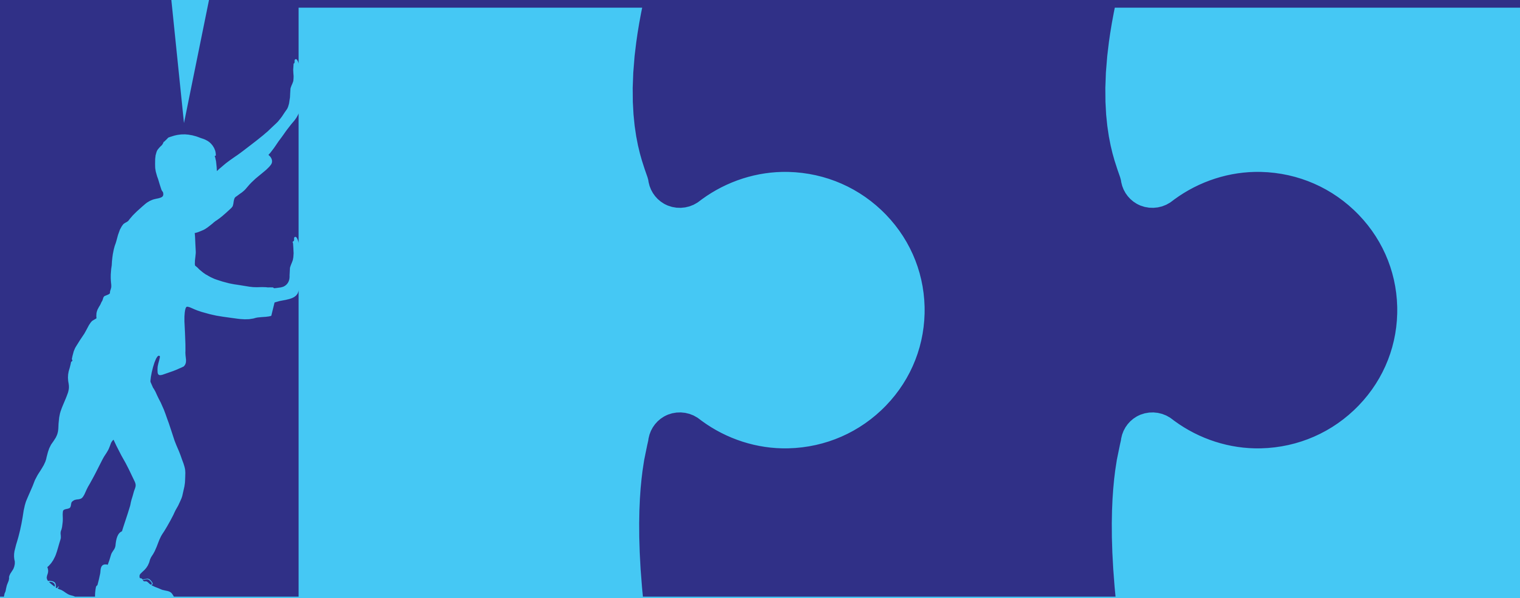
BETTER TOGETHER

ROBERT BROOK, ESRI, AND STEVE ROBB, CYGNET SOFTWARE, USA, DISCUSS HOW GIS AND SCADA CAN WORK TOGETHER TO IMPROVE PIPELINE OPERATIONS.



Pipeline companies strive to reach operational goals while responding to outside demands such as the volatile economy, environmental impacts on critical infrastructure, and increased regulatory pressures. Traditionally, operators have depended on the supervisory control and data acquisition (SCADA) system. Geographic information system (GIS) technology has also proven to be a critical technology. Recent efforts to combine SCADA data with GIS capabilities promise tremendous benefits to pipeline companies.

GIS approach

The majority of challenges faced by pipeline operators have a geographic component. In the event of a pipeline rupture, for example, the major considerations involve geographic complexities of the region - topography, climate, and proximity to people. Since public safety is one of the key elements of contemporary pipeline regulations, in this case, the influence of geographic factors is far reaching.

With an established GIS, a pipeline operator can work from a mapping interface, integrate information from many internal and external sources, and quickly create complex models. Within a GIS, outcomes of any analysis are displayed in conjunction with map data so that the real impact of the results can be quantified. In addition, supporting documentation, such as maps or reports, can be printed or published to the web. GIS is the only management system that allows the inclusion of geographic factors and relationships in a pipeline company's decision-making process.

GIS has been successfully used to solve many business problems within the pipeline community. Engineering and construction staffs depend on GIS during route selection and construction planning. Operations teams use the software for asset and facility data maintenance to ensure that the analyses are based on current information. Integrity and corrosion engineers apply GIS, integrating and analysing data to ensure safety and to design repair

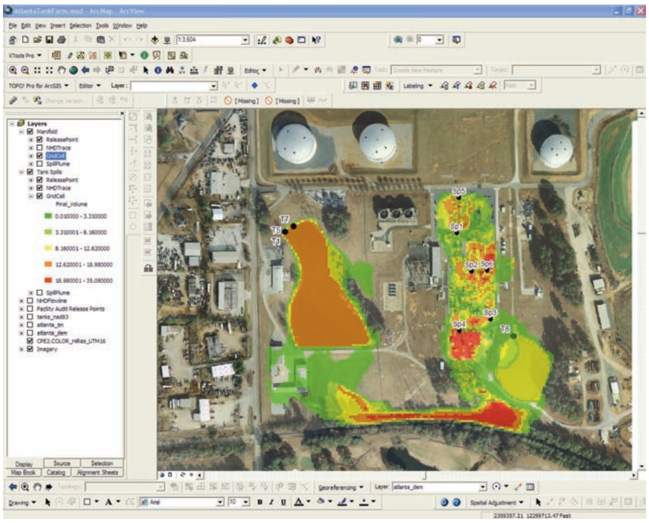


Figure 1. This image of a refinery incorporates spatial analysis for detailed planning purposes.

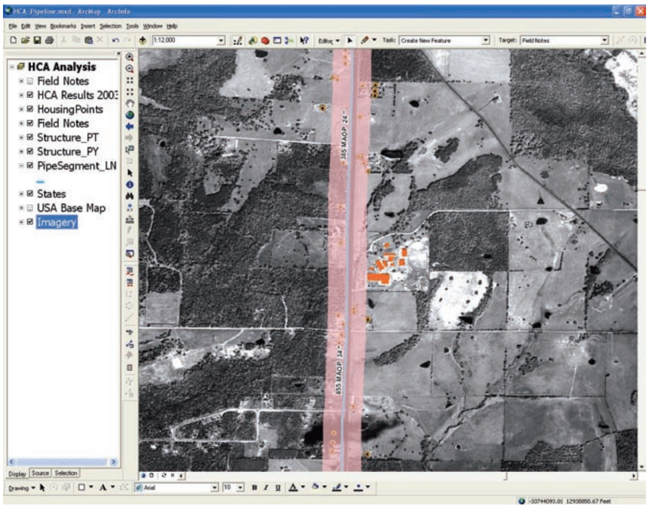


Figure 2. GIS is used to calculate pipeline high consequence areas.

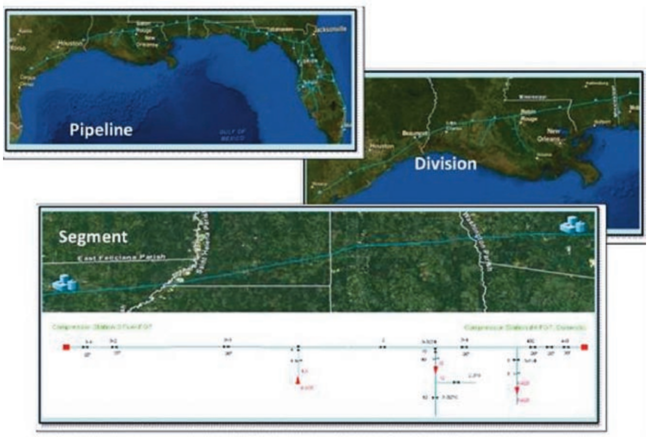


Figure 3. The three nested views demonstrate the capability to drill into the detail of an operational pipeline.

programmes. Field programmes use the solution for data capture, routing and logistics. With its movement from the desktop to the Internet, GIS also plays a foundational role in integrating regional teams and communicating with stakeholders.

While the capabilities of GIS are varied, the system requires relevant data. Historically, data consisted of as-built construction drawings with current maintenance and repair records layered with recent satellite or aerial photos. Within a GIS, operators can add data including land records, results of regulatory analyses, public safety exercises, topographic data, and other relevant datasets. Such data, essential in many decisions, is the necessary foundation for analysing operational and economic questions. To effectively improve decision-making processes, a GIS needs to be integrated with the SCADA system.

Evolution of SCADA

For as long as there have been pipelines to transport an energy commodity to market, there have been SCADA systems designed to collect and present field data. Originally, these control systems were based on rudimentary forms of distributed and local control. The design facilitated shared control and responsibility between the local site and a pseudo-centralised control facility. As with all things, both the footprint and the benefit of SCADA have evolved over time. Today, leaders in the commodity transportation business are leveraging aspects of the control system with asset management systems.

With first-generation topologies in SCADA 1.0, virtually the entire emphasis of system design was focused on methods to acquire elements of data from remote field devices. The communication and network infrastructure was rudimentary. In this generation of solutions, there was limited capability to provide or accept data from other enterprise systems; therefore, data related to field elements was siloed in a proprietary system.

Approximately five to seven years ago, a broad evolution started to occur based on two main aspects. Field devices were engineered to become more reliable, with a greater degree of sophistication. The network infrastructure with which to communicate evolved into SCADA 2.0. It is in this environment that massive amounts of data began to be collected from remote devices and, in most cases, copied to additional enterprise systems throughout the organisation. Although more effective than SCADA 1.0 solutions, the management, interface, and relevance of the data copied throughout the organisation became a burden to manage. Moreover, it was still not providing the desired benefit.

Today, we are on the leading edge of another evolution, SCADA 3.0, which facilitates the collection, management, and distribution of data from the field to enterprise systems while maintaining appropriate system of record (SoR) qualities. This enterprise approach to data collection and distribution has been adopted by GIS-based asset management teams and SCADA/operations departments. Founding the enterprise evolution led to a few rudimentary questions. What field devices are out of service? Where are field devices of a certain configuration and manufacturer located? What characteristics, such as right-of-way and high consequence structures, are geographically relevant during a troubleshooting event?

Pipeline operators have long desired the ability to tie spatial relevance to real-time operating conditions. For many pipeline companies, the operations function has evolved from the SCADA system alone to a geospatially enabled operations control centre.

Better together

SCADA, which controls geographically distributed assets, often does not depict those assets in an accurate geospatial context, nor does it contain information related to the assets themselves. Previous attempts to integrate SCADA and GIS have relied on the duplication or copying of information from the GIS to the SCADA system and vice versa. SCADA relies on predictable performance metrics and would often require GIS data to be translated into a proprietary format. Over the long-term, this approach is ineffective, as the cost of maintenance and upkeep becomes prohibitive. The process also leaves a gap in the most fundamental benefit of SCADA, which is to inform operations of updates and changes in the field.

SCADA system platforms are now required to evolve into open, distributed, and standard platforms. The objective is to both enable associated applications to consume the data and allow the enterprise operations platform to distribute information across departments.

Recently, major software companies CygNet and ESRI have combined efforts in an initiative to link GIS and SCADA. The tenets are simple. Each enterprise system will maintain its integrity with respect to the data it contains. The ongoing cost of support is minimal, as there are no transfer processes to maintain. The open and standard environments allow users to render and view GIS data in the SCADA system in real-time without impacting the performance of either system.

Conclusion

The linked technologies allow system optimisation by combining a schematic representation with the real world. For example, if the SCADA system tells an operator that well production is down, the problem may seem specific to one well. GIS gives the operator a larger picture to determine whether the situation is related to something regional. Are other wells affected? Is there an injection problem? Is the equipment faulty? Once the operator determines the source of the problem, field staff can be dispatched to the precise area in need of attention. Hence, the combination of GIS and SCADA improves the logistics of field staff in addition to improving the accuracy of problem solving.

Pipeline companies are just beginning to realise the value of SCADA linked to GIS. With an integrated GIS and SCADA, operators can view and select facility information on demand, increasing operational efficiency and supporting other business functions. WP

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