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The Exponential Business Benefits Of GIS

by Ken Congdon

San Diego is largely regarded as one of America's finest cities. With its miles of coastline, near-perfect weather, and legendary zoo, it's hard to argue with this distinction. Amidst all these attractions, it's easy for the effort the city puts into repairing and maintaining its streets to go unnoticed. However, anyone with experience in public works understands the coordination, communication, and responsiveness required to run an effective streets department — and San Diego does it better than most. So, how does San Diego keep its streets so classy? Well, it all revolves around the city's integrated GIS and SAP workforce management system.

INTEGRATE GIS WITH ERP TO ADD CLARITY TO PUBLIC WORKS PROCESSES

Ten years ago the City of San Diego went through a massive reorganization that merged the city's Urban Forestry and Electrical Divisions with the Street Services Division. Each of these divisions tracked their work using a different workforce management platform, and these disparate systems soon caused communication

Installation Profile

Technology User: With a population of approximately 1.34 million, San Diego is the second-largest city in California and the ninth-largest city in the United States.

Problem: As a result of a citywide reorganization, the City of San Diego's street department inherited five disparate workforce management systems. Using these separate platforms resulted in repeat work and increased expenses because project information was not effectively shared among department teams.

Solution: The City of San Diego adopted a single workforce management system that integrates SAP with ESRI ArcGIS platform. This solution not only provides the street department with a common platform in which to share information, it also provides workers with visual validation of work requests prior to dispatch. This capability reduced instances of wasted trips and repeat work. The initial investment of $1.8 million for this system was recouped in just two years as a result of these cost savings. Because of this initial success, the system has since been extended for use by city constituents, field technicians, and other city departments — each enjoying a distinct set of benefits from using the system.

Photos by Eric Laycock

Elizabeth Mueller, EAM (enterprise asset management) program manager for the City of San Diego, says the city's integrated GIS and SAP solution recouped its initial $1.8 million cost in just two years.

"We had instances where the street services group would go out and pave a street, and a week later the electrical group would dig it up to fix a cable. These types of scenarios resulted in repeat work and escalating costs."

Elizabeth Mueller, City of San Diego

and work efficiency problems once the divisions were combined.

"Operating on separate systems caused all kinds of problems because the left hand wasn't talking with the right," says Elizabeth Mueller, EAM (enterprise asset management) program manager for the City of San Diego. "For example, we had instances where the street services group would go out and pave a street, and a week later the electrical group would dig it up to fix a cable. These types of scenarios resulted in repeat work and escalating costs. We needed to transition to a single, unified workforce management system so that we had a common platform in which to share information and thus create synergy in the work efforts between the groups of our division."

The City began its search for such a new platform by looking for a best-of-breed solution that could integrate the job-specific features of many of the workforce management systems already in use (e.g. integrate a street paving management application with a tree trimming management application, etc.). Not only was this approach difficult to accommodate from an integration perspective, but Mueller was also concerned about the scalability of a platform of this nature over the long term.

"Technology evolves at a rapid pace," says Mueller. "And, many of the specialty industry solutions we were considering for a best-of-breed solution were only able to handle a finite number of records effectively. These solutions weren't built to handle the millions of records we were going to dump into the system from all the other division groups. If we went this route, I knew we would have to upgrade or rebuild the system in four or five years. As a result, we selected a less customized, but more robust and scalable platform for our workforce management system."

The platform the City of San Diego selected was SAP ECC (ERP Central Component) 6.0. While SAP was the ideal solution for data management, reporting, and workflow for the City of San Diego, it lacked the graphical, location-based interface the Streets Division depended on to respond to street repair or maintenance requests. To fill this need, the city integrated its existing ESRI ArcGIS 9.2

Build And Deploy Synchronized Mobile GIS Applications

To extend the power of its integrated GIS (geographic information system) and SAP workforce management platform to the field, the City of San Diego implemented ArcGIS Mobile 9.3. ArcGIS is a GIS software platform that enables organizations to deliver GIS data and services from centralized servers to a range of Windows Mobile devices (including smartphones, handheld computers, notebook computers, and tablet computers) via wireless networks. ArcGIS Mobile allows organizations to take GIS to the field where new data can be collected and updated in near real time to reflect real-world conditions.

The City of San Diego runs ESRI ArcGIS Mobile 9.3 on the Panasonic CF-19 Toughbook computers deployed to its field technicians.

The applications deployed have the ability to synchronize directly with ArcGIS Server when connected to a wireless or wired network. This allows both office and field personnel to instantly view and work with updates made by any field staff who are also connected to the network. Furthermore, when operating in disconnected mode, the application caches the information locally on the device and updates the database as soon as the device reconnects to the network.

ArcGIS Mobile can integrate with your existing GIS by consuming maps that are authored in ArcGIS Desktop and published as map resources with ArcGIS Server. Using the ArcGIS Mobile SDK (software developer kit), the solution can also be tailored to work with an organization's specific mobile workflows on any Windows Mobile device supporting a Microsoft .NET framework.

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platform with SAP. The two systems work together as follows.

The ESRI ArcGIS application serves as the front end user interface for most of the work performed by the Street Services Division. For instance, when a call comes into the call center to notify the city about a broken streetlight, a help desk employee asks the caller for an address and pulls up a map in ArcGIS that visually presents all the streetlights at that location. Using this map, the exact location of the streetlight in question can be verified prior to dispatching a repair technician.

ArcGIS provides visual information and basic data (e.g. ID number) for that streetlight, but the integration with SAP takes the functionality of the platform a big step further. For example, selecting the streetlight in question and clicking an "SAP" button embedded in ArcGIS launches an SAP screen that provides all the pertinent data associated with the streetlight's ID number (e.g. schematics of all components associated with that streetlight, a history of work that has already been performed on that streetlight, other calls that have been placed regarding that light, etc.). From this screen, the call center employee can also issue a work order and assign a technician to the job. All job status and completion information is tracked in SAP as well.

The initial implementation of the integrated ArcGIS and SAP ECC 6.0 system was a $1.8 million investment for the City of San Diego. However, Mueller states this project paid for itself in just two years. "We realized substantial cost savings through our integrated SAP and GIS system by eliminating false alarms and wild goose chases," she says. "For example, callers would often provide an inaccurate description of the location of an asset in need of repair, and our technicians would drive around for hours trying to find it. This unnecessary activity resulted in wasted time, productivity, and fuel. Furthermore, callers would often dispatch us to fix assets outside of the San Diego city limits. By visually verifying an asset's location on a map prior to dispatch, we have eliminated these costly scenarios."

EXTEND GIS TO YOUR CUSTOMER BASE

The initial success of the integrated ArcGIS and SAP solution was well-received, but city officials soon searched for ways in which the system could offer more value to San Diego and its constituents. As a result, an initiative was proposed that would make the platform available for citizens to use as part of the www.sandiego.gov website.

"We realized substantial cost savings through our integrated SAP and GIS system by eliminating false alarms and wild goose chases."

Elizabeth Mueller, City of San Diego

"A lot of folks internally lobbied against extending our integrated ArcGIS and SAP solution to the public," says Mueller. "They didn't think we had the labor to address thousands of added repair requests coming in via the Web. However, I felt this logic was a bit warped. For example, just because you have more people reporting a pothole doesn't mean you have more potholes. You just have the opportunity to provide better customer service to a larger number of people. Plus, the SAP system would automate much of these customer service efforts."

To see how a county government is integrating GIS with document imaging software, visit ISMinfo.com/jp/5575.

The majority of city officials eventually shared Mueller's viewpoint, and the project was given the green light in 2003. The web-facing ArcGIS and SAP platform basically gives citizens another medium (other than by telephone) in which to submit repair requests to the city. Constituents can now simply log on to www.sandiego.gov and click on the "Request A Street Repair" tab in the left-hand column of the home page. Citizens are then prompted to enter an address for where the maintenance needs to occur. Once entered, a map highlighting the area in question is displayed. Using a drop down menu, citizens can then select the type of maintenance required (e.g. streetlight repair, pothole, missing traffic sign, etc.). The geographic interface then either presents all the streetlights/traffic signs in that area or prompts you to select an approximate location on a street where a pothole is located. Once the exact streetlight/traffic sign or approximate pothole location is selected, the citizen is prompted to provide some basic contact information (e.g. name, email address, etc.) and submit their request. Once submitted, SAP automatically sends the citizen an email to verify that the request was received. SAP sends another automated email to the citizen once the job is completed.

"By extending our integrated ArcGIS and SAP system to the public, we're allowing citizens to enter a lot of the maintenance information our call center employees normally would," says Mueller. "This helps reduce manual labor and increases our efficiency. Furthermore, SAP can track how many people reported the same problem. This data helps us pri-

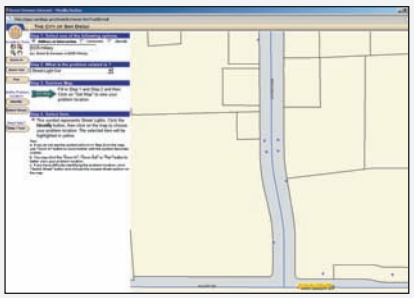
oritize which jobs to complete first. For instance, we can choose to fix a pothole 40 people have complained about before addressing a pothole one person complained about. This enhanced data combined with the automated email messages sent from SAP have helped improve constituent satisfaction with our services."

GO MOBILE WITH GIS AND RUGGED NOTEBOOK COMPUTERS

While the initial ArcGIS and SAP deployment helped the Street Services Division eliminate wasted trips and repeat work, the core functionality of the system was still tied to the office. In other words, street maintenance personnel received their daily work orders in the office each morning and tracked job progress on paper forms (called shop papers) while in the field. These forms were then returned to the office at the end of the day where the data was manually keyed into SAP by division supervisors. Not only was this an inefficient use of labor, it introduced an added opportunity for human error into the process.

To combat this issue, the City of San Diego decided to deploy the integrated ArcGIS and SAP platform to wirelessly connected Panasonic Toughbook CF-19 computers. The Toughbook computers are currently deployed to approximately 30 field technicians. Furthermore, the mobile application leverages ArcGIS Mobile 9.3 (see sidebar on page 4) and SAP's mobile asset management component. This component allows field technicians to continue processing job information even if there's a loss of wireless connectivity. The component simply stores this information locally until there is a return in coverage and the data is uploaded to the SAP back end servers.

The mobile deployment of ArcGIS and SAP was completed in April 2009. Jobs are now issued via the Toughbook computer, and field technicians enter information directly into the application rather than recording the information on shop papers. This new process has eliminated the need for supervisors to manually key the information contained on the paper forms into SAP. It also has eliminated the potential for lost forms, miskeyed data, and other points of human error.



The City of San Diego allows citizens to make accurate street service requests via the Internet by extending its GIS system to www.sandiego.gov.

The applications highlighted in this article illustrate the extent to which GIS and ERP technologies have permeated several facets of the City of San Diego's street services operation. However, these applications are but a sample of the impact the platform has had on the city as a whole. For example, the ArcGIS and SAP platform has also been integrated with GPS (global positioning system) technology on the city's street sweeper vehicles to enhance San Diego's street cleaning operations. The platform has also been extended beyond the Street Services Division to support the city's Storm Water, Publishing Services, and Communications Divisions as well. Finally, the city is currently investigating ways the ArcGIS and SAP platform can be extended to support the City of San Diego's entire Fleet Management Division. Talk about squeezing the most out of a technology purchase. By leveraging its SAP and GIS platform throughout the enterprise rather than keeping it siloed in a single department, the City of San Diego has maximized the value of and return on its investment. ❑

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