Solving the Data Puzzle

Data quality and accessibility are top priorities for natural gas pipeline and distribution operators. At GTI, we’re focused on developing and implementing tools to automate the data collection process.

Operators are looking for tools that will ensure effective data collection and management for their regulatory compliance efforts. For example, we saw a clear need for a vendor-neutral data model that would provide distribution operators with an industry standard approach for modeling data. The Gas Distribution Model (GDM)—recently developed by GTI—holds great promise for improving interoperability between operators and vendors.

GTI is also working to assist operators in their asset lifecycle tracking efforts. By extending the functionality of the new standardized identifier for asset tracking and traceability of gas distribution components, we’re helping operators track and manage system components from manufacturing through retirement.

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INTELLIGENCE AND INTEGRITY:

New Field Data Collection Tools and Technologies

Integrity management—the systems, strategies, and activities designed to ensure that infrastructure is maintained in fit-for-purpose condition—requires accurate, high-quality data that is accessible for analysis and decision making.

GTI’s Data & Integrity Management (D&IM) Program is developing tools that will assist operators in addressing a wide range of industry needs—from the development of smart phone-based data collection tools that ensure data quality to the use of probabilistic risk models that leverage this data.

Over the past year, GTI has worked with operators and industry experts to develop a vision and an R&D “roadmap” for the program to ensure that projects work together to meet common goals with deliverables that can be implemented in the short term.

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capabilities of GIS, field personnel can access current GIS data in map-based views on convenient portable devices, update the data, and move it from the field to the office for everyone to access in real time.

“When data collected in the field—for surveys, inspections, repairs, and new installations—can be directly attached to a specific asset in the GIS, there’s no need for manual data transfer and the processing that’s common with most electronic and paper-based data collection systems,” says Alicia Farag, GTI program manager. “Electronic data forms on the mobile devices can replace paper forms and records, optimizing the data management process.”

And, even though GIS applications are very complex, the new system will enable users to create data collection forms without the help of a GIS expert.

“The new field application provides a simple data collection interface using new consumer technologies that are becoming more prevalent in the computing infrastructure of utility companies,” says Bill Gale, senior engineer at GTI.

Following are some recent examples of applications that provide more efficient ways to collect and manage field data.

**Recording the Location of RFID Marker Balls**

Some underground utility lines simply cannot be detected with standard locating tools, so the GTI team is exploring new applications of Radio Frequency Identification (RFID) and smart tag technology for enhancing utility locating operations.

Because they are not affected by interference from nearby utility lines or metal structures and do not need a continuous conductor, RFID and other smart tag technologies offer capabilities uniquely suited for use in locating underground assets. Tuned to a specific frequency, they can be associated with a specific utility type, so field crews have the confidence that they are locating the correct utility line.

Recently, the Virginia Department of Transportation (VDOT) began installing programmable 3M RFID marker balls every 25 feet on all new installations, including utility lines that need to be relocated to accommodate highway expansions. VDOT collects the GPS coordinates of the marker ball installations and creates maps with information about the marker ball installations that they can share with DOT utility coordinators and project managers, as well as utility companies and their contract locators.

In a demonstration last August, technology partner Tri-Global demonstrated how UtiliMapper software on Trimble GPS hardware can be used to map the location of marker balls prior to installation.

Matt McLaughlin, construction manager for VDOT, reports that there have already been several instances in which the marker balls prevented excavation damage to unmapped utility lines. “These marker balls do not supersede any one-call requirements,” he says, “but they do provide the locator with additional information in case a line is not mapped accurately or is difficult to locate with traditional equipment.”

GTI continues to extend the RFID marker ball technology through the development of smart phone applications that enable operators to record the location of new marker balls, while geospatially attaching the marker ball to a specific asset in the GIS. Atmos Energy in Louisiana is currently testing this application on iPad.
devices. GTI is also working to overcome some of the inherent limitations of working with consumer-grade technology by, for example, developing mechanisms for obtaining higher-accuracy GPS.

**Excavation Monitoring on Smart Phones**

GTI, in partnership with Virginia Utility Protection Services (VUPS) and several technology partners, has developed an application that excavators can use to identify the boundary of an excavation zone for a one-call ticket—and to create a notification in the event that an excavation is occurring outside the boundaries.

At a recent demonstration, Dave Thompson, safety director at Henderson, Inc., a Virginia-based contractor, noted that, “With this system, we can use our on-board software to create avoidance zones around utility lines so that equipment operators can be provided with a warning of possible encroachment.”

GTI demonstrated the use of GPS-enabled locators to collect and coordinate data during routine locates for one-call tickets. These locators provide excavators with a birds-eye view of utility locations overlaid on aerial imagery—improving their ability to understand the layout of utility lines.

The data collected in the field can also be sent to utilities to facilitate map updates and corrections. Field supervisors can also use smart phones to view the location of excavation activities in relation to one-call tickets and underground assets.

**HCA Surveys on Tablets**

Over the past decade, Alabama Gas Corporation (Alagasco), the largest natural gas distributor in Alabama, developed an electronic mapping system that has essentially replaced the utility’s need for paper maps.

One important application of the new mapping system is the identification and assessment of High Consequence Areas (HCAs). To complete these surveys, which are required by federal regulations for identifying sites that are in the potential impact radius (PIR) of a pipeline, operators need a technology that supports GIS viewing in the field to determine the proximity of structures to a pipeline.

Using the field data collection system developed by GTI, surveyors at Alagasco are now using tablet devices and aerial imagery to gather information to identify sites that are in the PIR during their routine surveys.

“We will now be able to streamline the field data collection process and produce higher quality results in a more efficient time frame,” says Bethany Miller, compliance engineer at Alagasco.

**Routine Inspections and New Installations on Tablets**

GTI is developing applications for collecting routine inspection and survey data. An application for collecting cathodic protection (CP) readings was developed and a new application for collecting exposed pipe report data is under development.

The ability to record the position and capture asset attribute data during new main and service installations and replacements is probably one of the highest-value use cases for this technology. GTI is actively working to develop software and GPS functionality that will enable tablets to create electronic as-builts.

**The Intelligent Utility System Program continues with many other related projects that will leverage recent technology advances for the development of new field data collection applications.** One challenge that the GTI team is working to overcome is the limited quality of GPS receivers on consumer-grade smart phones and tablets. “Accuracy can vary from submeter to 10 meters,” says Farag, “which is unacceptable for most utility operations.”

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GTI and the GPS Consortium

Thanks to its work with the GPS Consortium—a membership-based program to facilitate the implementation of GPS technology in routine utility operations—GTI is pioneering the use of high-accuracy GPS with consumer-grade devices.

The objective of the work that will be done in 2012 is to integrate high-accuracy GPS from industrial grade receivers with low-cost, easy-to-use tablets that can serve as the user interface for GTI’s field data collection system. As a result, utility field crews will be able to use consumer devices for even more complex data collection activities such as new main and service installations.
If natural gas utility companies are going to effectively address new Distribution Integrity Management (DIMP) regulatory requirements, they need a comprehensive plan for tracking and tracing their assets.

The ability to track assets throughout their life is the foundation of an effective asset lifecycle management program. Benefits include early threat identification, risk reduction—through the ability to identify, locate, and remove problematic assets—and proactive compliance with regulatory requirements.

GTI and Operations Technology Development (OTD) are leading a new program designed to assist operators with their asset lifecycle tracking efforts. The overall goal is to provide a comprehensive solution that would support all facets of the utility asset data management process. "The program provides the ability to track assets from manufacturing through retirement, while attaching operational and performance data—for trending, tracking, and risk management—along the way," says Alicia Farag, GTI program manager.

New technologies—such as smart phones, barcode scanning, smart tags, and cloud computing—have made automated data capture for asset lifecycle management not only feasible but also cost-effective.

Setting the Standard
In 2011, OTD completed the first step toward making this new solution a reality with the development of a standardized identifier for asset tracking and traceability of piping and appurtenances of gas distribution systems. This unique identifier served as the basis of a new ASTM standard (F2897, Specification for Tracking and Traceability Encoding System of Natural Gas Distribution Components).

The new 16-digit alphanumeric code in the standard contains key information about each specific component—including manufacturer and lot number, as well as component characteristics such as size, material and component type. Manufacturers will now have a standardized format for identifying their products. Utilities will be able to use the standardized code to collect, store, and access the information they need for their asset management programs and for meeting regulatory reporting requirements.

To facilitate compliance with the new specification, a web-based application (www.componentid.org) is being developed with support from OTD for registration of unique manufacturer ID numbers.

This is a great start, but to effectively implement this, the GTI team has developed an Asset Lifecycle Management research program that will provide tools and practices for the industry to use in implementing the new tracking and traceability system. The program includes the development of work practices for using barcode scanning and smart device applications for capturing and storing the tracking number during new installations.

Other projects will include developing and testing mechanisms for attaching barcodes to assets during manufacturing, conducting pilot projects, and developing business case justification for implementation.

Beyond Installation
While capturing asset tracking numbers during the new installation process is critical, a true asset management system requires the ability to attach operational, environmental, and performance data to specific assets. Trending, threat identification, and risk modeling can only be accomplished at the component level if performance data is attached to specific assets.

Other research underway at GTI includes the development of applications and work processes that enable the capture of inspection and survey data as part of an asset record in the GIS. This technology will serve as the foundation for advanced modeling and analysis.
Setting Industry Standards

A data model is the foundation of a GIS and is important for structuring field data collection for regulatory compliance and integrity management. GTI has played a key role in developing vendor-neutral data models for the transmission industry through the PODS Model and is now doing the same for distribution operators through the Gas Distribution Model.

Gas Distribution Model

More than 10 years ago, GTI brought together a diverse group of operators, vendors, and industry experts to develop the Pipeline Open Data Standards (PODS) model—an open, industry-standard data model designed to meet the specific data management needs of pipeline companies that has since been recognized as the industry standard for pipeline data storage and interchange—and the backbone of a pipeline GIS database.

PODS stores pipeline geographic locations, asset specifications, inspections, integrity, regulatory compliance, risk analysis, operational, and historic data to support the visualization, analysis, and systematic decision making needed for responsible pipeline management. Pipeline operators use PODS to manage, verify, analyze, maintain, and deliver relevant information quickly and reliably to end users and applications.

In 2004, PODS became a non-profit association dedicated to creating an industry-standard pipeline data model. The PODS Pipeline Data Model Diagram can be viewed by clicking the link on the home page of their website at www.pods.org. Today, the PODS Association is an organization comprising more than 115 member companies.

In an effort to provide this same service to the distribution industry, GTI developed a Gas Distribution Model (GDM) to serve as a data exchange function between operator data models and vendor software products that would reduce the need for customization and to facilitate the integration and transfer of data between distribution and transmission data sets. Because of its success with the PODS model, GTI recently assigned the rights of GDM over to the PODS Association.

The plan is for the PODS Association to offer GDM as a standalone data model and—following proof-of-concept testing, documentation, and additional data modeling to integrate GDM with the PODS model—a modularized PODS Pipeline Data Model will be available to support assets from wellhead to burnertip.

According to Janet Sinclair, director of the PODS Association, “The PODS Model was developed to assist natural gas and hazardous liquids transmission pipeline operators meet integrity management regulations, and the addition of this similar model for distribution assets is a valuable contribution to that goal.”

GTI has several new projects that will be leveraging GDM in the future. As one example, a new project to define data collection requirements for integrity management and asset lifecycle management is underway. The data requirements that are defined in this project will be incorporated into GDM to further expand the scope of the model.

Equipment Output Standards

A new initiative at GTI will further extend the concept of industry data standardization by developing equipment output standards. As operators transition towards electronic data capture through methods such as Bluetooth, the ability to directly collect readings from equipment—such as leak detection equipment, pipe locators, pressure chart recorders and pit depth gauges—will provide a fully automated workflow. Manufacturers have started developing equipment that can output readings to a handheld device, however every manufacturer will have a different data format. GTI will be working with manufacturers to develop data output standards so that software vendors and operators have a consistent output from equipment.
GPS Takes the Paperwork Out of Leak Survey Documentation

The traditional leak survey process of using paper maps and records to document survey routes is not only time-consuming, it creates opportunities for data entry errors. One industry effort to seek new solutions uses a new GPS-enabled leak survey application developed by GTI and InMaps (now Ubisense), a geospatial consultancy specializing in utilities and leak surveying.

A recent pilot project at Greenville Utilities Commission (GUC) demonstrated the capabilities and benefits of the application. Commercialized as VeroTrack® Automated Survey Tracking, the application integrates GPS technology into routine leak surveying and pinpointing operations by electronically tracking survey routes and generating reports that document survey completion.

At GUC—a utility serving 22,000 customers in eastern North Carolina—two employee teams conduct residential leak surveys as well as annual leak survey for its commercial areas.

For the pilot project, the VeroTrack solution was combined with Bluetooth-enabled leak detection tools. The application attaches GPS coordinates to survey routes and leaks, while also tracking compliance requirements. It employs a streamlined process to automatically transfer electronic survey routes and electronic leak forms directly to the utility’s leak management system.

In addition to eliminating the need for paper maps and leak forms, the new system will enhance auditing and monitoring capabilities by creating a GPS “breadcrumb trail” of the routes covered by field personnel and providing real-time updates on survey status.

Implementation of the VeroTrack application is underway at several other utility companies.

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<th>GPS-Enabled Methods</th>
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<td>Field crews manually record leak survey routes</td>
<td>GPS enables electronic tracking of the location of leak surveys in relation to mains and services</td>
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<td>Field crews plan their routes manually in the morning and continuously look at maps throughout the day to determine the appropriate place to survey</td>
<td>Field crews use a digital map that guides them to the correct location with no need for paper map consultation</td>
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<td>There are many opportunities for accidental and intentional non-completion of leak surveying</td>
<td>GPS tracking provides oversight to reduce shortcuts and “shade tree” compliance. Leak surveyors and managers can use the system in real time to ensure that pipe segments are not missed</td>
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<td>Paper maps often included outdated information</td>
<td>GPS enables frequent map updates</td>
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How VeroTrack is Changing the Leak Survey Process

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