



Pigging Industry News

the newsletter of the Pigging Products & Services Association

THE PRESIDENT'S LETTER

By Jessica Nichols, Inline Services, USA

2019 has proven to be another solid year for the pigging industry. We have observed consistent growth in new pipeline construction projects, an increase in pipeline companies implementing pigging programs and the introduction of exciting new pig capability innovations.

The exciting growth and innovation in the industry are reflected in the 2019/2020 PPSA Buyer's Guide & Member Directory distributed in September. You may request your complimentary copy of the directory at <https://ppsa-online.com/subscriptions>.

I would like to take this opportunity to welcome new PPSA members and thank existing members for their continued support. Member participation plays an integral role in the PPSA's ability to provide events, information and tools, such as the Technical Inquiry service, to support operators around the world.

Upcoming 2019 Events:

The 2019 annual PPSA seminar takes place in Aberdeen, UK, on 19th/20th November. The seminar includes an exposition providing a unique opportunity to view new technologies, listen to technical presentations given by PPSA members, and network with fellow pigging industry professionals.

Some changes to the PPSA seminar format this year includes, a chance for anyone to visit the exhibition the day before the seminar, from 4-5pm, at no

cost, without attending the seminar. Also there is a social networking event at the whisky bar, and PPSA is hosting a visit to Petrofac's testloop in Montrose, Aberdeen. The visit is available to YPP members only (under 35 years). Details about the seminar can be found at www.ppsa-online.com/seminar.

2020 Events:

The PPSA golf tournament is scheduled for Monday 17th February 2020 in Houston, TX. We are looking for members to make up teams, sponsor holes, lunch, prizes and gifts. If you would like to participate, please contact Diane at diane@ppsa-online.com. All are welcome! Funds raised from the golf tournament will support the young pipeline professionals in the industry.

I would like to invite everyone to the Annual General Meeting (AGM) on Tuesday 18th February at the Marriott Marquis hotel in Houston, USA. This meeting is an integral part of learning and sharing ideas that

NEW Members

Full

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will shape the future direction of PPSA. Your participation in the AGM is encouraged and welcome.

PPSA will be accepting nominations to fill vacancies for two new Directors from the Western Hemisphere in 2020. 2020 is the PPSA's 30-year anniversary and we would like ideas from our members on how to mark this special occasion. All ideas are welcome, so let your creative juices flow and send them to Diane at diane@ppsa-online.com.



PPSA seminar in Aberdeen, UK



Rainer Schmidt hands over the title CEO of 3P Services

Rainer Schmidt has officially retired as CEO effective on August 31, 2019. Rainer Schmidt, petroleum engineer and Dr.-Ing. founded **3P Services** together with three partners back in 1992. Ever since he has served as head of the company.

During his era 3P Services developed from the classical “garage-type” start-up to a global player in the ILI-business. From the beginning, independence from “strong partners” has been maintained to preserve the freedom necessary for true innovation. Until today, ownership of the company remains entirely with the four shareholders.

As far as 3P’s market segment is concerned, Rainer Schmidt focused the company on inspection solutions for challenging pipelines from the very beginning, more than two decades ago. At times, when others in our industry still published papers to discuss circumstances why a pipeline might be “un-piggable”, under Rainer’s guidance 3P Services had already solutions for most of them.

The concept to “better tailor your ILI tools to the specifics of an un-piggable pipeline rather than modifying such a line to piggable” is followed (or at least claimed) today by practically all ILI vendors. 3P Services has lived by this philosophy for a quarter century. As a consequence, 3P Services has accumulated vast experience in special applications and has presented a number of innovations to the industry. One example, “free-swimming bi-directional inspection” (for single access lines, like e.g. tanker loading and offloading lines) was introduced by 3P Services in the last century. It is meanwhile appreciated by several vendors and many clients.

The present fleet of ILI equipment at 3P Services is quite impressive: more than 300 live tools serve 2” to 48” inspections in MFL, UT, GEO, DMR and SRD technologies. With this tool fleet, 3P Services is now a competitive ILI provider on standard lines as well.

Different from other vendors, 3P Services serves its projects out of its single and central operating base in Lohne, Germany. Teams and equipment are mobilized from here to operations meanwhile spread over more than 40 countries. The German team now counts 110 colleagues, quite young with an average age of 34.

About PPSA Rainer explains: “I had the privilege to work with Jim Cordell in the very beginning of PPSA, years before I founded 3P Services. As 3P, we joined **PPSA** in 1995 and have worked with the association in various functions since. At this moment I may add that the PPSA is meanwhile really an important factor in our industry. 3P has definitely benefited from its membership by getting in touch with individuals, companies and the business. I wish all the best for PPSA’s future and I am sure: PPSA is needed!” Rainer will still be working for 3P Services on specific projects and developments, however, at reduced time.

Meanwhile, the company is in good hands: His son Felix, with more than 10 years in various functions within 3P Services has gradually taken over management tasks from his father. Both together have headed 3P Services for quite some time. Felix Schmidt, presently also serving as Vice President of the PPSA, carries the title CEO of 3P Services since September 01, 2019.



Father and son

A banner for 3P Services. On the left, there is a technical drawing of a pig launcher/receiver assembly. The background features a world map with blue dots indicating global operations. The 3P SERVICES logo is in the top right corner. The main text reads "INNOVATIVE ILI SOLUTIONS WORLDWIDE." and the website "WWW.3P-SERVICES.COM" is at the bottom.

Case study: Long distance slurry pipeline cleaning operation

CPPI successfully carried out a cleaning operation for a slurry pipeline, which is 138km in length and 355.6 mm in diameter, with the high range difference between the head and terminal stations of 554m, located in Inner Mongolia Province, China.

The slurry pipeline has not been pigged since its operation in 2010. The scale of the pipeline is severe with a thickness of about 3 to 4mm. The scale is hard, and there are obvious flow marks at the bottom. The outlet pressure of the main pump has reached maximum design pressure, and the pipeline is near the minimum transportation capacity.



Internal views of the pipeline before cleaning

In order to ensure safe and effective pipe cleaning, CPPI carried out a pull through test with the designed steel brush Cleaning Pig and Scraper Pig



Steel Brush Cleaning Pig pull through test & Slurry Soaking test on steel brush



Scraper Pig pull through test & Partial shedding of scale after the pull through test

Based on calculating the diameter of the brush hair and the density of the brush, the steel brush can maintain a good passing capability after soaking in the slurry, and the steel brush Cleaning Pig has a good cleaning effect on the soft dirt in the pipeline.



Pipeline Cleaning at worksite

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The Scraper Pig is of alloy material, and equipped with 8 Scrapers, which divided the pipe hard scales into small pieces. The pigging runs using the Scraper Pig proved very successful in moving deposits and greatly reduced the risk of the pig getting stuck.



The scale after cleaning

According to the monitoring data, the rotating speed of pulp main pump increased from 52% to 58%, the pipeline pressure reduced from 14000 KPa to 12500KPa, and the transportation capacity increased from 470m³ to 500m³ per hour. The whole system has been restored to the design capacity of 5.5 million tons per year, and the cleaning operation has achieved obvious results. ●

Tracerco secure 7 subsea inspection projects in the North Sea, Gulf of Mexico and West Africa

Tracerco, part of Johnson Matthey Plc, has recently been awarded 7 subsea inspection projects to provide critical flow assurance and asset integrity data on a variety of pipelines, flowlines and risers in the North Sea, Gulf of Mexico (GoM) and Offshore West Africa.

Through the use of Discovery™, Tracerco's Subsea CT Scanner, each operator will obtain full tomographic images of pipe wall thickness and contents to gain an enhanced understanding of their pipeline condition and the process fluid. As CT scanning provides a non-intrusive inspection method, all assets will remain operational throughout each project, limiting the potential of any (further) deferment of production.

The first of the two inspection projects awarded in the North Sea will focus on an integrity assessment following potential damage to an export pipeline. The pipeline coating had been noticeably damaged. Discovery™ will be used to determine whether the damage extended to the pipeline itself. The second project will be a repeat inspection of another export pipeline to assess whether there has been any further degradation to the pipe wall thickness since the initial inspection in 2015. This data will be used as part of an ongoing pipeline life time assessment programme.

In the GoM, Discovery™ will be used to inspect the flowline and riser of a gas line for potential integrity issues and to look for potential condensate hold-up. Discovery™ will also be used in the GoM to obtain initial critical baseline integrity data on a new pipeline system. Discovery™ will then be deployed annually to reinspect the new pipeline system to identify potential corrosion / determine corrosion growth rates.

The final 3 projects, awarded in West Africa, will be the first subsea inspection projects in the region for Tracerco. Discovery™ will be used to inspect a number of flowlines to determine whether they can be extended past their original design life by gathering real time data on a variety of integrity issues including pipeline corrosion, pitting and wall thinning.

With over 3000 scans completed on over 70 pipelines since its launch, Discovery™, has been at the forefront of subsea pipeline inspection, obtaining accurate measurements of pipe wall thickness through any type of protective coating whilst simultaneously diagnosing and characterising flow abnormalities without interruption to normal pipeline operations. ●

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North Yorkshire pipeline pigging specialist celebrates 35 years in business

Richmond based pipeline pigging experts – **iNPIPE PRODUCTS™** – celebrates its 35th year in business this year with a strong order book and exciting plans for high tech innovations to bolster its extensive range of pipeline pigging products and bespoke solutions. The North Yorkshire firm – which was founded in 1984 by pipeline industry figurehead Ken Hemingway after a lifelong dedication in the field – has grown at an exponential rate from a 20,000ft² site in Colburn to its current state of the art facilities spreading across a 6 acre site with a 60,000 ft² production and testing facility in Brompton on Swale. The company really made its first mark within its field in 1986, when it successfully secured its first patented product, an omni directional intrusive signaller, which continues to be a market leader across the globe.

Exporting over 84% of all orders to major clients across six continents worldwide, including the likes of Aramco, Centrica, Shell, Esso, ConocoPhillips and Subsea 7, the company is an acknowledged world leader in pipeline pigging, maintenance and testing products and developing bespoke solutions. Headed up by Simon Bell, who played a major role in the company’s management buyout and relocation in 2013, iNPIPE PRODUCTS™ boasts one its most successful achievements to date was working on what it believes to be one of the largest pigging projects in the world only a couple of years ago.

This involved the company being commissioned by a South Korean conglomerate to supply a first of its kind integrated solution including cleaning tools, loading equipment, launching equipment together with integrated tracking which is now being used on some of the world’s largest pipelines, measuring an impressive 90 inch in diameter.

And since the successful delivery, the company has received several enquiries to complete additional projects on a similar scale, that is relatively unheard of. Speaking about the company’s 35th anniversary and its success to date, Simon Bell, Managing Director at iNPIPE PRODUCTS™ said: “We have a proud history of innovation and we have constantly evolved our products and services to suit the ever-changing market conditions and needs of our clients, which we believe has played a significant role in our success to date.”

“With a healthy order book for the next 12 months and the business receiving a growing number of enquiries as we benefit from green shoots of recovery in the oil and gas sector, we have great expectations for this next year to be one of our most successful to date. Our technical pigging experts have also been very busy developing and expanding our product range and, as such, we look forward to making some exciting announcements in the coming months.”

For the second consecutive year the business has also achieved a RoSPA Occupational Health and Safety Award – in recognition of the company’s achievement and commitment to raising the standards of health and safety management.



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Inline's new SCP tool continues to exceed expectations

Inline's new Speed Control Cleaning Pig Tool continues to exceed expectations through the success of a recent project involving over 300 miles of 30" and 36" pipelines containing numerous 1.5D short radius bends. The project consisted of 4 phases per each pipeline section with the overall objectives being:

- 1) Safe and effective pipeline cleaning.
- 2) With and without the use of cleaning chemicals.
- 3) Even distribution of corrosion inhibitors.
- 4) Maintaining gas throughput delivery commitments to downstream during the cleaning process.

Project Phase Overview:

I - Proving: Tools were tailored for each pipeline. Each section was first "proved" using an appropriate SCP configuration to ensure the tool could traverse safely through each pipeline section with no obstructions.

II - Chemical Cleaning: The client-selected chemical vendor provided a unique cleaning chemical mixture for each section of the line. The Inline Field Services team reconfigured the SCP with discs, cups, brushes and magnets to disperse the chemicals evenly as per the chemical vendors' specification. The vendor injected the cleaning chemicals in each section of the line to ensure the correct chemical disbursement. The SCP traveled through the line, disseminating the chemical onto the pipeline wall. This step was repeated, and the pig was reconfigured on-site until the desired result was achieved.

III - Dry Run: The objective of a "dry run" was to rid the pipeline of any lingering cleaning chemicals from Phase II of the project. After obtaining the desired results in Phase II, our field services team reconfigured the SCP with discs, cups, brushes and magnets that would provide the best results for a dry run or "sweep" without the insertion of cleaning chemicals.

IV - Corrosion Inhibitor Application: The SCP was reconfigured for even distribution of corrosion inhibitor on the pipeline wall. Similar to the chemical cleaning technique used in Phase II, the corrosion inhibitor was formulated by the clients' vendor specifically for these lines. The vendor's application specifications required the chemicals to be injected at strategically selected sections of each line. Once the chemicals were injected by the vendor, the SCP traveled through the lines, evenly dispersing the chemical to manufacture specification.

While the normal gas flow velocity was maintained, the SCP averaged an ideal control speed of 7mph (3.12 m/s), allowing for both efficient cleaning and no interruption of gas delivery.

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In addition, the recorded tool performance and IMU data was downloaded and analyzed onsite. The immediate access to the SCP's recorded data was key in streamlining the preparation of the tool for subsequent runs, as well as effective communication of job status to client project managers.

The project was an overwhelming success. The SCP performed flawlessly in all phases. The cups and discs, also manufactured by Inline Services, performed as expected, and the tool delivered accurate, comprehensive data following each run. ●

Vee Kay Vikram & Co. LLP develop a new machining facility in India.

VKVC – manufacturer and supplier of pipeline repair and maintenance equipment has increased manufacturing in its new 4600 square meter plant in Chhatral near Ahmedabad, India. The facility located in GIDC Phase IV, will enable VKVC to increase its production capacity further for manufacturing Quick Opening Closures and Hot Tap Fittings.

A CNC controlled Vertical Machining Centre 4 meter x 3 meter x 2.5 meter height has been installed to machine fittings upto 60 inch diameter.

The expansion program started in 2014 to add manufacturing capability has enabled the unit to manufacture at one location pipeline Pigs, Pig barrels, Pig signals, monolithic isolation joints, flow tees, leak repair clamps and sleeves plus hot tap fittings; making VKVC a one-stop solution for all pipeline repair and maintenance needs.

This new development has enabled VKVC to handle large projects for domestic and international market with shorter lead times. ●

It's magnetic! NOV introduces strong alternative to radioactive isotopes for pig tracking

NOV's magnetic pig tracking system has been in operation in the North Sea for more than two years

In a major field in the North Sea, a safe, reliable, and permanently installed alternative to conventional pig tracking was required, as several pigs were in the pipeline system simultaneously on a regular basis. Pig collisions at pipe Y-locations would have a huge cost impact and must therefore be avoided.

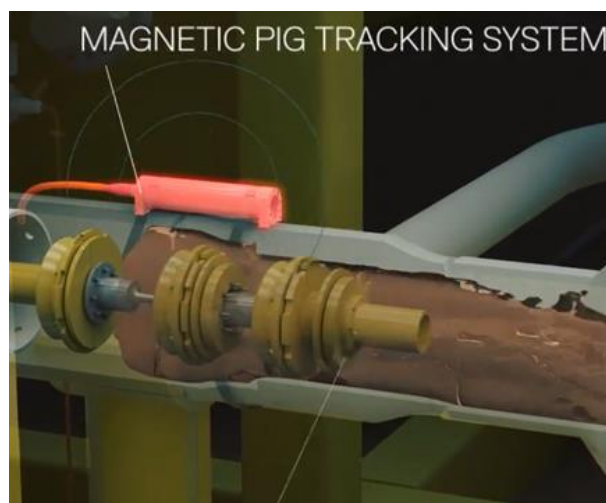
The magnetic pig tracking system was developed as a safe and cost-efficient alternative to isotope-based systems, which are associated with extensive HSE measures due to radioactivity. The system operates on a large pipeline system from several platforms performing frequent pigging operations to an onshore plant. The pig tracking system comprises a permanent magnet array on the pig and pig trackers registering pig passages at different crucial locations. Years of development has resulted in successful installation of both subsea and topside sensors, communication system, and operator interface.

The magnetic pig tracking system evolved from the pig tracking products developed for the "Subsea Automated Pigging System" (SAPL). This pig launcher system is designed with a replaceable subsea cassette of pigs and facilitates remote pigging from a control room by the push of a button without the propelling support from an expensive vessel. The pigs are pushed into the correct launch position one by one and are propelled into the production flow by diverting the production fluid during launch.

The SAPL system relies on positioning of the pigs by aid of a sensor that indicates the exact position of a pig even at standstill. A second sensor in passage mode detects that the launched pig properly enters production flow. A conventional pig tracker would employ radioactive isotopes to determine position, but as this was not an option for the project, and there was not a viable pig tracker on the market, NOV had to develop its own solution.



The core technology of these systems can now be used for multiple applications, which is currently in high demand in the market. It was important for NOV to demonstrate that the system performed flawlessly before the product was adapted into new solutions and applications, and with over two years of use in a North Sea field, it is ready for the market. The technology can now be adapted for temporary use in cases such as ROV-held pig trackers for finding stalled pigs or temporary trackers with an ROV-readable display to be placed on a pipeline during pre-com operations. For topside systems, ATEX certified pig trackers are available.



Pig has been positioned at correct position before launching ●

The Choice is Right

Selecting the right technologies lets you find the needle in a haystack

In a Nutshell:

Find the needle in the haystack – or better yet – find the pinhole in the pipeline. Although high-resolution magnetic flux leakage (MFL) technology seems to have become the standard in-line inspection (ILI) technology and has a very high success rate in detecting corrosion in pipelines, there are situations when this robust power horse reaches its limits. This article describes a situation where the collection of medium characteristics and the type of features present meant an even more precise approach was needed for a small diameter transfer pipelines.

Find the right technology for the job

The medium being transported (crude oil) had a water cut running at the bottom of the pipeline and contained suspended solids; together, these can create corrosion in the form of a channel (channeling corrosion). This “shape” of corrosion is difficult to measure properly with MFL-A, as this technology does not perform well for the detection of general wall thinning. It best detects sharp edges, and, especially for axial magnetic flux leakage (MFL-A) technology, channeling corrosion is not easily identified, because this feature would be longitudinal. The result can be an undetected feature, which may cause a leak. To mitigate this risk for the small diameter pipeline, although it had been inspected using standard MFL technology, ultra-resolution data on all features was not collected – however it needed to be clear that there were no so called ‘pinholes’ present, and if there were that they could be addressed. These features are tiny holes, less than 10 x 10 millimeters in size and very difficult to detect. Choosing the right technology can be difficult, as each has its advantages. For the detection of channeling corrosion, UT is actually most adequate. It is, however, restricted by its sensitivity to debris and would not be best for the coming inspection. What about MFL-C? That would do a better job at detecting the longitudinal features along the pipe wall, but it would still not be precise enough to identify any pinholes. After considering all the options, **ROSEN Group** experts concluded that a combination of two technologies would be the best approach. This would be MFL-A Ultra and internal eddy current (IEC).

MFL-A Ultra: Making the invisible visible

The choice for MFL-A Ultra became clear with the performance specifications, since it would be able to detect any pinhole features in the pipeline. For the development of MFL-A Ultra, new sensor elements were developed. These were optimized for a 1-millimeter (0.04-inch) axial resolution and 1.6-millimeter (0.063-inch) circumferential resolution, more than doubling the resolution of current

standard MFL technologies and essentially moving from individual data points to true imaging, an example of which can be seen in Figure 1 below.

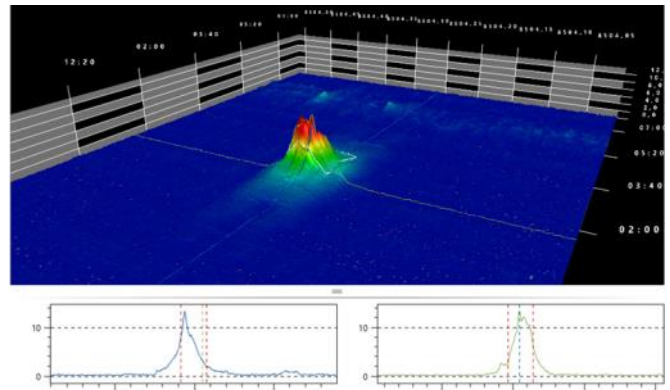


Figure 1: With the Ultra resolution, true pipeline imaging becomes possible

In addition, the mechanics and electronics of the new sensor elements were adapted. Traditionally, sensor carriers are placed on one sensor ring and located at least 2 millimeters (0.08 inches) apart due to mechanical constraints. To achieve the desired resolution, however, two sensor rings had to be mounted side by side and the carriers attached in a slightly offset fashion. Because of the high sensitivity of the sensors



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and the now offset physical location, two data sets needed to be generated – one measuring closer to the front and one closer to the back of the magnetic field. Using image-processing algorithms, these sets were then normalized in order to create one triaxial magnetic image for the pipeline. Figure 2 shows the data sets before and after normalization, with the separated data sets from each sensor ring on the left and the combined image on the right.

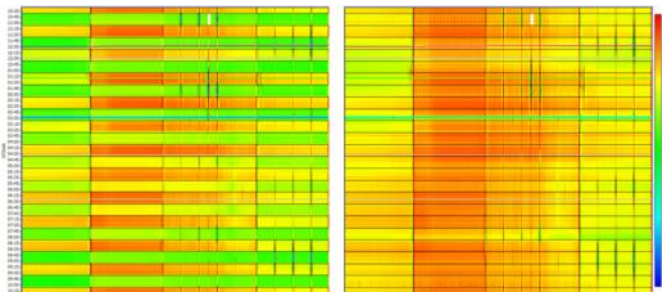


Figure 2: With two sensor rings, complete wall coverage is possible

The combination of the three elements – highly sensitive sensors, dual-sensor rings and image-processing algorithms – allows for full ultra-resolution circumferential coverage and the detection of the smallest pinholes.

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IEC: The trusted companion

In this case, IEC was used for support. Although MFL-A Ultra is optimal for detecting pinholes, its axial magnetization means lower sizing accuracies for long circumferential features in comparison to using circumferential magnetization. Therefore, the combination with IEC best addressed axial channeling corrosion in this pipeline. This technology allows for the detection of surface corrosion. Based on electromagnetic induction, eddy current testing involves placing a cylindrical coil, which carries an alternating current close to the pipeline. The current in the coil generates a changing magnetic field and thus produces eddy currents in the pipe wall. To collect data, the variations in the phase and magnitude of these currents are monitored by using a second coil or by marking changes in the current that flows in the primary coil. The IEC signal gives additional information about the length and width of a detected feature and as such significantly improves depth sizing.

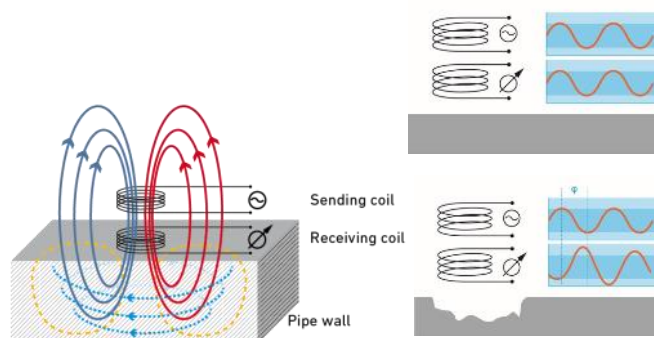


Figure 3: Variations in the electrical conductivity or magnetic permeability due to the presence of flaws will change the flow patterns of the eddy currents, and there will be a corresponding change in the phase and amplitude of the measured current.

After all was said and done and the data was collected, field verifications allowed the feature-sizing approach to be corroborated, verifying this process.

But WHY?

The well-thought-out choice of technologies goes a long way in identifying the threats present as well as those that are most relevant to the structural integrity of a pipeline. In this case, choosing the very precise MFL-A Ultra technology coupled with the supporting IEC technology to address any presence of axial channeling ensured the precision of the Ultra performance and, consequently, allowed for less conservative evaluation criteria, as doing so offers a much more accurate diagnosis. Ultimately, this equips operators with a much better understanding of the status of their pipelines, which in turn enables them to make better decisions for their future integrity. ●

STATS Group's challenging isolation at solar power plant

A solar power station in Abu Dhabi, one of the largest of its kind in the world, was the latest location for the deployment of STATS hot tap installed pipeline plugging technology. STATS deployed their patented BISEP® isolation tool into a 16" production line containing heat transfer fluid, during a planned shutdown of the power station. The production line is connected to five large storage tanks and was required to be isolated to allow four valves to be introduced into the system.

The solar power station uses parabolic trough technology to generate electricity and covers an area of approximately 2.5 square kilometers which makes it one of the largest of its kind in the world. The solar field contains many parallel rows of parabola-shaped reflectors which focus the sun's rays at 30 to 100 times its normal intensity. Heat transfer fluid inside the reflectors carries the heat to a steam generator, where water is converted into superheated steam. This steam runs a turbine, which puts an electric generator in motion, just as in a conventional fossil-fuel power plant.


During the shutdown the heat transfer fluid cooled to 80°C from an operating temperature of 390°C. In order to ensure the elastomer seals of the BISEP would perform as intended at the high temperature, STATS conducted a Factory Acceptance Test (FAT) at their operational base in Abu Dhabi. The FAT was conducted in a purpose-built test fixture to replicate the pipe specification and temperatures expected on site. The BISEP was deployed and hydraulically set in the test fixture containing heat transfer fluid which was maintained at a constant temperature of 90°C for five days. With the successful completion of the FAT the equipment was mobilised to the worksite.

Onsite a mechanical hot tap fitting and gate valve was installed onto the pipeline at the isolation location and leak tested. Hot tapping of the pipework was then conducted with STATS SureTap hot tapping machine and the pipe coupon was recovered, providing access for the BISEP. With the hot tapping completed, the BISEP in a pressure competent launcher was attached to the closed gate valve and leak tested. The pressure in the BISEP launcher was then equalised and the gate valve was opened allowing the BISEP to be hydraulically deployed into the pipeline. The dual elastomer seals of the BISEP were hydraulically set providing fail-safe double block and bleed isolation, without the need for additional hot tapped bleed or vent ports. The BISEP was then subject to a test regime to independently test both the primary and secondary seals with full pipeline pressure, the cavity between the seals (annulus) was vented to

ambient through the BISEP and verified as a zero-energy zone. The vented annulus void was then closed and monitored confirming leak-tight isolation. Following successful seal proving, an Isolation Certificate was issued to notify all parties of the safe isolation of the pipeline. The BISEP then remained in the pipeline for five days while all four valves were installed into the pipeline, during this time the BISEP seal annulus was monitored and remained leak-tight.

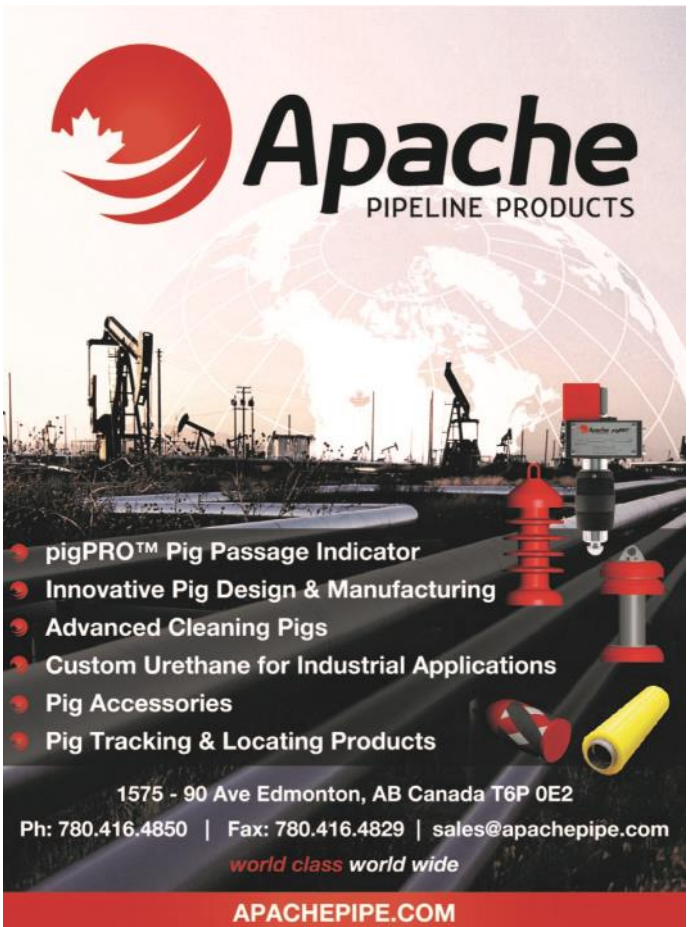


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Identifying SSWC with confidence

Corrosion is universal, but not always uniform. The challenge is distinguishing between similar corrosion conditions that pose distinctly different threats to pipeline integrity, which allows operators to assess risk and allocate resources wisely.

For example, selective seam weld corrosion (SSWC)—which occurs when corrosion attacks the seam material more aggressively than it does the base pipeline material—is a higher-risk condition compared to corrosion crossing the long seam (CCLS). However, the two conditions frequently intersect: SSWC is often recognized as a v-shaped groove in the long seam weld within a larger region of CCLS. (Figure 1)

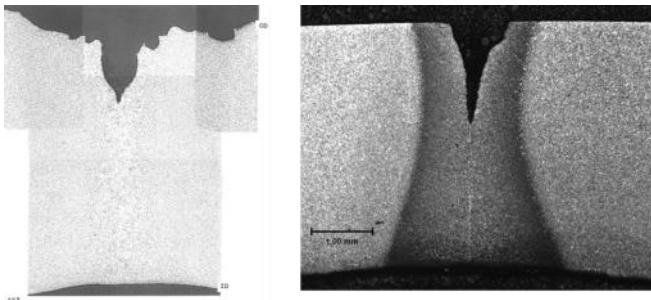


Figure 1: Selective seam weld corrosion (SSWC) creates a v-shaped groove in the long seam weld within a larger region of corrosion crossing the long seam. Photos: Kiefner & Associates

Although failure rates due to SSWC are low, incidents tend to be catastrophic. To help mitigate risk, the **Pipeline Hazardous Materials and Safety Administration (PHMSA)** requires operators to schedule evaluation and remediation of corrosion of or along the longitudinal seam weld within 180 days of discovery, regardless of the threat posed [1]. Evaluation by axial magnetic flux leakage (MFL) technology can detect volumetric metal loss but it can't differentiate between SSWC and CCLS. Differentiation requires a non-axial MFL to identify the seam and classify the axially oriented pipeline anomaly. Even then, making a final determination involves a subject matter expert's assessment, opening the process to human error.

Classification Algorithm Discriminates SSWC from CCLS

To reduce reliance on subject matter expertise, PHMSA asked the industry to develop and validate new techniques to improve location, sizing and classification of complex metal loss features, especially those located near or on the long seam weld. PHMSA awarded the project to global pipeline solutions provider **T.D. Williamson (TDW)** and engineering consultants **Kiefner & Associates** (Kiefner). TDW developed and Kiefner validated a

SSWC classifier that replicates the discrimination ability of the subject matter expert but avoids error-prone human input. The classification algorithm leverages field response profiles of axial MFL and spiral magnetic flux leakage (SMFL) to calculate the probability that a metal loss feature is SSWC, provide improved metal loss sizing and give operators greater control over risk assessment.

To date, the classifier has proven highly effective in discriminating SSWC. In a case study presented at the 2019 Pipeline Pigging & Integrity Management Conference [2], an axial MFL image indicated that metal loss produced a uniform response across multiple sensors circumferentially. (Figure 2) The field response recorded within SMFL documented both the seam weld (discoloration) and the characteristic sharp axial response. Clearly, the metal loss was a narrow, planar axial feature located coincident with the seam weld. The classifier leveraged the field response in each data and identified this region as having a high probability for the presence of SSWC. Dig verification confirmed the presence of an SSWC anomaly.

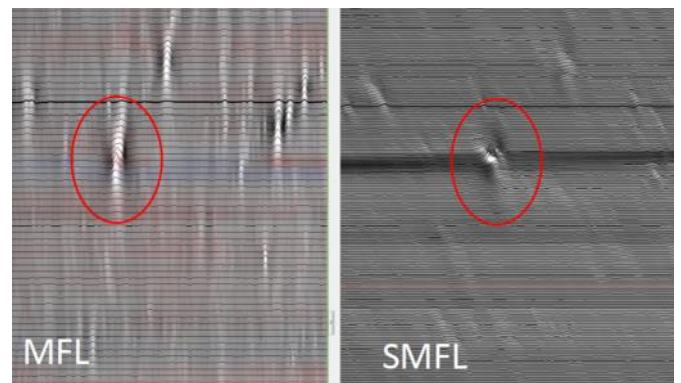


Figure 2: High field axial MFL field response to SSWC (left). High field spiral MFL (SMFL) field response to SSWC (right).

The research, development and validation processes are outlined in IPC2016-6484: Classification Approach for Dents with Metal Loss and Corrosion Along the Seam Weld [3] and the DOT final report [4].

- [1] Pipeline integrity management in high consequence areas, § 49 CFR 195.452(h)(4)(iii)(H).
- [2] Romney M, Nestleroth J.B., and Hindin B. 'Improved System for the Detection, Sizing and Prioritization of Seam Weld Corrosion', Pipeline Pigging and Integrity Management Conference (PPIM), 20-22 February 2019.
- [3] Nestleroth, J. B., Simek, J., & Ludlow, J. (2016). New Classification Approach for Dents with Metal Loss and Corrosion Along the Seam Weld [Abstract]. ICP2016-6484.
- [4] Nestleroth, J. B., and Simek, J., "Improve and Develop ILI Tools to Locate, Size, and Quantify Complex/Interacting Metal Loss Features" DTPH56-13-T-000009L, Project 498, <https://primis.phmsa.dot.gov/matrix/FilGet.rdm?fil=10469>, April 2016. ●

Internal ultrasound inspection of a manifold using a pushrod system in combination with an ROV

The Challenge

A semi-submersible integrated production, drilling and quarters (PDQ) platform located in the Norwegian North Sea was undergoing planned maintenance, which included the replacement of a “Christmas Tree.” During this scheduled shutdown, the operator also wanted to perform an in-line inspection (ILI) of one of the manifolds located under the platform. The goal of the ILI was to record data on the internal pipe wall thickness and obtain a visual inspection on the manifold condition. Due to the maintenance work and potential conflicts with planned drilling, the ILI needed to take place within a short time window to minimize the impact on operations.

The outer diameter of the manifold to be inspected is 141.3 mm with a wall thickness of 12.7 mm. Simulations of the pipe located the most critical area of corrosion to be approximately 1.5 meters into the manifold, just after the third 1.5D/90° bend; therefore, this section was determined to be the most distant point in need of inspection. Previous internal video inspection attempts of a neighboring manifold revealed a potential additional challenge of excessive weld roots, which made negotiation of that manifold impossible for the other service provider at that time.



Figure 1 – Mock-up of the manifold.

Solution

KTN, a company of the **ROSEN Group**, was called on to find an ILI solution for this so-called “unpiggable” pipeline. A mock-up of the manifold was utilized during the development and testing process of the solution (Figure 1). Sharp edges were added to the test manifold to represent the expected weld roots. One of these edges can be seen in Figure 2.

The initial proposal was to use a standard 10” crawler in a launcher with a reducer to fit into the 5” spool. The idea was to use a 5” sensor carrier with fixed probes, which would be propelled by a crawler module. This would be considered a standard KTN operation, using an umbilical winch located on the deck of the platform with the tether hanging 340 meters down to the seabed. However,

due to the ongoing platform maintenance, the limited space around the manifold and additional concerns the operator had about underwater currents potentially influencing the umbilical position, another approach had to be considered.

Through close collaboration between the operator and the tethered solution specialists at KTN, a new approach was conceived. This solution was unique in that the tool would be controlled by a Remotely Operated Underwater Vehicle (ROV) instead of a crawler; to enable the pushing and pulling of the tool through the pipeline by the ROV’s manipulator arm, a pushrod was designed.

Additionally, subsea cables were manufactured to run between the tool and available interfaces of the ROV to support power, video and Ethernet capabilities.

Using a pushrod in combination with an ROV was a new concept to most of the on-site personnel; therefore, during the testing period, modifications and improvements were made to optimize performance. One of the challenges with a pushrod system is to get enough force when pushing the tool forward, particularly in back-to-back bends or when there are restrictions like excessive weld roots, tees or deposits that the tool must negotiate. Therefore, a traditional flat push rod made of steel was selected due to its compatibility with the claw of the ROV arm, and centralizers with wheels were mounted to help optimize push/pull force efficiency and prevent the push rod from bending under pressure.

The launching concept itself also needed special considerations. A cap was designed to interface the temporarily open launcher on the front end. On the back end, an odometer arrangement was designed and mounted on the flat pushrod, enabling precise tracking of the tool’s progression through the manifold. During subsea transport, the tool was secured in the launcher via a tailor-made security handle for the ROV. Details of the final solution can be seen in Figure 3.



Figure 2 – 6 mm edge to represent an excessive weld root



Figure 3 – Black protection cap and “snap-on” launcher arrangement.

32 pulse echo probes were mounted on a probe ring in the front module of the ultrasonic ILI tool. A camera was also embedded into the probe ring and connected to a separate pressure vessel, which contained electronics connecting to the ROV. Two cables were used to connect the complete tool to the ROV. The main components of the inspection tool can be seen in Figure 4.

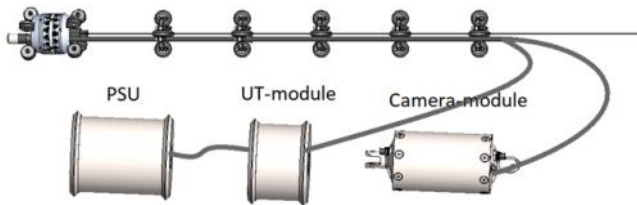


Figure 4 - Main parts of the inspection system.

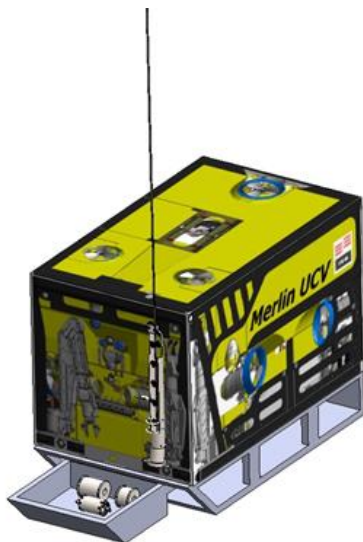


Figure 5 – The ROV with the inspection tool parts secured.

There were several steps that needed to take place before the tool could be launched. First, the ROV had to remove the blind flange of the manifold and then mount the cap to prepare for the installation. The tool was then electrically connected to the ROV and placed into the basket under the ROV while on deck (Figure 5). The ROV travelled with the launcher down to the seabed and mounted it to the

adapter. Finally, the ROV operator carefully pushed the tool into the pipeline via the push rod. As shown in Figure 6 and Figure 7, the operating space for the ROV was limited. As the ROV claw could easily damage the cables, the ROV operator had to proceed with extreme caution.

After the inbound inspection, the tool was pulled back slowly towards the launcher in small increments, as the arm had to be carefully repositioned several times. During this return run, the UT sensors captured the wall thickness data and sent it in real time over the ROV’s umbilical to the topside on-site analysts. During the job execution, the project team could follow the real-time progress of the subsea operation by logging onto a website that supported a live video stream of the ROV’s cameras.



Figure 6 – The ROV starting to push the system inwards.



Figure 7 – The umbilical and push rod in the launcher arrangement.

Benefit

Close collaboration was key to the success of this challenging in-line inspection. Thanks to the experienced personnel from the ROV company, the operator and the KTN experts, risks were already minimized during the preparation phase, and the inspection solution could be applied with confidence. The innovative inspection solution was applied within the specified timeframe, during previously scheduled maintenance and with minimal impact on operations. Through this project, the operator obtained high-resolution data on the wall thickness of the manifold and a visual inspection record. This information was made immediately available to the operator in an initial report on-site, then followed up by a thorough final report. This data enabled the operator to make confident decisions on the next steps in the integrity management of this asset. ●

NDT's Simultaneous crack and metal loss inspection

As part of a major oil and gas production company's pipeline integrity plan, a scheduled MFL metal loss inspection of a 48" diameter offshore loop line was halted when the caliper run encountered a severe dent. This 48 km (30 mile) pipeline is a crucial asset of the operators.

Due to the identification of a severe dent, successful inspection had now become a difficult challenge as a new technology would be required to inspect the loop line. The selected tool must be capable of negotiating the substantial ID reduction anomaly and inspect for mechanical damage, metal loss, gouges, and crack-like anomalies, all in a single run. Achieving high accuracy whilst maintaining a critical reporting threshold for cracks (1 mm depth, 25 mm length) was an essential element for the operator's post inspection Finite Element Method integrity assessments. It was also essential that the ILI report clearly and concisely interpret the results providing thorough analysis for future survey reference. The entire program had to be completed within 6 months, from contract award to submission of final report, Fitness for Purpose assessment and Finite Element Method report.

After evaluating available solutions, the operator asked **NDT Global** to inspect the pipeline. A combination run consisting of Evo 1.0 UC, Evo 1.0 Ump and Atlas UG robots delivered a comprehensive inspection in a single run. These technologies accurately detect, locate, and size metal loss and axially oriented crack-like anomalies, providing high-resolution mapping and XYZ coordinates for the pipeline. In particular, the company's innovative Enhanced Sizing for ultrasonic crack inspections removes depth sizing boundaries that previously existed for depths above 4 mm (0.16 in). NDT Global's technology is unique in its ability to perform a combination UT compression wave type ILI robot run, with XYZ mapping, for the detection of metal loss and lamination anomalies, while having the ability to simultaneously complete crack detection. High-accuracy inline inspection using NDT Global's ultrasonic technologies successfully detected metal loss and crack-like features. Critical reporting threshold for cracks 1 mm (0.04 in) depth, 25 mm (0.98 in) length) was maintained.

Results will guide future inspection frequency, using trend analysis, and anomaly tracking, while applying only the most stringent internationally accepted codes, standards and specifications. Data and recommendations enable the operator to prevent pipeline failures by; removing or repairing significant defects, determine the interval between future inspections with or without repair of identified defects and calculate maximum allowable operating pressure (MAOP). ●

i2i Pipelines develop the 3inch and 4inch Pioneer pigs for 3 way valves

Following on from the successful development of the single module 3inch and 4inch Pioneer smart pigs, **i2i**, along with support from a major pipeline operator in Canada, has continued to innovate even further and miniaturise the Pioneer™ range of smart pigs so they can launch and receive through 3 way valves, often referred to as pigging valves.

Pigging valves are a cost effective way of launching and receiving conventional utility pigs into typically small diameter gathering pipelines. Their ease of operation and small footprint can provide many advantages over the use of conventional barrel style launchers and receivers. They are also commonly used inside the rotating turrets of FPSO's where space limitation prevents the use of the typically longer conventional barrel style facilities.

By developing the single module 3inch and 4inch Pioneer tools so they can be deployed into pipelines with pigging valves in place, i2i have given pipeline Operators of small diameter gathering pipeline networks a high value alternative to conventional ILI smart pigging technology. The ability to inspect their gathering system network without the need to excavate and cut into operational lines to install conventional barrel style launchers and receivers so conventional ILI can be deployed provides significant costs savings to Operators. Reduced disruption to production as well as lowering the risk to the environment and excavations personnel provides additional benefit to this method of smart pigging.

As with all i2i Pioneer tools the 3inch and 4inch pig valve tools can run in any medium with a wide range of pigging velocities. The pigs can be pushed with any medium including existing production or nitrogen. The pig valve tools have been especially designed to negotiate the 90deg bends with changing pipe schedule that is common in these smaller diameter lines.



Pioneer tool being dropped into a typical pig valve

The 3 & 4inch Pioneer tools can be easily dropped into a typical pig valve, like an Argus valve or similar, and pushed through the pipeline by either the product or by Nitrogen.

The Pioneer smart pigs developed for pipelines that have pig valves in place is a great asset to any pipeline Operator that is looking to inspect their gathering pipeline network. The ease of deployment and the ability to get inspection data on pipelines that have previously been un-inspectable increases the overall integrity of the pipeline network by the collection of more inspection data but this can be carried out at a cost far lower than conventional ILI technology and with far less disruption to operations and the environment. I2i now have field proven pig valve ILI tools for 3inch pipeline and up. ●

3X Engineering restores aerial pipeline

The objective of the job, carried out in June 2019 in Austria, was to restore the pipe integrity of a 12” gas line suffering from external corrosion at weld connection. The access to the defect was complicated due to the height of the line. The aerial line is situated on a bridge crossing the Danube river. The complicated pipe location required Rope Access Work.

Each repair is designed specifically according to the characteristics of the pipe, the operating conditions and the size of the defect. According to ISO 24.817 standard and **3X ENGINEERING (3X)** repair calculations, 4 layers of REINFORCEKiT® 4D-EC were determined to reinforce the straight line.

Before starting the reinforcement, the coating was removed each side of the weld to have enough length for composite application. Surface preparation was then completed using Bristle Blaster® machine to get a good surface state and surface profile. Finally, the whole prepared surface was cleaned with acetone and roughness test and hygrometric measures were performed to ensure that all the conditions were satisfying before composite application.

The composite repair was then performed following several steps:

- 1/ F3X8 filler application on weld and defect to reshape the pipe.
- 2/ R3X1060 resin application on the whole surface to protect it from corrosion.
- 3/ Wrapping process using Kevlar® tape impregnated with R3X1060 resin → 4 layers completed for a total repair length of 400mm.
- 4/ Finalization of the repair. R3X1060 resin application over the repair to ensure good wetting of the fibers and good visual aspect and identification plate application for traceability purpose.

Hardness measurements on resin and filler samples were performed 10 days after job completion to check

the good curing and validate the repair. The project was effectively planned and executed by 3X specialists. This job demonstrated the capacity and adaptability of 3X technicians to work on specific conditions such as aerial work with rope access. This composite repair will extend the lifetime of the pipe while awaiting its replacement (design lifetime: one year, as per client requirement).



F3X8 filler application ●

15th Pipeline Technology Conference

The Pipeline Technology Conference (ptc), will take place for the 15th time from 30 March - 2 April 2020. ptc brings together pipeline operators and technology and service providers from all over the world to engage in a fruitful exchange about the latest challenges to the industry. Almost 80 different pipeline operators sent delegation to Berlin for ptc 2019.

More than 900 participants and 90 exhibitors are expected to participate in the 15th ptc in Berlin. The conference will feature lectures and presentations on all aspects surrounding oil, gas, water and product pipeline systems.

In addition to the traditional focus on pipeline safety, questions about the future of the industry will again be discussed in the coming year: Public perception, promotion of young talent, hydrogen / future fuels. The core of the next ptc will again be the 25 technical sessions with more than 80 speakers reviewed by the members of the ptc advisory committee. In addition to all these program items, the 15th Pipeline Technology Conferences offers several seminars, workshops, round table talks and social events. For more information please visit: www.pipeline-conference.com



Pipeline Technology Conference in Berlin ●

Young Pipeline Professionals Europe announces steering committee

Young Pipeline Professionals Europe (YPPE) are thrilled to announce the creation of their Steering Committee, comprising experienced individuals from the European pipeline industry. Each has shown they are committed to ensuring the development of young talent and closing the generational skills gap. The Steering Committee provides a mentorship function to guide the group in their quest to broaden the knowledge of their members.

Accepting invitations to join the YPPE Steering Committee are:

- Michelle Unger (Rosen, founder of YPP Europe)
- Cindy Dirx (Dirx Pipeline Management & Strategy, Chair of Pipeliner Foundation)
- Marion Erdelen-Peppler (Saltgitter Mannesmann Forschung, Chair of EPRG)
- Phil Hopkins (Phil Hopkins Ltd)
- David Willis (Rockrose Energy, representing PLUG)
- Iain Shepherd (Halliburton, former PPSA President)
- David Cockfield (Pipeline Innovations Ltd) ●

TDW Multiple Dataset Inspection Technology earns coveted TÜV SÜD Certification

T.D. Williamson (TDW) has received TÜV SÜD certification for its Multiple Dataset (MDS) platform, which combines several in-line inspection (ILI) technologies on a single device.

TÜV SÜD is an internationally recognized independent third-party validation organization with expertise in European Union (EU) requirements and expectations. Third-party endorsement of ILI systems is particularly important for pipeline operators in the EU market, who rely on it for independent verification of quality.

Specifically, the MDS platform is certified to VdTÜV Code 1069: Guideline for the qualification of in-line inspection tools.

According to Robert Mueller, TÜV SÜD Pipeline Application Certification Inspector, the significance of this achievement is to prove that under the objective and independent aspects of the VdTÜV Code 1069, the ILI tool is capable of fulfilling the specifications of the ILI tool vendor and is suitable for the intended purpose.

Certification covers the entire MDS fleet, from 6-inch to 30-inch.

The TÜV-certified MDS platform combines deformation (DEF), magnetic flux leakage (MFL), SpirALL® MFL, low field MFL (LFM) and mapping (XYZ) technologies on a single inspection vehicle. It can perform a complete inspection of the pipe body and long seam in one pass, detecting:

- Metal loss
- Metal gain
- Planar/crack-like anomalies (seam or pipe body)
- Dents with and without metal loss
- Mechanical damage
- Pipeline routing
- Bending strain

TDW Senior Product Manager—Advanced Inspection Technology Matt Romney said the MDS completed a rigorous, multiphase certification audit. In addition to an extensive document, process and procedures review, TÜV SÜD conducted an onsite audit and in-depth assessment of the resultant data. The audit also took into consideration the requirements of the 2016 version of the Pipeline Operators Forum: Specification and requirements for in-line inspection of pipelines. ●

ROSEN awarded Pipeline Industries Guild 2019 Award

ROSEN was awarded the **Pipeline Industries Guild 2019 Prestigious Technology Award** for its groundbreaking new Pipeline DNA and Pipe Grade Determination service. The new service brings together unique internal inspection technology for identifying pipe strength with expertise in specialist materials, to produce data that provides a complete picture of the pipeline. The award ceremony, hosted by the Pipelines Industries Guild, was held in the Hilton Deansgate hotel in Manchester on June 27, 2019.

The Pipeline DNA process using ROSEN's RoMat PGS data integrated with other information and applying the right expertise can help operators replace lost records, fully understand pipeline materials (the pipeline 'DNA'), identify rogue pipes from construction or repair and confirm the Maximum Allowable Operating Pressure (MAOP). Thus ensuring safety, compliance and performance.



ROSEN awarded Pipeline Industries Guild 2019 Award ●