

Utilizing GIS for Fort Bend County Homeland Security

Robert LaBarbera

The catastrophe of September 11th, 2001, forced many government entities to evaluate their current strategies that address domestic terrorism. Fort Bend County made initial assessments and performed a practice terrorism drill - the results of which showed a need for a revamped and updated Office of Emergency Management (OEM).

Within the new OEM, a tool was needed to easily assess geographic areas of possible domestic terrorist threats and to facilitate information sharing in the event of an actual crisis. With the assistance of the GIS Coordinator, the Director of the OEM discovered a powerful tool that could be used both in the prevention and assessment of a live event. The tool was ArcGIS

BACKGROUND

Fort Bend County

Fort Bend County is one of the premier residential and commercial counties within the Houston metropolitan area. For more than 15 years, Fort Bend has been in the top 20 counties in the United States for economic excellence, quality of life living standards and population growth. Excellent schools, affordable housing, and extensive recreational facilities have attracted families with impressive demographic profiles. These amenities can be found within the communities of Sugar Land, Missouri City and many other master planned communities located within the boundary of Fort Bend. The wide appeal to live in Fort Bend fosters much population growth, which results in diversity of cultures, languages, and business types. World-renowned companies such as Fluor Daniel, Schlumberger, Sprint, and Texas Instruments have established themselves in Fort Bend in order to lower overhead costs and to allow for a better quality of life for its employees.

Due to the terrorist attacks of September 11th, 2001, the President and Congress have decided upon a proactive policy regarding terrorism. The proactive policy consists of an aggressive stance on terrorism internationally and a strong defensive stance domestically. Because of

the need for a strong homeland defense force, a spotlight was placed upon all large metropolitan suburban areas and their ability to protect themselves from a terrorist attack. This focus also came upon the Fort Bend County Office of Emergency Management (OEM).

The conclusion made by county officials was that the OEM was not prepared for a local threat in its present administrative and structural form; the OEM needed upgraded hardware and software along with new personnel who could also manage the new technology. A revamped OEM would be needed to better protect the lives of Fort Bend County citizens.

For instance, Fort Bend County is home to 3 major chemical plants, an electrical power plant, minor light industrial complexes located within the Stafford Business Park vicinity, along with other numerous plants and industrial complexes scattered throughout the rural areas of the County. Fort Bend County needed to be prepared to handle a possible chemical, biological, nuclear or other form of terrorism threat immediately. The County also needed OEM personnel to accomplish this task.

So, as a direct response to the tragedies of September, 2001, Fort Bend hired Mr. Jeff Braun, the current director of the OEM, to implement the new changes and better protect the lives of the residents of Fort Bend. Mr. Braun contacted the Fort Bend County GIS coordinator, Robert LaBarbera, in order to learn more about GIS and how it could possibly assist in aiding the OEM in the event of a terrorist attack. After visiting with the GIS Coordinator, the OEM director learned the power and ability for GIS to present accurate geographic information instantaneously. Some of the tasks that the GIS could perform became integrated into the needs of the newly revised Fort Bend OEM.

GIS (Geographic Information System)

GIS was first established within the Fort Bend County Engineer's office around 1995-1996. At this time a GIS Specialist was hired to assist the County Engineer with multiple mapping services. Initially, both the GIS specialist and a computer-aided draftsman (CAD) utilized GIS. The GIS Specialist created hard copy maps for engineers, construction inspectors and administrative staff within the engineering department to assist in daily tasks. These daily tasks included maps for field studies or as exhibits for reports that inspection staff would create.

As time progressed, the GIS Specialist position took on more responsibilities within the county government. The responsibilities included providing

hard copy maps to elected officials, police and fire personnel, as well as maps made to assist departmental personnel. These maps were similar to the maps produced for the Engineering staff.

At this time (from 1996-1999) the type of software utilized by the GIS Specialist was 3 GIS applications by Environmental Systems Research International (ESRI) called ArcInfo (PC Workstation), ArcView 3.2 and ArcPlot. These applications allowed for the creation, update, maintenance, and plotting of maps and GIS Layers. In essence, the GIS at that time was a mapping "shop" where individuals would request map services and then receive a hard-copy map – created by the GIS Coordinator.

Beginning in 2001, Robert LaBarbera was hired as the GIS Coordinator and his new strategy was to include training of personnel on GIS so that engineering and other county staff could directly access map information to produce maps of their own. Over time, the engineering personnel relied less and less upon the GIS Coordinator to produce paper maps.

The Coordinator's original job duty was to create and maintain the data layers which created the paper maps. The GIS Coordinator's job did not consist primarily of creating paper maps nor was GIS intended to be a "map publishing shop". At this point in time, the GIS Coordinator could dedicate more time to producing better data, which was served to the various staff to utilize as well as free data on the County's FTP site.

Since the Coordinator was now able to better manage data rather than map production, it allowed him to begin planning an enterprise-wide method of distributing GIS data to all county departments. This would allow departments to produce paper maps for themselves much like how departments utilize word processors to create professional documents for themselves.

For phase 1 of the enterprise distribution of GIS data, Mr. LaBarbera installed ArcExplorer upon the PCs of elected officials and county administrators. ArcExplorer is a free GIS viewing software that allows for the printing and viewing of GIS information on local PCs. County administrators needed current geographic information and they needed a map to be produced relatively quickly; ArcExplorer was the simple solution to fulfill this need.

Starting around September – October of 2001, the GIS Coordinator completed his task of installing ArcExplorer on certain county PCs and the overwhelming response was very positive. Now, administrators could

query information within layers for themselves, print maps and answer questions over the phone with concerned residents in a matter of minutes – which normally would have taken days for the GIS Coordinator to accomplish due to the back-log of paper map projects which needed to be created.

Phase 2 of the plan involved the installation and creation of custom map projects placed out on the web via ArcIMS. This second solution would take the majority of GIS layers and place them into a live, dynamic, geographic web-based interface which would allow any individual who had access to the World Wide Web to query and produce paper maps for themselves. Starting in January of 2004, ArcIMS was installed and certain layers contained in the 5 mapping projects have been updated on a weekly basis in order to assist all internal county departments and anyone who has access to the World Wide Web. For national security purposes, not all GIS layers that the GIS staff uses are located on the ArcIMS page. Also, the current ArcIMS configuration that Fort Bend County uses does not allow for the creation or editing of layers at the ArcIMS site interface.

Engineering- GIS Software

The Current, software that the GIS Coordinator uses to update his enterprise system is:

- Novell Network (Server, Client) – Utilized by all personnel within Engineering
- Microsoft Windows 2000 or XP – Utilized by all personnel within Engineering
- ArcGIS-ArcInfo (2 licenses) Utilized by the GIS Coordinator and the GIS Assistant
- ArcView (1 license) – Utilized by 1 engineer/construction inspector
- ArcPublisher (future) – Utilized by GIS staff to publish GIS map documents for engineering personnel.
- ArcReader (future) – Utilized by engineering staff to read published maps created by the GIS staff.

The GIS Coordinator stores all layer files within a Personal Geodatabase (Microsoft database file format).

The GIS Coordinator and staff are constantly updating individual feature datasets within the personal geodatabase on a weekly basis.

NEEDS OF THE OEM

Aerial Imagery

The first facet of the GIS that could be utilized by the OEM, was digital imagery. Digital imagery would provide the Fire, Police, Health Services and emergency response directors the ability to see pictures of the County from the air. This would give them the ability to assess certain locations that could be targets of possible terrorist attacks.

Digital imagery would also assist ground personnel (Fire, Police, and EMS services) in the event that a terrorist event occurred. Fire, Police and emergency response directors- possibly miles away from the scene of the event - would have the ability to see "ground zero" in full color and assess the situation within the confines and safety of the OEM building. The directors would have the ability to locate certain objects that ground personnel could not see – either due to massive smoke, fire, or debris. The directors could instruct ground personnel on the best routes either to or away from ground zero. Directors would also have the ability to quickly assess where they could set up staging areas for residents in the event of a disease outbreak or massive contamination event.

Incident Site Location

Next, there was a need to pinpoint locations of terrorist attacks in real time as well as attaching multiple forms of information to each particular location. A stick pin or dot on a paper map would not be sufficient – information such as the time of the incident, address, phone number of contact personnel, and other forms of information would be needed for each site. This information needed to be associated with every incident that would happen – especially if there happened to be more than 1 terrorist event. There was also the possibility that the name and phone number of the contact person be attached to each incident, which would be used for recordation purposes and possible investigation.

Projecting Maps in the Operation Control Room

As the OEM and GIS Coordinator spoke more about the capabilities of live incidents being created ad hoc, the GIS Coordinator suggested projecting the GIS map images onto a wall or screen inside of the OEM's Operation Command Room. This would enable personnel to view what the GIS Coordinator viewed upon his screen. If personnel were in the Operation Command Room and wanted to make a quick status report to other departments, they could simply look up from their workspace and

see what incidents were happening in and around the County. Also, if a director or elected official wanted to see a specific area he/she could indicate this by pointing on the map that was being projected onto the wall. Then, the GIS Coordinator could immediately zoom into the area using his desktop PC.

Finally, from the results of the mock exercise completed in May of 2004, there was a potential need for the telephone operators handling incoming emergencies to see the digital maps as well. These maps could be projected onto the wall within the telecommunications room in order for operators to see all incidents, which they were reporting. Then, if the operators did not see a posted incident in a relatively short period of time, the operator could report the incident once again to the Operation Command Room for validation.

Digital Maps Viewed on all Future Workstations

Next, Mr. Braun needed to have digital maps projected onto each PC screen that the Operation Command Room staffs would utilize. This would enable each command center PC to view maps as well as any other forms of OEM communication that was going on between several departments simultaneously. During the discussion, a software application called WEB OEM was being considered. This application would stream textual communication between department directors and incident record keeping personnel. WEB OEM and the GIS could be placed side by side in 2 separate Microsoft windows on one screen, which the OEM personnel could maximize and minimize at any time.

Digital Mapping Data Sharing

There was a need to share digital GIS layer information with the local state and / or federal agencies. This information needed to be in a file format that most GIS specialists and technicians utilize. The information needed to be transferred via email over wide area networks in order to inform state and federal agencies of existing or new incidents that were occurring in the county.

If a terror incident occurred, the GIS information could be sent to either state or federal agencies within minutes, which would then be cataloged and stored for investigators, who would begin their work immediately.

Hard Copy Map Production

Finally, Mr. Braun and the Operation Command Room needed the ability to print hard copy maps – maps based upon actual incidents, which were being mapped digitally with the GIS in real time.

The hard copy map information would be given to pertinent elected officials and emergency personnel, who would then determine the course of action for the County. There would also be the option of sharing the hard copy maps with local and national news agencies.

OEM - GIS SOLUTION

Once the OEM director saw how all of the data and GIS information could be easily stored in 1 geodatabase file (Microsoft database) and updated easily to his OEM GIS PC, he realized that most of the difficult work was completed. Basically, if the GIS Coordinator already built the individual map layers, then it seemed that the hardest part in establishing a GIS within the OEM was complete. Now, all that was needed was a way of transferring the data to the OEM.

Mr. LaBarbera confirmed this fact and set up a proposed plan in order to keep the OEM's GIS up-to-date and have the ability to create new layers in the event of an emergency or terrorist attack.

Proposed Plan (currently being implemented):

- 1) An FTP server will be established at the MIS department.
- 2) The FTP server will receive bi-monthly updates of the personal geodatabase file that the GIS Coordinator creates within the Engineering department.
- 3) The OEM will download the new version as needed to a dedicated GIS PC located in the OEM.
- 4) Digital imagery would be installed directly to the GIS PC located in the OEM.
- 5) The OEM GIS PC would have Internet access and will be able to send and receive emails.
- 6) The OEM GIS PC would have 1 license of ESRI ArcView which would allow for the viewing of all of the feature datasets within the downloaded geodatabase file.
- 7) The OEM GIS PC would have the ability to use existing GIS layers to build new layers, on the fly, in the event of a terrorist attack.
- 8) LCD projector(s) would be purchased which would project live, GIS map projects (from the GIS PC) onto the walls in the Operation Command Center, possibly the telecommunications

room, and the Administration room (where the County Judge is located).

- 9) Live images from the GIS PC would be viewed on the individual PCs of the Operation Command Center personnel. These personnel would include Fire, Police (Sheriff), EMS, Health and Human Services, Road and Bridge, Engineering, Texas Department of Transportation, Texas Forestry Service, FBI (Harris Agency), CIA and any other PCs which would be hard wired into the Operation Command Center Local Area Network (LAN)

PRACTICE EXERCISE CONDUCTED MAY 2004

Around the first of May 2004, the County performed a practice terrorist drill - in order to better assess how the current OEM could handle a terrorist attack. It was also designed to point out deficiencies within the current configuration of the OEM.

Since the OEM did not currently have a dedicated GIS computer established for the practice drill, the GIS Coordinator agreed to transport his workstation PC - containing all of the digital imagery and GIS layers - to the OEM.

The Texas A&M University's National Emergency Response and Rescue Training Center (NEERTC) conducted the drill in cooperation with the Texas Department of Public Safety and the Division of Emergency Management. At the start of the drill, the NEERTC personnel oriented the county personnel as to the basic purposes of the drill. The drill was intended to test the amount of time it took before the County would contact federal agencies for assistance as well as determine if contact was appropriate for the circumstance. If the County could prove that it knew what it could and could not handle without Federal intervention and that it could involve the Federal authorities at the right time, then the County would pass the test.

The drill would involve all heads of critical departments who would need to be of assistance in the event of an act of terrorism. These departments included Road and Bridge, Health and Human Services, Sheriff, Fire, EMS, Engineering, GIS, Purchasing, Auditing, and numerous others. The drill would also involve all charter cities within the County, which employed their own fire, police and EMS personnel. Each city would act as a contact point and communication relay station for the County and would attempt to handle the simulated attacks within their city limits. In other words, each city would attempt to control fires, crime, traffic accidents,

medical emergencies and other instances initially. But, if situations worsened, and the city's resources were depleted, the city would call upon the County's additional resources.

The County would act as a central data exchange point. The County would assist the cities up to the full commitment of their resources. The cities would continue to provide information to the County as to the status and progress of events. If incidents got out of control and the County resources and personnel were being depleted rapidly due to multiple active terror threats at one time, the County would alert the Federal Government and assistance would come in the form of the National Guard, or other federal emergency or law enforcement agency.

On the first day of the drill, the GIS exceeded expectations. Incidents started to come in from numerous actors out in the county and the incidents were mapped and data was attached to each incident on the maps. Aerial photography was used which showed police, fire and EMS locations at sites which were hardest hit and allowed for plume diagrams to be drawn. The plume diagrams allowed the county EMS personnel to better assess where certain segments of the population could be harmed due to noxious chemical clouds.

Overall, the drill progressed with no major problems and the County was successful in assessing when to contact the Federal government. There were however some changes which needed to be made to the OEM to better handle a true terror event. The following items are items that the OEM is currently in the process of installing:

- 1) A Dedicated GIS Computer with ArcGIS software.
- 2) Digital workstations for all department heads.
- 3) Emergency management software, which will allow department heads to view incidents in real time.
- 4) Video screens and/or LCD projectors to show digital maps and incidents for all personnel to view – especially in the command center and phone operator rooms.
- 5) A centralized software application that will connect cities with the county OEM for better data exchange.

Currently, the OEM is implementing these changes, which will better prepare Fort Bend County for any possible act of terrorism.

CONCLUSION

The Fort Bend GIS has made huge progress in the 9 years since its inception. It has grown to be an integral part of the County's day-to-day activities and assists numerous county departments, private sector, and the general public through the World Wide Web. As time progresses, it will continue to grow and evolve into a more powerful and useful tool – utilized by many people and organizations that reside or interact within Fort Bend County.

In the past, the Fort Bend County OEM has been able to handle any form of natural disaster or storm related emergency without the use of any GIS or computer aided mapping service. Now that there is a strong possibility of a future domestic terrorism threat, the Fort Bend OEM has needed to prepare itself for a non-conventional emergency. Because of GIS' ease of operation, the power of GIS' ability to store and retrieve integral database related geographic information and the fact that this information can be shared easily from one department to another, GIS will continue to be an integral part of how the OEM better protects the residents of Fort Bend County.

Finally, because of the successfulness that Fort Bend Emergency Management has had with GIS, it is logical that GIS, used as a geographical tool, should be an integral part of every emergency management center – whether it be local, state, or federal agency.

Acknowledgements and References:

Braun, Jeff. Fort Bend County Office of Emergency Management, Fort Bend County. May, 2004.

Author Information:

Robert LaBarbera
GIS Coordinator
Fort Bend County Engineering
1124 Blume Road
Rosenberg, TX 77471
Phone: 281-633-7523
Fax: 281-342-7366
Email: rlb@co.fort-bend.tx.us