EVERYTHING'S CONNECTED

Figure 1. Pipeline under construction. PLTB aids in design, construction, operations, and integrity to maintain pipelines in a prudent manner. Image courtesy of Mears Group, Inc. HDD/DP Division.

Drew Lafleur, Technical Toolboxes, USA, examines how digital integration is helping operators to optimise safety and asset integrity management.

Digital transformation is now a global buzzword, regardless of the industry in which it is applied. In the oil and gas industry, the term is sometimes used interchangeably with 'integrated operations' or 'integrated oilfield.' Whichever terminology is chosen to describe the movement, the key concept revolves around the effort to increase profitability by creating paths of communication between people, processes, multiple data sources, databases and software applications, which have never 'talked' to each other before. Technical Toolboxes is a global provider of desktop and cloud-based pipeline engineering software, and has observed in many case studies how improved communication helps operators gain added insights into the status of equipment and operations, which may have previously been overlooked if close attention was not being paid to the data.

Changing formats

Digital transformation involves taking paper records and making them into databases, which can be used to extract individual data fields to load into calculations. It has been some time now since the industry-wide move was

made from paper to PDF formats (Figure 2). However, a PDF is not useful for operators attempting to feed that into an algorithm for a calculation. This type of data is required to be in a much more leverageable form. This is a key challenge that all industries face when they go through digital transformation, and is a large part of the challenge that the oil and gas industry is facing right now. One growing solution to this challenge is 'next-gen' data capture and immediate, pain-free, automated integration into analysis applications.

Easing the human workload

Once a certain amount of data and information is gathered around a given problem, it can be enhanced and made more user-friendly with the help of automated workflow routines that take a lot of the day-to-day, time-consuming tasks out of the job remit for engineers and operations personnel. These days, a computer can perform many essential tasks if the time is taken to tell the computer to do it. Commands can be based around looking out for certain triggers, for example, 'to survey the entire pipeline and alert the operator if any one sensor goes out of its trend range by 10%,' or, 'alert the operator if any one sensor goes beyond 12 000 psi,' or, 'alert the operator if flowrate goes below a certain amount.' This type of digital automation is known as surveillance by exception, and it eliminates the need for a person to laboriously check all the data sources to find out if any one of them has met any of those triggers.

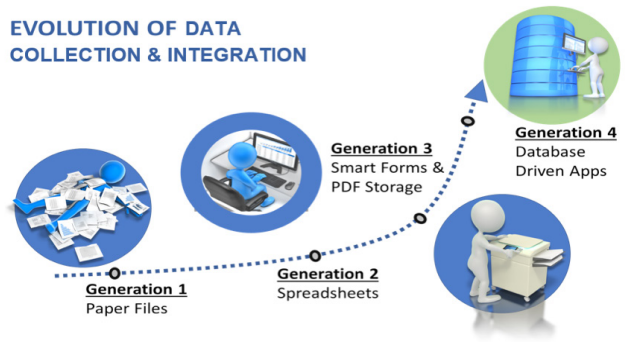

Figure 2. Paper records have undergone a digital transformation to have critical data captured as leverageable digital databases, in real-time.

Figure 3. MIC corrosion at girth weld. With suitable data analysis, costly pipeline digs can be reduced by 30 - 50%.

Supporting the move from reactive to proactive

Once the basics of digital transformation are in place, more complex, sophisticated algorithms can be employed. Key performance indicators can be combined with contextual data about the operating environment and pattern recognition, to produce a more reliable automated interpretation of events such as RPM and discharge temperature variations in compressors and pumps, etc. The time of a company's workforce is then freed up substantially. Operators no longer need to spend time sourcing data, inputting it into a tool that can analyse the data, then seeking out exceptions and deciphering what they mean. Essentially, a reactive mode of operating is replaced with a proactive mode.

For example, a particular cylinder on a machine in a remote location might be suddenly identified with an unusual data signature. With experience, the signature can be observed to indicate a high likelihood of machine failure in the subsequent 60 days. With this foresight, an engineer can be dispatched to the location in plenty of time, and can perform pre-emptive repairs before a failure occurs. In this way, the disruption to the system can be controlled before it fails and puts the operator into a reactive or more problematic situation.

Trusting the change

The oil and gas pipeline industry is characteristically resistant to, or sceptical of, changes to entrenched processes and technology. Therefore, change management is the most difficult aspect of conducting a successful digital transformation within a pipeline company. Encouraging operators and engineers to trust the process and believe in the quality of the data that is feeding these calculations actively contributes to the continuous improvement of the process. Put simply, if the software users do not trust it, they will not use it. In a situation of poor trust, the user will return to their previous solution and digital transformation initiatives will falter.

The cost of corrosion

One of the costlier activities for a pipeline operator is to dig up a pipeline to see if a repair is needed, or to actually carry out a repair (Figure 3). Smart pigs are run through the lines to gather data about defects and abnormalities that may not have been present at the time of construction. With this large data set in hand, the operator faces the task of identifying the problem areas within the pipeline. The common problem that needs to be solved is deciding whether the pipeline needs to be dug up and a whole section repaired, or if it is possible to focus on just a few spots or one short piece within that section. If this problem is addressed correctly, the number of locations that are targeted for digging can be reduced by 30 - 50%, saving the pipeline company time and money and again freeing up the workforce to focus on preventing failures in other parts of the business.

One of Technical Toolboxes' software products, PRCI RSTRENG+, is particularly suited to this activity and works to identify the specific areas of the pipe within long stands of corrosion that would actually cause a pipeline failure at a given operating pressure. The RSTRENG+ software is offered as desktop or cloud-based, allowing for both report and case sharing, enabling

users to collaborate prior to a report's generation. Through the software's import/export capability, cases can be sent directly to collaborating team members, allowing data to be input by both parties to build an inclusive report.

Eat or be eaten

In today's active pipeline fields, the cathodic protection (CP) catchphrase is 'eat or be eaten.' If a pipeline operator does not apply CP to their pipe, it essentially becomes a sacrificial anode to someone else's pipe. In other areas, operators face the CP challenges of natural earth chemistry. In locations with overhead power lines, the electromagnetic field that those power lines generate can cancel out an operator's CP measures. On Technical Toolboxes' integrated software platform, analyses using the PRCI AC mitigation application are enhanced and automated in a way that saves weeks of analysis and deals specifically with this phenomenon. Using the information gathered from the software, engineers and technicians can create models to mitigate or modify the design of pipeline CP systems enabling the reduction of AC density effects, helping users meet the criteria specified either by a client or the National Association of Corrosion Engineers (NACE) standard. Because of its intuitive nature, mitigation scenarios can be generated in minutes to reduce the effects of overhead AC power lines on buried pipelines.

Managing protection at surface

General earth-level construction that involves a large amount of heavy, moving equipment can also pose a problem for pipeline operators. Every time an element of heavy industry crosses a pipeline, someone needs to consider the risk of the weight deforming, cracking or collapsing the pipeline beneath it. Questions to be asked include, 'Are rig mats required?' or 'Do bridges need to be constructed which will take the vehicle off the ground and away from the pipeline?' Several major North American pipeline operators use Technical Toolboxes' Pipeline Toolbox (PLTB) software in order to solve these challenges. PLTB contains engineering calculations needed to quickly solve daily challenges across the pipeline lifecycle. More than 230 different pipeline-specific oil and gas applications and calculations are integrated into a complete, industry-validated software application, which has become the industry standard over the past 20 years.

Case study of a major North American pipeline operator

Overview

To accommodate activity happening on the land surface, heavy equipment needed to cross pipelines. At the same time, due diligence needed to be performed to protect the pipelines. Technical Toolboxes' PLTB software has been employed for more than a decade to help the company analyse individual crossing requests for external loading potential, confirming compliance with specifications in a timely manner.

Background problem

Before using PLTB software for wheel load and track load analysis, a home-written program was deployed using the Spangler method. This solution proved to be relatively slow, inefficient and cumbersome to use in practice. The biggest pain point was the long time required to respond to internal customers. For example, if two analyses were to be run, each needed to be completed separately. This meant that all the data for one analysis needed to be input, run, then all data fields re-input a second time to perform an additional analysis.

Example in practice

A field operative raised a call to managers and explained that there was a cement truck approaching. The cement truck was making a delivery for a house construction project. Initial questions raised were, 'Can he go across the line?' 'What measures need to be taken to safeguard the pipe?' With PLTB, engineers could quickly perform an external analysis and tell them how much ground cover was needed over the pipeline to support the load without damage to the pipe. Field operatives could then identify a spot that had the depth of cover required, or deduce that there was no location with adequate depth of cover and inform the cement truck that they could not cross. Essentially, it was better to block the cement truck and let a load of cement go to waste than damage a pipeline at a cost of millions of dollars. The advantage of using PLTB in this process was the timing, as a rapid analysis was performed at short notice.

Benefits observed with the software

In the past, this team had six or seven staff that regularly used the previous method. Now, only one member of staff is required for the same activity level using the PLTB (85% reduction), freeing up 240 hours per week of engineering time to focus on other activities. Training on PLTB for wheel load and track load analysis is quick and easy; staff can become competent in a relatively short period of time. This means it can accommodate the business today, in which people move more frequently, internally and externally, and younger recruits take the place of retired staff.

Future outlook

In order to move in step with pipeline operators' needs, Technical Toolboxes has released the Pipeline HUB (HUB^{PL}) to integrate pipeline data and facilitate customers' technical work. This new platform paves the way for automating integration and analyses to reveal advanced insights into design and operational fitness of infrastructure. The HUB^{PL} connects engineering standards and tools to users' data across the pipeline lifecycle. Integrated maps provide for visual reconnaissance of existing databases and allow automation of geospatial analyses. The HUB^{PL} continues to support core software products (such as PLTB) while integrating the IP of partners to create a more holistic midstream platform, paired with automation to improve the user experience in engineering workflows.

Conclusion

As the industry continues in its digital transformation, sophisticated, integrated holistic analysis tools will become the norm. The HUB^{PL}, for example, has been engineered to integrate solutions for design, construction, operations and integrity. This will enable users to make more efficient and accurate decisions to ensure pipeline safety, and improve their management of asset integrity.