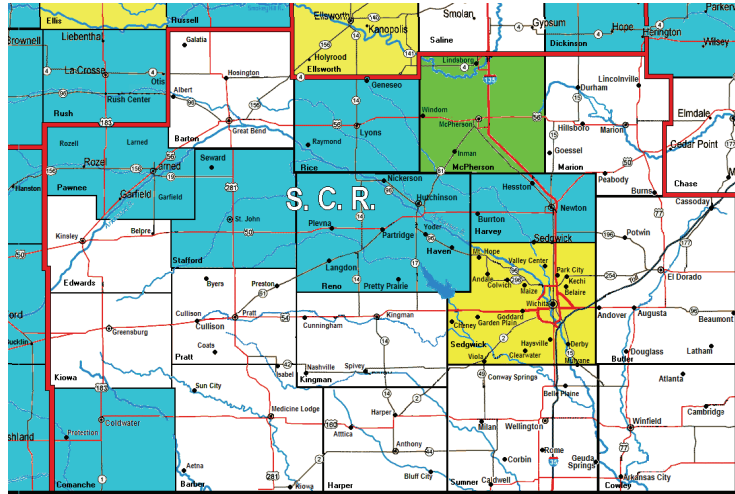


Geographical Information Systems (GIS) and Emergency Management



Introduction

Geographical Information Systems (GIS) have proven to be an important asset in Emergency Management. The ability to retrieve information on areas affected by a disaster and quickly display it on a map has proven to be a vital asset to emergency personnel. Despite this fact GIS personnel are often the last to be trained, involved in exercises or given adequate preparation for providing support to Incident Commanders and their staffs.

The purpose of this handbook is to give both GIS and ICS staff a brief outline of the contributions GIS can make to Emergency Management and how GIS personnel can best prepare to make those contributions.

What is GIS?

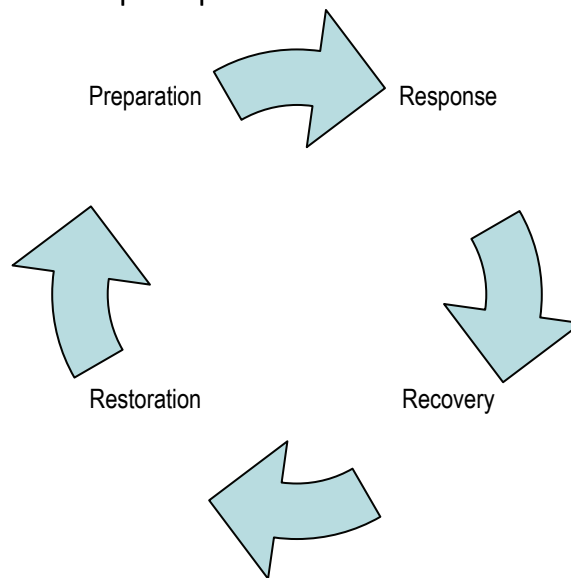
Simply put Geographical Information Systems (GIS) tie various types of data to points, lines and areas located on the face of the earth. GIS systems are most frequently used to draw maps or print tables of information concerning property ownership used by local and state governments to regulate real estate transactions, assess taxes, etc. GIS systems are also used to support

government and private industry management of critical infrastructure, natural resources and just about anything else you can imagine.

What is Emergency Management?

Emergency Management (EM) is the coordination and management of public and private resources before, during and after an emergency. Emergency Management does not employ cops, fire fighters, paramedics or dispatchers, yet EM coordinates the activities of public safety personnel during the four response phases to an emergency. EM does not own any police cars, fire trucks, ambulances or communications systems, yet EM coordinates the management of these resources under the Incident Command System (ICS).

EM operates in four different response phases:



1.) Preparation

During the Preparation phase Emergency Managers conduct vulnerability assessments, draw up response plans, conduct exercises and drills. Public Safety organizations draw up response plans, conduct training, exercises and drills. Local governments, private industry and non-governmental organizations develop Continuation of Operations (COOP) plans in order to permit continued operations following a disaster.

2.) Response

During the Response phase Emergency Managers will assist the Incident Command System by managing the Emergency Operating Center where large scale emergencies are supported. Although control of an incident remains with local jurisdictions and the appropriate public safety discipline. Larger incidents can easily involve multiple jurisdictions and require assistance from other jurisdictions, state and federal assets. During the initial part of the response phase the Fire Services are normally in command as long as there are hazards to mitigate and victims to rescue.

3.) Recovery

During the Recovery phase command may transition to local law enforcement and/or an Incident Management Team. During this phase the documentation of the incident occurs and any crime scene investigations are conducted. Deceased victims are removed and damage assessments take place. During this phase debris removal begins, disruptions to critical infrastructure are addressed and the restoration process is mapped out for the affected locations.

4.) Restoration

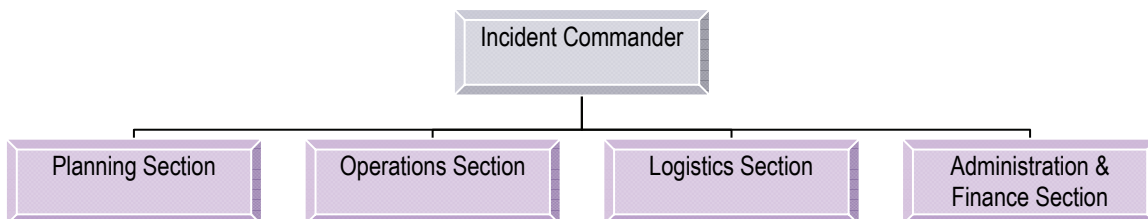
During the Restoration phase command functions are returned to local personnel. In this phase debris removal is finished and the restoration of damaged governmental and private infrastructure is begun. Depending on the magnitude of the disaster this phase can literally take years to complete.

5.) Preparation

The Preparation phase continues throughout the other phases as Incident Command and local officials learn from their experiences in responding to the emergency. Using the lessons learned they will be better prepared to respond to future incidents.

The Incident Command System (ICS)

The Incident Command System is divided into four sections reporting to the Incident Commander. These sections are organized along functional lines and are designed to make it possible for organizations drawn from personnel from different jurisdictions and response disciplines to function effectively in response to an emergency.



1.) Incident Commander

The Incident Commander is in overall command of the incident he is responsible for the overall control of the incident requesting and releasing resources and authorizing expenditure of funds, etc.

2.) Planning Section

The Planning section is responsible for assisting the Incident Commander and other members of his staff with planning incident operations by developing an Incident Action Plan. GIS normally falls under planning, although it touches upon each command function. Planning looks into the future and GIS is one of the crystal balls it uses to develop effective plans to manage the incident.

3.) Operations Section

The Operations section is responsible for carrying out the Incident Action Plan and directs the work of incident resources toward that end. GIS can be vital to the function of the Operations section by providing maps and other data needed to properly marshal operational resources.

4.) Logistics Section

The Logistics section locates, mobilizes and demobilizes incident resources under the authority of the incident commander. Developing GIS map layers that depict FEMA typed resources such as firefighting apparatus or interoperable communications assets can greatly improve the ability of the Logistics section to manage incident resources.

5.) Administration & Finance Section

The Administration & Finance section tracks expenditures for equipment and personnel participating in the response. Although it may seem that GIS may not have much to offer this section, in reality GIS can use maps and mapping programs to track and estimate damage and prepare realistic estimates for recovering from the incident and to begin the process of restoration.

Where does GIS fit into the Emergency Management cycle and ICS?

GIS can greatly enhance the ability of Emergency Management and the Incident Command System to effectively plan for and respond to incidents. GIS has much in the way of useful data that can easily be accessed by computer or plotted maps. Some examples of this essential data include:

- 1.) Highways and Roads (Street Center Line Data)
- 2.) Rivers, Streams and Lakes (Hydrography)
- 3.) Jurisdictional Boundaries
- 4.) Public Safety and Government Buildings
- 5.) Fire Hydrants
- 6.) HAZMAT Facilities
- 7.) Healthcare Facilities
- 8.) Critical Infrastructure
- 9.) Public Safety Communications installations
- 10.) Airports and Helipads
- 11.) Schools
- 12.) Special Needs Populations
- 13.) Shelters and Emergency Facilities
- 14.) Agricultural Facilities

GIS in the Preparation Phase

GIS can be a valuable asset in planning for disasters due to the wealth of information GIS contains and the ease of which it can be displayed on a map. Some examples of GIS data applications for disaster planning include:

- **Floods**—GIS can develop maps that show flood prone areas along with affected dwellings, infrastructure and special needs populations contained in those areas. GIS maps that include terrain elevations can be used to locate evacuation routes, shelters and staging areas above the local flood level.
- **Tornados**—GIS can develop maps that show tornado shelter locations, primary and alternate Emergency Operating Center (EOC), Public Safety Answering Points (PSAP's, aka 911 dispatch) locations along with other public safety facilities.
- **HAZMAT**—GIS can develop buffer zone maps around existing HAZMAT facilities that show the initial isolation distance and down wind evacuation distances for worst case scenario releases. GIS can also be used to display threatened areas following a release of a toxic chemical.
- **Winter Storms**—GIS can develop maps that show shelters, special needs populations and other resources in place that can be used to respond to a winter storm that may include power outages and other interruptions of critical infrastructure which can be significant during cold weather incidents.
- **Wild Fires**—GIS can provide firefighters with maps that include road maps overlaid with overhead photography for fire fighting operations that often move cross country. These maps can also include a layer for fire hydrants and other water sources in rural areas.

GIS should also preposition maps of the local area at more than one location should the primary GIS location become unusable for whatever reason. Locations picked for these maps should include those outside of the immediate area and those which are located in tornado shelters or above the flood plain.

GIS In the Response Phase

GIS can render significant assistance to the Incident Commander and his staff during the response phase of an incident. During this phase GIS should stand ready to develop maps to assist with the response. This is especially important when receiving help from outside the local area from personnel who are unfamiliar with local geography.

GIS can also be utilized to assist with managing the incident, by developing maps that show the damage track of tornados, flood zones, HAZMAT releases, etc. GIS maps can be also be updated and printed off showing security check points, evacuation routes, shelter locations, staging areas, traffic detours, etc.

GIS maps can be especially helpful in the planning process by identifying areas that require search and rescue sweeps, contain HAZMAT sites or special needs populations

responders need to deal with. This is especially important in situations similar to the May 4, 2007 Greensburg tornado that completely leveled the town, including all the street signs.

GIS in the Recovery Phase

During the Recovery Phase of an incident GIS can play an important part in damage assessment and calculating the amount of damage sustained in an incident. Using real estate plats and tax valuations GIS systems should be able to give a fair estimate of the dollar value of damages to structures in the aftermath of a disaster.

GIS can also be utilized to graphically display the location of significant events that occurred during a disaster including fatalities, injuries, HAZMAT spills, damaged property, etc. This capability would be enhanced by damage assessment teams, Crime Scene Investigators or HAZMAT technicians having access to mapping grade GPS units to locate these significant events.

GIS can also be useful in the coordination of debris removal and disposal which is one of the most challenging aspects of disaster recovery. GIS can be used to identify collection and disposal areas for the different types of materials encountered during this process.

GIS in the Restoration Phase

During the Restoration Phase GIS can be utilized to assist local government with restoring local services and issuing permits for construction, demolition, etc. GIS data can be consulted to insure zoning, building codes and other requirements are met during this phase of the incident response.

Conclusion

Geographical Information Systems (GIS) are an important and largely unrecognized asset in Emergency Management. The ability of GIS to retrieve information on areas affected by a disaster and quickly display it on a map is a vital asset to emergency personnel responding to an incident. Although GIS personnel are often the last to be trained, involved in exercises or given adequate preparation; the support they can provide to Incident Commanders and their staffs is enormous.

Emergency management, public safety and local governments should take steps to make maximum utilization of available GIS resources in their communities.

GIS DISASTER CHECKLIST

1. () Is my data backed up off site at a secure location?
2. () Do I have platted maps stored at my office as well as tornado and flood proof locations?
3. () Do I have the contact numbers for my local Emergency Manager, Public Safety Answering Point(s), Law Enforcement, Fire and Emergency Medical Services?
4. () Do I have a plan to continue GIS operations in the event my office is destroyed?
5. () Do I have plenty of paper and ink on hand to print a large number of maps?
6. () Do I have contracts and vendors in place to acquire ink, paper and other consumable supplies in an emergency?
7. () Do I have colleagues from nearby jurisdictions who can assist me in an emergency?
8. () Have I completed a base level of NIMS required Incident Command courses, including IS 100 and IS 700?
9. () Have I sat down and discussed the role of GIS in disaster response with my local Emergency Manager?
10. () Have I discussed the role of GIS in a disaster with my immediate superior?
11. () Does GIS have work space in the local Emergency Operating Center?