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Enterprise GIS

The Key to a New Wave of GIS Users

Introduction by Christopher Thomas

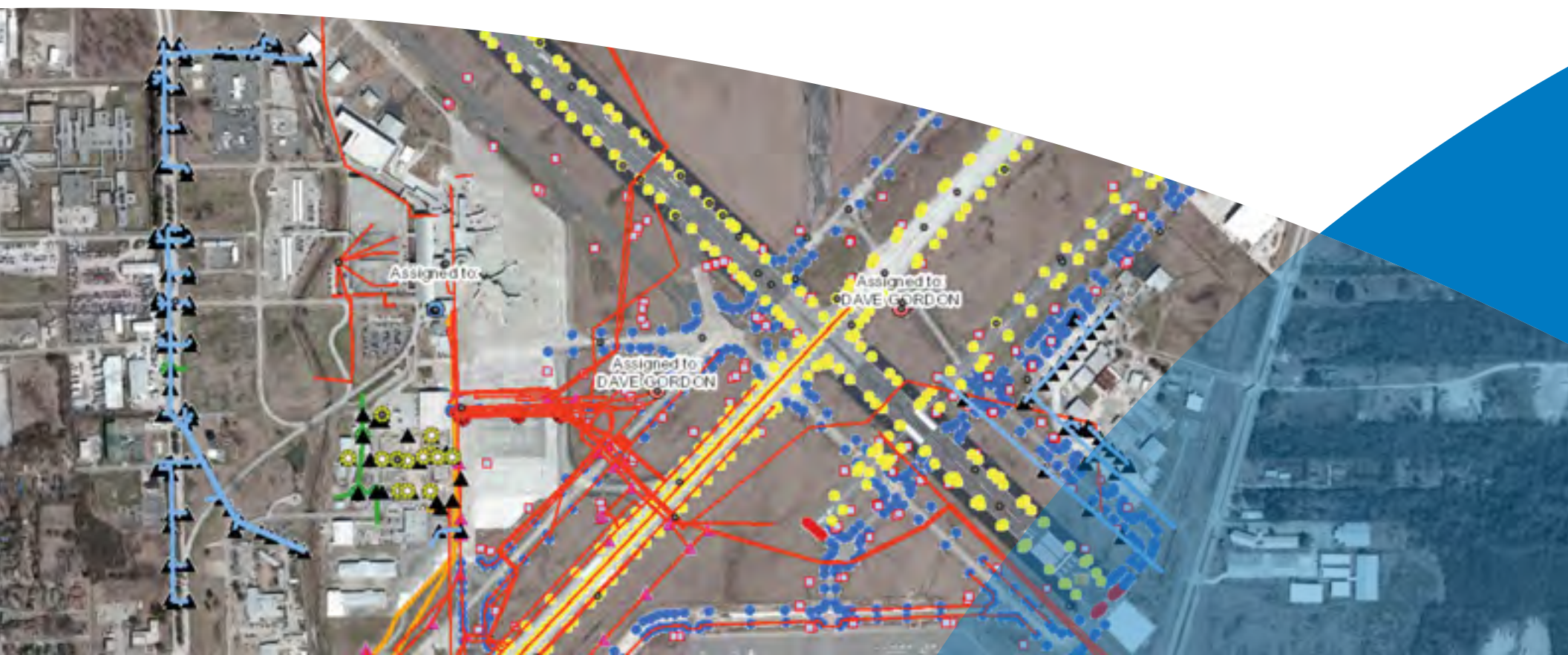


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Introduction

The Key to a New Wave of Enterprise GIS Users

By Christopher Thomas, Director, Esri Government Markets—Federal, State, and Local

In my early days as a GIS administrator, one of my number-one priorities was to build an enterprise, or organization-wide, GIS program.

I worked hard to figure out how to get GIS software directly into the hands of people in fire, planning, building and safety, engineering, public works, finance, parks and recreation, economic development, airports, code enforcement, housing, and any other discipline who would take a moment to listen to the benefits of GIS. As the Esri tools and supporting technologies progressed, the GIS team was able to achieve a vision of “no department left behind.”

We went from mainframe applications, extended through emulation software on dumb terminals, to stand-alone and networked desktop software, and eventually to Internet and mobile devices. My team and I moved closer and closer to this vision each and every day. And along the way came a lot of firsts: from GIS use on fire trucks to nonsurvey uses of GPS for public works asset data collection, from public access to GIS via the public library to the use of GIS for 3D statistical modeling, and from using GIS for revenue auditing to being one of the first local governments to use GIS on the Internet. The journey we took led

us to a greater understanding of the return on investment of GIS, and we realized a lot of innovation by becoming creative as we sought to reinvent government.



Some of my peers in information systems and GIS, both inside and outside the organization, openly and critically questioned why I would want to encourage others to use the technology themselves. I was puzzled by this question. These peers would go on to ask, If everyone else was able to use the power of GIS, what would we do?

These were the same peers who could not understand why the GIS profession could not gain significant traction inside their own organizations. I simply did not see the logic in this line of thought. After all, there were so many other things we could work on: creating new datasets, developing data repositories, integrating GIS into mainstream applications like 911 and permitting systems, building kiosks and front counter applications, building citizen engagement websites, increasing operational efficiency through

in-vehicle and mobile applications, and developing regional cooperatives, to name a few. There was just so much more to do.

And the more GIS was embraced by the various departments and the public, the more GIS became mission critical to the organization, and the more important we became to the organization. While the question my peers asked so many years ago still exists, we have been presented with an even greater opportunity to extend the power of GIS to every discipline in government.

More important, there's an opportunity for GIS personnel to become even more mission critical to their organizations. The key today just might be Microsoft Office 2010. Think about the number of individuals who use Excel spreadsheets and PowerPoint presentations in your organization. There are millions of Microsoft Office users worldwide. What if you could harness their work to extend GIS through a tool they are already familiar with? With respect to Microsoft Excel, what if instead of performing analysis through pie charts or scatter diagrams, people could show their information on a map by clicking an Esri Map button on the toolbar?

Well, that's exactly what your users can do with Esri Maps for Office, a simple plug-in for Microsoft Office. The power of mapping comes through an ArcGIS Online subscription extended through the add-in. Microsoft Office draws from basemaps

and leverages the data you and your colleagues have been developing and maintaining for decades.

Public works professionals could take spreadsheets of capital projects and create interactive maps of the locations of those projects ranked by cost, time to completion, or any other factor and perform their own analyses. Finance directors could take spreadsheets of delinquent payments by billing route or by month and build heat maps of the patterns to better understand their businesses and citizens' payment habits and set course corrections. Or the same department could show where money was being allocated across a community. These maps and analyses could be used for internal review or, with the click of a button, turned into web maps that could be embedded in public-facing accountability and transparency websites.

Consider the hundreds of PowerPoint presentations created each year. While these presentations are impactful and professional, what do you do if someone asks a question about the information in a map image and the map itself doesn't contain the answer? You may come off as unprepared, or you may have to have another meeting. With Esri Maps for Office and ArcGIS Online, you can create presentations with live maps embedded in them. When an elected official raises a question, you simply click the live map inserted into the PowerPoint to navigate to the answer. You move from presentation to interaction.

These are simple routines that GIS professionals have performed on behalf of other disciplines for years. Now everyone can make his own maps. Try ArcGIS Online and Esri Maps for Office yourself—or better yet, show them to the finance director. See esri.com/maps4office.

(This article originally appeared in the Winter 2014 issue of *ArcUser* magazine.)

Turning a Requirement into a Benefit

Enterprise GIS helps airport use the data it collects

By Matthew DeMerrit, Esri Writer

The enterprise GIS developed by a Louisiana airport helps not only to meet federal reporting requirements but also to save money and better connect the airport with its customers.

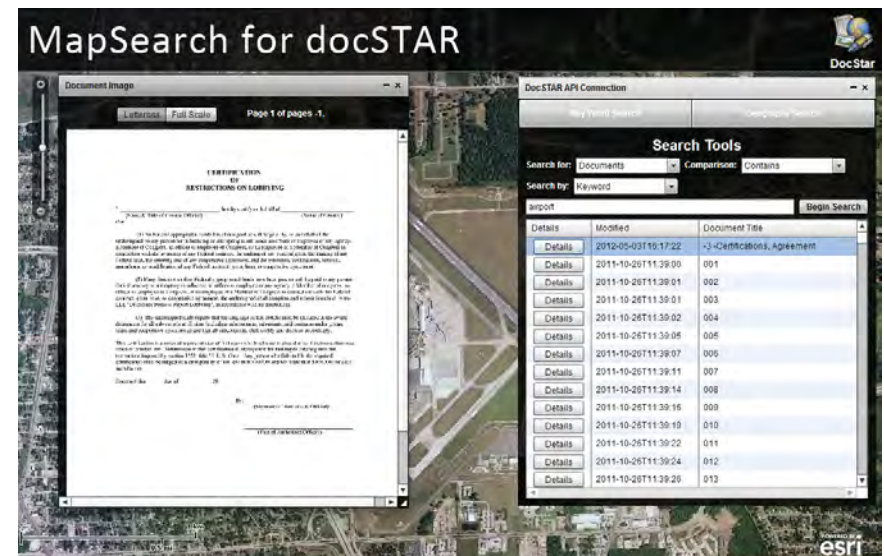
Recently, the Federal Aviation Administration (FAA) began implementing NextGen data requirements for airports. NextGen is an umbrella term for the ongoing transformation of the National Airspace System (NAS) in the United States from a ground-based system of air traffic control to a satellite-based system of air traffic management. The NextGen initiative mandates that airports collect survey-grade datasets, called Airport GIS (A-GIS), so the FAA can manage the spatial data needed to support safe aviation. Although many small- to medium-sized airports without major IT resources are fulfilling the requirements of the FAA, many do not fully benefit from the A-GIS data they collect.

To address that concern, Baton Rouge Metropolitan Airport (BTR), located in the southeast portion of Louisiana along the Mississippi, partnered with GEO-Jobe GIS Consulting to extend the reach of its A-GIS data. With some grant money received through ongoing airport projects that can benefit from GIS, the airport

was able to implement an enterprise GIS solution that includes Esri's Aeronautical Solution and ArcGIS Online.

Coordination Challenges and Cost Cutting

Like municipalities, airports comprise different departments and interact with various entities. Airports host multiple airlines, fixed-base operators (commercial businesses that provide aeronautical



MapSearch for docSTAR associates documents to geographic locations. It can search by keyword or by clicking on the map.

services), and retail tenants. Airports must maintain the highest level of coordination to ensure consistent revenue generation and comply with FAA standards and constantly changing land-use rules. In addition, to stay competitive, airports must execute expensive, multi-year airport improvement projects: runway extensions, obstruction analysis, pavement projects, and terminal improvements.

“To confront the rising costs, airport managers sometimes turn to IT consultants to implement ‘improved’ technology,” said Eric Edmonds, vice president of marketing at GEO-Jobe. “However, once installed, many of their investments never actually get used by airport staff. Over time, the glamour and promise of technology wears off and staff just gets cynical.”

Building Trust

BTR wanted to avoid that situation. In 2010, the airport partnered with GEO-Jobe to perform a health check of its operations. Over the course of a week, GEO-Jobe met with airport personnel and found opportunities for GIS to play a critical role in the decision making and daily operations of the airport.

Enterprise health checks are rarely welcomed by a work force. Like a patient visiting a new doctor, departments can be suspicious of an outsider evaluating the inner workings of a familiar system. “Our initial presentation on basic Airport GIS wasn’t well received by several administrators,” said Edmonds.



The Part 139 Inspection Dashboard provides in-office users with focused inspection information for monitoring activities throughout the day.

However, when GEO-Jobe staff met with department heads individually, managers relaxed and talked openly. Casual conversations with BTR staff revealed operational pain points. These interactions built trust and identified opportunities to make processes more efficient.

Initial Implementation

The solution born from GEO-Jobe’s assessment was an enterprise GIS that allowed the airport to push its A-GIS to the FAA. “We started by mining data and installing all the necessary hardware and software to host and serve it,” said Edmonds. Collecting

existing GIS datasets from local government agencies and adding them to the airport's geodatabase was a crucial first step.

To make all facility information accessible through the platform, Edmonds' team converted BTR's Airport Layout Plan and information, which included CAD drawings and blueprints of construction projects, into a format that could be added to a geodatabase. ArcGIS for Server, ArcGIS Online, and Esri Aeronautical Solution were used to give the airport a central platform for creating and sharing GIS data across departments and with the FAA.

In the first show-and-tell meeting with the airport after the initial implementation, one of the staff members asked GEO-Jobe to calculate the area of a recently acquired parcel adjacent to the airport. The airport had just spent several days surveying the property even though it only needed sub-meter approximations. To show how even the simplest GIS tools can empower them, one of GEO-Jobe's staff members traced the same parcel using the measuring tool in ArcGIS Online. "It took less than 10 seconds to trace and calculate the area," said Edmonds. "The difference between calculations was only a few feet."

Simplifying Inspections

GEO-Jobe's evaluation of one of the airport's most critical procedures—Part 139 Inspections—came early in the needs assessment. *[The FAA, under Part 139 of Title 14, Code of*

Federal Regulations, issues Airport Operating Certificates and conducts periodic inspections to ensure airports are meeting the

The screenshot shows a mobile application interface for a 'PART 139 INSPECTION FORM'. At the top, there is a blue header with a 'Back' button and the title 'PART 139 INSPECTION FORM'. Below the header is a section titled 'Inspection / Job Information'. This section contains several input fields: 'Type of Work' (DAILY_INSPECTION), 'Job Number' (2964), 'Created By' (ALVIN GREEN), and 'Created Date' (2013-03-21T18:04:53.95). There are also empty fields for 'Customer Name', 'Street Address', 'City', 'State' (a dropdown menu showing '-- Select --'), and 'Zip'. Below these are fields for 'Personnel Assigned' (DEBRA WALLACE), 'Priority', and 'Scheduled?'. A large text area for 'Work Order Instructions' is also present. At the bottom, there is a section titled 'Field Information' with fields for 'Accepted / Completed By', 'Job Status' (DISPATCHED), 'Progress', and 'Completed Date'.

Part 139 Inspection Mobile provides a single point for inspection, creation, dispatch, and completion in the field.

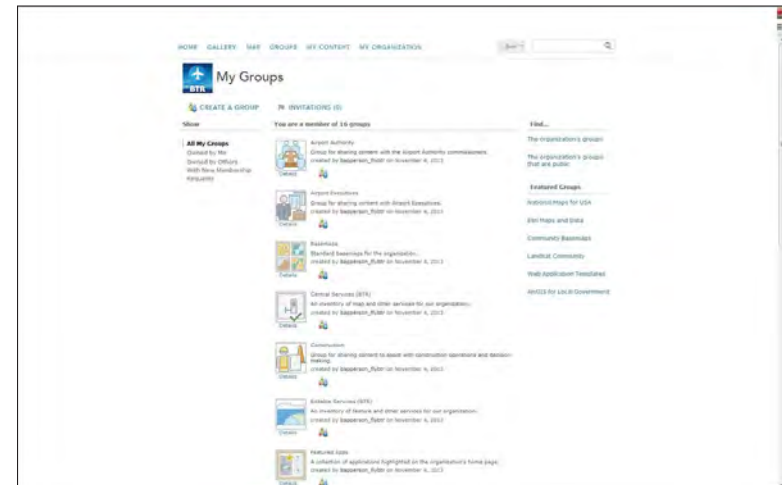
requirements of Part 139.] Inspections were a major headache for the Operations Department. After carefully canvassing the runway and taking handwritten notes, inspectors would input their notes into a system in the office that generated new work orders. The status of these work orders was tracked on a white board.

GEO-Jobe eliminated that cumbersome process by creating a Part 139 Inspection app that enables field crews to create, dispatch, and complete work orders and inspection reports on the fly. With the app, the operations manager can also track the status of inspections and work orders and locate his field crew at all times.

Sensible Documentation Access

To reduce the generation of paperwork and archiving of paper documents, GEO-Jobe refined the airport's document management process by creating a location-based document management system. The system enabled instant classification of all paperwork, which was fully accessible via a web application to staff who had the necessary security clearances.

The system resembles a typical digital library catalog. All digitized documents are linked to features and areas on the airport's main map viewer. By clicking on specific property, airport staff can quickly pull up documents such as lease agreements, construction bids, architectural drawings, proposals, building



BTR is strategically organized within ArcGIS Online through 16 defined groups.

footprints, bid acceptance, and repair orders. Correspondence between the airport, its consultants, and the local government is also tracked in the application.

The later stages of the airport's GIS overhaul will involve creating additional apps for both the airport and the public. Several apps that are currently being registered with the airport's ArcGIS Online account include an airport information map, marketing map, construction status map, and noise mitigation status map. Through its partnership with GEO-Jobe, BTR has become a model for small- to medium-sized airports.

“The project has proven that, with the right platform, airports can comply with FAA standards and also use the data to build a

full-scale GIS that can be used across airport departments and better serve travelers and the local community,” said Edmonds.

(This article originally appeared in the Winter 2014 issue of *ArcUser* magazine.)

Quick Learner Saves San Francisco Bay Area Rapid Transit District Millions of Dollars

This article is part of an ongoing series honoring individuals who have made a difference in the world by applying a GIS solution to conservation or community challenges. Since these unique individuals have been selected for their innovations or special achievements, the series is appropriately named GIS Heroes. Esri recognizes Travis W. Engstrom as a GIS hero.



Travis W. Engstrom

With six siblings and a journeyman police chief for a dad, Travis W. Engstrom, manager of information systems at the San Francisco Bay Area Rapid Transit District (BART), learned independence at a young age. That independence drove his work ethic early on, inoculating him to the pressure of large-scale projects. The career path that eventually led him to overhaul the BART GIS began in 1999.

That's when the City of Lakeport, California, hired him to lead its fledgling GIS effort using hardware and software acquired from a grant. Engstrom was assigned to map the city's water, sewer, and storm drain infrastructure. Engstrom confidently dove right in with no previous GIS training or experience.

In three months, Engstrom built an entire water, sewer, and storm drain layout for Lakeport's community of 5,000 residents. The effort included manually capturing utility assets using an ArcPad enabled GPS receiver on more than 62 miles of curb, all on foot.

Later in his career, Engstrom applied his GIS expertise in a more nontraditional context for a nonprofit in Durban, South Africa, organizing volunteers and relief aid using GIS. There, he performed analysis with Esri demographic data tools and made maps in ArcGIS while managing a staff of 120.

"The organization I worked for was massively GIS-centric," says Engstrom. "It used geospatial technology to focus its mission, find people in need, and plan the distribution of its outreach services. This was a great experience in teaching me how to use GIS creatively, and it paid huge dividends later on."

Consultation

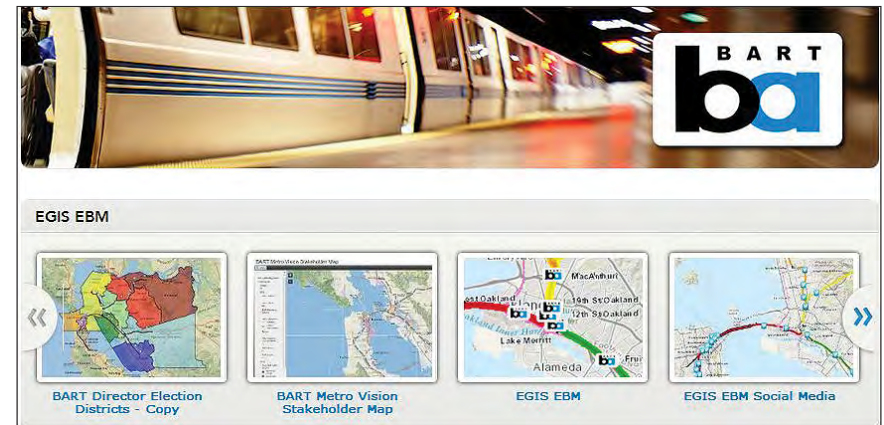
Engstrom went on to earn a law degree from Berkeley and simultaneously work as a private GIS consultant with North Star Precision Mapping, LLC. For 10 years, Engstrom performed a mix of municipal consultation and staff training for more than 1,000 government agencies. The work could be grueling. At times, Engstrom averaged 20 to 30 training sessions a month, educating agency staff on everything from how to jump-start GIS services to how to manage assets more efficiently. At the same time, he was also performing GIS builds from scratch for numerous Native American tribal governments throughout the Southwest.

Eventually, Engstrom, who was married with two sons, tired of living out of a suitcase and working on the weekends. When the opportunity came to overhaul the GIS of one of the most sophisticated public transportation systems in North America, he jumped at the chance.

BART

In 2011, BART contacted professional services firm Universal Field Services, Inc., to create an enterprise GIS pilot project. The firm passed the request on to Engstrom, well aware of his record and ability to create successful GIS builds from the bottom up. Being within driving distance of his Bay Area residence, the new opportunity was just the move he wanted. Although it was only a 10-month contract to perform a total assessment of BART's needs

and develop a long-term enterprise GIS strategy for the network, Engstrom recognized an opportunity to build something great."

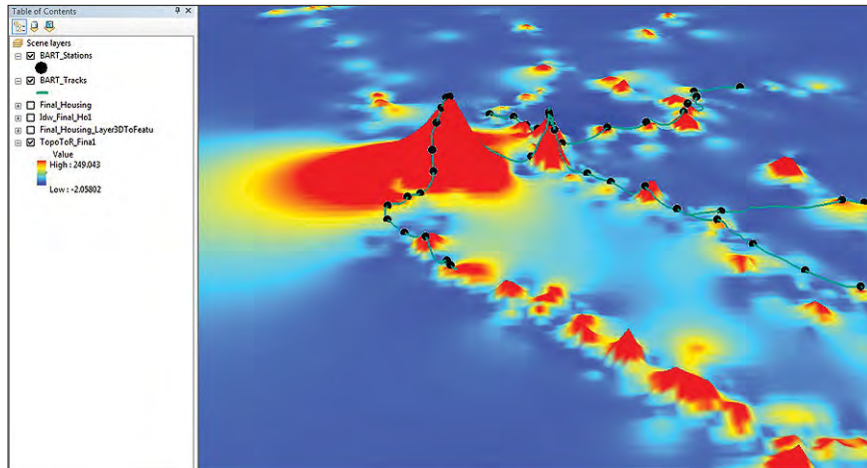


Built with ArcGIS Online, BART's internal mapping system (Enterprise GIS-Enhanced Base Map) serves the mapping needs of every division within the agency.

"BART wanted me to come up with budget suggestions, staffing suggestions, and business cases to do a full return-on-investment analysis," says Engstrom. "I was confident that the project would be a success simply because BART said they'd continue the effort if the proof of concept worked. I had enough experience under my belt to know proof would be ably demonstrated in a short amount of time."

Engstrom enjoyed the BART assignment and the freedom it offered to develop innovative enterprise solutions. When the

opportunity arose to manage the IT division, he applied for and was given the job.



The 3D map depicts housing density in proximity to BART tracks and stations.

A Babel Problem

With 3,200 employees, 103 miles of infrastructure, and 44 stations, BART presented some significant communication challenges. One of the agency's biggest obstacles was the years-long accumulation of nonstandardized terminology by different groups, which led to information silos. Different offices used different names for the same objects, which hindered communication and made uniform mapping impossible.

To put that in perspective, at the time of Engstrom's hiring, the main maps used by BART were simple station maps to help orient the public. No maps existed to show the communities and jurisdictions through which trains ran. BART track schematics consisted of straight-line drawings without the benefit of scale or orientation. Engstrom's first major achievement at the agency was to create a uniform map with the exact geographic position of the entire system—including track centerlines, mileposts, and critical facilities. The map served as a key to "unsilo" the information between departments.

"That first map showed the potential of a comprehensive view with layers that could be toggled on and off according to the needs of every department," says Engstrom. "In very short order, major decisions were made to convert to a standardized system where everyone spoke the same language."

Putting the ROI in Irony

Being initially hired as a GIS contractor, it's ironic that Engstrom ultimately helped BART achieve independence from GIS contractors. Prior to Engstrom's enterprise developments, consultants would be hired to perform expensive research required by the federal government to understand the demography of the citizens BART served. Experienced in demographic analysis since his work in South Africa, Engstrom used Esri Community Analyst to conduct the same research. Community Analyst not only provided superior demographic

reporting compared to the outsourced services BART previously paid for; it also integrated into the ArcGIS system, allowing demographic information to easily be included in any map-based report BART generated.

A significant portion of BART's budget is spent on asset life cycle replacement programs, including dive teams to replace underwater infrastructure on the network's Trans-Bay Tube that connects Oakland to San Francisco. Performing maintenance on this equipment involved sending out divers to manually inspect and carry out repairs. With little to no assistance from location



The BART network runs more than 30 miles through subways and tunnels such as the Transbay Tube.

technology, this work took a considerable amount of time and money.

"BART was able to convert existing AutoCAD drawings of the tube to GIS, reference this data against known survey records, and equip the diving teams with GPS coordinates showing exactly what features needed to be inspected and replaced," says Engstrom. "That alone saved us \$800,000."

Subsequent analysis revealed that, within five years, BART's enterprise GIS will generate a net present value of \$6.6 million. Those numbers led BART to establish a permanent GIS team. The figures also forced a major shift in organizational perspective at BART, essentially making GIS the linchpin of the enterprise and expanding Engstrom's role to include advanced anti-terrorism applications and cyber defense. Engstrom's reorganization of BART's GIS project has since spawned more than 100 other major projects at the agency, resulting in a new enterprise license agreement for all the Esri software BART uses.

(This article originally appeared in the Winter 2013/2014 issue of *ArcNews* magazine.)

Riverside County Takes GIS to the Next Level

By Monica Pratt, *ArcUser* Editor

Riverside County, located in Southern California, is known for many things. It was the birthplace of the California citrus industry. It is currently the fourth most populous county in the state. And it has been, over the past 50 years, one of the fastest-growing areas in the entire nation.



However, the county's CEO Jay Orr wants Riverside County to be known for something else—for being the best place in America to live. Orr believes that the delivery of "customer-centric

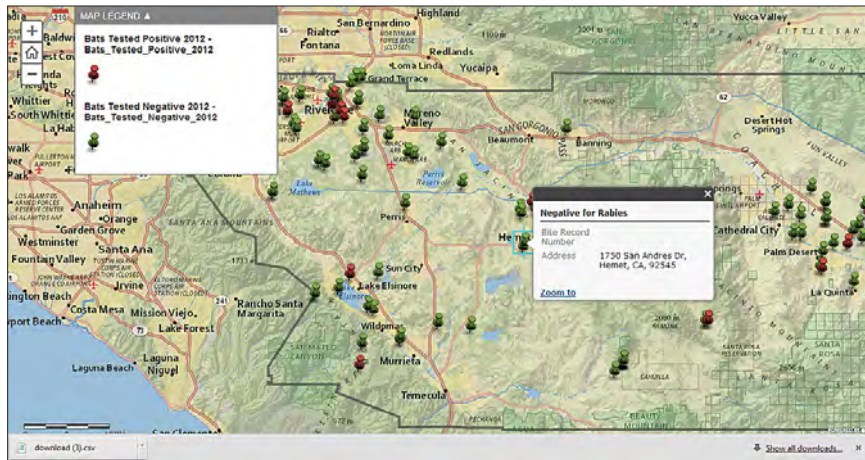
public service that is better, faster, and fiscally prudent through technology" is critical to making this vision a reality. To help accomplish this, the county has adopted a new enterprise GIS strategy that makes extensive use of ArcGIS Online.

A GIS Veteran

GIS is not new to Riverside County. It was an early adopter of Esri software and began integrating GIS technology into government functions in 1989. The county soon found innovative ways of applying GIS.

For example, in 1993, when fires burned thousands of acres in the county, the GIS team assisted the Emergency Operations Center with its response efforts by identifying the owners of destroyed or damaged properties to speed recovery assistance. Subsequently, GIS also helped determine the boundaries of burned areas so strategies for controlling flooding and mudslides could be developed and damage to environmentally sensitive areas evaluated.

As the cost and operational efficiency benefits of GIS were recognized, individual departments implemented GIS with great success. The county Transportation and Land Management



Riverside County uses ArcGIS Online for internally facing web maps like this one showing where bats were trapped and tested for rabies.

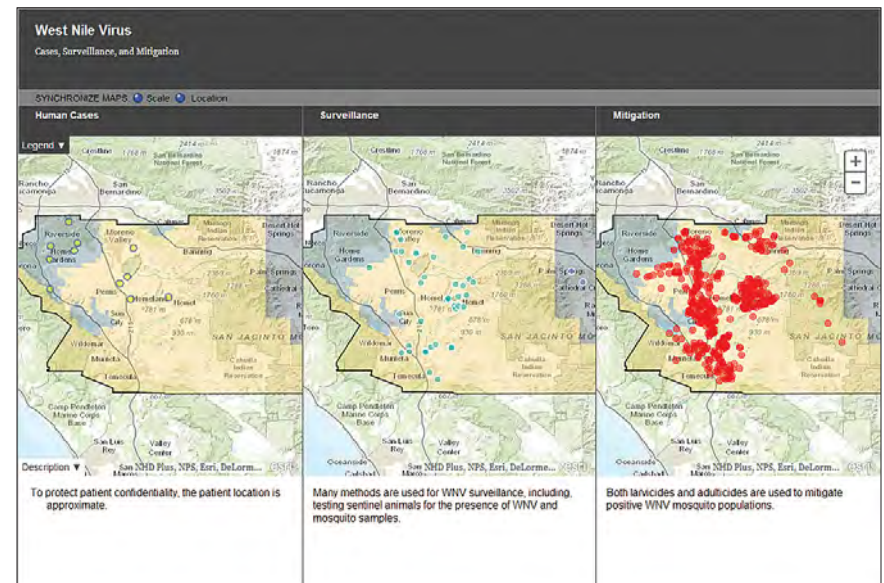
Agency (TLMA) and sheriff and fire departments made extensive use of the technology and worked together to facilitate the creation, maintenance, and use of foundation GIS layers such as parcel, road network, and point locations. Other county departments that have made substantial use of GIS include the Riverside County Department of Public Health, the Riverside County Flood Control and Water Conservation District, and the Assessor Clerk Recorder.

A New Vision

County leaders, who were dealing with the effects of the recent economic recession, began exploring ways that technology could be used to deliver more value for the county. Although it has had

a successful history in Riverside County, GIS was identified as a technology with the potential to deliver even greater returns.

The decision was made to move from a collection of individual GIS implementations to a truly enterprise-wide GIS centralized in the Riverside County Information Technology (RCIT) department. The county's enterprise GIS is not designed to be a one-size-fits-all solution. Riverside County CIO Kevin K. Crawford noted that while it transcends departmental interests, enterprise GIS must support departmental and operational requirements. It must serve, not detract from, the business functions of each department and be implemented to meet the varied business



This three-panel map relates the occurrence, surveillance, and mitigation efforts in response to West Nile virus.

requirements of county agencies. The goal is not just sharing automated data but improving business processes.

“The principal purpose is to implement a shared vision for the use of GIS and geographically based data,” according to Colby Cataldi, assistant CIO, who oversees enterprise GIS. “The vision represents the crucial outcome of action, direction, purpose, collaboration, and willingness to bring the best thinking into discussion about global issues that may appear to be unique to a department or agency but may also affect departments countywide.”

In 2012, the TLMA GIS group moved to RCIT and the county created the Geographic Solutions Division (GSD), which manages the county’s enterprise GIS. GSD supplies a variety of geospatial services not only to internal customers but also to the Southern California Association of Governments (SCAG); University of California, Riverside (UCR); the Western Riverside Council of Governments (WRCOG); and the Coachella Valley Association of Governments (CVAG).

In 2011, the county entered into a public safety enterprise license agreement (ELA) with Esri. That experience led the county to evaluate a broader, countywide ELA. With wider access to GIS software, the county could more easily develop a common GIS framework that would improve collaboration within and across departments, make staff more efficient and productive, and enhance customer service. The countywide ELA, signed with

Esri in November 2012, has enhanced sharing of GIS information across the organization, with business partners, and the public.

A Dramatic Change

With its ELA, Riverside County gets an ArcGIS Online organizational account that provides a large block of named users and credits. This opens up GIS resources to the entire organization as maps, apps, data layers, and web services, eliminating the learning threshold that had limited access to and benefits from the county’s GIS.

With ArcGIS Online, a cloud-based system for creating and sharing maps and geographic information, organizations can



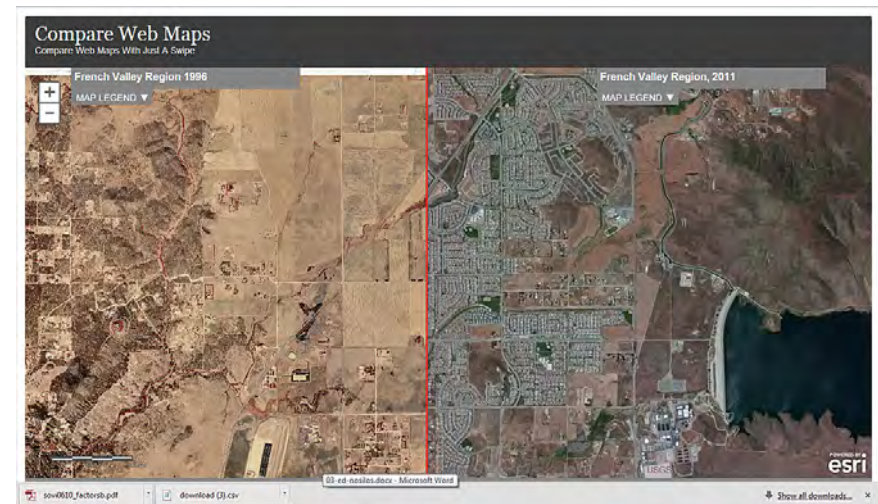
upload and easily publish data to create intelligent web maps that can be viewed on any device and embedded in websites, blogs, and applications. ArcGIS Online users have access to ready-to-use, high-quality global basemaps that are constantly updated and data that has been shared by others.

Previously, users of the system needed at least some level of GIS knowledge to directly use the system. Often, the value derived by those working directly with the system was dependent on their skill level with the software. Non-GIS staff members obtained maps and reports by making requests to GIS specialists.

The county will still require GIS professionals to perform analysis, create and maintain data, and develop web maps and apps. However, once created, those maps and apps can be made immediately accessible to knowledge workers, decision makers, other non-GIS staff, and the public via ArcGIS Online. Everyone in the organization can be empowered to get the maps and answers they need. They can also contribute back by adding data, refining information, and creating their own maps shared on ArcGIS Online. This helps the entire organization by allowing decisions to be made based on the best available information. This dramatically increases the value the county receives from its GIS.

ArcGIS Online is seen by the county as a key component of its enterprise strategy. Implementing ArcGIS Online “will transform the way we spatially interact with data and information,”

according to Tom Mullen II, assistant CIO. “The ability for policy makers to spatially see the affected areas of the county and how citizens are cared for, in an interactive map, adds to their depth of knowledge and understanding of the unfolding events and how best to effectively respond to the areas of greatest need in a dynamically changing environment. It provides a department [with] the ability to spatially visualize relationships between services they provide and the communities they serve in an interactive map,” said Mullen.



Policy makers can easily appreciate the changes over time to an area known as French Valley.

In this cloud-based environment, users can quickly create maps utilizing standard templates and best-practice cartography. Using

templates also gives maps on the county website a standard look and feel as well as helps county staff rapidly deploy them.

Reaching a Larger Audience

Shortly after signing the ELA in November 2012, the county started creating web maps and apps. By March 2013, the first ArcGIS Online maps were up.

The county's externally facing sites furnish information to county residents and the general public. These sites also promote government transparency. One of the first sites to take advantage of ArcGIS Online capabilities was the Meet the Supervisors site. Using an Esri story map template, this site introduces each supervisor, indicates the location of the district served by that supervisor, and links directly to individual district websites.

The County of Riverside Ag Trail website leverages ArcGIS Online through a collection of embedded web maps that show the location and give directions and website links to more than 100 businesses and events related to agriculture in the county. This information is of interest to both residents and tourists. Maps feature farms; wineries; fairs and festivals; and stands and markets that sell organically grown products, fresh fruits, and vegetables.

Because building healthy communities is a top priority for the county, the Riverside County Department of Public Health (DOPH) has used ArcGIS Online to create many kinds of information products, such as the County of Riverside Healthcare

Inventory map, which helps residents locate health service providers near them such as hospitals and clinics.

Other county internally facing websites use ArcGIS Online maps to enhance communications within and between county agencies and departments to improve operations. The Department of Animal Services tracks the occurrence of rabies in bats by mapping locations where it has impounded bats and results of tests on those bats.

The West Nile Virus Activity map reports the location and status of surveillance traps, the location of spraying sites, and the boundaries of vector control districts in the county. Information on the occurrence of West Nile virus in the human



population, as well as surveillance activities and mitigation efforts, can be compared using a three-paneled web mapping application. (Patient confidentiality is protected by supplying only approximate locations on the map.)

Some ArcGIS Online maps, like the Licensed Healthcare and Social Vulnerability map, help policy makers identify potential problems so they can be mitigated. On this map, care facilities, services, and clinics are mapped against the USA Social Vulnerability Index (SoVI), which measures the vulnerability of US counties to environmental hazards based on factors that may reduce a community's ability to recover from floods and other hazards.

Other maps provide greater perspective for policy makers. A three-panel map shows changes in the population density for the desert community of Mecca. Data for 2000 and 2010 can be compared with projections for 2050. Another map lets the user swipe across the map to compare the dramatic growth that has occurred between 1996 and 2011 in a portion of southwestern Riverside County known as French Valley. Maps like these can help county staff make better decisions regarding where to strategically locate resources to best serve the needs of residents today and tomorrow.

Ingredients for Success

A clearly enunciated vision of the role of GIS in the county and buy-in by the top departmental leadership have contributed

to the success and growth of enterprise GIS. By eliminating redundant and competing systems, the county is saving both time and money. ArcGIS Online is making information in the county's GIS directly available to knowledge workers and decision makers in a timely fashion.

The enterprise GIS remains a work in progress according to the county's CIO. The county will focus on the five patterns of GIS business behavior: data management, planning and analysis, field mobility, operational awareness, and citizen engagement. "Moving forward, Riverside County will develop and deploy a common GIS standard and continue to leverage the power of geographic data in an effort to expand the use of shared information; improve the business processes; and promote more timely, informed decisions," said Crawford.

(This article originally appeared in the Winter 2014 issue of *ArcUser* magazine.)

US Forest Service Sees Regional Horizons

Southwest Foresters Round Up Data

The United States Forest Service (USFS) has been using GIS in various forms throughout its nine regions in the continental United States and Alaska. Public lands in USFS' national forests are vast, encompassing 193 million acres. GIS helps USFS meet long-term natural resource management goals for these lands.

The USFS Southwestern Region (Region 3) is the first USFS region to standardize its data by putting it into an ArcGIS geodatabase. The region includes Arizona and New Mexico and parts of Texas and Oklahoma, with a total of 11 national forests and 3 national grasslands. The region's GIS is a strong model for other regions to follow. The reason is that foresters using ArcGIS can better manage data, perform analysis, and generate reports and maps that are useful to managers and resource specialists for making decisions about land management activities.

The region's GIS is a distributed enterprise system, with each national forest having its own GIS geodatabase. Because all these geodatabases have been built using the same standard, forests can easily share data with the regional server, which is located in Albuquerque, New Mexico. This makes it simple for forest managers to quickly access ecological data across the region and develop both local and regional views of forest and grasslands.

This improves project planning, such as campground and road design, long-range planning, and inventory and assessment. GIS users can monitor land use and natural resources, analyze heritage and cultural sites, assess watersheds, and support other USFS activities and missions.

The GIS enterprise system puts geographic analysis into the hands of forest personnel and provides natural resource data to the public. Getting to the point of reaping these advantages takes time and effort to develop standard data dictionaries and schemas. In addition, shapefiles and coverages must be migrated to the geodatabase.

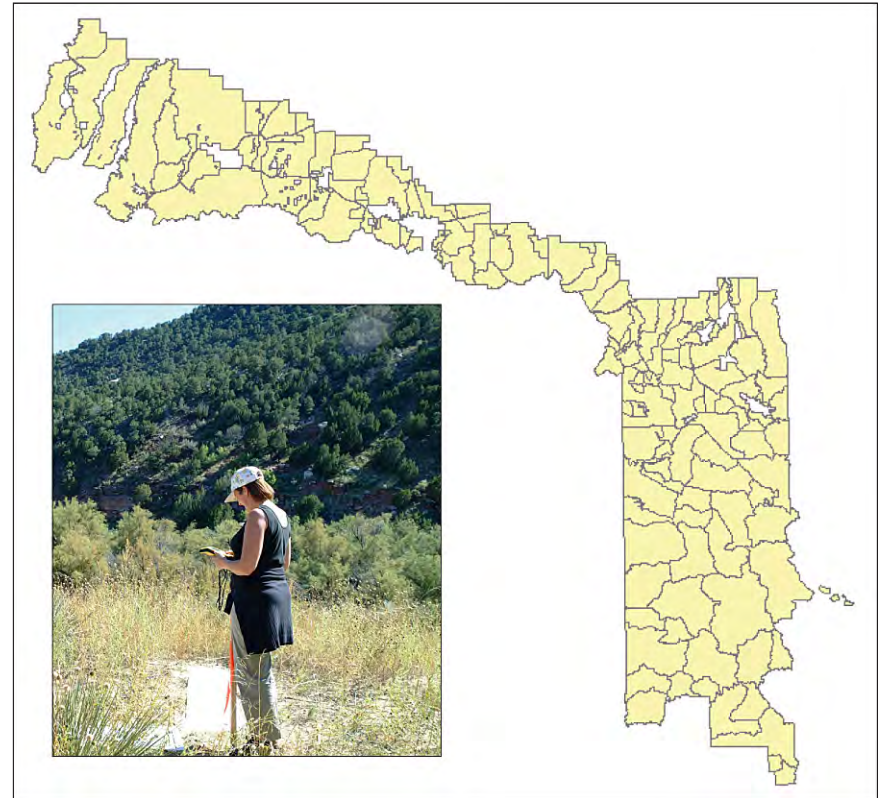
Working with the Tennessee Valley Authority and Esri Professional Services, the region was able to set up data standards. The GIS program manager for the Southwestern Region, Candace Bogart, explains the work involved. "It took our team of five people three and a half years to complete the data migration. We designed a data dictionary that includes 15 themes. We made all the data digital and put everything in the same format. As for the return on investment—oh my gosh, I can't even quantify it. We are really harvesting the fruit of all that labor."

A geodatabase enables users to maintain integrity of spatial data with a consistent, accurate database. It provides a multiuser access and editing environment. This capability is highly valuable, since each forest agency is responsible for its database management and editing. Quality assurance tools from Esri Production Mapping were implemented for the project.

Today, more than 450 USFS staff members use the enterprise GIS. USFS invited AllPoints GIS, an Esri Partner based in Denver, Colorado, to write a training program and hold workshops. Participants work with their own forestry data in class and are therefore able to start working on their projects immediately. It has been much easier and more efficient for the Southwestern Region to contract with AllPoints for the training program than to have its own staff conduct this training.

Each of the regions' forest supervisors' offices has its own server. The regional office in Albuquerque, New Mexico, has a central AIX server that brings the distributed data together and enables users to access it via an internal network. If, for instance, the GIS team needs to do road editing for an area in the Coronado forest, it accesses the Coronado regional office's geodatabase. Because the structure of each forest's database is the same, data is easy to access and use.

The USFS Southwestern Region puts ArcGIS to work for a variety of forestry purposes. For a riparian mapping project, forest service ecologists wanted to know the location and attributes of



The USFS Rangeland Allotment data layer helps foresters understand land use. Inset: Feature coordinates are captured in the field and uploaded to the geodatabase.

the region's riparian vegetation. Because this region has a lot of desert area, it is important to know where the riparian areas are to monitor and preserve them. They used data elevation models in the GIS to calculate valley bottom models and then construct indexes for wetness, adjacency, and steepness to create a data

layer of valley bottoms. Another layer contains vegetation data. A relationship of valley bottoms and vegetation was shown for a watershed. Large-scale aerial photography was also added to the project.

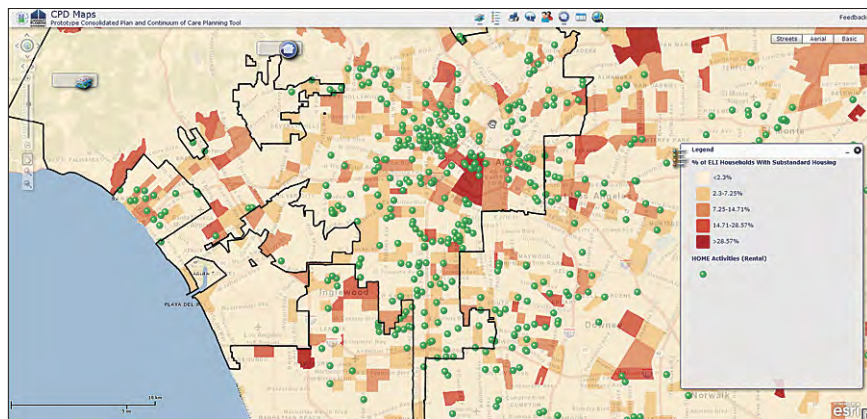
Making data available to the public is also an important part of the USFS Southwestern Region GIS staff's work. Using Esri Production Mapping, they export their region-wide and individual forest datasets to shapefiles and post them on their website for public consumption. Scientists, academics, and contractors can go to www.fs.fed.us/r3, click GIS, and use the datasets for research and business purposes. The USFS Southwestern Region is using ArcGIS for forestry inventory and land management planning. An online, interactive map helps staff access this information for developing a forest plan. Forest plan information is posted and viewed by the public via a GIS viewer that provides basic tools for panning, zooming, and layering data.

Candace Bogart, regional GIS program manager, USDA Forest Service Southwestern Region, who provided much of the information for this article, acknowledges the work of Geospatial Services Technology Center and especially Aaron Stanford, who created a template for the forest plan revision site that enabled the R3 data to be dropped into the template and uploaded. She also acknowledges USFS Southwestern Region's planning staff, Reuben Weisz, and the region's GIS staff.

(This article originally appeared in the Summer 2011 issue of *ArcNews* magazine.)

HUD GIS Web Service Helps Target Aid

A household that is homeless or at risk of becoming homeless will likely receive help from a local housing or service provider supported with funding from the US Department of Housing and Urban Development (HUD). HUD's Office of Community Planning and Development (CPD) grants funds to state and local governments to provide people with decent housing and economic opportunities. HUD rules describe a process called the Consolidated Plan, where funding decisions are based on an evaluation of needs and market conditions in each grantee's jurisdiction.



HUD maps areas in need of housing rehabilitation investment in Los Angeles, California.

HUD's new eCon Planning Suite—which was rolled out to 1,200 grantees around the country in May 2012—is designed to meet the executive place-based directive by providing tools and data that all HUD grantees can use to make affordable housing and community development planning decisions. Among these tools is CPD Maps, a geospatial application that provides data and maps to help grantees understand how to target aid based on where needs are greatest. By providing tools that allow users to identify census tracts with particular conditions, grantees can find neighborhoods with the greatest needs. For example, grantees can now see concentrated poverty on the map.

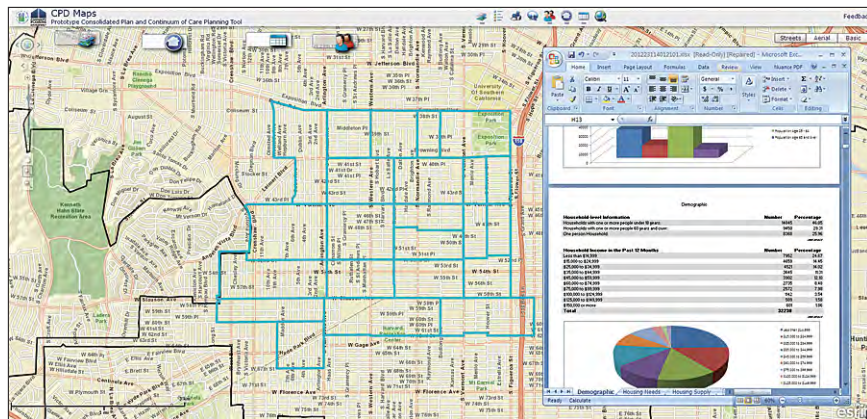
HUD secretary Shaun Donovan says, "We know that in a time of huge budget cuts at the state and local level, it's harder and harder to have the resources to bring that information together. This technology that we're providing is going to be really revolutionary in helping all our grantees work smarter."

CPD Maps is one of many applications hosted on HUD's enterprise GIS platform, which is built on ArcGIS for Server and which is a component of CPD's eCon Planning Suite.

The eCon Planning Suite provides an online Consolidated Plan template to guide grantees through an intuitive planning process.

The template instantly imports information from CPD Maps about housing needs and market conditions into plans that can now be submitted electronically to HUD for review. This reduces grantees' paper work burden, saves time and money, and creates a strategic road map for targeting federal funds where they can do the most good.

HUD's GIS analysts used application tools in ArcGIS for Server to create CPD Maps, then used ArcGIS API for Flex to build a user-friendly web application to help grantees and the public use GIS technology to make planning decisions. CPD Maps users can perform queries of multiple variables, create thematic maps, and generate detailed reports. This functionality is supported by shared REST services, so CPD Maps applications can interface with other web services.



Users locate areas of need and access demographic data within the mapping environment.

Anyone can use CPD Maps to map funded projects, neighborhood rents, economic need, and more. Grantees and the public alike can access CPD Maps from the HUD website, see where federal dollars are being spent, and identify neighborhoods with the greatest need. This information empowers the public to more effectively join the discussion about where federal investments ought to be made.

HUD's CPD Maps is a perfect example of how organizations can use modern GIS software to customize routines and work processes that help users perform analysis and complete specific planning tasks within the template interface.

At the federal level, CPD Maps uses HUD's enterprise GIS platform to analyze a national geodatabase, collate information from many resources, and create GIS tools that help grantees make decisions. CPD Maps can also be used to create a view of project locations throughout the nation. In addition, the platform provides a portal for sharing GIS information with other federal agencies, such as the US Department of Transportation and the US Environmental Protection Agency.

[Experience CPD Maps](#) yourself. Learn more about Esri [GIS solutions for federal government](#).

(This article originally appeared in the Winter 2012/2013 issue of ArcNews magazine.)

US Department of Homeland Security Simplifies Its Enterprise Mission with Web GIS

Geospatial Information Is Served to Tens of Thousands of Users

There are a few instances where television gets it right. Whether it's *Homeland* or the now defunct *24*, the hit shows delve deep into fantastical faux-real-life adventures where government agents work at a fever's pitch to protect people—and the nation—from enemies both foreign and domestic. While the plots and technologies often require the requisite "suspension of disbelief," the one area consistent—and grounded in reality—with these shows is the use of information as the asset for investigation and protection. It's where truth and reality meet. Real homeland security and law enforcement agencies comb through mountains of data to piece together clues for catching criminals. The key hurdle for the 21st century isn't collecting the data—it's making it easily understood and accessible. By using location as a common denominator between disparate datasets, users can connect the dots in a meaningful way that drives more informed decision making and more targeted and forward-leaning response.

The US Department of Homeland Security (DHS) Geospatial Management Office (GMO) has designed and deployed a truly remarkable enterprise system—the Geospatial Information Infrastructure (GII)—that just might seem like the stuff of television. The GMO was established to advance the use of



The GII Platform, which is based on Portal for ArcGIS, supplies shared and trusted geospatial data, services, and applications for use by the homeland security community.

geospatial technology across the DHS enterprise to promote geospatial tradecraft in support of DHS operations, promulgate geospatial standards, and implement a geospatial data strategy that enables individual DHS geospatial program offices and empowers frontline operations with location-based tools. The GII

is a critical, common component that supplies geospatial data and application services to the diverse suite of DHS missions encompassing law enforcement, border protection, emergency management, critical infrastructure protection, and national operations and data fusion centers. The GII is a consumer-driven geospatial enterprise resource that is built based on mission needs and operational requirements that are aligned to the Homeland Security Geospatial Concept of Operations (GeoCONOPS) and informed by national geospatial policy and doctrine.

“With the increased demand for centralized services, especially with the data center consolidation, the need arose for centralized geospatial services,” says Noah Goodman, GII project manager with Ardent Management Consulting. “GII delivers common data to the DHS enterprise.”

GII currently supports the 200,000 DHS employees and 50,000 DHS contractors, plus homeland security partners within the state, local, tribal, and territorial communities. What makes the system so unique is it provides fast, efficient access to Sensitive but Unclassified (SBU) or Controlled Unclassified Information (CUI) data. Agencies across the country have access to valuable information for a wide range of mission-critical needs.

“We want to improve access to geospatial resources across all operating networks,” says David Alexander, director of the Department of Homeland Security’s Geospatial Management

Office, “and use geospatial technology to facilitate meaningful information sharing that helps not only connect the dots but also make those connections more understandable through geospatial visualization and maps. Geospatial capabilities must be fast, reliable, easy to use, and intuitive if we want to have a greater effect on frontline missions and alter perception about the utility of geospatial technology, as well as strengthen the relevancy of geospatial tradecraft. The goal was to increase operational effectiveness and introduce new efficiencies by providing the Homeland Security community with mission-relevant information that is map enabled. The GII provides a national resource to do just that.”

From Public to Private Information

The Department of the Interior’s geospatial information officer, Jerry Johnston, took the lead on developing a public-facing geospatial solution that could provide maps and data to anyone. Alexander and Dan Cotter, DHS’s geospatial information officer, reached out to Johnston to discuss how they could collectively work on this government geospatial transformation. The initial collaboration involved integrating [GeoPlatform.gov](https://www.geoplatform.gov) into the DHS GeoCONOPS as the public platform for all DHS data.

The GII was then identified as the platform for managing and distributing SBU or CUI geospatial information. Since then, the two teams have worked collectively toward a common goal

of improving access to geospatial maps and data services, regardless of the data classification and security.

“GII was designed as a national geospatial platform,” says Alexander. “Large volumes of information are needed by agencies to do their jobs effectively. Much of it isn’t publicly available.”

SBU is unclassified information that is simply too sensitive to make public. This is the arena in which most first responders, emergency managers, and homeland security professionals work.

One of the key attributes that make the GII such a unique and powerful platform is it serves all 22 DHS components, including the Federal Emergency Management Agency (FEMA), the US Coast Guard, the United States Secret Service, Customs and Border Protection, Immigration and Customs Enforcement, and the Transportation Security Administration. In addition, all state emergency response centers, state fusion centers, local emergency managers, and other state and local agencies have access. The GII capabilities and services are used at all levels of government.

The power of enterprise access means decisions are improved by being able to obtain the information in a much quicker time frame. And analysis is bolstered. People can analyze natural disasters and technological hazards and assess critical risks, such as population, infrastructure, or natural resources. Critical infrastructure and cultural centers can be identified and

protected against potential threats. GII analysis and maps also help with special event planning (Republican and Democratic National Conventions; the Presidential State of the Union address), illegal border activity, search and rescue operations, continuity planning, and more.

Virtually every DHS mission has some touch point with natural disasters and terrorism threats for the continuity of operations or as emergency support functions to national response scenarios. The FEMA GeoPortal was established using shared services from the GII and GeoPlatform.gov—in advance of 2012’s Hurricane Isaac and Superstorm Sandy to provide quick access to data from disaster response and recovery operations and give the community access to near real-time data to inform its action plans. The enterprise geospatial capabilities are transforming how DHS provides situational awareness and shares information with support organizations and citizens.

GII Building Blocks

The DHS GII takes advantage of the Open Geospatial Consortium, Inc. (OGC), Web Feature Services (WFS), Web Map Services (WMS), and REST services to make data available to stakeholders that access control systems to provide system- and user-level access. GII services allow users and system owners to connect to data they would otherwise maintain across their own IT infrastructures or workstations. Today, the GII comprises four

key areas that provide global support to the homeland security community:

- **Geospatial Discovery Platform (GII Platform)**—The GII Platform, which is based on Portal for ArcGIS, supplies shared and trusted geospatial data, services, and applications for use by the homeland security community through the SBU Homeland Security Information Network (HSIN). The platform enables authoritative real-time data exchange. The GII team actively collaborates with the Federal Geospatial Platform team that manages GeoPlatform.gov, the unclassified public platform that provides the same data discovery capabilities.
- **Turnkey Map Viewer (DHS OneView)**—The GMO invested in developing an intuitive viewer—called DHS OneView—that is tailor-made to address homeland security issues. OneView is a web-based mapping application that delivers visualization capabilities for GII. The viewer is built on top of ArcGIS API for Silverlight and has been identified by the DHS CIO as the standard common operating picture for all DHS components.
- **Hosted Content Delivery Services (GII Services)**—The GII provides more than 400 hosted geospatial web services for the homeland security community to consume. The hosted web services contain important DHS datasets, as well as key national infrastructure data, including the Homeland Security Infrastructure Program. Through the GII, DHS provides access to these critical hosted services to state, local, tribal,

and territorial homeland security systems, including those in Oregon, Idaho, and Virginia. The GII services are hosted in a virtualized environment running ArcGIS for Server.

- **Geospatial Enablement of Enterprise SharePoint (HSIN)**—The GII is embedded into the HSIN enterprise SharePoint environment, which is based on Esri Maps for SharePoint. Each community of interest, of which there are 68 today, has the ability to include a mapping component as part of its SharePoint community that supplies access to the full set of GII data services. The environment currently supports 46,000 federal, state, local, tribal, and territorial homeland security professionals.

Future Innovation

The DHS GMO's future road map for the GII involves expanding DHS geospatial content holdings available to the community. This expansion will provide mobile applications and hosting services, federate catalog services between the GII and GeoPlatform, and lead efforts to streamline geospatial data discovery and access. This can be accomplished by encouraging registration of publicly available data to the Federal GeoPlatform and SBU-level data registration to the GII and advancing a "no wrong door access policy" through the implementation of Global Federated Identity Management exchanges across the geospatial community.

(This article originally appeared in the Fall 2013 issue of ArcNews magazine.)

Improving Records, Reducing Costs

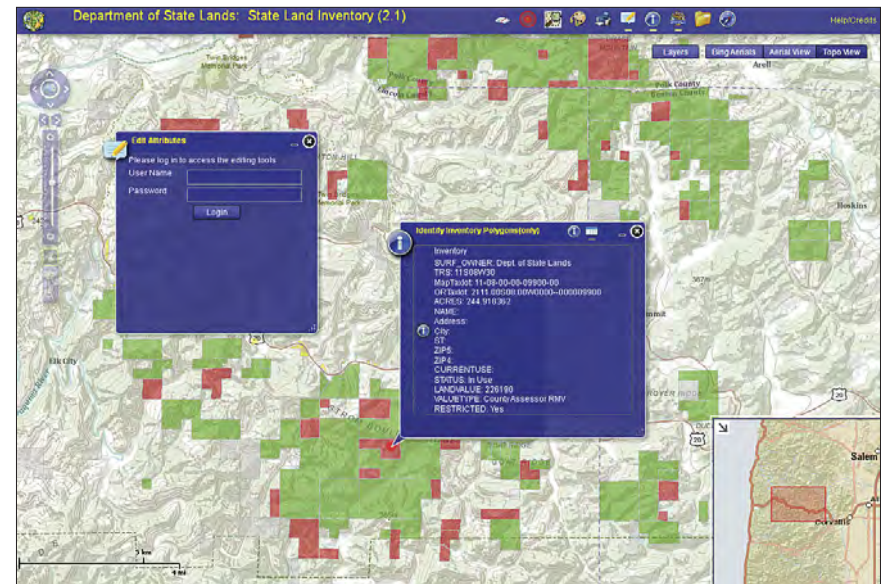
Oregon's online State Land Inventory system

By Randy Sounhein, GISP, Oregon Department of State Lands

Editor's note: Staff from each of the state agencies responsible for managing Oregon's real property holdings can now determine property ownership and update their own records using a web application created by the Oregon Department of State Lands (DSL).

In early 2004, the Real Property Service section, part of the Enterprise Asset Management division of the Oregon Department of Administrative Services (DAS), was tasked with developing a graphic and comprehensive inventory of state-owned lands that would be accessible to members of the governor's office, legislature, state agencies, and the public. DAS has the statutory responsibility, per Oregon Revised Statutes (ORS) 270.180 and 276.227, to maintain a current statewide lands inventory.

What DAS needed was an online web-based geospatial database that would allow members to conveniently ascertain information about state-owned land. DAS initially hired The Gartrell Group, a consulting firm and Esri partner, to determine the feasibility of this endeavor and come up with a cost estimate for accomplishing it.



Personnel from each agency can go to an online website to quickly ascertain property ownership and update information about their agency's property assets.

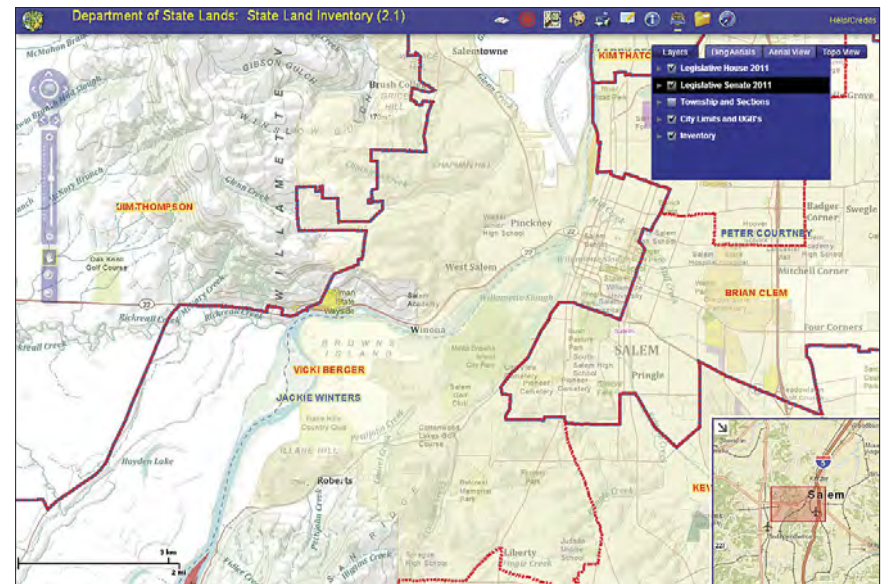
At the same time, DSL had developed a comprehensive, statewide mineral rights ownership geospatial layer utilizing Esri technology (e.g., ArcInfo, ArcIMS, ArcSDE, ArcGIS). DSL is responsible (per ORS 273.790 and 273.099) for maintaining records of all subsurface minerals rights on state-owned lands. Since DSL had experience working with both ArcIMS

web technology and [ArcGIS for Server](#) 9.3, both DSL and DAS determined that the best approach would be to utilize something based on ArcGIS 10 for Server. While ArcIMS had gotten the agency started using GIS on the web, that technology had become dated and didn't meet the agency's requirement for a contemporary ArcGIS enterprise environment.

Taking Advantage of Newer Technology

ArcGIS for Server software provides some sophisticated tools that allow for web-based capabilities that could be further leveraged via APIs for Adobe Flex, Microsoft Silverlight, and JavaScript. Esri had also created the [ArcGIS Viewer for Flex](#), a GIS web client mapping application for ArcGIS for Server built with the ArcGIS API for Flex. This client application contains a number of functional widgets, which can be deployed out of the box without requiring any programming. The viewer also allows developers to extend its functionality by modifying or creating additional widgets via the ArcGIS API for Flex.

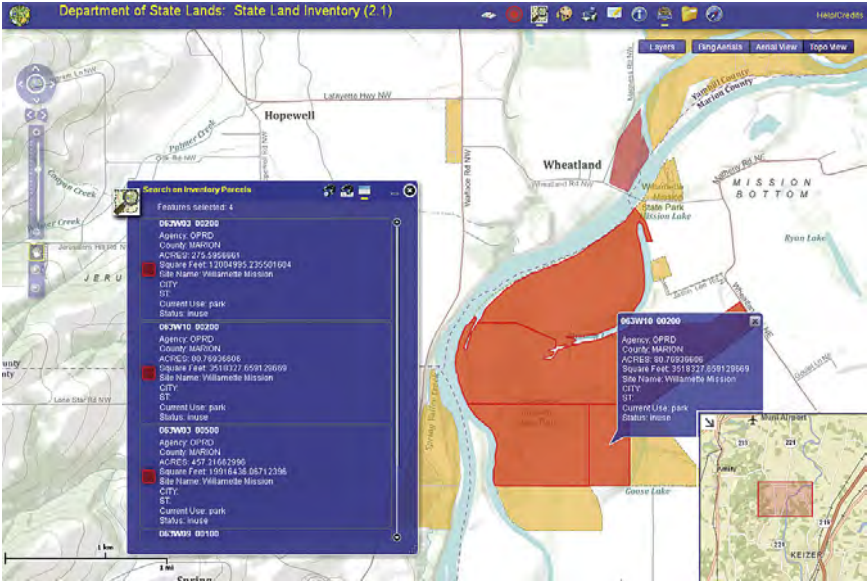
Because the Flex environment is more mature, it was selected over the others. The first step in utilizing the ArcGIS Viewer 2.1 for Flex was to download the uncompiled source code for the ArcGIS Viewer from the Esri website and import it into Flash Builder 4.0. Though Esri provides both uncompiled and compiled versions, creating customized applications with an API requires uncompiled source code and some programming knowledge.



The application incorporates agency and legislative district boundary information.

Editing in the ArcGIS 10 for Server and Flex ArcGIS viewer environment is accomplished via feature services (i.e., map services with feature access), which create REST endpoints that are then referenced in the application. The feature services are accessible to the web API via a feature layer, where the attributes and geometry are actually edited. The features reside in an ArcSDE geodatabase. Similar to editing in ArcGIS for Desktop in a multiple user environment, if modifications are made by two or more users at the same time, the last edits in are committed to the ArcSDE geodatabase.

results are helpful because queries are run against both agency boundaries and legislative districts throughout Oregon.



The application fulfills the desire of state agencies for reports of surface ownership derived from queries against attribute tables for multiple layers.

Conclusion

Overall, the value of this application to the state is that individual agency personnel can simply go to an online website and quickly ascertain who owns real property in the state and make updates to information about property assets managed by their agency. The State Land Inventory site also reduces the need for dedicated software licenses and staff trained in GIS. Esri has done a great

job creating APIs that can be used to create efficient web-based GIS applications that provide an alternative to desktop GIS and further the movement of GIS to the cloud environment. DSL was able to organize the data, create the application, and get it up and running in just a few months. This resulted in a major cost savings for all stakeholders. The application will continue to evolve with the technology. View [the current version](#).

Acknowledgments

The author thanks members of Esri’s Technical/Professional Support Services for their advice and input into the project; Eric Andersen, IT manager at the Department of State Lands; and the many people at the State of Oregon who helped make this effort possible.

About the Author



Randy Sounhein has a master’s degree in environmental science from Washington State University, a bachelor’s degree in geology from Central Washington University, and more than 22 years of hands-on experience with geospatial technologies and Esri products. He worked as a senior groundwater quality/GIS analyst for the State of Idaho from 1990 to 1997. He is

currently the GIS coordinator for the Oregon Department of State Lands in Salem, Oregon.

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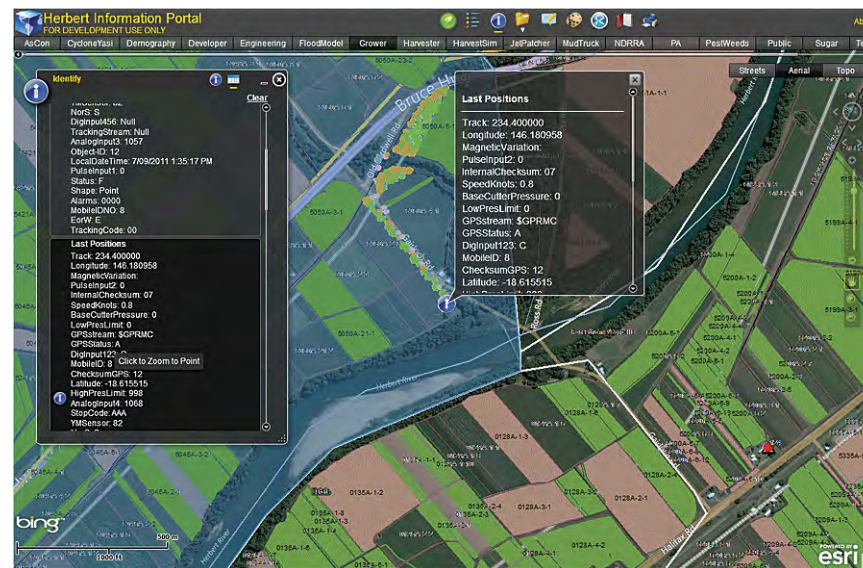
Enterprise Solution a Sweet Reward for Australian Sugarcane Farmers

Technology Supports Sustainable Development of Local Industry

The roots of cooperative sugarcane cultivation in the Herbert River catchment basin in North Queensland, Australia, can be traced to the early 1880s, when six small-area landowners formed the Herbert River Farmers Association. Shaped by the social and economic conditions of the day, the landowners believed that both the sugarcane industry and local residents would be better served by cooperative farming rather than the plantation model that had flourished in the area for the preceding 20 years.

Two years later, Colonial Sugar Refining Company (CSR), the primary sugarcane processing company in the region, offered agreements to the newly formed association to centrally mill its cane. In 1891, CSR subsequently subdivided its Homebush Estate into small farms, which it leased to local farmers with an option to buy.

Though farming methods in the Herbert River catchment have changed greatly during the succeeding 130 years, its cooperative nature has grown even stronger with the founding of Herbert Resource Information Centre (HRIC). Established in 1996, this nonprofit organization supports the sustainable development of the sugarcane industry in the Lower Herbert River catchment through technological innovation and is responsible for building



Herbert Information Portal showing harvested areas and cane harvester movements.

community networks between local industry, government, and residents.

Shortly after its formation, HRIC conducted a mapping project of the Herbert River floodplain. The results of the project proved difficult to disseminate to both the HRIC coalition and the local farming community. Members decided to implement a GIS that

would allow HRIC to better analyze local sugarcane farming and distribute its findings. Consequently, HRIC launched Herbert Information Portal (HIP), a collaborative GIS using Esri software.

Today, HIP has evolved into an enterprise system built on [ArcGIS for Server](#) and [ArcGIS for Desktop](#) and extensions. The GIS is web based so that HRIC partners and local farmers have easy access to information. HIP supports most of the critical business processes in the region's sugar industry supply chain by acting as the catalyst for implementing precision farming technology, from improved harvesting and transport management to more efficient milling operations. Applications include Cane Mapping and Management, Real-Time Cane Harvester Monitoring, Sucrogen Rail Safe Integration, and Cane Yield Monitoring systems. These applications use GIS to promote efficiency, productivity, and improved environmental outcomes for HRIC partners and sugarcane growers.

Because the Herbert River catchment basin is sandwiched between two environmentally protected areas—Wet Tropics World Heritage Area and Great Barrier Reef Marine Park—the cane-growing industry uses the tools provided by HRIC to improve productivity while monitoring and reducing impact on the environment.

“Though initially established as a technology center,” says Raymond De Lai, HRIC manager, “we quickly realized that the most significant value that HRIC could provide to our partners

was the opportunity to build and enhance relationships among people and organizations. We are strongly focused on building trust, commitment, and cooperation through a shared vision among our partners and the wider community.”



Technology has come a long way for sugarcane farmers in the Herbert River catchment basin of North Queensland, Australia.

The partners in the HRIC project include local government representatives from Hinchinbrook Shire Council; the CSR group that refines and transports the processed sugarcane; and Terrain Natural Resource Management, a nonprofit agency that builds regional consensus for natural resource management. Also included in the management coalition are representatives from

the Bureau of Sugar Experiment Stations and Herbert Cane Productivity Services, which provide research, development, and extension services to the sugarcane industry.

“For us, the advantage of a partnership approach to an enterprise GIS is the sharing of its cost, risk, and—of course—the benefits,” says De Lai. “Any one of our HRIC partners would find it very difficult to fund their own system. Together, we are able to buy into a large enterprise GIS infrastructure, data management processes, capacity building, and a relationship with our partners that provides benefits beyond GIS projects.”

The mutual support and interaction between HRIC and the community is essential because sugarcane production in the area is a complicated process that includes a number of well-coordinated steps, from planting to harvesting. The process is underpinned by the automatic collection and transmission of spatial data to HIP for analysis and decision making.

“Our sugarcane growing and harvesting procedures require a high level of interdependence within the community because the process is not vertically integrated, except for the milling and transport,” says De Lai. “We rely a great deal on the growers to provide regular updates on the status of their fields.”

Because sugar production can be increased with better management of harvest scheduling and decision making based on regional variations in soil, irrigation, and climatic conditions, the growers have fitted their harvesting equipment with onboard

computers, electronic logbooks, base-cutter height sensor kits, and yield monitors. Data is automatically collected by the sensor systems installed on the tractors and other field equipment and transferred to HIP for processing and analysis with ArcGIS.

When analyzing yield variation within a field, the system suggests how growers may be able to reduce their costs through varying farm inputs. By closely managing irrigation and monitoring climatic conditions, the optimal harvesting time can be determined to maximize the sucrose content in the sugarcane. An increased sucrose yield increases the profitability of the harvest.

Since harvesting is the costliest activity on a sugarcane farm, it is important to keep the cane harvesters in constant operation during the cutting season. This is facilitated, in part, through the use of Twitter, the social networking site. Farmers Tweet the status of the harvester in their field so that the owner of the subsequent field knows exactly when the equipment will arrive to begin the next job. It is expected that this concept will be used for other projects in the near future, such as identifying the location of cane trains and broadcasting the estimated times of arrival.

“Using enterprise GIS has allowed us to integrate our various data inputs and provide real-time access for managers and decision makers,” De Lai concludes. “In development terms, we are doing things now in hours and days that would previously have taken us weeks and months. Technically, we can put in place anything we

envision at the moment. Our challenge is to identify the business models that are sustainable and support those opportunities through GIS.”

(This article originally appeared in the Winter 2011/2012 issue of *ArcNews* magazine.)

eCoastal Program Fosters an Enterprise Approach to Data Management

United States Army Corps of Engineers Protects 12,000 Miles of U.S. Coastline

From the beaches of Hawaii to the harbors of Maine, the United States Army Corps of Engineers protects and restores the shoreline many people call home and even more call the perfect vacation spot. Though images of peaceful waters and pristine sand may be fixed in our minds, the more than 12,000 miles of U.S. coastline are fragile and ever changing.

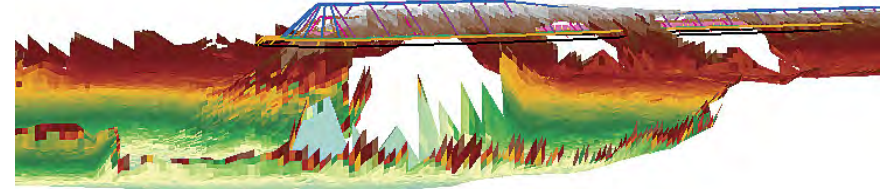
As they address issues such as coastal flooding, navigation, regional sediment management, erosion, and hurricane damage, Corps districts, like the Mobile (Alabama) District, collect unique data to support engineering, environmental, and economic decisions. Their projects require information such as regional coastal mapping data, the date and time shoreline imagery is collected, detailed designs of coastal structures, and much more.

Historically, as the Corps districts in these areas collected data for coastal projects, it remained siloed in the confines of the project.

“An engineer might not ever know the data she needs already exists, even if she sits five cubicles away from the person who has it,” says Rose Dopsovic, eCoastal project manager, U.S. Army Corps of Engineers, Mobile District, Spatial Data Branch.

To improve data sharing and acquisition, the Mobile District developed the eCoastal program-the letter e stands for

enterprise. It focuses on optimizing data access in each district, preferably in a geodatabase. The program utilizes Corps spatial data standards and implements national policy to provide a customized framework for spatial data standards, geodatabase structure, and ArcGIS software-based GIS applications that supports the development of enterprise GIS in and across coastal divisions.



A 3D wireframe representation of a jetty in East Pass, Florida, is combined with survey data showing that the structure has degraded.

“Now, regardless of which project data was collected for, if it’s indexed and archived properly, anybody who’s interested in the data can find it and apply it to his own project,” says Dopsovic. “We tried to put together a standardized architecture to allow people to find the data they need-even if they didn’t pay for it themselves.”

The program also addresses the requirements of districts that don't have GIS experts in-house. It gives districts the analytic tools, lessons learned, and data structure they need to effectively use their geospatial information.

Coastal Customization

Generally, Corps engineers use the Department of Defense's spatial data standard, known as the Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE). The standard includes hundreds of data models, but only a few are relevant to coastal engineers. To make it easier for coastal engineers to access the models they use, the eCoastal program isolates the pertinent portions.



The eCoastal Online Map Viewer allows Corps engineers to select a navigation channel and view dredged channel information, including historical data.

The Mobile District also requested changes to the Spatial Data Standards committee. For example, coastal engineers need to include the intricacies of CAD drawings in GIS. Historically, a coastal structure would look like a simple line in a GIS. The data model now supports integration of those drawings, giving engineers geometry that accurately represents coastal structures so they can analyze them effectively.

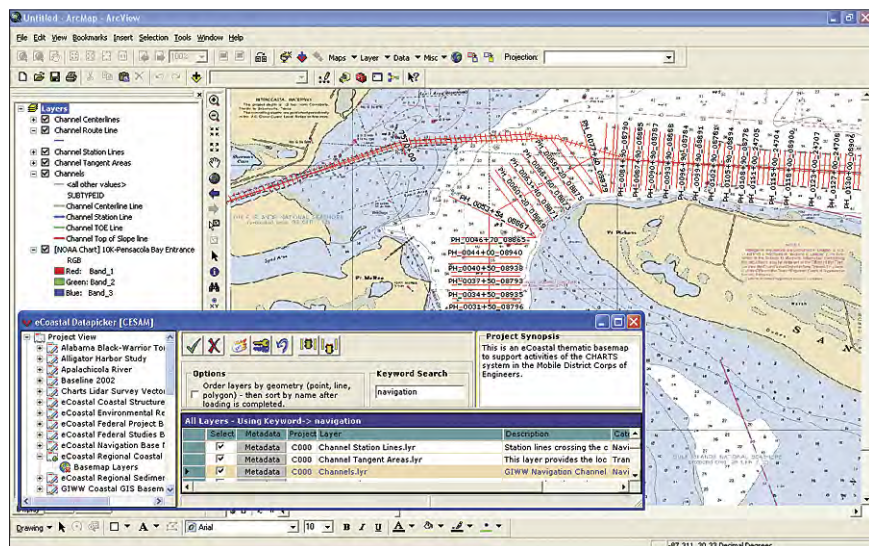
In addition to providing data models, eCoastal includes a suite of custom tools. For example, the eCoastal Datapicker tool allows a user to easily find and connect to needed data. With the ArcGIS Desktop software-based tool, users can search by keyword or category, then load data directly from their own or other Corps districts.

The Coastal Structures Condition Assessment (CoSCA) tool, developed by the Mobile District and the Corps's Engineering Research and Development Center's Navigation Research and Development Program, allows users to make 3D models of structures, such as jetties. A 3D CAD drawing is overlaid on survey data to calculate composition of and damage to structures. Then, engineers can calculate repair costs.

The Mobile District freely shares the eCoastal documentation and source code with other districts, as well as entities outside the Corps, such as the Florida Department of Environmental Protection, universities, and the public. Much of the complimentary material is available on the Web site at

ecoastal.sam.usace.army.mil. However, if an organization would like help setting up its GIS, it can access experts from the Mobile District.

(This article originally appeared in the Winter 2010/2011 issue of ArcNews magazine.)



The eCoastal Datapicker tool allows users to easily search a Corps district for data and related metadata.

Many districts are taking advantage of this program, adopting all or part of the suggested framework. Buffalo, New York; San Francisco, California; New Orleans, Louisiana; and Charleston, South Carolina, have implemented the full eCoastal architecture. Those that have implemented some elements of the program include Honolulu, Hawaii; New York, New York; Los Angeles, California; Philadelphia, Pennsylvania; and Jacksonville, Florida.

GIS Integrates and Transforms Sewer Operations

For the San Francisco Public Utilities Commission, Benefits Abound

Situated on the Northern California coastline, San Francisco is consistently among the top tourist destinations in the world. Rich in history and culture, the “City by the Bay” is home to iconic landmarks, such as the Golden Gate Bridge, cable cars, Alcatraz, Fisherman’s Wharf, and the famed Chinatown district. The city also is known for its striking architecture and notably steep, rolling hills.

The hilly terrain that so readily defines the city also poses special challenges for area utilities, such as the San Francisco Public Utilities Commission (SFPUC). Rain events can produce flooding so significant that SFPUC can generate up to 100 service requests/work orders an hour. The question for SFPUC becomes, How do we mitigate these calls and deploy staff quickly to resolve the problem? While the problem simply may be clogged storm water drains, if not handled swiftly, intense flooding threatens to damage nearby homes.

The Challenge at SFPUC

SFPUC Wastewater Enterprise operates and maintains 993 miles of combined sewers, collecting sanitary sewage from homes and businesses and street runoff. It also operates and maintains

storage facilities and three sanitary sewage and storm water treatment plants.



San Francisco iconic slope—Lombard Street. (Photo: iStock.)

The immediate need in SFPUC’s Sewer Operations was to resolve the disconnect that existed between the work order and asset management system and the field service work taking place. As existing users of ArcGIS and IBM Maximo, staff could view asset

data in tabular format within the work and asset management system and see assets using ArcGIS but could not view assets and work orders in proximity to each other.

The existing process was tedious and time-consuming. Sewer Operations received service calls based on address/service locations. Calls were converted into work orders and assigned to field personnel on 3 x 5 cards. Work orders were then assigned manually to assets by looking up asset IDs in GIS and copying the information into work orders.

“We had two islands of information that were not connected,” says Lewis Harrison, manager, SFPUC’s Wastewater Collection System Division. “There was a synergy there just waiting to happen.”

SFPUC sought to integrate its existing GIS with IBM Maximo Spatial Asset Management to resolve workflow issues and help address other challenges, including the following:

- *Odor issues*—Visualizing on a map to better understand and solve calls relating to odor issues
- *Intersection flooding*—Responding quickly and efficiently to emergencies caused by heavy rains and identifying hot spots using GIS, asset data, and location data from incoming calls
- *Duplicate work orders*—Eliminating multiple work orders opened on the same service issue

- *Asset data*—Identifying key assets in the sewer system
- *Access to data in the field*—Reducing time and travel to obtain asset information and perform service
- *Formalized asset management program*—Developing a program to better understand asset condition and life cycle costs



The redlining feature allows SFPUC field service crews to redline errors while in the field and send them to the GIS data steward via the work order.

Esri Silver Tier Partner EMA, Inc. (St. Paul, Minnesota), was selected to help the utility with the implementation. EMA’s experience with GIS, asset management, and technology integrations supported SFPUC’s goal to create tools that would enable service calls and assets to be viewed geospatially.

“Our work order history needed to be visible on the map,” Harrison says. “Integration of our data and systems was key.”

The Project

The project team identified the functional requirements of the integration and designed and developed solutions during the project’s pilot phase. Implementation in Sewer Operations included a workflow gap analysis, configuration with the work and asset management system and geodatabases, data loading, synchronization, and testing.

ArcGIS Interaction with Spatial

Using an ArcGIS API for JavaScript technology platform, maps were embedded inside Maximo screens, allowing users to interact and perform common GIS tasks and to access and view their data on actual maps.

Integrating GIS and Asset Database

GIS data resides outside the asset database in a separate geodatabase. GIS feature classes are registered as objects in the asset database, keeping the data separate but available for use in all systems. GIS attribute data would be fully accessible via the geodatabase interface, which would use an Esri SQL API to integrate the database. The direct link between the geodatabases would eliminate any need to replicate data.

Key aspects of the implementation included the following:

- Redefining/Recasting assets to address existing data errors
- Securing GIS data steward services with another city department to ensure timely data updating
- Training both before and after launch that encouraged active participation and feedback, kept everyone informed, and supported the project’s success
- Integrating with San Francisco’s 311 (citywide 24-hour customer service center) to leverage the citizen service request and dispatch system

Benefits

The new functionality brought monumental improvements to the wastewater enterprise. The project improved the planning, scheduling, and dispatching of work in Sewer Operations by enabling staff to see what work is being done and where. Staff can cluster incoming service calls to identify problem areas to deploy crews rapidly, particularly during storm events.

“In the past, we were not concerned about the type of equipment that responded to a site but just that someone was responding,” Harrison explains. “Now we’re looking at our screens, understanding more about a problem, and determining what kind of equipment to send.”

Workflow improvements have eliminated multiple work orders for a service issue and reduced the dispatching of multiple service crews to the same site. At the same time, asset management tools are efficiently tracking and planning maintenance work.

“The increased knowledge we have on the state of our assets helps us with our maintenance, repair, and replacement decisions,” Harrison says.

ArcGIS query capabilities can be performed within the work and asset management system, and asset data and location data is up-to-date—even for those in the field.

“Data quality has improved dramatically,” says Lily Dryden, enterprise GIS coordinator at SFPUC. “Field service crews redline errors in the field and send them to our GIS data steward via the work order. Updates are seen within a day, so our knowledge on field conditions is reflected on our GIS maps.”

(This article originally appeared in the Fall 2013 issue of *ArcNews* magazine.)

Arizona Public Service Expands Viewing and Analysis

Utility Develops Solution for Smart Grid, Renewable Energy, and Vegetation Management

Driven by the motto “The Power to Make It Happen,” Arizona Public Service (APS) staff consistently look to improve outage response and vegetation management. At the same time, APS stays ahead of the curve on new utility challenges, such as smart grid and renewable energy.

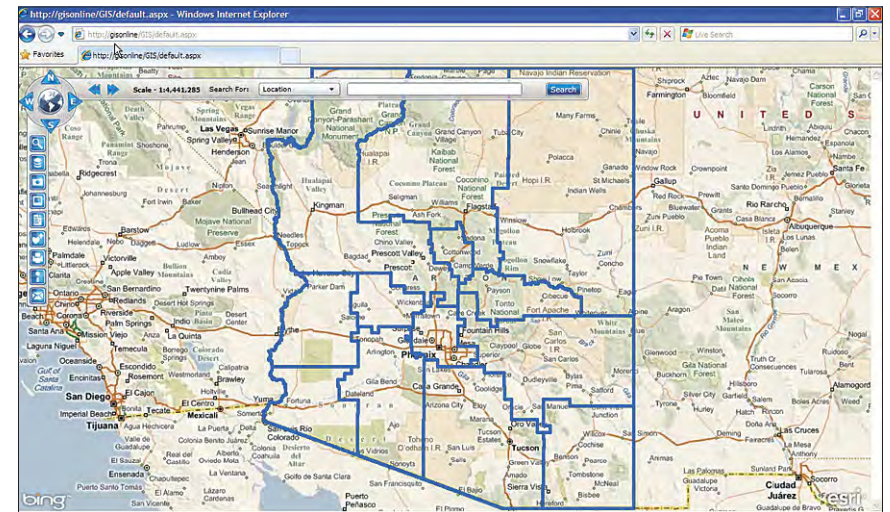
APS, headquartered in Phoenix, is Arizona’s largest and longest-serving electricity utility, with more than 1.1 million customers in 11 of the state’s 15 counties. Integral to the success of a utility is the wisdom to take full advantage of resources, and APS does just that with its GIS technology.

Recently, APS expanded the use of its GIS by developing a web-based application for company-wide viewing, planning, analysis, and data management.

The web-based application, developed with ArcGIS API for Silverlight, is used by field crews, engineers, and decision makers to meet crucial utility requirements, such as smart meter installation, vegetation management, and pole inventory.

The application was built to provide a near real-time look into the enterprise GIS distribution facilities geodatabase (GDB). This GDB is updated daily as new facilities are installed and old

facilities are removed or maintained. Spatial analysis capabilities allow personnel to query specific devices or view a specific area in the network.



The Arizona Public Service basemap allows employees to navigate to their service area, separated by divisions such as northwest, southwest, northeast, southeast, and metro.

APS extended the technology used to construct this application. The utility built a foundation for additional applications and web services that allow planning for placement of smart grid devices

and smart meters, tracking of mobile assets, and locations of photovoltaic and other alternative energy generation devices. The application also enables APS staff to view the proximity of wildfires to high-voltage facilities.

While the application mainly supports APS electric distribution facilities, the company is now developing another complete GIS for APS transmission facilities. This GIS will include facilities and vegetation data, as well as high-resolution imagery. As part of this effort, APS is building web and mobile applications to view, edit, and analyze various functions within transmission maintenance and vegetation management along transmission corridors.

APS began building its GIS in the early 1990s. The GIS provides data to its Distribution Operations Management System (DOMS). Currently, DOMS provides workers in the Operations Center with the ability to address and monitor problems and corrective actions being done in the field.

(This article originally appeared in the Fall 2011 issue of *ArcNews* magazine.)

USDA and Esri Build Geospatial Portal Mapping Service

Private GIS Cloud Opens Enterprise Opportunities

The US Department of Agriculture (USDA) and Esri have partnered in the implementation of a fully cloud-based geospatial portal. USDA's prototype portal, Enterprise Spatial Mapping Service (ESMS), is built with [Portal for ArcGIS](#), managed by Esri, and hosted on the Amazon cloud within USDA's secure environment.



USDA portal is a Cloud GIS.

Stephen Lowe, geospatial information officer for the United States Department of Agriculture (USDA) Enterprise Geospatial Management Office, and Esri product and Professional Services teams designed the prototype's geospatial interfaces with a focus on search and discovery, managed service hosting, and web service publishing of USDA-owned data. The portal introduced GIS productivity services for provisioning and consumption of web map services and the

capability to geoprocess, display, and analyze data. The private cloud GIS makes the central repository for authoritative content accessible to users within the department as well as other public agencies. ESMS provides a platform to

- Quickly create maps and apps using templates and web mapping APIs.
- Form groups to collaborate on projects or common activities.
- Share maps and apps with private groups or the entire organization.
- Embed maps and apps in custom web pages or blogs.

USDA and other external government agencies go through the portal to access valued agricultural datasets and maps from a browser and perform spatial analytics. [Esri Managed Services](#) maintains and supports the GIS and infrastructure for USDA. Users have the same collaboration and sharing tools as those provided in the public cloud mapping environment [ArcGIS Online](#), but the site retains the USDA customization and brand. Esri's Portal for ArcGIS is a geospatial content management system that can be hosted on-premises or as an off-premises cloud environment to provide a private, multitenant, geospatial

content management system. USDA will eventually integrate its eAuthentication access control system with the private cloud solution to make the platform more secure.

In May, the prototype USDA portal was tested at the New Madrid National Level Exercise 2011, which is an event for developing regional catastrophic response and recovery activities. USDA representatives from the Animal and Plant Health Inspection Service (APHIS), Farm Service Agency (FSA), Natural Resources Conservation Service (NRCS), and other USDA agencies worked with the portal as a means to search for, discover, and share disaster response geospatial content. ESMS map products were used in presentations and briefings.

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