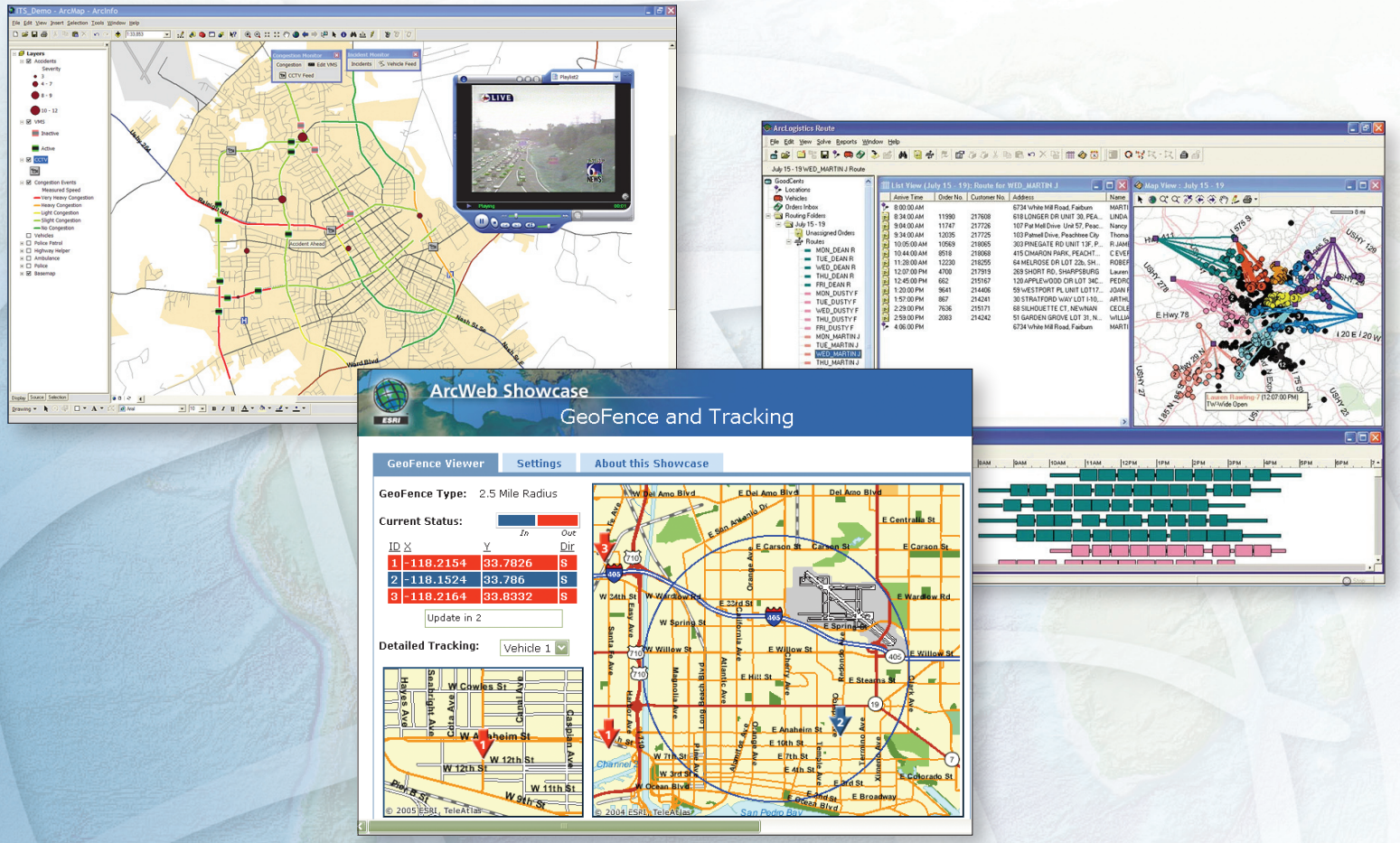
GIS Best Practices

Mobile Resource Planning and Logistics



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ESRI

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What Is GIS?

Making decisions based on geography is basic to human thinking. Where shall we go, what will it be like, and what shall we do when we get there are applied to the simple event of going to the store or to the major event of tracking vehicles as they perform customer deliveries. By understanding geography and people's relationship to location, we can make informed decisions about the way we live and the impact we make on our planet. A geographic information system (GIS) is a technological tool for comprehending geography and making intelligent decisions.

GIS organizes geographic data so that a person using the digital map can select data necessary for a specific project or task such as locating a vehicle or routing service personnel. A thematic map has a table of contents that allows the reader to add layers of information to a basemap of real-world locations. For example, an operations manager may add distribution centers, delivery areas, and routes to more fully understand his/her business activities. With an ability to combine a variety of datasets in an infinite number of ways, GIS is a useful tool for nearly every field of knowledge from scheduling to routing and from archaeology to zoology.

A good GIS program is able to process geographic data from a variety of sources and integrate it into a map project. Many countries have an abundance of geographic data for analysis, either from government-funded projects or private companies. Data can also be gathered in the field by global positioning system (GPS) units that attach a location coordinate (latitude and longitude) to a feature such as a gas station or service area.

GIS maps are interactive. On the computer screen, GIS users can pan the map in any direction, zoom in or out, and change the nature of the information displayed on-screen. They can choose whether to see the roads, how many roads to see, and how roads should be depicted. Then they can select what other items they wish to view alongside these roads such as rest areas, truck stops or loading facilities. Some GIS programs are designed to perform sophisticated calculations for figuring costs and optimizing schedules. GIS applications can be embedded into common activities such as verifying an address or rerouting vehicles around delays.

From routinely performing work-related tasks to scientifically exploring the complexities of our world, GIS gives people and companies the geographic advantage to become more productive, more aware, and more responsive citizens of planet Earth.

GIS Improves Mobile Resource Planning and Logistics

In today's fast-paced society, customers demand service and products sooner than ever. Companies offering delivery services are finding they need to provide quick deliveries and accurate time windows. While companies struggle to meet these demands, they also must weigh their costs for services since mobilizing workforces can be an expensive endeavor in both assets and personnel resources.

Small companies and Fortune 500 companies alike are finding that ESRI's GIS software for mobile resource planning is critical to meeting these goals. They are discovering how ESRI software makes it easier to improve business operations so they can get the right goods and services to the correct place at the appropriate time for the least cost.

Transport operators, logistics companies, and service engineers are realizing major improvements in operational efficiency, cost reduction, and resource deployment. Using a GIS-based, geographically focused logistics package allows users to

- Calculate realistic travel times and distances between stops, deliveries, and depots.
- Improve work area balancing, work scheduling, and route optimization.
- Create more realistic and accurate routing and scheduling plans that consider natural barriers, street-level travel times, traffic flows, and holdups.

ESRI's GIS software can be used for many aspects of logistics and supply-chain management including site selection analysis, asset and property management, route optimization, scheduling, vehicle tracking, and long-range planning and forecasting.

Large-scale users of ESRI software have shown an average savings of $15 million over traditional manual methods, while other operators have found a 15–30 percent inventory reduction by taking corrective action earlier and mobilizing their inventory more effectively.

To avoid being overwhelmed by the scale and cost of planning deliveries and operating fleets efficiently, businesses are turning to GIS-based logistics solutions, replacing guesswork with strategy to generate the most efficient routes.

Along with cost reductions of 10 percent in labor and more effective inbound and outbound transportation, companies are also realizing a 5–10 percent revenue enhancement through quickly responding to customers, managing their inventory more efficiently, and being able to reduce price markdowns. A 5–15 percent reduction in delivery times gained through route analysis, improved tracking, and the use of real-time data solutions saves these businesses even more.

ESRI provides solutions for nearly 100,000 field-workers worldwide, and these logistics systems fit organizations of any size. ESRI's software products and industry-focused solutions provide a wealth of capabilities for the logistics and supply-chain managers as well as business operators in general. ESRI packages for logistics include

- ArcLogistics Route
- Network Analyst Extension
- Territory Optimizer
- ArcWeb Services
- ArcPad Street Map
- ArcIMS Tracking Server Extension
- SequenceEngine
- ArcIMS RouteServer
- Modular Enterprise Logistics Solution

DS Waters Increases Efficiency and Profits with GIS and LBS

Field Technicians Equipped with Ruggedized GPS-Enabled Cell Phones

DS Waters, headquartered in Atlanta, Georgia, is the U.S. leader in home and office water delivery. DS Waters' bottled water products include leading regional brands, such as Alhambra, Belmont Springs, Crystal Springs, Hinckley Springs, Kentwood Springs, Sierra Springs, and Sparkletts. Water is bottled at more than 25 manufacturing facilities and then delivered by a fleet of more than 2,000 delivery trucks to millions of homes and offices across the country. DS Waters employs approximately 5,500 people in more than 30 states with annual estimated revenues of approximately $1 billion.

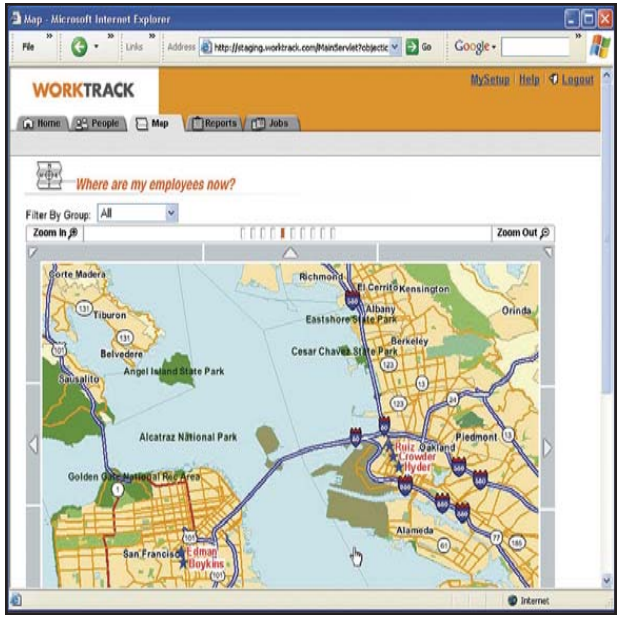
DS Waters experienced explosive growth over the last few years and wanted to continue its growth as well as scale for the longer term. It recognized an opportunity to improve its productivity and service levels by looking to standardize its internal applications and leverage mobile technology.

What's Really Happening in the Field?

DS Waters has a highly mobile workforce across different work areas using multiple systems and devices. DS Waters has been competitive and has done well in its market.

"But we knew we could do better," says Bob Bramski, vice president and CIO of DS Waters. "We knew if we could get more detailed, accurate information about what our employees were actually doing in the field, we could improve our operations and become more profitable. But we have routes and deliveries going on all over the country, and closer field supervision would just cost too much."

Considering the sheer volume flowing through the company on a daily basis, keeping track of everyone involved in manufacturing, delivery, and service has become a Herculean effort. In addition, getting the right information to customers was increasingly becoming a larger challenge. Customers were growing impatient and frustrated with the lack of easily accessible information. "We knew we had to address these issues, and we also knew technology was out there that could solve our problems," adds Bramski. DS Waters began researching wireless and GPS technology that it hoped would help manage and monitor field activities and technicians.



DS Waters' operations dispatchers can track mobile workers and delivery personnel with LBS.

Can Technology Really Make a Difference?

DS Waters embarked on an aggressive plan to deploy wireless devices and software to make field technicians more productive while making customers happier by being able to provide them with accurate information. WorkTrack, the GPS-enabled time, job, and location tracking system, was selected after an evaluation of three competing vendors. DS Waters evaluated many criteria during its selection process, including support for specific business processes, accuracy of the system, and ability to integrate with multiple back-end systems. It found that the WorkTrack solution from Aligo, Inc. (San Francisco, California), offered the most flexibility, security, and scalability, as well as the support necessary to grow with DS Waters' needs now and in the future.

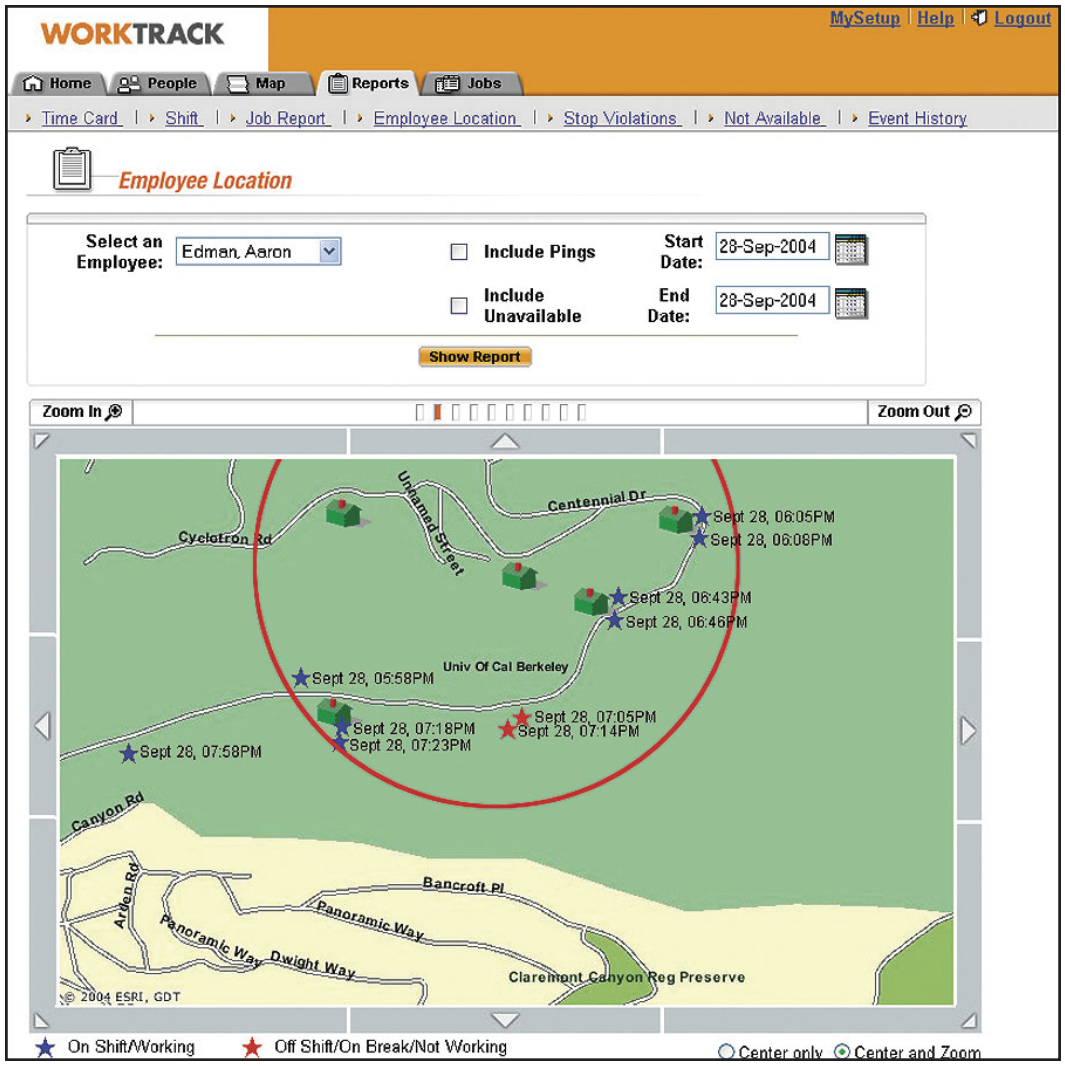
In addition, Aligo's strong relationship with ESRI made a difference as Bramski was a user of ArcSDE and ArcIMS products from ESRI for DS Waters' delivery routing. At first, the program was piloted to DS Waters' field service technicians—approximately 100 employees who install and service coolers and filtering devices in homes and offices across the country. Each

technician was given a ruggedized GPS-enabled cell phone with the application loaded, along with a training session on the use of the application over the phone. However, given the intuitive nature of the application, field technicians found it easy to use after a few days. While the initial pilot was conducted with the field technicians, DS Waters ultimately rolled out the system to the delivery drivers—for a total of more than 2,000 drivers.

Is There a Silver Bullet?

The assisted GPS technology allows back-office dispatchers and operations managers to view the location of technicians or drivers in the field using ArcWeb Services. "We started out thinking that keeping track of employees," says Bramski, "would be the key factor in improving productivity, but tracking thousands of employees with hundreds of thousands of routes just was not practical."

He discovered that management by exception was his silver bullet to making this technology work successfully. Bramski explains, "You know the data is there if you ever want to see it, but being alerted to issues, such as when a technician is running behind on his job by more than one hour or a delivery truck has not moved in the last 30 minutes, was the greatest benefit we saw early on." This capability allowed DS Waters to manage its employees based on triggers that were determined to be critical to operations. They were able to run standard weekly or daily reports as desired, but this approach led to major productivity and service level increases.



Bottle delivery route activity is tracked and shown to company managers via ArcWeb Services.

DS Waters' operations can track the location of delivery people using ArcWeb Services through WorkTrack. Field technicians rely on the system to accurately capture their job hours and status. DS Waters' system integrates directly with many different systems, such as Cignify, Kronos, and Oracle, saving time and money while achieving government compliance.

With this new technology, a technician runs through a simple menu on his cell phone to enter shift, job, and break information. The information is transmitted to the back-end system, which enables the dispatcher or operations manager to know when the technician is available or unavailable for another job. Because the system tracks where the employee is, the dispatcher can smartly dispatch the next job to the closest technician, thereby optimizing service levels. The technician receives the new job and can also obtain information regarding that job, such as address and driving directions, through ArcWeb Services.

Hard-Dollar Savings Demonstrated

Before the system was implemented, field technicians relied on radios, cell phones, and two-way pagers to communicate with dispatchers and often waited hours to receive a new job. Today, no paperwork is required, and tracking of specific parts purchased can be captured and sent back to the system in real time. In addition, Bramski states, "Every other Friday was a nightmare in our corporate office, trying to process thousands of time sheets for all our field employees." Frustration levels for field employees were growing as fax machines were usually busy for hours at a time, and many times the paychecks were fraught with errors that took weeks to correct. "Now, we simply pull the employee time report from the system and approve it for processing in our payroll system," Bramski explains. To date, DS Waters estimates that WorkTrack has saved each technician approximately 15–20 minutes of productivity a day, which translates into approximately $1,500 per worker per year. For 2,000 employees, this means an annual increase in productivity worth more than $3 million per year.

Bramski says he sees many possibilities for new uses of WorkTrack and expects the project to continue delivering benefits well into the future. "I love hard-dollar savings and short return on investments," he explains. "This is how technology is supposed to work in a business; nothing about the gains I have experienced to date is theoretical, and that is the way I intend to keep it."

(Reprinted from the Summer 2005 issue of *ArcNews* magazine)

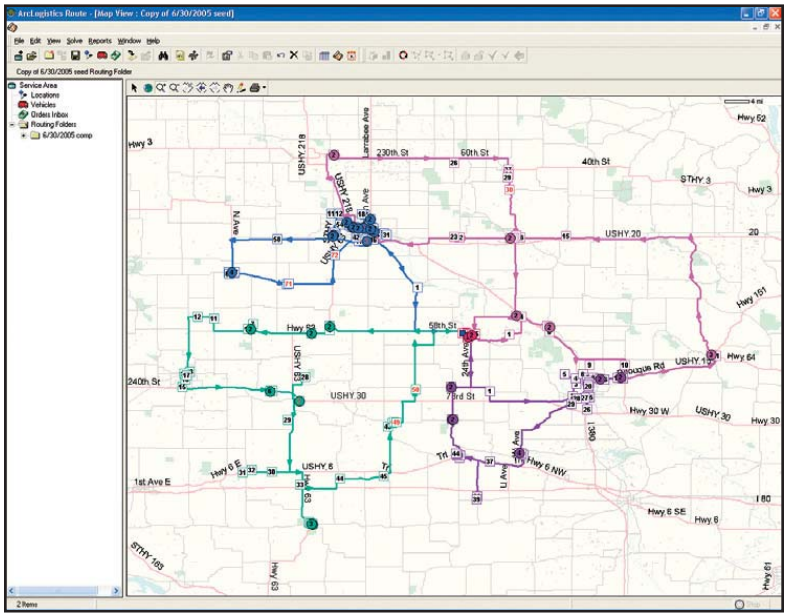
Apex Office Supply

GIS Transforms Company's Way of Doing Business

Apex Office Supply is a small office supply company that thinks big about getting value from its geographic information system (GIS). Based in Vinton, Iowa, the company serves approximately 300,000 people in east central Iowa, bringing services and products to 1,500 active customers in two major cities, Waterloo and Cedar Rapids. With a delivery radius of approximately 50 miles, five ever-changing routes, and an average of 200 deliveries a day, the company knew it had to make the best use of its fleet to stay ahead of local and national competitors.

The Challenge

When Apex Office Supply first began in 1986, it was easy to process orders by hand. The driver manifest was printed after the orders were entered into the system, then it was up to the drivers and delivery manager to decide how to schedule delivery. This process took time, and orders were not always delivered in the most efficient manner. Drivers had fixed routes, so a new request would slow down the entire delivery process or drivers would be unable to complete assigned workloads.



Through a mapping interface, ESRI's ArcLogistics Route displays delivery truck routes and stops.

In addition, the limited flexibility in scheduling meant that there was little opportunity to address personal appointments and unforeseen events that occurred during their delivery times. A continuing concern was that there wasn't enough time allotted for deliveries, which was a problem for customer service and driver safety. "We used to have a real problem with drivers speeding," says Kurt Karr, owner, Apex Office Supply.

Even though the company had been using a GPS to track vehicles, it had its difficulties. Many drivers felt they were being constantly watched. The data wasn't real time; instead, it was downloaded when the trucks came back to the office. If there was a question, such as why a driver spent more than a normal amount of time at one location, the question couldn't be asked until the next day, and the tone of the conversation was often confrontational. Apex Office Supply realized it needed not only a more effective method to deliver products that satisfied customers in the best economic fashion but also solve problems, such as speeding and driver-management relations, in the workforce.

The Solution

Karr knew he needed a software program to help him plan his delivery routes and that choosing the right package would help him overcome some of the other issues within the business. Says Karr, "I knew about ESRI and its GIS products by reputation. I did some reading on its logistics package, ArcLogistics Route, and thought it was the right choice for our company." The software is a complete solution for complex routing and scheduling problems, whether you have a small fleet operation or work in a large multiuser environment.

Apex Office Supply asked Pathfinder Logistics, a logistics solutions company based in Springfield, Pennsylvania, to come to Iowa for a week and perform the installation of the software. "That's all it took," says Jason Hicok, director of information technology, Apex Office Supply. "One week with a Pathfinder Logistics analyst and we knew what we were doing with the product. The software package fits in well with our standard business systems and offers customer services that we had never before considered."

Apex applied the same standard office procedures to process delivery orders each day, but now they have a software system that can adapt to their needs. It flexibly handles scheduled and catalog deliveries; special projects; and after-hour, high-priority deliveries.

Driver Manifest

Apex now has a solution that routes deliveries overnight, then prints invoices and driving instructions. The next morning, drivers pick up the invoices that are organized by order of delivery, which improves the efficiency of loading the trucks. "ArcLogistics Route has redefined how our business processes work," says Karr. "We are more efficient than ever."

Results

ESRI ArcLogistics Route successfully captured and implemented the company's vision together with drivers' knowledge and experience. The drivers were at first skeptical but now have come to rely on the routing software. Karr explains that when ArcLogistics Route was first implemented, the drivers were invited to try the software. "Instead of forcing them to follow the new manifest, we let them experiment on the computer with attempts to compete with the

system. They would make changes, then look to the system for the cost differences. They rarely won."

Before implementing the software, the drivers would count packages. "Now they load according to the manifest generated by the software, thereby saving time. They have no issues with ArcLogistics Route, and they trust it," says Karr. ArcLogistics Route has become a valued solution.

Because the software is so adaptable, Apex has been able to respond to customer requests easily, even scheduling delivery to a church on a Sunday. The software retains this specialized delivery information, giving Apex an advantage for customer service and market specialization that larger supply delivery companies cannot match.

The consequences of the routing software implementation have been extremely positive. Drivers no longer speed, because they have confidence the system has allowed them enough time. Deliveries are more efficient. Drivers have more personal flexibility and can rely on decisions they do not need to make themselves.

For example, a heavy item such as a large desk or fireproof filing cabinet has to be delivered. ArcLogistics Route schedules another driver in the vicinity to help with unloading. This improves safety for the drivers and cuts down on liability since they do not ask for help from their customers.

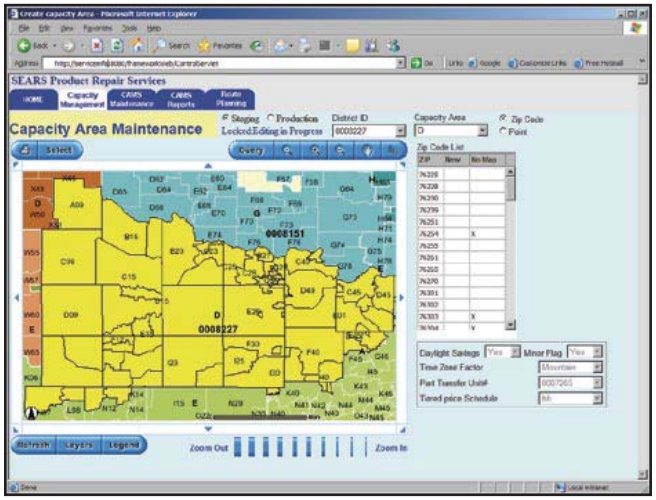
Cost savings from the system have been significant. The company has decreased fuel usage by 4.3 percent, reduced labor hours by 18 percent, and cut drive time by an average of 7.4 percent. This, in turn, has allowed the company to promote drivers to managerial positions, giving them increased pay and control of their careers. The end result is a more streamlined and adaptable business that effectively responds to its customers' needs and supports Apex Office Supply employees.

Sears Product Repair Services

Enterprise GIS Improves Product Repair Services and Home Delivery

Overview

Sears Holdings Corporation is a true megastore. With nearly 900 full-line stores and 1,100 specialty stores, the company has more than 48 million active Sears customer households. It is also the largest repair service provider in the United States.



Capacity Area Management System, specifically designed for Sears by ESRI Professional Services, is a GIS application that manages the planned capacity of a region's available service technicians.

The Challenge

Sears manages one of the largest home appliance repair businesses in the world, with six distinct geographic regions that include 50 independent districts. More than 10,000 technicians throughout the United States complete approximately 11,000,000 in-home service orders each year. The business of supporting a mobile workforce requires good management, and Sears knew that geographic information system (GIS) technology was the answer to routing, a geographic problem.

Sears originally turned to ESRI in 1994 to improve its home delivery routing, reducing its delivery time window and ultimately building on its century-old promise: Satisfaction Guaranteed or Your Money Back. The resulting application, called the Enhanced Home Delivery System (EHDS), was

based on ESRI ArcGIS software. Subsequent teaming with ESRI created four more highly successful systems for improving delivery and other business functions over the last decade.

The EHDS system was complemented by a Warehouse Forklift Optimization System, which optimally routes forklifts through large warehouses across the United States. These forklifts execute routes that pick and stage merchandise for loading delivery vehicles in last-in, first-out order. Sears was hoping for one more pick per forklift, per hour, and the ESRI application yielded 12 additional picks per hour. Sears realized it could extend the opportunity for improvement out to the field as well. Seeing the increase in profitability and efficiency in home deliveries, it looked forward to bringing these savings to the home service repair business.

The Solution

Once again, Sears teamed with ESRI Professional Services to build the Computer-Aided Routing System (CARS) and the Capacity Area Management System (CAMS) used by Sears Product Repair Services. CAMS manages the planned capacity of available service technicians assigned to geographic work areas. CARS provides nationwide street-level geocoding and optimized routing for more than 10,000 mobile service technicians daily. The mobile Sears Smart Toolbox application provides service technicians with repair information, such as schematic diagrams, for products. It also contains a GIS module provided by ESRI for mobile mapping and routing, which gives in-vehicle navigation capabilities to assist in finding service locations and minimizing travel time. Accurate street data is critical for supporting geocoding and routing for the Sears applications, so Tele Atlas Dynamap street data is used.

Mobile GIS application gives service technicians access to work order information such as schematic diagrams. The application also includes in-vehicle navigation capabilities and fleet mobile mapping and routing modules. This has increased technicians' productivity by 10 percent daily.

Results

GIS optimizes routes in many ways that are not available through other means. These systems consider more routing options than a dispatcher can, such as finding the optimal (not just the shortest) path between stops. This increases routing accuracy. The optimal routes add productivity, and vehicle costs are reduced.

Before using GIS, Sears manually managed the number of calls taken and routed them by hand. With the GIS-based CARS system, the travel time has been reduced on average by approximately four minutes per call, which adds another one-half call per day completed on each technician's daily schedule. This addition increased the productivity of the technicians by more than 10 percent.

Sears benefited from other support cost savings as well. Before using GIS, more dispatchers were needed. Now, GIS allows one person to handle three to five times the number of technicians. The size of the district territories has increased, reducing the number of other

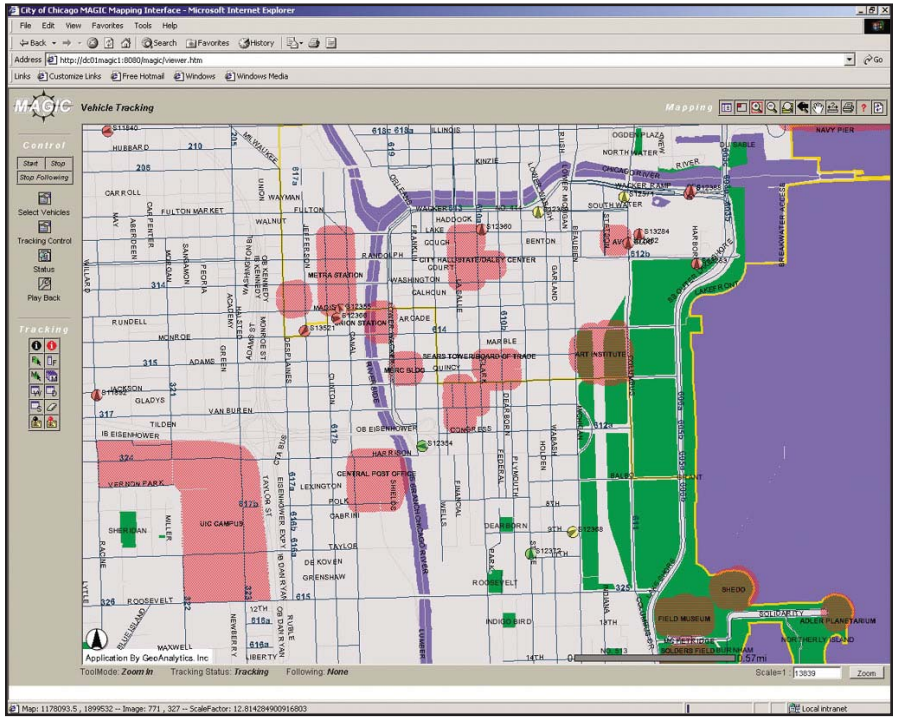
support associates needed. Sears has found that the IT costs incurred to support the GIS are more than made up by the savings the technology provides.

Sears continues to explore further updates and advancements using GIS in partnership with ESRI and Tele Atlas.

City of Chicago, Illinois, Takes GIS to the Streets

Department of Fleet Management Implements Real-Time Vehicle Data Logging and Reporting

The city of Chicago, Illinois, through its Department of Fleet Management, manages and maintains a fleet of nearly 8,000 vehicles with an annual budget of $100 million. These vehicles help provide a wide variety of public services including snow removal, trash pickup, street maintenance, and other functions as well as support for Chicago's airports including the world's busiest airport—O'Hare International Airport. To meet growing demands, officials have been modernizing department information systems over the past two years. The goal of this modernization has been to enhance the efficiency and effectiveness of fleet operations and management. This has been done with an eye toward cost savings and improved fleet security.



The goal of MAGIC was to create a single standard environment for wireless data communications in support of field-based GIS and fleet monitoring.

After implementing a computerized fleet management system in 2001, the Department of Fleet Management, with the assistance of ESRI Business Partner System Development Integration (SDI) in Chicago, began investigating real-time automated vehicle location (AVL) solutions. Discussions with other city departments demonstrated a significant, common interest in such a solution based on wireless data communications. In fact, many city departments were already exploring wireless technologies in order to make business applications available to their workers out in the field. It became apparent that there existed a fundamental need to adopt a common wireless data communications infrastructure as part of implementing an automated vehicle tracking system.

Birth of MAGIC

Based on a directive from the Mayor's Office, the city's Multi-Agency Government Integrated Communications (MAGIC) project was born. The goal of MAGIC was to create a single standard environment for wireless data communications in support of field-based GIS and fleet monitoring and tracking. Phase 1 of the MAGIC system was deployed in late 2001. It involved establishing citywide wireless data communications through a contract with Verizon Wireless and implementing the Advantage System from engineering, sales, and marketing company Products Research, Incorporated (PRI), of Addison, Illinois, for real-time vehicle data logging and reporting. Wireless sensors and GPS receivers were installed on more than 300 city snow removal vehicles. Sensors provide instant information on vehicle location as well as diagnostics such as water temperature and oil pressure.

A key component of the Phase 1 rollout, completed in early 2002, included vehicle location tracking using a desktop GPS Viewer application built using MapObjects technology. This client desktop application was integrated into the Advantage System and leveraged city GIS basemap data made available in shapefile format.

"Phase 1 of MAGIC demonstrated the viability of this technology," says Rudy Urian, Department of Fleet Management's MAGIC project manager. "It also provided a technical and organizational framework upon which city departments could add functionality to support their specific, future operational requirements. MAGIC's electronic monitoring of city trucks and equipment will allow the city to be more efficient in its deployment of vehicles as well as proactive in spotting potential issues before they become major, costly problems."

Given the success of the Phase 1 MAGIC system, the city decided in early 2002 to embark on a broader rollout of MAGIC in preparation for the 2002–2003 winter season. This Phase 2 implementation included outfitting nearly 500 of the city's vehicles with wireless communication equipment and GPS receivers. It also involved developing a Web-based front end to the

Advantage System. This replaced the original Visual Basic desktop client solution and incorporated ESRI's ArcIMS and ArcSDE technology into the overall environment.

"A major goal of Phase 2 was to make the MAGIC system a more integrated part of the city's IT and GIS enterprise," says Scott Stocking, MAGIC technical project manager with the city's GIS Division under the Department of Business Information Systems. "We realized that the system needed to be more scalable over time and easier to maintain. It was also important to improve the currency and accuracy of GIS data presented to our users. This required reengineering the middle and top tier components of the system. A Web-based solution that could be centrally administered, utilize ArcIMS 4, leverage our enterprise database using ArcSDE, and communicate with the PRI Advantage vehicle database server made the most long-term sense. Also, since ArcIMS is a foundational technology for future city GIS applications, we decided this was a prudent direction in which to take the MAGIC system."

Responding to Security Requirements

The Phase 2 initiative also offered the opportunity to enhance core MAGIC system capabilities. This included support for a drive card swipe to authorize use of the vehicle, text messaging, and vehicle reporting such as snowplow up/down and salt on/off status. Other enhancement objectives included spatial alerts when vehicles pass near critical facilities or ones that are off route, street address resolution based on vehicle location, and historical playback to determine past locations for selected time intervals. Many of these new features were identified in response to the need for heightened fleet security. The city now requires that fleet assets be operated in a controlled fashion only by authorized personnel and fleet status/location be known at all times so fleet vehicles can be directed to the appropriate areas of the city during an emergency.

Phase 2 has been completed by the city working closely with PRI and GeoAnalytics, Inc., an ESRI Business Partner with offices in the Chicago area and Madison, Wisconsin. GeoAnalytics has developed middleware components based on Java and an HTML client application that communicate via XML. These Web-based system components communicate with the Advantage database server via a SQL-stored procedures interface.

"We built the new MAGIC application around two subsystem components," says Peter Thum, president of GeoAnalytics. "One performs background status monitoring and is responsible for maintaining the status of each vehicle, any security alerts, and messages between the application user (commander) and vehicle drivers. The second subsystem handles all client requests made by MAGIC application users. This includes changes in GIS map display,

vehicle queries, etc. It is a sound design and one that will scale well to meet future city vehicle monitoring and tracking needs, and it can also be interfaced with the city's enterprise applications such as the 311 service request system. The historical playback function is especially valuable."

Next Steps

Like many other cities around the country, the city of Chicago is currently under extreme budget constraints, and all projects and applications are under intense scrutiny. Subsequently, financial justification for new system investments is important. It is estimated that the Phase 1 MAGIC system rollout to support Streets and Sanitation's snow removal saved the city thousands of dollars in overtime staff costs because the snowplows were operated more efficiently.

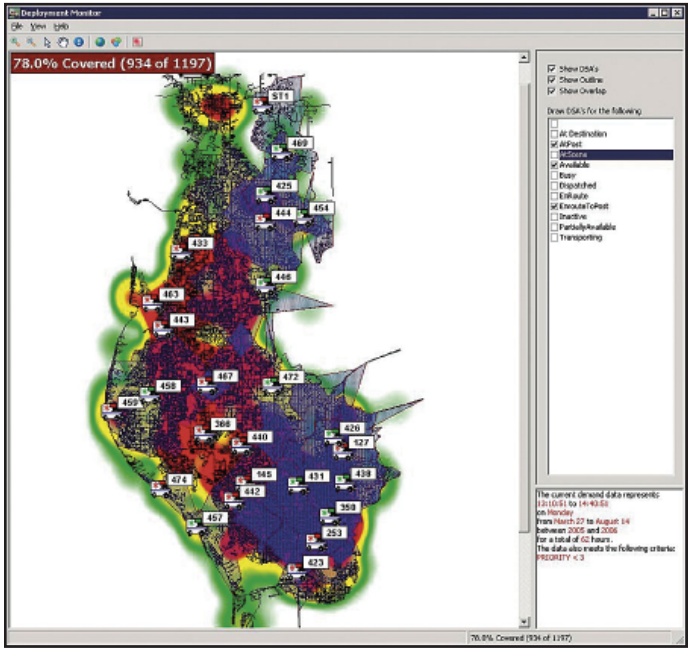
This significant cost savings is impressive, but it is just the beginning. Other efficiencies in managing the city's fleet are emerging as departments begin to think of ways to include the MAGIC system in day-to-day operations. The Department of Fleet Management will be able to save significant time and money on vehicle maintenance by monitoring key vehicle operation characteristics (such as voltage, oil pressure, coolant temperature, etc.) to eliminate major repairs. The city's Department of Transportation can monitor truck traffic to and from construction sites to ensure the optimal flow of materials to these areas. Finally, the Water Department can dispatch repair trucks using the system during line breaks and know which shutoff valves to use by including their facility locations as a map layer in the MAGIC system.

(Reprinted from the Summer 2003 issue of *ArcNews* magazine)

Maximizing Time, Resources, and Money with Real-Time Vehicle Tracking and Intelligent Routing

Pinellas County, Florida, Implements Cutting-Edge GIS Solution for Emergency Medical Services

For any emergency medical services (EMS) responder, time is the most precious commodity. It can mean the difference between life and death. For Sunstar Paramedics in Pinellas County, Florida, GIS is helping the county ambulance service provide more accurate and expedient emergency planning and response. The EMS system takes advantage of GIS as a cutting-edge solution to place ambulances in the best possible locations, track vehicles in real time, and provide intelligent time-of-day-based routing that improves response capabilities for its entire fleet. This result is faster response times, which can make all the difference in an emergency.



MARVLIS is a complete solution for dynamically managing and deploying public safety resources to consistently meet response time requirements while reducing costs.

"Getting an ambulance to the scene of a 911 call might seem simple on the surface," says Jim Pennington, director of Information Technology for Sunstar Emergency Medical Services, "but the planning required to ensure that the right number of emergency medical technicians are working at the right hour of the day and are posted at the right geographic location takes a tremendous amount of time and effort. Our GIS assists in this planning and makes this task easier with more accurate results. We can place our vehicles where they need to go in the fastest time possible."

Raising the Level of Response

Pinellas County is populated with nearly 950,000 year-round residents and is a peninsula bordered by the Gulf of Mexico on the west and by Tampa Bay on the east. Located in the west central portion of the state, the county is 38 miles long and 15 miles wide at its broadest point. Its land area covers approximately 289 square miles.

Like many emergency service agencies across the United States, the Pinellas County EMS organization is a public utility model. The county EMS is managed and operates as a public service agency, similar to a publicly owned and operated electric, gas, or water company. An elected board has oversight authority and contracts out to a private company to provide ambulance service under a performance-based contract.

In 2004, Paramedics Plus won the contract to provide emergency medical services to Pinellas County under the Sunstar oversight agency. The company is a high-performance EMS agency, one of the largest in the nation. It is a leader in system status management (SSM) for emergency operations, which is a process of dynamic resource allocation based on where calls are likely to occur during a given time of day and a given day of week using up to 20 weeks of historical data.

The county benchmark for EMS services under the previous contractor required meeting a response time of 90 percent of calls within an industry-standard 10-minute time period between when an emergency 911 call is received and when EMS arrives at an incident. Prior to deploying GIS, the county's previous contractor had a difficult time meeting the 90 percent rating for incident response within the 10-minute time period standard. Dispatch commanders used paper and manual mapping methods for planning purposes. Paramedics Plus, under its contract proposal, promised to improve the response times and meet a 92 percent benchmark.

"The Sunstar EMS operation had new and more stringent emergency response time requirements beginning in October 2004, and utilizing the traditional automatic vehicle location (AVL) tools alone was not going to be enough to be successful with our new standards,"

explains Pennington. "Paramedics Plus, the contractor organization under Sunstar, turned to GIS and the ESRI-based solutions for advanced applications that would provide a new level of service. These applications provided our organization with new tools and methods for planning, implementing, and monitoring the deployment of our ambulances in Pinellas County."

Paramedics Plus selected Washko & Associates, which has a successful track record working with other Paramedics Plus companies, for SSM implementation and consulting services. Washko & Associates helped Paramedics Plus learn to effectively implement the Mobile Area Routing and Vehicle Location Information System (MARVLIS), which provides a complete solution for SSM through enhanced GIS. MARVLIS is a suite of GIS applications from ESRI Business Partner Bradshaw Consulting Services, Inc. (BCS), a leader in providing GIS solutions for public safety. In addition to providing its MARVLIS solution, BCS also provided training and implementation services to Paramedics Plus.

MARVLIS Deployment Planner at Sunstar Paramedics.

MARVLIS uses several ESRI software components, including ArcView with ArcGIS Spatial Analyst, MapObjects, and NetEngine for high-level spatial data management, desktop query and analysis, routing, and map visualization functionality. It provides GIS functionality in a customized application environment designed specifically for public safety professionals.

"The science has been around for 20 years," says Jonathan Washko, president, Washko & Associates. "The technology tools have finally caught up with the science. They're really the first in the industry to deal with the science behind the scenes for EMS in a way that makes sense and is extremely accurate. And it's proven to work as it's been deployed in many agencies and all with similar results as Pinellas, which was one of the first."

The System: Working Before, During, and After an Incident

The newly implemented GIS provides preplanning; real-time resource tracking; incident response; and postevent information capture, analysis, and redeployment of personnel and resources.

For preplanning, MARVLIS Demand Monitor is used by EMS staff to look at historic views of call demand based on queries to the computer-aided dispatch (CAD) incident database. Demand Monitor uses embedded components of ArcGIS Spatial Analyst to generate likely hot-spot areas for a specified time period. The application mines CAD data to provide an information-based method for predicting future demand. EMS staff not only utilize demand analysis and mapping for decision making, but they also have a faster, more efficient means to update and track demand as often as every five minutes. The Deployment Planner application uses the data from Demand Monitor to determine the best possible location to position ambulances in the county in anticipation of the next 911 call. The program uses historic CAD information to determine the best place to station available EMS vehicles based on demand and time of day and day of week, as well as other variables, such as emergency type. Previously, the county used a paper map and pins to geographically plan unit posts.

At the command and control center, a large computer screen shows a county area map, along with road networks and emergency station locations, such as hospitals, vehicles, and response coverage areas. Each vehicle location, whether the vehicle is moving through the street network or stationed at a post, is displayed on the digital map. MARVLIS Deployment Monitor uses MapObjects to provide a map display of AVL and current status. It also utilizes embedded NetEngine components to generate a drive-time polygon around each vehicle, known as a Dynamic Service Area (DSA), which represents the distance a vehicle can travel in the specified response time (nine minutes). The DSA polygons and vehicle locations allow

EMS personnel at the command and control center to visually monitor vehicles in real time and ensure that potential high-demand areas are always covered by an available vehicle. Staff can also make sure that units are not overlapping in coverage and can move vehicles as needed to fill a coverage area left unattended by a vehicle responding to an emergency. The MARVLIS Impedance Monitor application also captures and analyzes the real-time AVL information to determine the actual travel speed of each road for the current time of day. This information is used to refine the deployment-planning process, improve routing, select the best vehicle for a response, and size the DSA in the Deployment Monitor application.

When an incident occurs, information from the dispatch center is sent via wireless networks to in-vehicle computers. In addition to sending the full incident report from the command center, a detailed map and intelligent routing to the incident and the nearest hospital are provided. Paramedics enter new information as the response happens by simply pressing application touch screen buttons. The CAD system at the command and control center is instantly updated to display the new status data.

Since deploying the system, Pinellas County EMS has received tremendous results. The contractor not only met its 92 percent benchmark but has exceeded it with a 95 percent on-time incident response since its implementation. The agency has been able to do this with fewer vehicles, maximizing resources and achieving cost savings in the process.

Says Pennington: "We have the flexibility to perform new and different types of analysis as needed, and we can constantly update our database to refine and reassess our deployment plans. Commanders have a visual, real-time method for carrying out their daily tasks."

More Information

For more information, visit www.bcs-gis.com.

U.S. Military Uses GIS for Transportation Logistics and Real-Time Tracking

On any given day, the United States Military Surface Deployment and Distribution Command (SDDC) coordinates the movement of thousands of military vehicles, freight, equipment, and personnel worldwide.

Its team of civil, mechanical, and computer engineers, along with operations, transportation, and computer specialists, documents and synchronizes the movement of more than 750,000 shipments annually on a global basis.

The U.S. Military Surface Deployment and Distribution Command Transportation Engineering Agency (SDDCTEA) is a major component of SDDC. SDDCTEA is the U.S. Department of Defense deployment engineering and analysis center whose core mission is to manage and improve the global deployment of U.S. armed forces in support of the National Military Strategy and to oversee ports, roads, and rail for national defense programs.

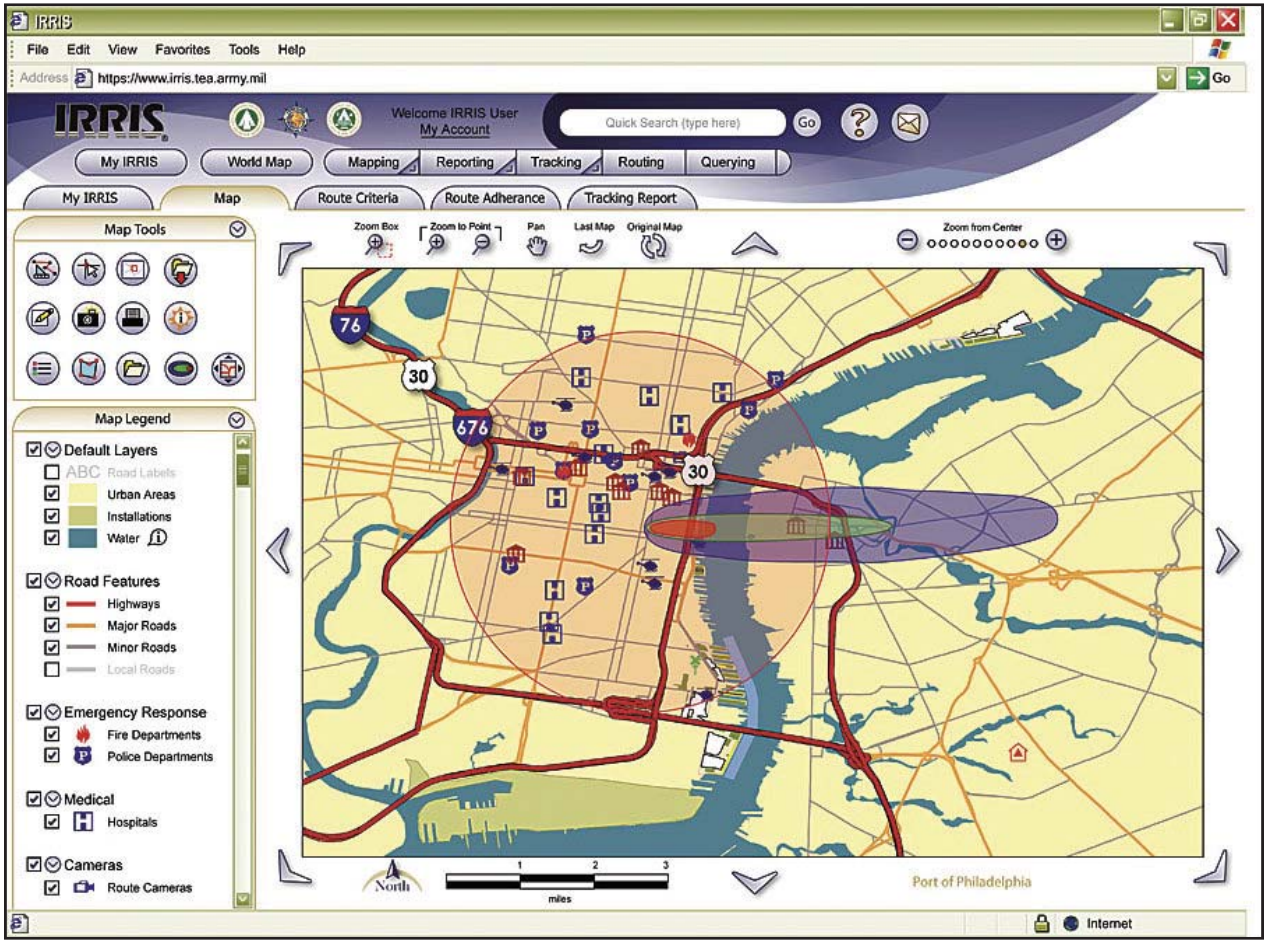
Working together, SDDC and SDDCTEA are fully committed to meeting national security objectives. In recent years, however, their roles have become increasingly important and demanding.

The terrorists attacks of September 11, 2001, reinforced the need for an integrated logistics information tool to facilitate and coordinate the movement of personnel and resources in response to emergency situations. Emergency response crosses all levels of government, and September 11 highlighted a need for a secure tool that can aggregate data with other information systems and integrate various data sources in a common operating environment.

More recently, the U.S. military has placed an increased emphasis on logistics and transportation to support military strategy and tactics. At any time, SDDC must be prepared to deploy, project, and sustain armed forces anywhere in the world. The agency's success depends on its ability to properly coordinate emergency response and manage military assets.

A robust system to support SDDC's strategic role in national security began to evolve in 1999. At that time, SDDCTEA partnered with longtime ESRI Business Partner GeoDecisions, a Camp Hill, Pennsylvania-based information technology company that specializes in geospatial solutions, to spearhead the development of Intelligent Road/Rail Information Server (IRRIS) technology, a fully

secure, Web-based GIS. SDDCTEA selected GeoDecisions for its previous experience with U.S. General Services Administration contracts.



IRRIS technology demonstrates plume modeling tools forecasting the effects of hazardous materials releases and/or explosives on a geographic region.

Today, IRRIS technology has developed into a global multicomponent display, reporting, and analysis application able to monitor military cargo across U.S. transportation networks and overseas.

It integrates location-based services, intelligent transportation systems, wireless technologies, and GPS, as well as critical transportation infrastructure data (roads, tunnels, and dams) and real-time information sources (road conditions, construction, and incidents), from more than 150 worldwide datasets.

SDDC uses the system to generate highly detailed maps useful for troop and cargo transport. Maps can identify optimal routes and display an array of static and dynamic features, including road and weather conditions, schools, hospitals, bridges, and waterways.

SDDC can also track vehicles/shipments in real time and even pinpoint the exact location and content of any shipment. Alerts are provided if cargo deviates from a charted course.

In early 2005, an updated version—IRRIS 6.0—was released with ArcIMS and ArcSDE software. The redesign was developed using ArcIMS as the mapping engine due to its interoperability with other military data sources and enhanced Web-based mapping capabilities.

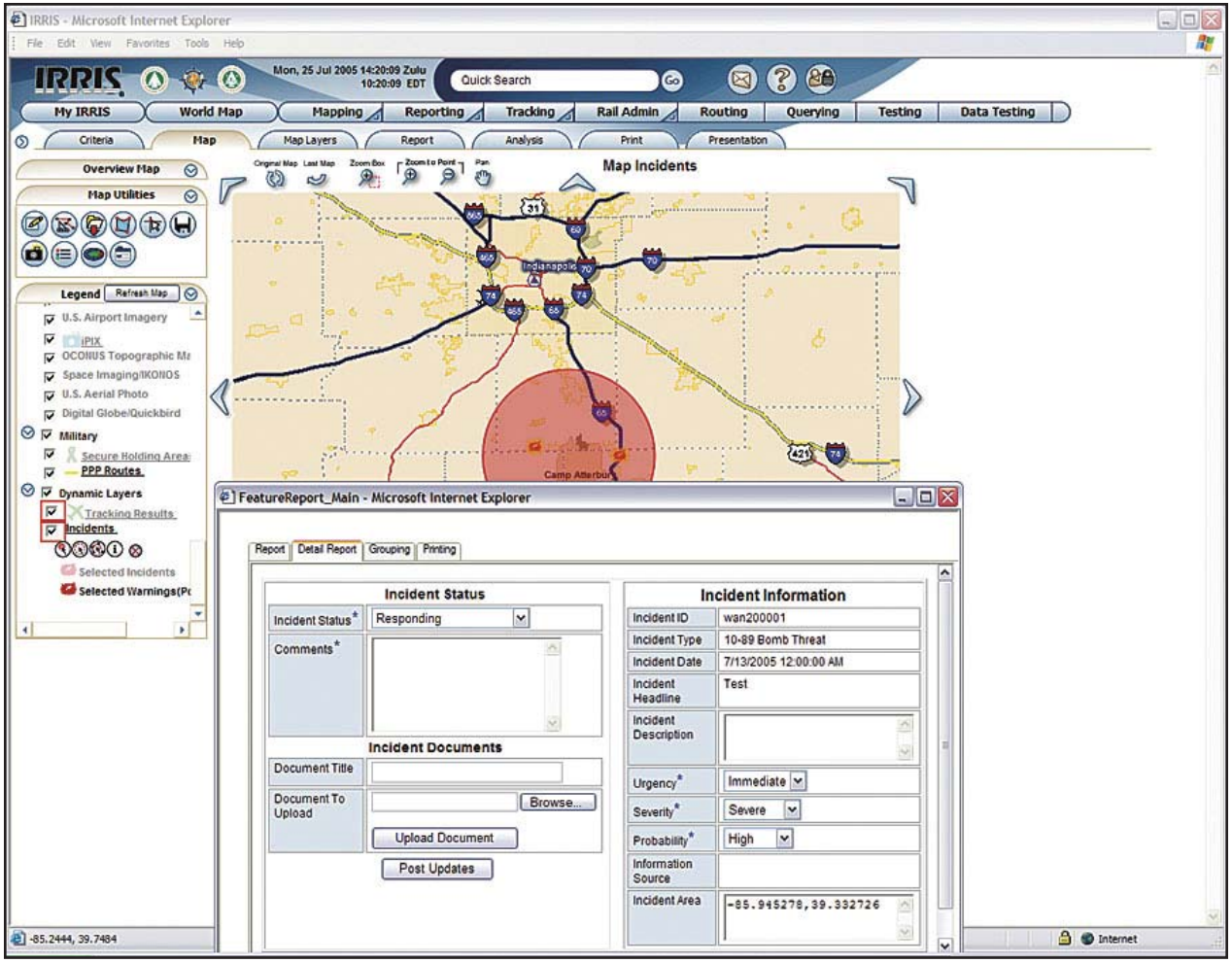
One key function of the ESRI-based system is its advanced emergency response capabilities. IRRIS users are now able to illustrate the effects of hazardous materials and/or explosives on a geographic area through state-of-the-art plume modeling tools.

Additionally, the Internet mapping capabilities offered through ArcIMS software have enabled IRRIS to move from a transportation data display tool to a global system for effective decision making, logistics, and asset management.

Now, users worldwide have a single interface to visualize assets critical to security, such as airports, dams, water plants, bus and commuter rail lines and facilities, nuclear power plants, and power grids. This common operating environment can help to improve response times and minimize fatalities during emergency situations and global deployments.

"SDDC has significantly improved its ability to organize, manage, and track military personnel and military cargo throughout the world," says Paul Allred, SDDCTEA's IRRIS program manager. "We can also monitor the status of sensitive shipments like never before."

For example, during the 2005 inauguration of President George W. Bush, SDDC's Surface Cell Operation Team was able to determine if any truck carrying hazardous materials, arms, ammunition, or explosives was within 50 miles of Washington, D.C. The team offered the same protection during Super Bowl XXXIV in Jacksonville, Florida. In both instances, users were better able to prevent and respond to a potential incident.



IRRIS real-time query features allow users to effectively track military cargo being transported and respond to reported incidents.

IRRIS 6.0 enhancements for SDDC include

- A fully redesigned user interface for optimal usability

- A customized home page with frequently used maps and queries
- Mapmaking capabilities via a wizard-like interface or by defining a desired location on a world map
- Enhanced feature-rich mapping and cartographic display
- Updated reporting tools displaying data or query results as charts and graphs
- Ability to instantly export maps and query results into PowerPoint presentations

Overall, SDDC is now better able to manage military logistics, implement emergency response plans, and save time and resources. SDDC estimates that the technology solution saves U.S. taxpayers nearly $20 million per year through more efficient and streamlined operations; it additionally saved taxpayers approximately $15 million during Operation Iraqi Freedom. Likewise, SDDC has drastically reduced the command's time and costs for military training due to the intuitive and user-friendly nature of the system.

Today, IRRIS technology has more than 1,500 users and handles 2.5 terabytes of data. In addition to SDDC and SDDCTEA, the Defense Threat Reduction Agency, Federal Highway Administration, Naval Operational Logistics Support Center-Ammunition, U.S. Department of Transportation, U.S. Federal Emergency Management Agency, and U.S. Transportation Command all use the Web-based portal to support their operations.

Jon Pollack, vice president of advanced technologies for GeoDecisions, explains, "IRRIS technology was designed to be a vendor neutral, open system that leverages best practices in information technology and easily integrates with existing systems." With this flexibility and its ArcIMS software platform, the technology can continue to grow and adapt to the changing needs of each user.

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Since 1969, ESRI has been giving customers around the world the power to think and plan geographically. The market leader in geographic information system (GIS) solutions, ESRI software is used in more than 300,000 organizations worldwide including each of the 200 largest cities in the United States, most national governments, more than two-thirds of Fortune 500 companies, and more than 5,000 colleges and universities. ESRI applications, running on more than one million desktops and thousands of Web and enterprise servers, provide the backbone for the world's mapping and spatial analysis. ESRI is the only vendor that provides complete technical solutions for desktop, mobile, server, and Internet platforms. Visit us at www.esri.com.

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