Audit Ready
USCG Validates Real Property Assets

In 2012, the United States Coast Guard (USCG) had to complete an enterprise-wide shore infrastructure real property audit within a year to comply with a new federal act. The agency completed the audit within the required time frame using a validation process that incorporated ArcGIS and GPS.

Changing Audit Requirements
The Chief Financial Officers (CFO) Act of 1990 established chief financial officers in major federal agencies and enhanced federal financial management activities to include annual audits of financial statements.

Building on the CFO Act, president George W. Bush issued Executive Order 13327 in 2004, which focused on federal real property asset management and stated, “The policy of the United States is to promote efficient and economical use of America’s real property assets and to assure management accountability for implementing federal real property management reforms.”

This order created the Federal Real Property Council (FRPC) to establish and enforce more stringent annual real property reporting requirements. The council outlined no less than 26 data elements that must be captured for uniform reporting of federal real property assets. “The provisions of those directives required that federal agencies document the existence and completeness of all real property inventories,” said Peter Spinella, real property specialist at USCG. “This means the Coast Guard must thoroughly demonstrate knowledge of its real property holdings and have recent photographic evidence of each asset.”

Previous shortcomings in accounting for real property contributed to failed attempts by the USCG to pass CFO Act audits. The USCG made a commitment to the Department of Homeland Security (DHS) to pass the 2012–2013 audit. This required validation of the USCG’s real property inventory of more than 50,000 individual assets at locations from Maine to Guam before June 2013.

Forming a Plan
The USCG developed a real property Asset Enrollment Template (AET) for

continued on page 10

↑ Mapped GPS points obtained from asset photos show the location of USCG real property.
GeoPlanner for ArcGIS

New Premium App Uses Geodesign for Smart Planning

Planning professionals across a wide range of industries must frequently weigh different variables against multiple scenarios to make a decision or recommend a course of action. A new web-based premium application—GeoPlanner for ArcGIS—delivers the power of ArcGIS Online and a geodesign workflow while enabling users across an organization or a community to collaborate on design decisions.

GeoPlanner for ArcGIS, available in ArcGIS Marketplace, provides tools that support every step in a planning and design workflow: project creation, data identification and incorporation, scenario creation, site condition assessments, evaluation and comparison of alternatives, and reporting. Users are able to create, analyze, and report on alternative planning scenarios in support of better, more informed decision making.

Because it is accessed by a browser, the application provides a way for stakeholders both within and outside an organization to participate in the design process.

Planners, scientists, students, policy makers, analysts, and others, can use GeoPlanner regardless of their prior GIS experience. It is designed to be easy to learn and use by a wide range of non-GIS users and can be configured by GIS professionals in an organization.

GeoPlanner can be used for a broad range of industries, from public safety to energy to natural resources. Sample configurations are provided through ArcGIS Online. These sample configurations illustrate features commonly used for land-use, public safety, and special event planning.

Using ArcGIS for Desktop tools, these samples provide a starting point for GIS professionals to build on and create configurations that meet their specific needs. One of the powerful capabilities of GeoPlanner is weighted raster overlay. With it, users can overlay different information layers, weight the importance of each, and generate a web map displaying the results. The application allows values to be easily adjusted as users work through the design process and quickly generate multiple scenarios.

As part of the ArcGIS platform, the application integrates with a range of business tools, like Esri Maps for Office. For example, once users have worked through the design process and are ready to report their findings, GeoPlanner includes a Save Presentation button that creates a web map for the current view. Those maps can quickly be inserted into a PowerPoint presentation or used to develop an Esri Story Map app.

One potential use, demonstrated at the Esri 2014 Federal GIS Conference, is locating drilling sites to minimize impact to sensitive wildlife habitat. Users can define prime habitat sites using weighted raster overlay with the landscape layers available in ArcGIS Online and then draw that into GeoPlanner to help guide and evaluate their proposed design.

From there, each well site and road needed to support it can be plotted and visualized. The application allows users to repeatedly redraw roads and move sites. Pop-up dashboards provide a quick impact analysis and can be compared from scenario to scenario to minimize the environmental impact.

For more information, go to esri.com/geoplanner.
Turning a Requirement into a Benefit
Enterprise GIS Helps Louisiana Airport Use the Data It Collects

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 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, multiyear 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 wear off and staff just get 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. 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 were crucial first steps.

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 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 submeter approximations. To show how even the simplest GIS tools can empower them, one of GEO-Jobe’s staff 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 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 whiteboard.

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, operations managers can also track the status of inspections and work orders and locate their field crews 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 a specific property, airport staff can quickly pull up documents such as lease agreements, construction bids, architectural drawings, proposals, building 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.
The United States Capitol and its grounds are maintained by its own architect—the Architect of the Capitol (AOC). The US Capitol and Visitor Center, Senate and House office buildings, Supreme Court, and Library of Congress—17.4 million square feet of buildings—are cared for by nearly 2,600 AOC staff. They also are responsible for keeping the more than 460 acres of Capitol grounds in impeccable condition. This isn’t easy when you consider that members of congress, their staff, and approximately two million visitors come through the US Capitol Building each year.

When it comes to providing excellent client service, one of AOC’s important duties is helping members of the House of Representatives select the location of their offices after each election. Every two years, 435 members of the House go through a highly organized process to select their office suites. Based on their seniority, House members draw lottery numbers and then are ushered into a room to choose from a subset of rooms that are available to them.

During the November 2012 transition, however—the 113th time the House has been elected into office—instead of selecting office space from paper maps and photographs, members were presented with an interactive map app that provided access to photos; complete information on the suites, such as window views, access to elevators, and committee hearing rooms; and even a 360° panoramic view of the available offices.

AOC staff had been in the midst of transferring paper architectural drawings and floor plans into digital files when an idea struck them. With the office lottery fast approaching, since the drawings were being stored in a new server so AOC staff could access the files, why not create a congressional move application at the same time?

“It was the right moment in time—we were doing a lot of data conversion,” says Christopher Smith, director, Technical Support Division for the Architect of the Capitol. “We thought this would be a good tool for transparency for the House and help everyone rethink how we manage space.”

### Suite Selection Made Easy

The app was ready in time for the AOC to use during the House’s postelection transition. To get started, the representatives and/or representatives-elect and their staff sat down with an AOC professional staffer and opened the app to view the variety of office options available to them. Making things even easier, the app was designed to be used on iOS devices, which has become a standard smart device used by AOC staff. By just typing in an office number and tapping a button, a view of the suite’s location pops up on a 2D map. The viewer also offers a 3D image of the building.

By navigating the screen, the member could view the various attributes, such as square footage, the window view, and the condition of the existing carpeting and drapes. (Carpet and draperies are replaced after six years, not during every move cycle, as a cost-saving measure.)

“All this information at one time was dispersed in many different systems,” explains Smith. “Now we have it all integrated and available in one location.”

The user can also hover over or touch an object on the screen to get additional information about it. For example, if an office contains a room-dividing partition, the user can tap the partition to see if it is ceiling height or not—something that was impossible to do before the app was developed. In years past, the clients would have to visit each office suite if there was a question about its configuration—which was difficult to do in the short amount of time they’re allowed to select a suite. Now, the user can view the room in 3D using actual partition heights.
that are stored in the GIS to get a much more realistic view of the suite.

“We couldn’t possibly do this on a paper map,” says Smith. “GIS brought these capabilities to them, all while supporting the existing lottery system that was in place.”

AOC took this new concept and embraced it—GIS is now the hub for all AOC’s automated systems. When it was first introduced in 2007, it was through simple visualization of data on computer desktops. Today, AOC staff have built an enterprise GIS portal that gives all their colleagues access to the data they need.

Smith’s team is also able to publish data to the web more easily, and the web apps can be used on any device. Many staff have tablets, so the need to develop apps for tablets and smartphones was at the front of the team members’ minds.

To ensure the app looked great in the device environment, the developers created a simple JavaScript app that provided them with the ability to start seeing the data and get a feel for what GIS can offer. “For the first time in my career, the desktop environment was a secondary environment,” says Smith.

**Keeping the Old and Introducing the New**

This platform allows them to support a large number of users, very large datasets, and graphic-intensive processes. The system they built to handle this is substantial, and several computer drawing personnel worked for three months to get the data into the system. There was a heavy investment of time in the beginning to get the drawing files into shape. The drawings had to be cleaned up, the polygons were closed, standard text blocks were created, and the drawings were all labeled in a conventional manner to make them more useful. As the fundamental data gets into better shape, the time staff spend on data conversion will decrease. A full-time GIS analyst keeps the developed apps up and running and slowly introduces new functionality.

There are master drawings of the campus that are kept on file and changed as construction happens, which is almost every day. Smith’s team receives the as-built drawings, quality checks them, reflects the changes on the master drawings, and then updates the rest of the drawings on a monthly cycle. After this update, the information is updated on the map services.

**You Can Use the Same System**

Besides the lottery app, AOC staff—those responsible for the upkeep and care of the buildings and grounds—can log in to the system via another app that accesses different workflows to help them keep the facilities running smoothly. This has provided a lot of efficiencies—code can be reused so developers aren’t writing individual apps for each type of user. The apps can be easily expanded as well by adding themes with core map tools and functions. It’s also given Smith and his core team some peace of mind: “We know the web GIS world is there, and we can make it work for all sorts of different user groups; we aren’t going to try and do everything at once,” says Smith. “We can plug in additional functions as they are needed by using different technologies.”

For more information, contact Christopher Smith, director, Technical Support Division, Planning and Project Management, Architect of the Capitol (tel.: 202-226-4711).
GIS has improved the process of assigning students to schools and transporting them as well as managing physical assets for one of the largest school districts in Texas.

The Garland Independent School District (GISD) is located in north-central Texas, adjacent to Dallas. The district encompasses approximately 100 square miles and serves the Dallas suburb cities of Garland, Rowlett, and Sachse. With an enrollment of about 58,000 students, it is the thirteenth-largest school district in the state of Texas.

Enabling Choice
GISD’s “district of choice” policy allows parents to choose where their children will attend school, based on established criteria for ethnic balance. Annually, the district has a one-month selection period for both secondary and elementary schools. Once the selection period ends, the district’s Student Services department begins the process of assigning students to campuses based on building capacity, grade-level capacity, and seat availability. Other criteria, including campus demographic data, are considered before making the final decision on school placement. To help with student travel and support the district of choice policy, the district’s GIS department developed a Flex application for distance routing. With this application, officials can determine the location of a student’s home and local schools within the immediate vicinity.

Converting AutoCAD Files to Geospatial Data
Garland maintains 7 high schools, 12 middle schools, 47 elementary schools, and 2 pre-K schools, as well as a number of administrative offices and special-use facilities. Managing these facilities for compliance with governing standards, current use, past maintenance, and potential renovation and remodeling projects became increasingly difficult. It was decided that an automated system was needed to prepare plans and data for quick and easy access.

For several years, the district used Autodesk’s AutoCAD for facilities management. The district’s AutoCAD facilitator was responsible for converting all paper drawings into AutoCAD drawings and maintaining facility floor plans during the district’s $385 million bond program. Approximately four years ago, the facilities department began implementing a GIS to be used in conjunction with AutoCAD. The district retained all facility floor plans in AutoCAD while using GIS to provide easy access to site plans, floor plans, room numbers, and data referenced to them.

With the arrival of GIS analyst James Walker, the decision was made to create a separate GIS department and convert all existing AutoCAD site plans and floor plan files to Esri’s ArcGIS format to make greater use of the district’s ArcGIS for Server installation.

“Because we have used AutoCAD for so long, it is very important to us that the new GIS-based drawings look exactly like the CAD plans for easy visual recognition among staff members,” said Walker. “This means that all the details in the original files must be included in the new ones.”

Walker found the conversion process challenging because existing floor plans often included small features such as door swing paths, stairwells, and other details that totaled 30,000–40,000 polylines when converted to ArcGIS. For example, curves were made up of many very short line segments rather than a single continuous line. “When you brought a converted AutoCAD drawing into the geodatabase, it could take 10 minutes or more to draw because of its complexity,” said Walker. “So I built a module for our AutoCAD processing model to simplify the drawings.”
Walker’s module removes all the unnecessary polylines in the AutoCAD drawings by running a spatial buffer with a dissolve around it. Because he set the buffer value at one-quarter of a centimeter, he got a half-centimeter line on either side of the polyline. The result is that all the thousands of tiny polylines become one complex polygon that draws very quickly.

In addition, Walker uses Esri’s ModelBuilder to extract data from the AutoCAD drawings and create new layers in the geodatabase. “We apply structured queries to the polygons and annotations in AutoCAD to extract GIS feature classes from roof plan outlines and their related buildings,” said Walker. He used the same method on the construction history of both the original buildings and other structures that were subsequently attached to the original buildings. By doing this, he created about a half dozen new layers from the original AutoCAD files that could then be used to analyze the condition of district buildings.

Standardizing Room Numbering
Reconciling the various classroom numbering conventions found throughout the district was another significant benefit from implementing GIS. In the past, photocopies of school floor plans were distributed to the maintenance, security, technology, energy management, and other departments. The same photocopied floor plan could remain in use for several years, despite the fact that building renovations or modifications had occurred or the room numbering had been changed. In some cases, departments had different versions of the floor plan for the same school.

“Because the existing CAD system maintained multiple unconnected drawings for a school, there was no way to know whether or not a room number was used more than once,” said Walker. “So it was possible for a classroom on the first floor and a utility closet on the second floor to have the same room number.”

Another aspect of room number standardization is its impact on security and emergency response. School entrances and exits throughout the district are now numbered in such a way that they are in compliance with police and fire department guidelines. This allows first responders to react quickly and efficiently once they arrive at a campus. “We’ll soon begin to incorporate the new numbering system with GIS views and printed maps that relate to the current construction of each facility,” said Walker.

Thinking Outside the Classroom
Managing building use is an ongoing challenge in many school districts. Because demographic data is joined to the classroom a student is assigned to, it is possible to analyze the campus as a whole as well as individual rooms. Each building is reviewed annually in conjunction with enrollment projections, program offerings, and staffing requirements. For example, elementary schools often have both regular and English as a Second Language (ESL) kindergarten classes, but as students progress, the need for ESL classrooms begins to vary from school to school.

GIS is also used to analyze the building construction data collected so that the district can track the conditions of major building components, such as flooring; roofing; and heating, ventilation, and air conditioning systems. Data collected includes installation date, manufacturer, installer, and product information. This data assists various departments in developing their budgets for replacement based on the age of a component and aggregating yearly budget projections across the district for similar replacement work. This allows some basic life cycle costing of major facility components within the district. In future years, it will also provide valuable information for bond projections.

In addition, the GIS department recently helped the district’s transportation department with the implementation of a new GIS-based routing system. Currently, the district transports approximately 28,000 students on 250 buses daily, totaling 3.5 million miles per year. To supplement and enhance this system, GISD is using the ArcGIS Network Analyst extension to build an extensive street and sidewalk network.

“We are beginning to expand our use of GIS,” said Walker. “We plan to implement a GIS process for data collection. As we gather and centralize more data, we will begin to perform more detailed analyses with our data to better understand the dynamics of the district and provide increased services to school district employees and our students.”
capturing the information necessary to meet CFO Act/FRPC documentation standards. Each real property asset in the portfolio has an associated AET on file.

Each AET contains data about an asset that includes its real property unique identifier (RPUID); age; historic cost; unit of measure; and size along with a current photograph containing an embedded date stamp, RPUID, and the asset’s geographic coordinates. These are just a few of the 26 data elements that the FRPC requires for uniform reporting. The status of each file, from creation to final approval, is tracked in Microsoft SharePoint.

Initially, the methodology for gathering and processing the data required to generate an AET was unnecessarily arduous. It used professional surveyor-grade GPS receivers and Microsoft Office software—two products not designed to interoperate—to crudely layer GPS information onto digital photos.

To increase work efficiency, the USCG Civil Engineering unit in Providence, Rhode Island, researched and tested a GPS-enabled camera and its accompanying software application. The GPS-enabled cameras easily and quickly acquired geotagged photos, and their use was adopted throughout the USCG as the most efficient method for acquiring AET photo documentation.

Capturing Big Footprints

In addition to photoprocessing challenges, Spinella and his team also discovered that measuring larger assets using traditional methods, such as measuring wheels and tapes, significantly limited efficiency. With so many large assets to validate, this threatened to delay completion of the DHS audit.

The USCG had to develop a new method to gauge the area of its large-footprint real property holdings. It started by building a geodatabase for the site using the correct state plane and projections and creating polygons and features.

“This gave us a table so that, if we were measuring the gross square area of a roadway system, each polygon showed up in the table for that feature class,” said Spinella. “That returned not only the individual sizes but also the total square area of the roadway system.”

By demonstrating the accuracy of building and structure measurements using ArcGIS software and current aerial imagery, Spinella and his team were able to convince stakeholders that ArcGIS could determine the size of infrastructure, such as airfields and property lines, to within 5 percent accuracy, eliminating the need to physically measure large structures.

“Incorporating these two technologies into our AET production/property validation process saved thousands of man-hours and millions of dollars in travel costs,” said Spinella.

Keeping Up-to-Date

Moving forward, the USCG is currently working to establish a process to keep the property inventory data current, as normal operations and maintenance will inevitably require updates to the metadata of individual assets. Spinella and the team are currently developing the capability to give operational commanders asset visibility using ArcGIS. With the mountain of data gathered during the initial inventory validation establishing the USCG shore infrastructure real property baseline, creation of near real-time links to project and work order databases, and new configuration control processes that hold officials accountable for unauthorized changes, the Coast Guard will be able to sustain its real property inventory in audit-ready condition.
PenBay Launches InVision 1.5

"PenBay Solutions was instrumental in helping us with all the agencies we worked with to gather data and for implementing a public safety system that met our needs for the Super Bowl.”

Captain Steven Pollackov of the New York City Fire Department (FDNY) GIS Unit

PenBay Solutions, a developer of GIS-based facility management and public safety software, introduced InVision 1.5 at the 2014 Esri User Conference in San Diego. The new technology was also featured at the InVision Special Interest Group lunch held at the conference.

InVision software is built on the Esri ArcGIS platform to help users visualize, analyze, and interpret data in ways that reach beyond individual buildings and site maps. InVision bridges the gap between managing exterior and interior built environments by aggregating all facility and infrastructure data from various sources into a single, comprehensive visual system for portfolio management, operations, and safety and security.

The 1.5 release of InVision software introduces several new features and enhancements with an emphasis on mobile capabilities, such as mobile viewers for:

- Space management: View space types, uses, and assignments while in the field to more easily find and understand space use and classification.
- Asset management: Remotely view utility and asset types, statuses, and conditions to more quickly locate and evaluate assets.
- Campus viewing: Provide information about campus points of interest so employees, residents, and visitors can easily find what they are looking for.
- Security planning: View security plans—including both indoor and outdoor environments—and share that security information via mobile devices with outside public safety agencies and response personnel.
- Security operations: View critical building, floor, space, and security asset information in the field to better understand the location and status of security assets in real time.

"Mobility is critically important to our customers," said Stu Rich, chief technology officer at PenBay Solutions. "These new InVision mobile viewers are just the beginning. We’re in the process of developing mobile applications designed for data collection, data editing, and inspection workflows as well. Watch for announcements around those exciting new applications in the coming months."

The InVision Secure Event Management Solution supports a range of activities and users throughout event planning, coordination, and operations. With InVision Secure, users can coordinate plan creation, manage the review and approval process, and securely share information that is relevant to the safety and security of events. The solution helped make Super Bowl XLVIII a safe and successful event, according to PenBay Solutions.

"PenBay Solutions was instrumental in helping us with all the agencies we worked with to gather data and for implementing a public safety system that met our needs for the Super Bowl," said Captain Steven Pollackov of the New York City Fire Department (FDNY) GIS Unit. “As we move forward, we will be utilizing this platform more and more.”
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