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LEVERAGING RFID TECHNOLOGIES FOR PIPELINE ASSET MANAGEMENT

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LEVERAGING RFID TECHNOLOGIES FOR PIPELINE ASSET MANAGEMENT

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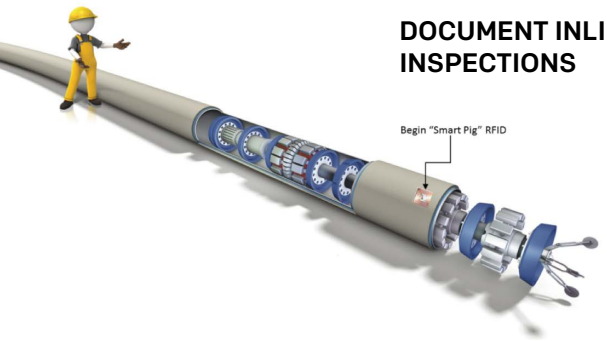
Emerging technologies, including Radio Frequency Identification (RFID), are readily available to be utilized to improve oil and gas pipeline asset management business processes. RFID in particular continues to help industry leaders with identification and compliance in the Energy space. The old days of using banding, bar coding, and ball peening numbers and colors have been greatly improved with the introduction of advanced RFID technology. These old technologies that are still used today however, continue to be time consuming and are prone to errors in data collection. Additionally, in the Energy space the tools and assets used are in a very rough and dirt filled environment, making the collection of the data even more difficult. RFID technology benefits from the ability to identify an item without line of site and acquire the part information in a matter of seconds. This creates a positive means to identify the part/tool, as well as the ability to record and update local and enterprise systems at the same time.

The technology has advanced to the point where we can now embed RFID tags in steel tools and assets and use the tag information as a unique ID that survives the use of the tool. This provides for the full pedigree of a tool to be kept and managed electronically down to the item level, providing info such as born on dates, certification dates, days in use, etc… Total lifecycle management of a part is possible, down to the unique tool by part number. Bar codes have provided the means to accomplish some of this, however the data acquisition of a bar code has been proven time and time again as being 10x slower than RFID. Additionally, a bar code does not last too long in the lifecycle of a tool, and becomes very difficult to scan after even just the first use. Modern RFID capabilities coupled with mobile and cloud enterprise geospatial systems provide an opportunity for the oil and gas industry to transform their current processes from traditional paper-based systems to more efficient electronic systems. These modern systems provide significant business value in areas such as cost reduction, compliance, material management, information exchange standards, and a reduction in both risk and liability associated with pipeline failures.



- Record and Document "Pigging" Activities
- Track Volumes of methanol or Corrosion Anomalies
- Provide Regulator with Time/Date Stamps

The oil and gas pipeline industry is one of the few industries that does not currently benefit significantly from the use of mobile and cloud based business solutions. Although this industry requires a vast amount of data across its entire value chain, currently this data is still largely recorded on paper. Storage of large amounts of paper-based data poses a significant challenge, both in terms of space and cost. In addition, finding paper-based files can be a major issue when they need to be found and distributed. This paper-based practice is not only cumbersome and time-consuming, but also leads to unnecessary errors and delays which ultimately may increase the risk of a pipeline incident. Electronic data, on the other hand, can be retrieved or updated from either the office or the field instantaneously and easily found, verified, and shared.

The oil and gas pipeline industry requires process redesign to streamline their overall governance procedures of data collection, storage, and retrieval across the construction, operations, maintenance, integrity, and inspection processes. There are numerous companies offering radio frequency-based technical solutions that enhance the process of data collection and storage, some of which are now providing cradle-to-grave, fully-integrated business solutions that are natively RFID-enabled.

Recently developed RFID best practices provide an opportunity for pipeline businesses to transform their asset management and pipeline integrity management processes away from traditional paper-based systems to more efficient, highly-integrated electronic data solutions. Going forward, we expect that RFID technologies coupled with location-based services and cloud computing will provide a business process transformation opportunity for all pipeline operations. Scott Henley, an active member in several of the Canadian Standards Association's technical committees, including CSA S-250 "Mapping of Underground Utility Infrastructure", and CSA Z-247 "Damage Prevention for the Protection of Underground Utility and Energy Networks" says that he "expects to see a major shift in asset management practices caused by increased regulation as well as public safety and environmental concerns. New developments in RFID, Mobile and Cloud technologies will play a prevalent role in the transformation of the current practices to redefine every aspect of the asset's governance, including purchasing, warehousing, installation and maintenance."

PUTTING IT ALL TOGETHER: RFID, LOCATION-BASED DATA SERVICES, AND CLOUD COMPUTING

How could pipeline asset management practices benefit from RFID, location-based data services, and cloud computing?

In the location-based, RFID, and cloud data services scenario, a

materials manager can collect data from a handheld device (scan or photograph documents supplied by the manufacturer) in the field and link the documents to the manufacturer's RFID tag on the component (e.g. pipe, valve, or fitting). This data is then available for quick retrieval. In the case of a manufacturer recall of a pipeline component, field crews could be dispatched to the exact location of the faulty material. The field crew could then dig down to faulty materials and verify, while in the field, the manufacturer RFID tags, and additional metadata information from the cloud. This information would be used to determine whether the correct "faulty material" was located. Once the faulty material was found, the field crew would then be able to decommission the affected equipment and update the cloud-based system with a decommissioned indicator. The field crew would then replace the defective component and update the construction RFID tag with pedigree, task, and maintenance information on the new material, and create or update the geolocation of the newly installed RFID tag to the cloud. Finally, the inspector and project manager could track progress and be notified when the work is completed and validate the completed work from either the field or the office. Once verified, the inspector could approve the new pipe installation. The removal of paper and temporary worksheets in this scenario ensure that the point of control links back to the field where the transaction is actually created and saved. In addition, the time lag related to the paper trail and subsequent time for data entry of current maintenance operations is completely eliminated.

By providing critical information necessary to manage equipment in real time, downtime can be minimized. As maintenance is performed on the equipment, field and maintenance crews can update RFID tags with pedigree, task, and maintenance information and update the RFID record on the cloud. The inspector or project manager is able to view construction quality control data for a construction project from the field or from the office. Quality control data can be captured for each of the installed components, as well as the specifications. Operators are able to generate compliance reports at a very granular level using a combination of both RFID and precise GPS coordinates, and monitor pipeline integrity issues during the asset's entire life cycle. Pipeline operators can also view equipment maintenance history from either the office or while in the field with the RFID reader.

Monitoring the location and status of physical assets through RFID and cloud applications also helps with inventory management. Deployment of materials into the field is more efficient because management can use real-time information to make decisions regarding asset procurement, supply, and deployment.

CURRENT TECHNOLOGY CAPABILITIES

A comprehensive and highly integrated solution should possess the following capabilities:

- An RFID-centric software component that provides the RFID data read/write and the business rules around RFID data capture and display,
- A mobility component that provides a location-based binding to the RFID data along with the flexibility needed to support the pipeline mobility scenario, and finally
- A cloud data storage component that provides data management services, analytics, business process integration, and application security.

These advanced capabilities are described below to provide clarity around how they function together to provide a viable business solution for pipeline asset management and pipeline integrity management.

RFID-CENTRIC SOFTWARE

RFID-centric software should read and write RFID data with the ability to bind location-based data with the RFID record. It would be advantageous to have a form-based interface that can enforce data integrity, quality, and standardization in accordance to business rules as RFID data is being collected as saved.

Key features of RFID centric software should include:

- A menu-driven software that runs on mobile handheld devices such as smart phones and tablets and saves data into cloud based applications;
- The ability to save data into a dashboard or portal that can provide integrated views of maps and geospatial analytics;
- The ability to integrate with existing GIS systems and cloud computing services;
- The ability to combines GPS, RFID and data streams to track asset attributes;
- The ability to document construction, maintenance, and operational inspections for quality control;
- Military-grade security protocols for data access while eliminating data silos of information; and
- The ability to help ensure regulatory compliance, review audit requirements and improve operational recall efficiencies.

MOBILITY

A GPS-centric mobile software application that enables authorized field personnel to capture precise asset locations and other location-related information from a smart phone or tablet is an essential component. One that can collect precise GPS location points and associate "metadata" to the points would provide additional advantages. A comprehensive mobile solution should provide field workers with the ability to visualize their proximity relative to existing infrastructure, view any historical data

relating to that infrastructure, and provide the ability to update location data. Additional features might include the ability to take geo-referenced photos, complete electronic forms, markup design drawings, take field notes or create sketches before submitting the information to the geospatial database service.

Key features of mobility should include:

- The ability to track and trace your workforce and see the physical progression of field activities in real time;
- The ability to add geospatial fix and data elements from the field;
- The ability to create a folder of features associated with a point, line or polygon;
- Easy to use sketch tools allowing the user to mark up photos and create field sketches;
- Role and privilege-based security features to assure only authorized users have access;
- Measurement of lines, areas, radius, perimeter, circumference of objects
- The opportunity for real time interactions between field personnel and colleagues back in the office;
- The ability to complete forms in the field; and
- The ability to take geo-tagged photos and annotate.

DATA MANAGEMENT AND SITUATIONAL AWARENESS

It is important to have a robust desktop management component that provides all stakeholders the visualization, situational awareness, and precise location data required to enable better decision making, meet regulatory compliance, and complete tasks with greater efficiency. Having easily searchable geospatial information and documentation related to a project at your fingertips can allow a user to make critical business decisions with a high degree of confidence. By providing quick and easy access to mission critical information to field and office personnel, a significant increase in productivity, compliance, and safety can be realized.

Key features should include:

- A cloud-based, easy to use, and familiar user experience;
- Imagery for many sources including client defined base maps allowing for user-specific imagery;
- The ability to view maps and geospatial analytics via an integrated dashboard and portal; and
- Satellite view, map view, street view functions.

"Asset management, linked to precise positioning, is a powerful practice for sustainable and resilient infrastructure issues," according to Jim Anspach, Director at Cardno TBE. "When coupled with cloud data storage and instant secure access, both field and office functions realize significant efficiencies, safety improvements, and governance capabilities." The ongoing development and deployment of solutions involving RFID technology integrated into enterprise geospatial systems will continue to provide an opportunity for businesses in the oil and gas industry. We expect that the trend away from paper-based systems will continue and result in better asset management practices and governance for companies in the oil and gas industry, as well as many others. ■

LAYNE TUCKER

Layne Tucker is the founder of EchoRFID™ and cofounder of ProStar. Layne brings over 30 years of pipeline construction experience and along with his associates leads a consortium of RFID experts. EchoRFID has successfully developed a system that will revolutionize how integrity management will be conducted in the future and provide significantly greater value to pipeline owners and operators in the area of materials management, construction documentation, and finally, pipeline integrity management.

PETER FORSTER

Peter Forster is the Chief Technology Officer at ProStar Geocorp, Inc. Peter has over twenty five years of extensive application software development, design, and implementation experience. ProStar is a provider of precision geospatial services & solutions designed to serve the utility and pipeline industries. The company's focus is to improve the accuracy, content, and effectiveness of asset location data. ProStar services combine patented processes with modern GPS, cloud, and mobile technologies to enhance all aspects of current utility and pipeline asset management and damage prevention practices.