GIS FOR DISASTER DRILLS & EXERCISES

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EVOLUTION OF GIS FOR EMERGENCY RESPONSE

In the past, Geographic Information Systems (GIS) were used primarily for cartographic production of hard copy maps. During disaster events, these printed maps were often used as a "sketch pad" in the Emergency Operations Center (EOC). These GIS situation maps have also been quite useful during public meetings and during press conferences.

GIS as an Integrating Technology

Present technology allows GIS to take a much more active role in emergency response situations. This includes more interactive applications and the use of live status maps within the EOC. ***GIS can take a central role as the integrating technology for a wide variety of rapidly-changing information.***

Maximum interoperability is a main consideration when implementing a GIS for the EOC today. GIS provides a rich graphical status map, just like the big table-top maps in the old war movies. Only in the case of GIS, the map is interactive and is constantly being updated. Snapshots of the current situation map can be sent to remote locations via .pdf files and web viewing applications.

On-Line Data Portals

The recent establishment of on-line GIS data portals has made the acquisition of map data during an emergency response event much more convenient. But always have a backup plan. If Internet access is impaired or unavailable, then so is the data that you may have grown accustomed to accessing on-line. This problem was highlighted during the responses to Hurricanes Katrina and Rita, when critical infrastructure was destroyed and the Internet was out of service for an extended time. Organizations learned that GIS data should be acquired and archived in advance, whenever possible. Data can be organized onto external USB hard drives, which can be easily transported or stored in a safe location off-site.

Keep it Rugged and Simple

When evaluating the use of emerging technologies for use in an emergency response environment, two key factors to consider are ruggedness and ease-of-use. Often, volunteers and other non-technical personnel will be called upon to perform data collection or damage assessment activities, so the more user-friendly the tools are, the better.

All-Hazards GIS

GIS should not be implemented with only one type of disaster in mind. Instead, an "All-Hazards" approach should be used. Many of the same GIS data layers that would be useful during a HAZMAT incident will also serve during a biohazard

incident. The same goes for severe weather, earthquakes, wildfires and many other types of disaster situations.

Virtual EOC Concept

The future includes the emergence of a completely mobile GIS and EOC. This "Virtual EOC" grew as a result of the events of both 9/11 and Hurricane Katrina when it was learned that fixed, central locations for EOCs may not be the ideal solution.

The New York City EOC was located in World Trade Center complex and was totally lost in the disaster, just when it was needed most. During Hurricane Katrina, the New Orleans EOC and 911 call center were flooded and rendered useless. It took weeks to set up a replacement call center in a downtown hotel building. The concept of allowing first responders to move about while taking care of business and yet remain connected is the goal of the Virtual EOC.

Drills in Corpus Christi, Kingsville, New Orleans, Fort Worth and Ingleside all featured a portable EOC GIS. The systems initially deployed to the command post locations in the field and then moved to the EOC location during the event as a part of the exercises. Since EOCs can become inaccessible, these portable systems can be set up anywhere. The availability of emergency power and internet can be provided by solar, generator and satellite sources. Texas A&M has a small utility trailer that includes a generator, satellite internet for data and voice communications and, perhaps most importantly, air conditioning. This type of response trailer is designed to be extremely portable and to provide these critical services during the first hours of an emergency response.

Use of GIS as a Simulation Environment for Disaster Drills and Exercises

The National Spill Control School at Texas A&M University Corpus Christi has utilized GIS in its professional training courses since the early 1990s, where GIS has been used to help generate both tabletop and deployment drills.

In the summer of 2005, something new was proposed: Why not use GIS as the simulation engine for disaster drills and exercises? While at the same time demonstrating the usefulness of GIS and training command staff on its basic use.

GIS was used not only to setup the scenario, but also to track response activities during the drill so that the event response could be "played back" during the critique session.

The Navy drills were designed to fulfill annual training requirements and in order to provide an opportunity for incident management staff to get to know each other. This included not only base staff, but responders from outside organizations including Federal, State and Local government and the private sector.

The drills have involved multiple departments including the Base Fire Department, Air Operations, Disaster Preparedness, Finance, Security, Safety, Public Works, Naval Hospital, Environmental, Contracting, MWR, Fuel Farm, Officer of the Day, Base Commander and Executive Officer. Outside agencies included the U.S. Coast Guard, U.S. Fish & Wildlife Service, Texas General Land Office, Texas Parks & Wildlife, Lousiana DEQ, Corpus Christi Area Oil Spill Control Association, Portland Fire Department and Christus Spohn Hospital.

Setting up the Scenarios

First, GIS data was acquired for the areas of interest from Federal, State and Local government sources and websites, including aerial photography and environmental map data. GPS-linked photos were also captured in locations within the specific area of interest around the planned disaster sites. All of this GIS and multi-media information was used to provide total situational awareness and in order to generate the disaster scenarios.

The drills included a variety of scenarios including a crash landing of a training jet, a fuel truck accident, microburst from a severe thunderstorm, HAZMAT release from a refinery and a hurricane.

One example of integrating GIS with related technologies includes a HAZMAT program from the Environmental Protection Agency called ALOHA, which was used to input the local weather conditions, chemical source information and properties in order to generate an airborne HAZMAT plume. This plume footprint was placed on the GIS map using aerial imagery as a guide, in order to determine the resources-at-risk and to plan evacuations, if necessary. ALOHA is a fine stand-alone program, but its true power is only realized when combined with GIS.

Realtime weather was also used to provide input for ALOHA and GIS. Weather information including radar, rainfall totals, wind speed and direction and other factors can be acquired from both free Government websites and value-added datasets are available from commercial sources. Weather affects just about any type of scenario, so having sources of this information in GIS format is key within the EOC environment. Obviously, sometimes weather is the focus, as in the case of severe thunderstorms, hurricanes, winter storms, etc. But even minor HAZMAT or oil spills are driven by winds and other weather conditions.

The GPS-linked photos were useful in showing incident mangers what things look like on the ground. This was especially useful in describing the situation to responding agencies that did not necessarily have an intimate knowledge of the site. Communications and decision-making were improved by having this type fo visual intelligence available within the GIS. There was one case in which the base public works director was unaware of flowing water and wildlife in a drainage ditch until the GPS-linked photo was displayed. Prior to that, the ditch was assumed dry.

Lessons Learned

Lessons learned included the fact that not all technologies worked as well as desired. Wireless aircards that were being used to transmit .pdf maps turned out to be very slow. Some email services actually stripped-off the .pdf attached maps during transmission.

Another thing that was learned by the participants, is that while it is OK to compress time during a disaster drill, you must allow sufficient time for events to take place. Otherwise, during a real event, you will have an unrealistic expectation of what can be done in a given amount of time.

One pleasant surprise was that GIS was adopted immediately as a visualization tool by the decision-makers in the EOC, even though they had no prior experience with GIS. Maps are such a natural method of communicating events and complex scenarios, that it required little or no instruction to be put to work right away as a response tool.

The scenarios and responses were captured in a series of GIS screen snapshots, so that during the critique phase of the exercise, events could be played back and the response activities could be discussed.

As has been seen in recent actual disasters, the cooperation of federal, state and local government agencies is critical to the success of any response. Practice through mock disasters, drills and exercises needs to be taken seriously. Drills and exercises allow emergency managers and first responders to get to know each other and rehearse the use of the National Incident Management System (NIMS). Drills and exercises also provide the opportunity for GIS to be put to work in order to execute a more effective response.

The National Spill Control School at Texas A&M University Corpus Christi provides both classroom and on-site training for Emergency Managers using GIS, including tabletop and deployment drills and exercises. Students include professionals from federal, state and local government agencies, contractors, utilities, shipping and petroleum industries. For more information on the National Spill Control School, go to http://www.sci.tamucc.edu/nscs or email devon@waypointmapping.com .