BIOGRAPHICAL INFORMATION

Ronald J Langhelm
GIS Coordinator
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Emergency Preparedness and Response/FEMA

Specific Responsibilities

Ron Langhelm joined FEMA in January 1996 to provide GIS support for the Winter Storm/Flood disaster in Oregon. In 1998 he accepted the position of GIS Coordinator for FEMA Region 10. Ron is responsible for the GIS and Remote Sensing needs for the Region 10 office of the Department of Homeland Security, Emergency Preparedness and Response/FEMA. This office covers the daily operational support for their involvement with the states of Alaska, Idaho, Oregon, and Washington. In addition he is rostered on one of three emergency response teams with similar responsibilities for catastrophic disasters.

Past Experience

Ron Langhelm began his career in the Emergency Management field 13 years ago volunteering with the Washington Mountain Rescue Association. In 1996, Ron served as president of the Association's Whatcom County Council. In the private sector, Ron was employed providing mapping services to local emergency management organizations within Washington, as well as owned a company that developed a wide-variety of GIS products for clients nationwide. An employee of FEMA since 1996, Ron has been a leader in the continued development of the Agency's Geographic Information System and Remote Sensing capabilities across the country. Ron has been the lead for FEMA's Technical Services in a multitude of disasters including the 2001 Nisqually Earthquake in Washington State, the 2001 World Trade Center (WTC) Collapse in New York City, New York, the 2002 Winter Olympics in Salt Lake City, Utah, and the 2003 STS-107 Space Shuttle recovery operation in Texas.

Educational Information

Professional Memberships

GIS SUPPORT FOR THE SHUTTLE RECOVERY OPERTION-THE HUMAN FACTOR

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ABSTRACT

While observing this tragedy on television, the tragic loss of life overshadowed any thought of the recovery effort that would be required. This effort was immediately being organized, as a multitude of federal, state, and local entities came together under the President's declaration of an emergency to perform the largest ground search operation in our countries history. Supporting the geospatial needs of such an effort has been unlike any disaster GIS operation FEMA has experienced.

INTRODUCTION

When responding to and supporting catastrophic events, there are many combined factors that make our GIS operations successful. We are all aware of the various pieces of a GIS; hardware, software, data, and people. Of the four, I rely on people the most.

When I left my home in Washington State to assist in the recovery of the Shuttle Columbia, I was a one-man show with support staff awaiting deployment. After assessing the overall situation, we deployed the resources required to meet the geospatial needs of the event.

The recovery operation for the Space Shuttle Columbia, STS-107 ran from February 1st 2003 to May 1st 2003. Over this 3-month period we employed 115 GIS professionals at the FEMA Disaster Field Office (DFO) in Lufkin Texas. With an interagency GIS

Figure 1, Staffing Pattern

operation staffed by DHS/FEMA, Texas Forest Service (TFS), the National Aeronautics and Space Administration (NASA), the National Imaging and Mapping Agency (NIMA), and many other agencies, we worked aggressively to meet the requirements of our managers. In addition to our office in Lufkin, there were local GIS staff, the first responders who were working at field facilities providing necessary support to the field teams.

The TFS was assigned to be the lead for the State of Texas. They had the initial GIS presence in Lufkin. When I arrived on February 2nd, I met with TFS and NASA to develop a plan for the GIS requirements. We agreed that we would develop an Interagency GIS operation with FEMA as the lead for GIS and NASA as the lead for Remote Sensing. This team would be in place to support the geospatial needs of the entire operation. Staff for the DFO in Lufkin were pulled from multiple sources. FEMA would provide the management, pulling in staff from across the country. TFS would provide GIS analysists as needed. NASA would bring in GIS/Remote Sensing analysists as well. In addition to these obvious assets, we pulled support staff from state agencies, NIMA, Interagency Wildland Fire Resources, and several contractors from ESRI.

INCIDENT SPECIFIC DATA

With the extensive GIS operation for this event, only 3 data products were created at the DFO. These datasets were generated in the first few days to meet our immediate needs and evolved into more valuable products as time passed.

Debris Data

The creation of the Shuttle Interagency Debris Database (SIDD) started on day one. In an effort to share information, people were faxing hard-copy debris reports from one emergency management facility to anyone they thought might need it. This was all done with the best intentions but without a data collection plan, a bad situation was quickly getting worse. Someone needed to take control of this information and our team took on the challenge. Additional assistance was sent by the state, and two employees from the Texas Natural Resources Information System (TNRIS) arrived on February 3rd. One of them was the GIS Database Manager for TNRIS. This individual was the key component in developing our SQL Server/ArcSDE database. Several days later, a second database administrator from TNRIS arrived to assist.

Search Grid

In any significant search certain information is essential, such as a tracking the areas searched, monitoring the level of completeness, and area assignments. This was done in several different ways in the initial days of the operation.

Working with the Air & Ground search managers, the decision was made to use a 2-mile by 2-mile grid to manage the search area. Two members of our GIS team worked with 2 members of the astronaut staff to identify the bounds of the grid. We then expanded these boundaries to accommodate potential growth of the search area and generated the grid product. Each grid required a unique number and attributes to support Air Search, Ground Search, and management of our GIS production.

Debris Line

The overriding topic of discussion was “Where is the debris?” Because of the initial sensitivity of the debris data and the difficulty in making sense of all the point locations, the simplest way to display the debris was using a line. With GIS support at multiple locations, products were developed and delivered with conflicting lines.

Again, members of our GIS team worked with the astronaut staff to derive an "official" line to be used on all products. The first line was derived by manually estimating the center of the debris path focusing on 3 heavy items recovered in Louisiana. The second version of the line was produced on February 20th and used a linear regression model and a subset of the SIDD. This subset focused on heavier items estimated to have traveled a straight path following breakup and was used for the remainder of the operation.

INCIDENT PRODUCTS

In tandem with the development of our data a wide assortment of products were created. In the first couple weeks, most products were produced per individual requests. Anyone involved with the recovery effort could submit a GIS product request.

As we moved into the second week, we were making plans to support an aggressive search operation, supporting the daily needs of 3000 ground searchers and 35 helicopters. This would require unique products for the Air and Ground search teams. One member of the team was a programmer from ESRI. He was tasked with automating the search maps. This required two distinct formats, each with a unique representation of the same information. Page sizes were different, one with a single panel the other with two. One major difference was the format of the latitude/longitude coordinates identifying the grid centroid and the tick marks around the perimeter. The ground teams required decimal degrees and the air teams degrees and decimal minutes. This minor problem proved rather difficult to overcome. The application developed allowed for the production of large quantities (1000+ daily) of map products with minimal effort.

The products required by the search managers focused on the big picture. As managers of the GIS, we needed to maintain a high-level of productivity in our staff. After several days of tracking search status, many similar products were in production with slight variations from each other. A meeting was held with the search managers to consolidate the many products into 3; Air Search, Ground Search, and Overall Search Status. This maximized our productivity for the delivery of Search Status maps.

Of the 4 field camps, we maintained GIS support at only one, the lake search operation on Toledo Bend. This facility was responsible for all water search operations. They were using citizen reports, several forms of water-based sonar, a team of image analysists, and divers to conduct their operations. Prior to this event this group had not utilized GIS. The local first responders introduced it and it became a requirement of the water search effort. The GIS team members working there needed to be very self motivated and capable of dealing with their technical issues in house. New team members were interviewed upon arrival and candidates were selected for the field camp duty.

One of the first products requested by the Federal Coordinating Officer was a product to explain to the incident managers how the recovered materials were moving across the country. This request came on February 3rd, prior to having our GIS fully operational. I replied that the first product would be ugly but would get better.

Figure 2, Material Flow Map

The product I delivered the following morning covered Texas and Louisiana and consisted of only some basic vector data (streets, highways, water, county & state boundaries) and hand annotations depicting field facilities, the debris path, and an arrow to Kennedy Space Center. This was received with some amusement and every day the quality of the product improved.

OVERALL SUPPORT

One of the most significant decisions made in this operation was which GIS software platform to use. FEMA’s standard does not conform with the majority of other federal and state agencies. In the past we have supported large disasters with multiple platforms. This compromises our productivity and inserts unnecessary confusion. On February 3rd I held a meeting standing next to the loading bay door in the back of the convention center to discuss this issue. We agreed that as a group we were most comfortable with ArcView 3.2 and decided that this would be our standard software. The next day I readdressed the question, stressing the extensive capability of the newer ArcGIS 8.2 platform and it’s utility in this operation. Although there was a general feeling of discomfort amongst the group, all agreed that most had some exposure to it and as a team we could quickly increase our proficiency. This was critical in the success of the operation. We moved to a corporate-type solution, serving data to anyone who needed access and utilizing the best available technology.

Although the SIDD database began as a GIS centered project, it evolved into the core piece of information for the entire event. While the GIS team was compiling a comprehensive database of debris reports and retrievals, the Environmental Protection Agency (EPA) was tracking actual shuttle items recovered. This information was very similar and at the same time different. EPA was assigned with ensuring public safety, retrieving hazardous materials, and the general recovery of debris. Our team was working with them from day one. After several days, the two databases were compared and discovered duplicate and missing records. I met with representatives from EPA and NASA to discuss the problem and develop a solution. The primary problem was that there were too many opportunities for duplication of records! In this meeting we decided

Figure 3, Early SIDD Design

that we would design the SIDD to collect all reports through a web interface which could be accessed from any data collection location. All relevant records would be passed to EPA through a near-real-time replication with their server. When EPA had taken action, the updated data would be automaticially passed back to the SIDD where it was available for our GIS products as well as off-site mapping and analysis. This system was designed in the field and required the human-to-human interactions to implement and maintain. We brought the database administrators to the field office and worked many long days & nights to see it through. With this plan in place, an agreement was made between an EPA representative and myself, that if problems were identified within our own agencies which could compromise the system, we would immediately notify our partners. This core agreement was factored into my daily life and actions throughout my deployment. The success of the SIDD was dependant on this agreement. It had to work.

Throughout this operation we were consistently performing duties outside any perceived job description, understanding that things had to be done. We sent several folks with a pickup truck to locate and retrieve our GIS server. After about 7 days on site, we physically moved all of our GIS operation to a new DFO location several blocks away.

With solid leadership and a positive environment, our Interagency GIS team maintained a close working relationship. The group was mutually supportive in every instance. On more than one occasion, someone would leave for lunch and return with a cart load of food to feed everyone. When planning a trip to the lake operation, we asked if they needed anything, they requested fresh fruit, vegetables, and bottled water. We stopped at the store and made the purchase for them. As staff rotated in and out, one would train their replacement, maintaining the continuity of our operation.

With this large surge population came many day-to-day difficulties. Housing was scarce; local residents took many of the first responders in. Individuals were forced to share rooms with strangers, as some of the hotels were over 30 minutes away. On several occasions, one of our team members chose to sleep at the nearby shelter rather than loose an hour traveling to her hotel. In the end, we all have new friends and incredible memories.

SUMMARY

Without the support of well over 100 individuals, the GIS provided to the Shuttle Recovery Operation could not have been a success. The personal sacrifices put forth by the members of our team were invaluable. These folks were there because they wanted to be, not because they were assigned. I rely on people more than anything else. With the right team, most anything can be accomplished.

When asking people to support these type of events there is not much I can offer beyond the unique experience. While on site they are faced with high stress, poor living conditions, abnormal diets, and time not spent at home. When they leave, they have a new understanding of their skills and abilities. Hopefully this provides them with additional confidence in their personal and professional lives.

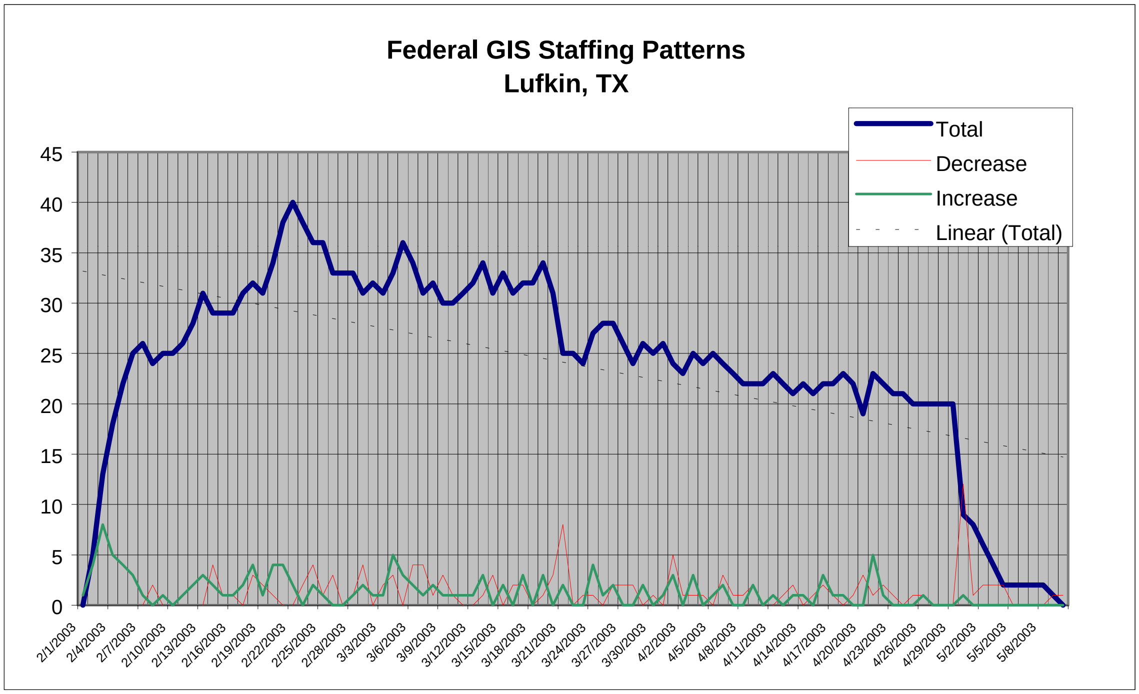

Figure 1, Staffing Pattern

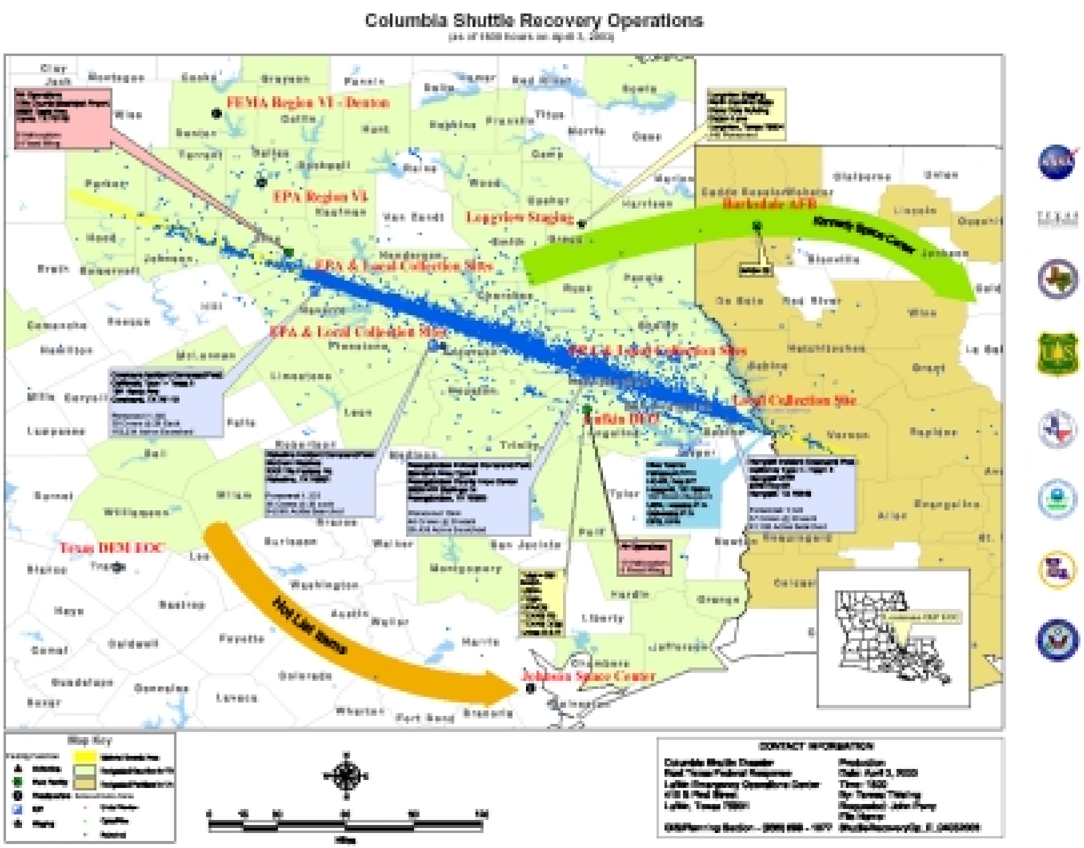

Figure 2, Material Flow Map