drive, Suite 120
San Diego, California 92130
858-481-3119
www.theomegagroup.com

MaxResponder

MaxResponder™ is an integrated suite of software applications operating in a GIS environment based on ESRI's MapObjects® 2 software. It provides the first responder access to all necessary information to make rapid decisions in an emergency situation. Access to information includes routing, GIS map layers, preplans, floor plans, chemical-biological, National Emergency Response Guide, imagery, and other mission-critical data for mobile computing hardware.

By:
Applied Ordnance Technology
Building 2
4815 Pine Hill Run Road, Suite 17
Lexington Park, Maryland 20653
301-863-0422
www.maxresponder.com

CATS

CATS (Consequences Assessment Tool Set) is a PC-based system that works with ArcView GIS. CATS provides a comprehensive package of hazard prediction models, casualty and damage assessment tools, and population and infrastructure data for a wide range of applications. It also offers the user the opportunity to add databases for custom analysis.

By:
SAIC
10260 Campus Point Drive
Mail Stop C2
San Diego, California 92121
858-546-6022
www.saic.com

eteam.com

eteam.com is an Internet-based work flow management application designed for emergency and event personnel. It allows Web-connected users to enter and access standardized reports, requests, and directives; view and edit annotated maps; and access common databases in order to manage an event or disaster. Much of the guesswork about what is going on during an event or emergency is eliminated. Problems are quickly identified and prioritized because everyone is looking at the same information. Scarce resources can be deployed optimally. Map displays are built on ESRI's ArcIMS™ Internet GIS software.

By:
eteam.com
742 Hamshire Road, Suite A
Westlake Village, California 91361
818-932-0660
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Conclusion

E-fire

100 years ago, the way fire officers displayed their fire protection problems was on Sanborn maps. Drawn by hand, building by building, block by block, they were eventually abandoned because they were too labor intensive. Today fire officers need specific information on fire problems more than ever. And they have a new tool: GIS. Just like firefighters no longer fight fires with steamers, they should not be using century-old techniques to define fire problems with a pad of paper and a pen. Electronic fire management means using a computer to achieve excellence in fire planning.

Ronny J. Coleman
Retired California State Fire Marshall

Future Considerations

The opportunities to utilize GIS for planning, managing, and evaluating fire service operations appear to be virtually limitless. Mapping of hazardous materials storage sites, residences of physically challenged persons, municipal hydrants, dry hydrants and drafting points, planning facility locations, emergency event modeling, and a host of other tasks can be simplified, shortened, and made more efficient through the application of GIS technology.

Developments in GIS technology can provide tremendous enhancements to today's fire service managers. Future developments will further revolutionize the way we do business, automating and improving efficiencies for responders and fire prevention

personnel as well as managers and supervisors. Current and future fire service leaders should be encouraged to develop a growing awareness of the applications of GIS technology to their business.

For more than 30 years ESRI has been helping people manage and analyze geographic information. ESRI offers a framework for implementing GIS in any organization with a seamless link from personal GIS on the desktop to enterprisewide GIS client/server and data management systems. ESRI GIS solutions are flexible and can be customized to meet the needs of our users. ESRI is a full-service GIS company, ready to help you begin, grow, and build success with GIS.

Corporate

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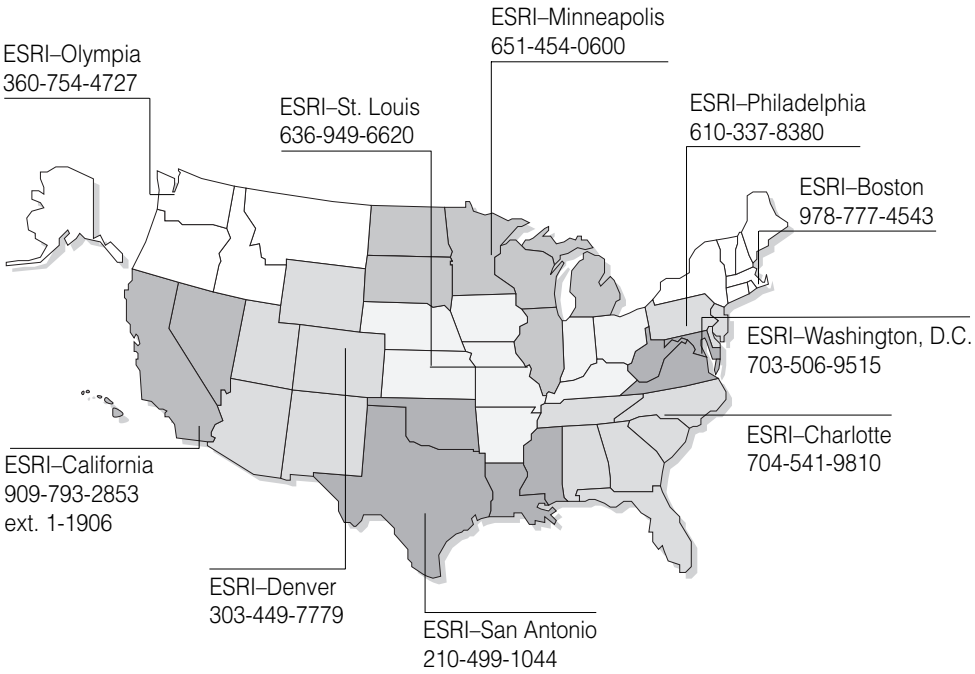

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