Merging Two GIS Platforms for Utility Data into One:

FRAMME to ESRI Conversion and all of the other pieces and parts

ESRI 2005 User Conference
Paper: UC1619

By: Amy Miller, Manager - GIS/CAD Standards
JEA, Jacksonville, Florida

Abstract

JEA is the largest community-owned utility in Florida and the eighth largest in the United States. The electric system serves approximately 360,000 customers in Jacksonville, FL, and parts of three adjacent counties. JEA's water system serves more than 240,000 water customers and 186,000 sewer customers. Since 1992, JEA has been utilizing Intergraph's FRAMME to manage/store GIS data for landbase and electric distribution. Water and sewer have been on an ESRI platform since 2001. Operations & maintenance of two platforms has become cumbersome, expensive, and has caused many problems, so JEA has begun converting the electric and landbase to ESRI format. This project also includes development of a mobile solution for use by field forces (including a two-way communication and incremental automatic data updates) and an intranet web solution. Several internal applications (such as outage management and engineering analysis tools) will also be integrated with the GIS in this project.

Project Mission Statement

The purpose of the GIS software implementation and data migration project is to provide a single, state of the art integrated information system that will support development and maintenance. JEA also wanted a system that would allow engineers and designers to model electric, water, and wastewater systems in order to better plan the expansion of networks and manage available resources effectively while reducing operating costs. An enterprise-wide geospatial decision support system will ensure access to infrastructure and facilities data by all staff – in the office, in the field, and from remote work locations.

Project Objectives

The major corporate objectives of the GIS Software Implementation and Data Migration Project are identified as:

1. Capability to view Electric, Landbase, Water, and Wastewater maps (e.g. base maps, digital orthophotos) in a single ArcGIS client/server environment.
2. Capability to document and manage electric facility and service area data.
3. Capability to add future feature data sets to the Electric, Landbase, Water, and Wastewater feature data sets so the entire collection can interoperate as an Enterprise Geodatabase.
4. Specify and implement detailed requirements for interfaces to Outage Management, Engineering Analysis, and Transformer Load Management applications.
5. Capability to use all existing systems in a timely, accurate, sequenced, and tested manner without delays and workarounds for critical requirements.

History of the Project

GIS at JEA has been an evolving system, as has the company itself. JEA was formerly the Jacksonville Electric Authority, providing electric service to Duval County, Florida. Prior to 1992, all electric and landbase maps were hand drawn and stored in a paper format. As the popularity of computers grew in the early 1990's, so did interest in converting paper maps to a digital format. In 1992, JEA chose Intergraph's FRAMME technology as the preferred platform to manage and maintain the electric and landbase data that was previously only available on paper.

In the meantime, the water and sewer operations for Duval County were owned and operated by the county Water and Sewer Department. In 1997, The Jacksonville Electric Authority acquired the county's Water and Sewer Department and became known simply as "JEA". The water and sewer data was incorporated into FRAMME and remained there until 2001 when it was migrated from FRAMME into ESRI format. Electric and landbase data, however, have remained in FRAMME.

In 2003, the decision was made that it had become too cumbersome and expensive to operate and maintain two GIS Platforms. No one in the company was able to see ALL of the utility's assets on one map. The manager of GIS/CAD Standards and the Technology Services Project Management Office joined forces and began researching all available GIS options. The team interviewed all current and potential GIS users in the company and began gathering functional requirements for what the system should do, and also created a functionality 'wish list'.

Two platforms were compared during the functional needs assessment – the new Intergraph G-Series (GElectric, G-Water and GeoMedia) and ESRI's ArcGIS with Miner & Miner's ArcFM program – to determine which of the platforms would best meet JEA's requirements. The JEA GIS Steering Committee selected ESRI.

Following the functional needs assessment, an RFP was produced and POWER Engineers, Inc., one of the nation's top T&D consulting firms based in Hailey, Idaho, was selected as the prime consultant to perform the GIS software implementation and electric data migration. POWER'S GIS department provides expertise in application development, data migration, inventory management, ArcIMS implementations for utilities around the country. POWER is also responsible for the management of the mobile and web-based intranet applications and interfaces. POWER has chosen to partner with several subcontractors that have a history of successfully implemented enterprise GIS and related systems at several large utilities.

Much emphasis has been placed by JEA and POWER on thoroughly defining and clarifying the scope of work, the work plan, and project schedule. The following activities were instrumental in building the framework for this project.

1) Project workshops
   - Workshops were held to validate and understand the previously gathered customer requirements.
   - The workshops held were specifically targeted to the different aspects of the project (electric, landbase, interfaces, web, mobile).

2) Modeling Sessions
   - Modeling sessions were held to completely construct logical and physical electric and landbase models.
   - Several iterations were plotted out and worked through in the sessions until mutually acceptable models were decided on.

3) Communications
   - Meetings were held with the end-users and other stakeholders to set expectations about the scope, timeline, and protocols of the project.

4) System Architecture Design Strategy
   - JEA engaged ESRI to assist in formulating a capacity plan and a system architecture design that will best suit the anticipated use and needs of the GIS System. For more details on the system infrastructure chosen please use the contact information at the end of this paper.

Key Components of the Project

Desktop

The focal point of this project is migrating the electric and landbase data from FRAMME (Intergraph) into ESRI Format. Having completed the models, work began on the first migration. Twelve circuits were chosen to migrate as a pilot and to ensure that the electric model developed on paper was indeed what would work on a computer screen. The circuits were in a well developed area and the original intention was to freeze work being done in FRAMME in this area, track all of the work orders that came in, and hold them until the end of the project when they would be re-entered. However, as the project progressed, the team realized that saving this pilot data to later be updated would not be productive for JEA. It was agreed that this pilot would be a dry run and the data would be thrown away in the end.

POWER Engineers selected Velocite Integration Inc of Green Bay, Wisconsin to perform the data migration services. Velocite is a software consulting firm that integrates GIS technology with enterprise IT systems for utilities, municipalities, and telecommunication companies.

JEA exported the pilot data from FRAMME and delivered it to Velocite in August 2004. POWER Engineers then configured the geodatabase to function with the ArcFM software. The newly migrated data was returned to JEA in November. The testing period took approximately two months and was extremely detailed; the process took the full-time dedicated resources of five individuals. The team tested every piece that was delivered, commented on placement, scale ranges, connectivity, symbology, the overall model, domains, editing behavior, annotation behavior, and any other general comments. After a lengthy review with the consulting teams, the electric and landbase models were revised as necessary by POWER and the migration scheme was approved. To verify this migration scheme before the entire dataset goes to migration, the team will review one final 'pilot' run of the same data. The full dataset migration begins in July 2005.

Besides migration of electric and landbase data from FRAMME to ESRI format, the desktop application will include some other customization by POWER. JEA will be utilizing the ArcGIS 9.1 series of software, ArcSDE, as well as Miner & Miner's ArcFM and Network Adapter. Several auto updaters will be written into the editing functions. A few examples of these include:

- Phase Auto Updater (from units to feature level)
- Capacitor Bank Size Auto Updater (from units to feature level)
- Labeltext Auto Updater (from units to feature level)
- Symbolization Auto Updater (for web, mobile, and desktop)
- Workorder Number Auto Updater (from units to feature level)

A "Reserved Device" application is also included with this project. In order for electric projects to be designed, any project requiring switches must have a switch number assigned prior to construction. This ensures that the switch number on the construction plans is the same number on the physical switch that gets installed in the field. Some switches are reserved for years; a complex system for storing switches was used in FRAMME. However, the new reserved device application developed by POWER will streamline the process and keep design and construction flowing smoothly, without a lot of confusion within the GIS System.

Interfaces

Three major interfaces with the desktop application are planned in the first phase of this project. They include:

1) Engineering Analysis

The JEA Planning Department uses Advantica Stoner SynerGEE software for analytical modeling, simulations, optimizations, and overall system planning purposes. As a part of this project, a one-way export tool will be created to take data from GIS to SynerGEE using Stoner's MiddleLink utility. By using information contained in the GIS rather than creating a separate network within SynerGEE, JEA staff can leverage the benefits of a GIS system. Additionally, less data entry will be necessary as changes occur to the GIS network because subsequent exports will pick up the changes and apply them to the SynerGEE network. Finally, a reduction in the chance of network errors will be gained because only one network (the GIS network) will need to be maintained.

2) M3i Pragma Line (Outage Management)

In order to perform outage analysis and manage JEA resources, the current implementation of M3i's Pragma Line outage management system requires a connected model of JEA's electrical distribution. Prior to the introduction of ArcGIS and ArcFM software as JEA's GIS platform, software was created to export the necessary data from FRAMME to the outage management system using Pragma Line's GISIMPORT routine and standard three-file format. The extract routines will be reengineered to operate from an ArcGIS environment and supply data to Pragma Line in the same format as in the past.

An interface tool will be created to export on an ad-hoc basis the required connected model of JEA's electrical distribution facilities from ArcSDE to the standard three-file format that can be imported into Pragma Line via M3i's existing GISIMPORT tool. This will provide the outage management system with the most current and complete distribution network available.

3) Transformer Load Management (TLM)

Transformer Load Management is a valuable tool used by the System Analysis and Planning teams. By interfacing TLM and ArcGIS/ArcFM, this project will:

- Develop functionality that enables users to read JEA's Customer Information System (CAIR) information and Network Meter Reading (NMR) system and formulate peaks.
- Provide functionality which will calculate transformer demands using corporate formulas for winter, summer and off-peak seasons; read data for calculations from CAIR, store meter counts and demands for each transformer (in the transformer).
- Provide the ability to analyze transformer loads based on customer energy usage and demand and aggregate or roll up the demand to the feeder level based on the connectivity model in order to identify no load transformers that could be recovered and re-deployed.
- Provide the ability to query historical information about transformer loading and primary customer load demand information.
- Provide the ability to view and query information about the highest load on a segment of the overall circuit.
- Provide the ability to view and query information about transformer tap positions.

Mobile

JEA and utilities around the country are recognizing that to even further increase the responsiveness to customers and operate efficiently they need to deploy GIS data to the field. There are many advantages to having up-to-date digital data in the field. The field crews can help keep the asset data accurate and current. By giving the field crews tools that allow them to mark incorrect data, the company's investment in the data is secured. Also, with tools that allow the field crews to do analysis on current data, they can operate more efficiently and respond to customer needs faster. Another key customer service feature is meeting with customers for new service requests. JEA wants their customer service representatives to have a view of the data and be able to show customers the necessary improvements to provide service to their home or business. Lastly, digital GIS data in the field aids in damage restoration efforts. Having access to up-to-date information while walking a circuit or reviewing other storm damage helps to protect lives and property in the event that a leak or short is detected and needs attention. Traces performed on the network data can help identify the valve or switch that should be operated to isolate the problem area. However, GIS often seems too complicated for personnel used to working with paper maps.

In response to this movement from paper maps to up-to-date digital maps, POWER Engineers engaged the Geospatial Solutions Division of Tadpole Technology Group to take advantage of their many years of field mapping expertise. The latest generation in field mapping comes in the form of a mobile sketching application built on ESRI technology ~ GO! Sync™ (Redline), the smart way to create and manage field sketches (for data correction or staking).

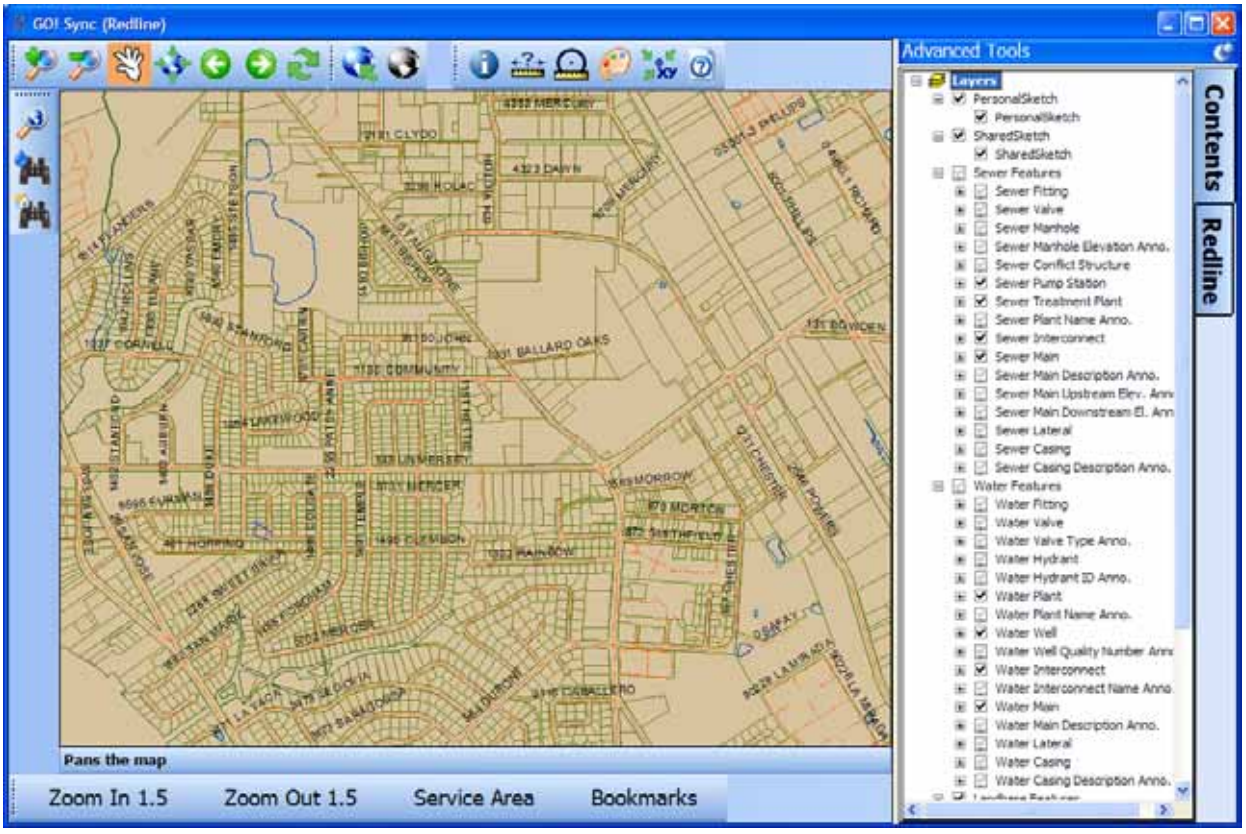

Figure 1 – Mobile Map Viewer Window

The software is built for simplicity so that even the novice user can find map navigation intuitive using gesturing commands. By circling an area on the map, for example, the application zooms into that region. The application features few menus, larger buttons for ease of use in a field setting, and an auto-hiding menu panel which optimizes map real estate.

GO! Sync (Redline) has view, query, and sketching capabilities. It is built upon an ESRI Geodatabase and maintains many of the usability factors common with the paper map approach, including drawing on the map for sharing map data corrections, work-related drawings, or personal notes.

With JEA's GIS system still in the growing stages, redlining was a key requirement for the mobile application. GO! Sync (Redline) provides a forum for the field forces to mark up the maps and send their comments back to GIS Central for correction or update, a loop that was not traditionally occurring. Using the Go! Sync technology, changes are pushed in both directions, from the field and from the office, ensuring that both ends have the latest and greatest data and information. This drastically reduces the amount of time that the technology services team needs to spend with each field laptop. With the previous system, every laptop had to be physically touched in order to either update the software or the data. Now the changes to both the application and the data are automatically sent out over the server every time the user hits a wireless 802.11 hotspot or by an always-on connection via 'air card'.

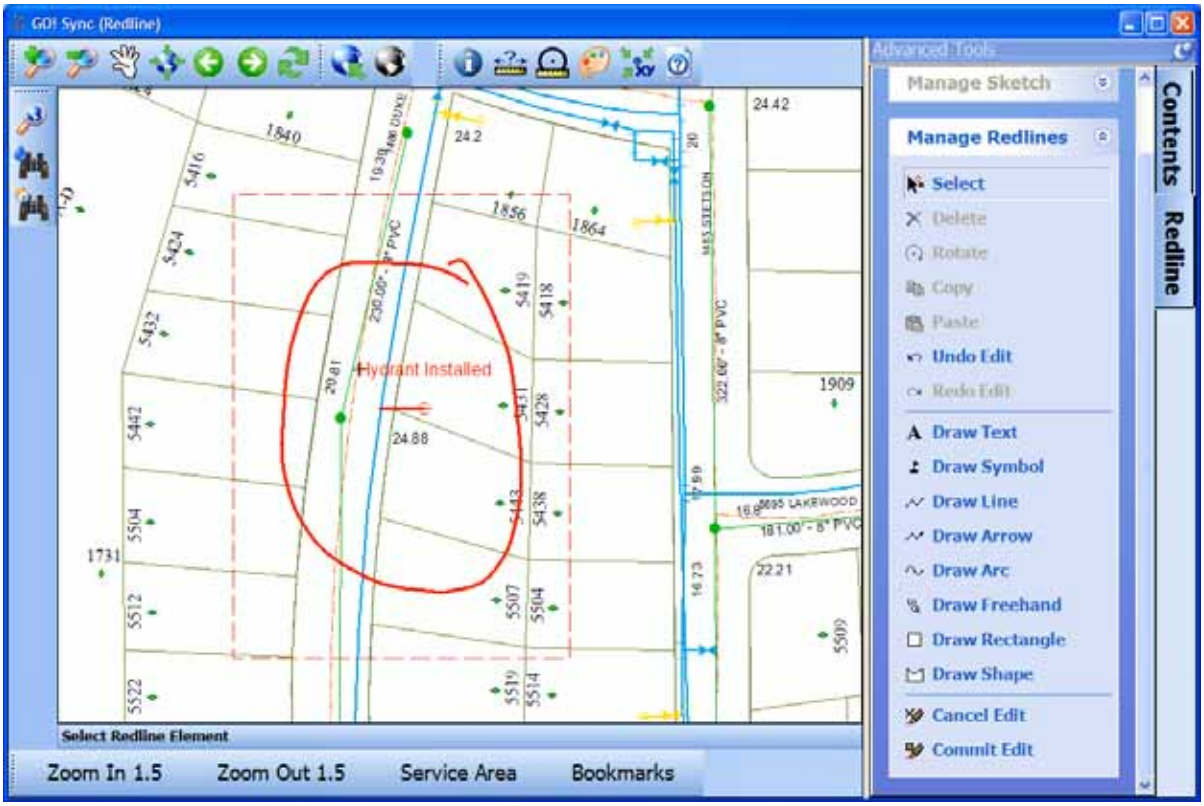

Figure 2 – Redline Capabilities

With the transition from paper maps to GIS, utilities are able to leverage the power of geographic information in the field. Common-sense searching is possible, useful for finding networked features, equipment, addresses, and street intersections. All these allow the field user to operate more efficiently in the field. With GIS in the field the crews can more reliably find customer addresses.

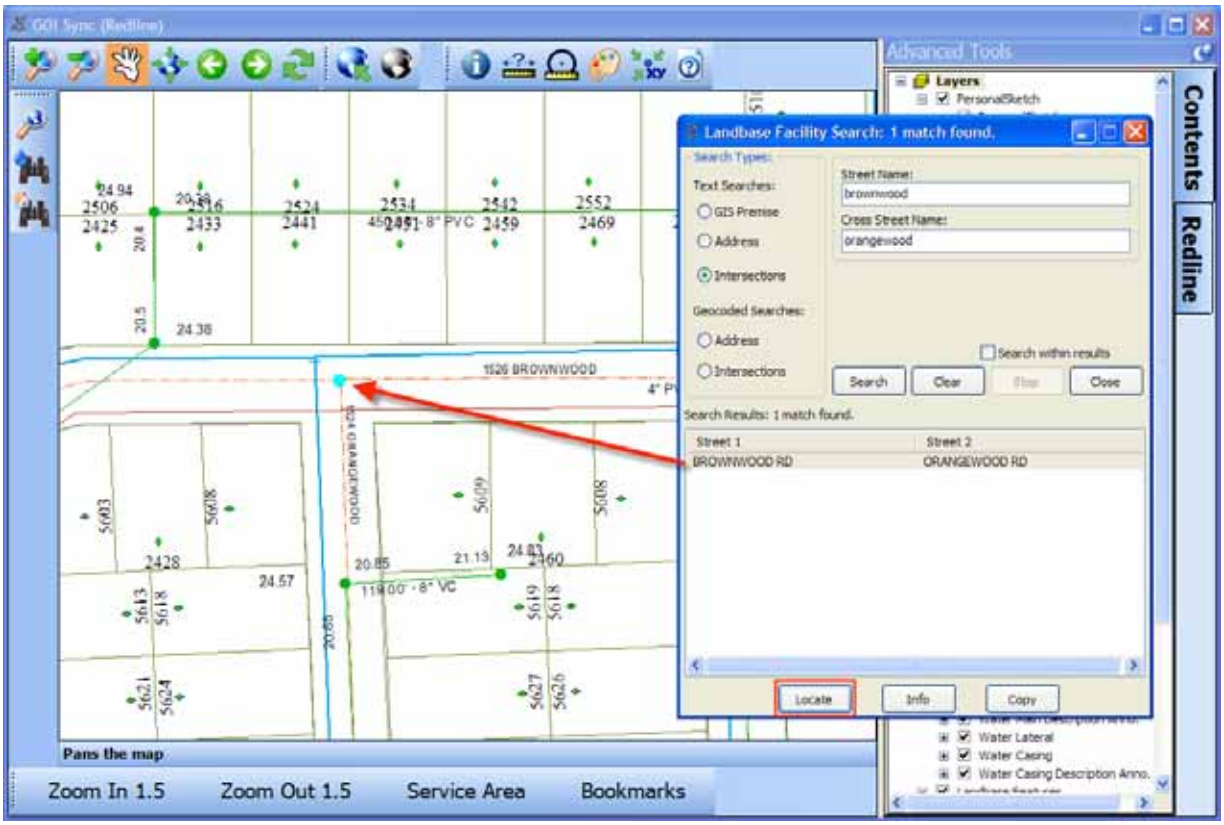

Figure 3 – Search and Locate Address or Intersection

Additionally, more advanced tools are available that allow sketching or redlining, network tracing, and even routing. On paper, tracing is a tedious task that is not feasible in limited conditions (light, weather, etc) using large scale maps. However, using an ESRI Geodatabase, field personnel can perform both elementary and sophisticated network tracing. This functionality is particularly useful during outage and restoration efforts allowing field crews faster navigation to disabled devices for better response.

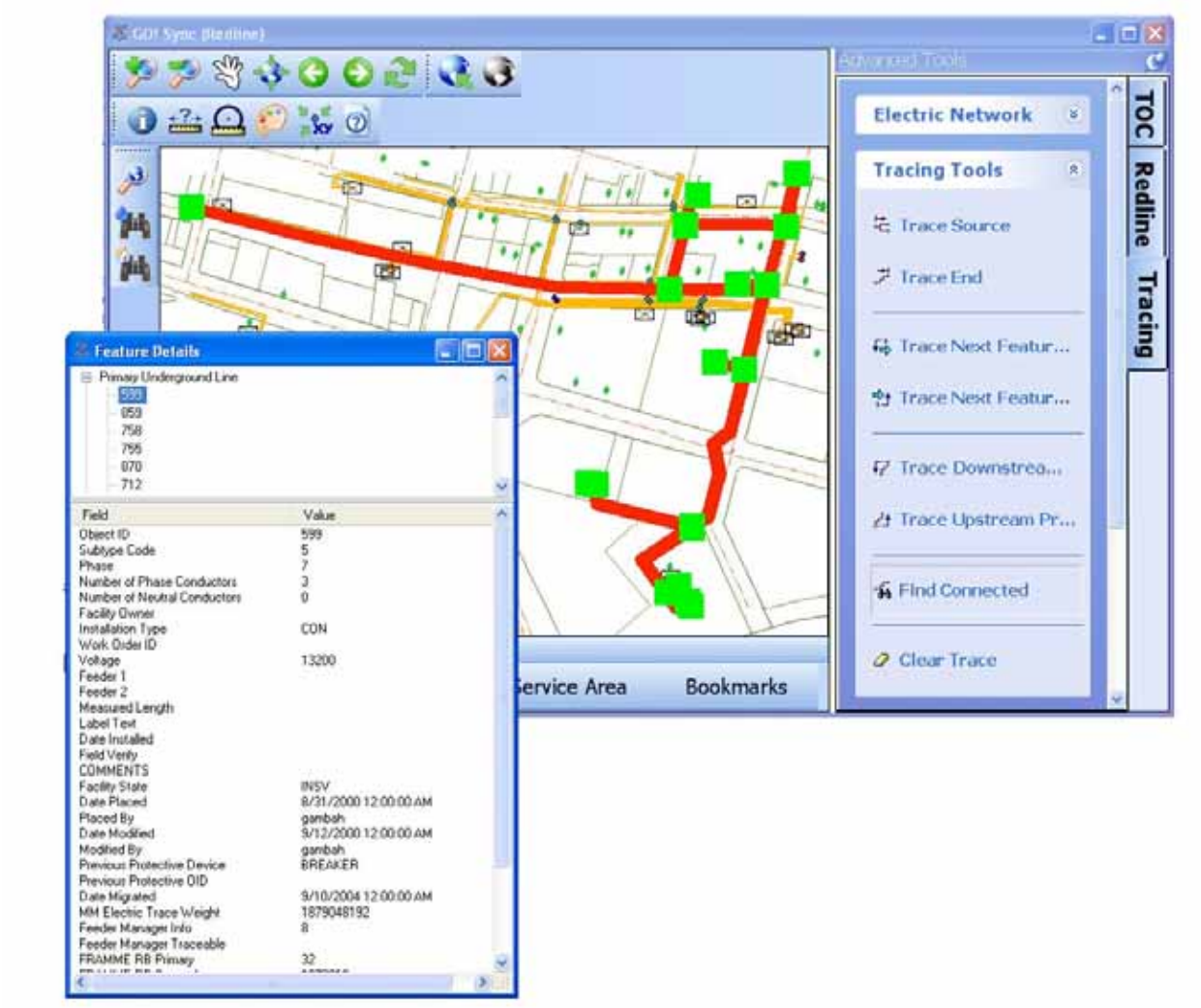

Figure 4 – Tracing Functionality

GO! Sync (Redline) is built fully integrated with GPS to allow workers to leverage positional readings while in the field. The GPS functionality can be used to collect facility locations, track current location, plot it in real-time on the map, and even for creating routes to the next destination. This creates efficiencies that allow the field crews to respond to customer issues better. JEA is currently coordinating with several local agencies to utilize Automatic Vehicle Locator systems (AVL) and in the near future plans to integrate that technology with this software.

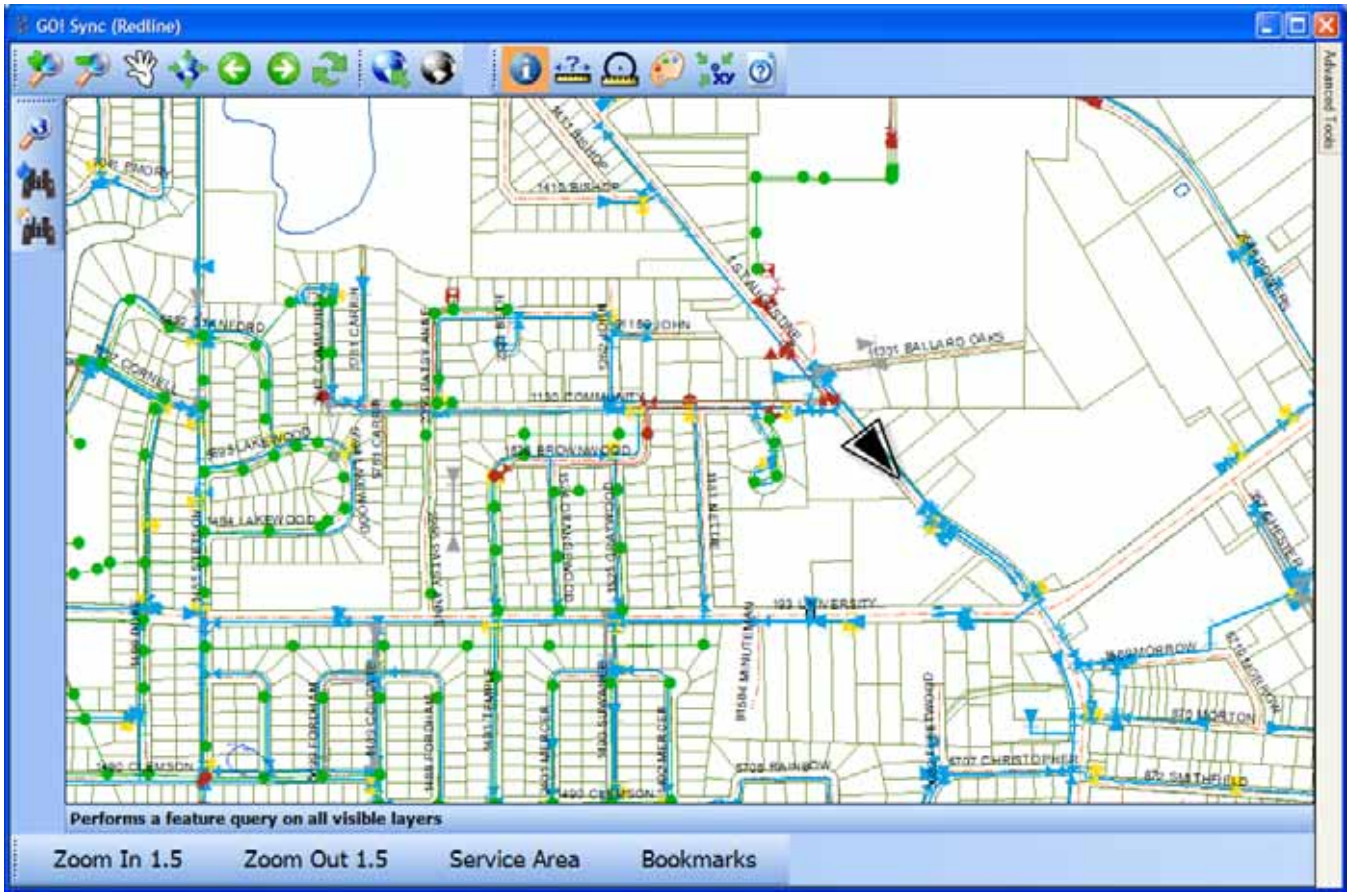

Figure 6 – GPS and AVL Capabilities

GO! Sync (Redline) can be integrated with 3rd party systems, allowing the organization to streamline field operations by coupling work orders, service orders, locate tickets, etc. with mapping. Now field personnel can see and use a map alongside their scheduled and unscheduled work information. JEA Field Forces have already seen the power of this technology and are planning enhancements. In the first phase of this product, there will be an integration with the outage management system. The next external integration will be with the ticket dispatch system that JEA uses to receive work notices from Florida Sunshine One-Call ("Call before you dig").

This mobile application is a complete system framework, designed to be easy to use while preserving a field-friendly profile. It is also extendable to better integrate into all aspects of the organization.

Web

The need for accurate, timely, easy to navigate information stretches far beyond just the field forces. With several hundred customer care consultants working daily to maintain customer satisfaction, and hundreds of other employees dedicated to keeping the business running smoothly, the need was identified for a way to serve centrally linked and controlled GIS Data to the masses. POWER Engineers identified Orion Technology of Toronto, Canada, and the value that their products could bring to JEA was instantly realized.

Since its inception in 1998, Orion has been dedicated to creating leading edge IT and GIS solutions. Orion has achieved phenomenal success in securing and delivering projects for reputable clients worldwide - from small organizations to entire countries. Orion's Web-GIS solutions have helped local governments reduce barriers between customers and services.

OnPoint, Orion's Web-GIS Solution, provides a single-window mapping interface to access GIS data as well as all related data from business systems databases (such as the customer information system) through multi-level joins using a web browser. This means no need for expensive desktop seats for accessing data, system administrators don't have to maintain multiple data access applications, and that the users use a web browser and don't have to learn multiple applications or be a GIS Professional.

With OnPoint, each department can have its own web application to serve their needs by simply creating a separate instance of OnPoint and without worrying about the GIS data warehouse and ArcIMS map services. In addition, within the same map, users can choose from several tabs that each house different bits of information. Users can flip between the tabs, keeping the same area on the map, but adding and removing different portions of information.

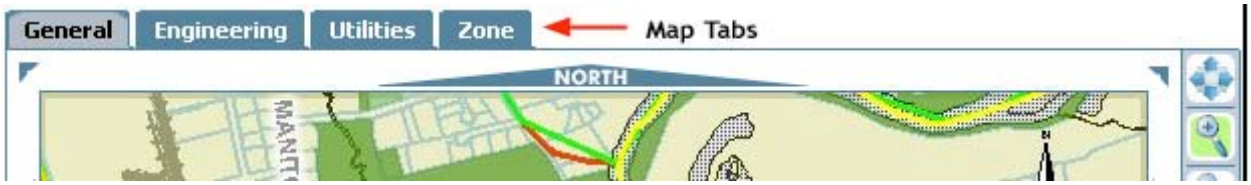

Figure 7 – Web Map Tabs

On-Point allows you to create Web-GIS applications without any programming. Instead, the POWER team used the point and click interface to build and customize the application. The ability also exists, for future enhancements of the project, to create custom user interfaces for management, staff, and customers, or even to create department specific interfaces. By using these rich setup tools, the time to go live on the web was dramatically reduced, allowing the team more time to focus on developing custom tools that will increase productivity and decrease the learning-curve for the average JEA employee.

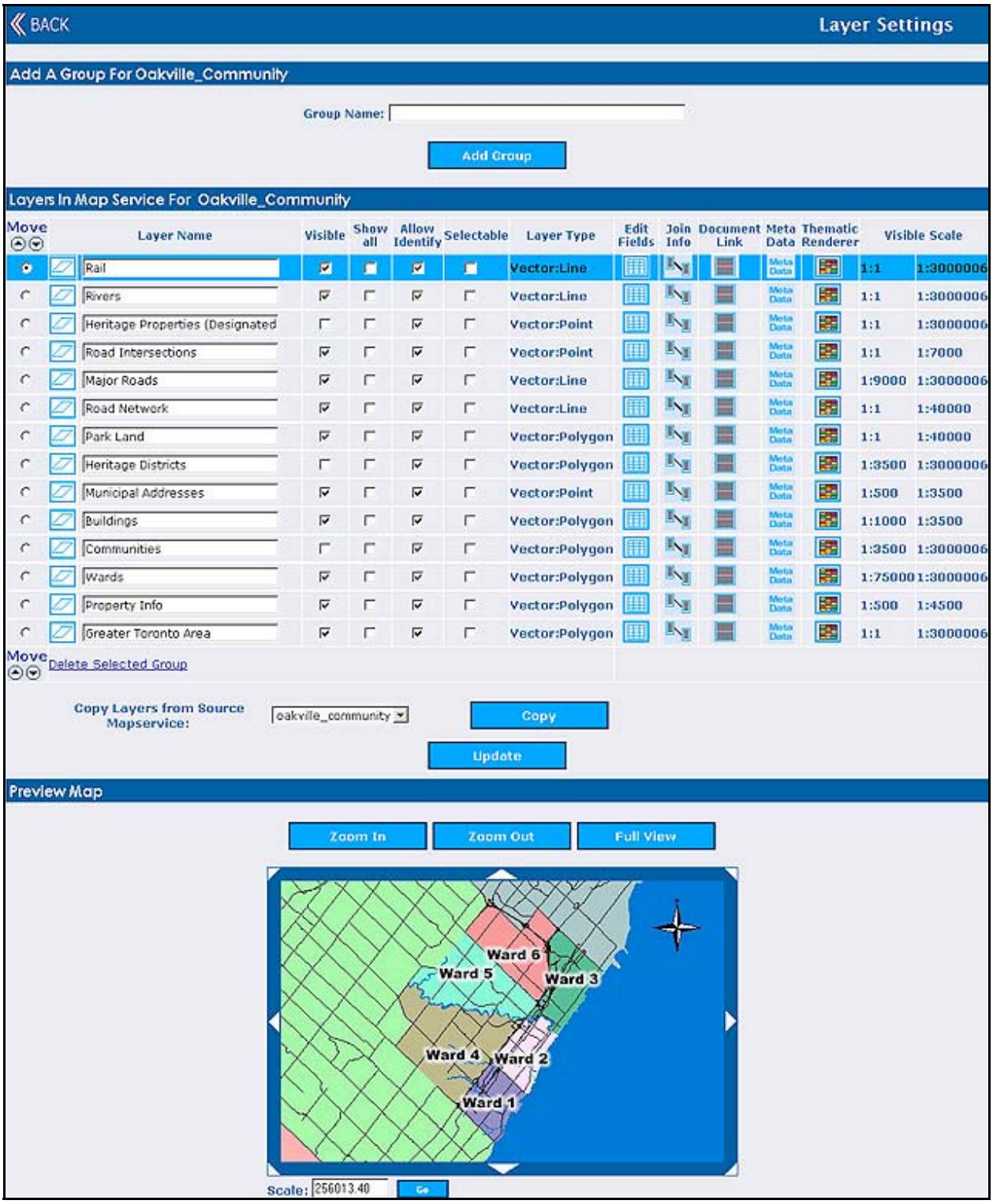

Figure 8 – Web Administration Tool

As with the mobile application, the web version of this project also incorporates redline capability. When a change is made, the redline edits will be converted into a JPG drawing and emailed to the GIS department for further research. This means that virtually every employee in the company has the opportunity to work on improving and maintaining the integrity of the GIS data.

Figure 9 – Web Redlining Tool

The web application is similar to the mobile in that there are simple query capabilities available for the novice user and more complex query capabilities for the more advanced users. Areas can be located and selected and more information can be gathered from any feature on the map. This information can then be viewed and/or exported from the application. OnPoint also allows robust printing and map sharing via e-mail.

Figure 10 – Simple Searching Functionality

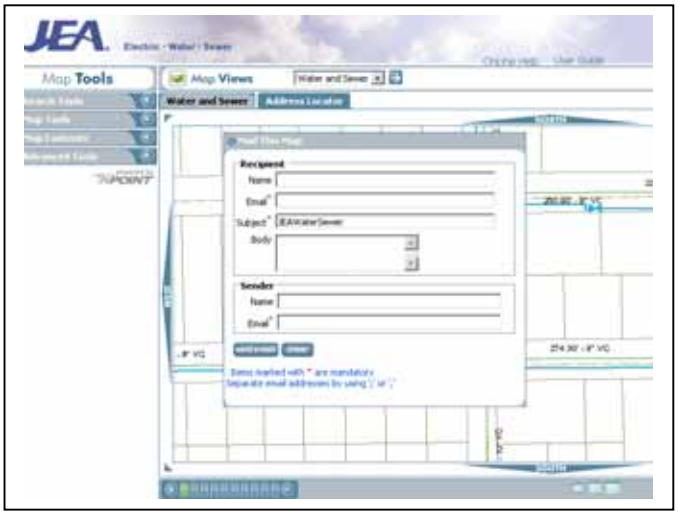

Figure 11 – Simple E-mail Functionality

Business Logistics

Communications

Communications play a key role in the success of the project. Keeping the team members and other stakeholders completely informed is imperative.

- Weekly 'core team' meetings
- Monthly communications meetings with all interested parties invited
  - PowerPoint presentation of the highlights from the last month
  - Question and answer period for users to address their needs
  - The last 30 minutes of the meeting dedicated for a user-group type forum

- Established a GIS Project e-mail box for all project related questions

Change Management

Since this project entails a major overhaul of the way business will be conducted, having a dedicated team member to cover change management issues is key. JEA is a Six Sigma company and the project enlisted the services of a 'Black Belt' to assist with change and process issues. The Black Belt conducted workshops to understand the current processes taking place. The teams identified gaps and possible problem areas, and work to bridge the gaps and revamp processes that will be changing as a result of the project.

Risk Management

With a project as large in scope as this one, the need to manage risks is huge. A matrix was created to help track issues as they arose. An escalation strategy was also put into place to help resolve any issues that could quickly go from 'small smoke' to 'big fire'. When an issue arises, a risk mitigation plan is created and sent out to the primary individuals that may be able to resolve the issue. If the issue is not resolved by this team, the problem is escalated to the Program Manager or Project Management Office Director for one week. If the problem is still not resolved, it is then escalated to the Vice President of Technology Services who has agreed to work with the teams to resolve issues within two days. This keeps issues that could potentially be 'show-stoppers' from bringing the project to a grinding halt.

QA/QC

Working again with the project Black Belt, the team developed an aggressive quality control plan to ensure that all of the requirements of the project were met. For the mobile and web applications, extensive test plans were created. They included the original requirement from the customer, the script that will be used to test the requirements, the outcome of the test, and the signoff of the customer.

For the actual migration and the desktop implementation, there is also a test plan similar to the mobile and web. To ensure proper migration, POWER Engineers and the project Black Belt have worked together to create a QA Matrix that addresses all of the potential issues that need to be quality checked after migration. Some item examples include: feature counts, output reports, and representative sampling.

Software Development Life Cycle (SDLC)

The purpose of the Software Development Life Cycle model is to standardize the process to develop new JEA Technology Services systems and enhance existing systems, thereby ensuring that systems are developed efficiently and cost effectively to meet user needs. Specifically, POWER customized the JEA Software Development Life Cycle to:

- Establish a common framework as the basis for applying software configuration management to the Technology Services software activities as outlined in the Technology Services Policy on Software Configuration Management.
- Define the activities, participants, and responsibilities in a systems development project.
- Standardize the activities and product formats among the many systems development projects in JEA Technology Services, thus improving quality and communication.
- Indicate where standard controls such as security, quality assurance, and management reviews enter into the systems development and enhancement process.

The SDLC model is divided into eight phases. All the phases are required for any custom systems development whether it is a standalone application or modifications to a commercial off-the-shelf package project. However, not every project will require that the eight phases be executed sequentially during its development. Depending on the size and complexity of the project, phases may be combined or overlap. The phases are as follows:

- Planning
- Analysis
- Design
- Construction
- Testing
- Start up
- Turnover
- Post Turn-over Software Support

All of the documentation for the project is stored in a central location on the company network and is accessible at all times by all stakeholders needing more information on any part of the project. After each phase of the SDLC is completed, a thorough document review is required of the project management team, and these documents must then be approved.

Training

Training is a key element of this project. Throughout the project, the project core team has been attending training sessions or working hand-in-hand with POWER and their subcontractors to begin understanding the different technology pieces and skill sets necessary to successfully run the project.

As the mobile and web pieces of the project were completed, JEA and POWER held “train-the-trainer” sessions to train key internal employees. These employees have been taking the new products back to their work centers and training their co-workers on the applications. Wide scale training will be offered on all pieces of the project at the completion of the project.

Lessons Learned

Every technology project is a constantly evolving creature. This project has been no exception. There are a few general lessons learned that can be shared to the benefit of others who will be embarking on a similar journey.

Communication within the team

We learned early on that communications could make or break the project. Weekly core team meetings have been a huge benefit to the group as a whole. The meetings help keep each arm of the project (business, technical, key users, stakeholders, and executive sponsors) in the loop on what has transpired in the week before. Aside from the entire core team meeting, the core project team members who are closely related with the daily operations of the project meet once a week on a conference call with POWER Engineers and any of the other vendor teams that may need to be involved that week. There is also a weekly Project Management meeting where the project manager, business lead, and technology lead from both JEA and POWER Engineers meet on a conference call. This meeting handles all higher level issues including funds, change orders, and any project or team issues. The forum is open, and honest communication helps resolve any outstanding issues and keeps the project moving smoothly.

Bottom Line:

- Meet often (weekly).
- Keep everyone informed.
- Keep some of the details at a project manager level, not concerning the project team members that are involved in the daily operations of the project.

Requirements Gathering

The requirements for this project were gathered *very* early on in the project. They were gathered by a team of consultants who were relatively new to both GIS and the business of the company. When business customers were interviewed to develop the customer valid requirements (CVR) document, there were no parameters set. This means requirements were collected that were so broad (to the point of outrageous) and never should have been discussed in relation to GIS. When they were being validated two years later, in the thick of the project, they were difficult to validate, and it was difficult to explain to the customers that their request would not be incorporated with GIS at this time.

Bottom Line:

- Have GIS savvy individuals gather the requirements.
- Wait to gather requirements – do it right before the project starts.
- Set expectations with customers up front. Do not include outrageous requests in the requirements documents.

Gaps in Technical Knowledge

Several gaps in technical knowledge were discovered early on in the project. These gaps had the ability to be 'show stoppers' to the project. It is imperative to have team members on the project that have the proper skill sets. If they do not, they should at least have the desire and aptitude to learn the new skills. There should also be funding available and executive level support to send these individuals to the appropriate training courses.

Bottom Line:

- Make sure your team members have the needed technical skills well in advance of the project start date.

Scheduling Around Hurricane Season

This lesson was learned in an extremely painful manner during the 2004 hurricane season. Being a water, sewer, and electric utility, if the wind blows and the rain comes, you have to be ready to move. The original project schedule was set to be extremely aggressive. There was no padding incorporated to cover unforeseen events. The delays from hurricanes Charley, Frances, and Jeanne affected the entire project. The immediate project team was dispatched to the customer center to assist with answering telephones. Decisions and information were needed from end users who were otherwise engaged in the restoration efforts both in Jacksonville and other areas as a part of mutual-aid agreements. The stretch of the schedule due to the 2004 hurricanes sent the project schedule for 2005 from spring into summer – right back into hurricane season for 2005. Instead of having the project wrap up in late spring, it will now be finished at the very end of storm season (November 30, 2005).

Bottom Line:

- Include enough flexibility in the project schedule to allow for unforeseen events.

Credits and Contacts

JEA
21 W Church St
Jacksonville, FL 32202
www.jea.com

Amy Miller, Manager, GIS/CAD Standards
mcgrah@jea.com
(904) 665-5746

Maria Benavides, GIS Project Manager
benaml@jea.com
(904) 665-7046

Karen Kincade, Technical Project Lead
kinckd@jea.com
(904) 665-2496

POWER Engineers
1295 S. Eagle Flight Way
Boise, ID 83709
www.powereng.com

John Terry, Project Manager
jterry@powereng.com
(208) 378-0022

Velocite Integration, Inc.
1620 South Ashland Avenue, Suite 106
Green Bay, WI 54304
www.velocite.com

Bart Koenig, President
bkoenig@velocite.com
(920) 432-1820

Tadpole Technology
2237 Faraday Ave Suite 120,
Carlsbad, CA 92008
http://www.tadpoletechnology.com/

Jason Linley, Director of Operations
jason.linley@us.tadpole.com
(760) 929-8345

Orion Technology, Inc.
1550 Sixteenth Avenue
Building "C" North
Richmond Hill, Ontario
CANADA L4B 3K9
http://orion-gis.com/

Michael Franschman, Senior Sales Associate
mfranschman@oriongis.com
+1 905.508.6900