PIGGING PRODUCTS & SERVICES ASSOCIATION

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Pigging Industry News

the newsletter of the Pigging Products & Services Association

THE PRESIDENT'S LETTER

By Chuck Harris, T.D.Williamson, USA

Happy New Year! 2017 was a great year for the PPSA. We were involved in many industry events, rolled out our new website, engaged with the next generation of industry leaders, held another excellent seminar in Aberdeen, and developed training materials, among other things. These successes could not be accomplished without you, our members. I know I speak for the Board when I say thank you for all you do to advance PPSA's role in the industry by promoting the knowledge of pigging and its related solutions.

Our Operational Pipeline Pigging Seminar was November 7th and 8th in Aberdeen. Sessions included two excellent tutorials and ten papers that are currently available for download at https://ppsa-online.com/papers.php. If you have not participated in this event previously, I encourage you to attend in 2018.

The Pipeline Pigging and Integrity Management (PPIM) Conference is just around the corner, and PPSA will once again have a major presence. Our annual golf tournament will be held at the Black-Horse Golf Club in Cypress, Texas, on Monday January 29th. For information on this course visit: https://www.blackhorsegolfclub.com/. If you would like to enter a team, join a team, or provide a sponsorship, please contact Diane for details on how to get involved at diane@ppsa-online.com.

The Annual General Meeting (AGM) will take place at 3 p.m. in the Marriott Marquis Hotel in Houston, Texas, on Tuesday January 30th. This is a great opportunity to get updates on Association activities and help guide our future. We will also be electing new Directors for Eastern Hemisphere. The AGM will be followed by the opening of PPIM, with a reception and exhibition from 5:00 p.m. at the George R. Brown Convention Center. PPSA will be in booth 716. We will have the newly developed pig launcher and receiver simulators on display. Please drop by and see us!

My last responsibility as President will be the AGM, although I will remain on the Board as Director. As such, this will also be my last President's Letter. It has been a pleasure serving the Association and I thank you all for the opportunity. Finally, I would like to congratulate Michael Rapp, our incoming President, who will take over following the AGM.

NEW Members

Full Member

4Pipe Engenharia Industrial LTDA, Brazil

Subsea Technology & Rentals Ltd, UK

Propipe Ltd, UK

Individual

Satya Narayana Nelanti, India

Dennis Fandrich, Germany

Many thanks to all our golf tournament sponsors:

The PPSA golf tournament is taking place at the BlackHorse Golf Club, Houston, USA on Monday 29th January 2018.

Sponsorship opportunities and player places are still available. Everyone is welcome to take part (teams and individuals). Come and join the fun.

For details please visit : http://ppsa-online.com/golf.php.

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The longest ever gas pipeline run in North America

One of the leading energy infrastructure companies in North America needed to inspect a substantial length of gas pipeline, stretching from near Winnipeg, Manitoba to where Saskatchewan borders Alberta. BHGE had the solution.

Challenge
The customer was concerned with the cost, time and risk to facilitate an inspection with an inline inspection tool. The 941 km pipeline stretched across prairie lands, as well as portions of densely populated Winnipeg. Diverting the pipeline contents for the extended outage that would be required to construct and fit additional launchers and receivers was a complication the customer would rather avoid. Consequently, they preferred that the inspection be done in one pass with as little commercial disruption as possible and that the data be comprehensive so as to assess the integrity of the line.

Solution
BHGE came to the table with multiple scenarios that met the customer's requirements and offered them contingency options, giving them significant confidence in BHGE's abilities to assess the pipeline's cleanliness and safely navigate the 941 km line. Ultimately, the customer chose a single run, saving millions of dollars over the life cycle of the asset, as well as reducing pipeline footprint in the Canadian prairies.

Because of its superior defect characterization, industry leading specification, and the customer's experience and confidence in the technology, BHGE used the VECTRA™ HD GEMINI for the inspection run. The VECTRA HD GEMINI has the tightest tri-axial sensor spacing in the industry, giving a more accurate look at potentially complex anomalies within pipelines, as well as providing high resolution metal loss data.

BHGE first tested the line's ability to accept the VECTRA HD GEMINI with a specially designed gauge tool which featured the identical suspension as the GEMINI tool. Once the gauge tool successfully traversed the line with minimum wear and tear, a debris assessment tool was run to quantify any debris that may be in the line. Subsequently two cleaning runs were performed with heavy duty magnetic scraper tools to ensure successful passage of the VECTRA HD GEMINI I tool.

Results
The run took a little over 3 1/2 days from launcher to receiver and the inspection tool was tracked along the buried pipeline by the customer using a low frequency transmitter on the tool that communicates with above ground tracking boxes that are linked to GPS. Disruption and diversion to gas flow was kept at a minimum.

An industry first.
"We are grateful to be able to leverage BHGE's technical expertise and a trusted and deep-rooted relationship to advance our capabilities to inspect our pipelines. This monumental project was an industry first and will substantially advance our ability to keep communities safe and reduce costs and service disruptions for **TransCanada** and our customers." Bryce Lord - Vice President of Canadian Gas Operations, TransCanada.

The pipeline stretched across Canadian Prairie Lands

CPPI inspects pipeline using its new 28-inch Circumferential MFL Tool

The 28-inch circumferential excitation MFL (CMFL) tool developed by **China Petroleum Pipeline Inspection Technologies Co., Ltd.** (CPPI) had a successful run in the Harbin Gas Pipeline "Dongguan-Pingfang" segment of Daqing Oilfield Natural Gas Branch. The inspection was carried out in a 28-inch, 23.4 Km pipeline with the wall thickness of 7.1mm and operated under 2.17 Mpa pressure. The flow rate of this segment was 8×10^4 m^3/h.

The circumferential MFL (CMFL) tool is at the trapping site

Furthermore, a tri-axial MFL inspection tool based on axial excitation of the axial magnetic field distribution (MFL) was used for verification and comparison in the same segment.

Two special defects were selected for excavation and verification. The first defect is not found in the tri-axial data signal but is obviously appeared in the data signal of the circumferential excitation tool. It is an external axial feature with metal loss depth of 8%t via the judgement of data analysts.

The left side shows the MFL data and the right the CMFL data

Through field excavation and verification, this defect was found to be an external axial defect with long and narrow feature whose depth is 0.59 mm (as shown below), where the normal wall thickness of the pipeline is 7.1 mm. The result is strongly consistent with the data analysis.

Field measurement of the first defect

The second defect appears as an independent metal loss in the tri-axial data signal but presents as two separate metal losses in the circumferential data signal.

The left side shows the MFL data and the right the CMFL data

This defect was analyzed as an internal metal loss so the measurement was made using nondestructive testing tools. The results of X-ray and A-scan demonstrate that there are two separate internal metal losses.

The results of A-scan and X-ray

The result of excavation and verification concludes that only use singular technology of MFL to carry out pipeline inspection is insufficient, due to the limitation of one direction magnetic flux leakage technology. No matter what kind of magnetic field distribution, the defect can only be detected when it cuts magnetic field lines so the MFL and CMFL inspection technologies should complement each other in order to get a more accurate assessment for the inspected pipeline.

Improved eddy current technology for inline inspection of heavy wall gas pipelines

Dr. Kathrin Schroeer, ROSEN Germany GmbH

Pipelines containing heavy wall thicknesses—predominantly offshore pipelines— can face a primary threat of internal corrosion. Performing a standard MFL inspection on such lines is challenging, and sometimes even impossible, due to internal diameter (ID) restrictions, extreme wall thickness, multi-diameter pipeline setup, the requirement to clearly discriminate between adjacent features, etc. In addition, general pipeline thinning cannot be accurately sized with standard MFL-A tools alone. A viable option would be the use of ultrasonic testing (UT) technology. However, as UT requires a liquid medium, it is not a desirable solution for use in gas pipelines.

In order to overcome the limitations of the previously mentioned inline inspection (ILI) technologies, ROSEN has developed the RoCorr IEC Service, which utilizes Eddy Current (EC) technology. This service can additionally be combined with any other desired sensor technology, including MFL, to further increase the reliability of subsequent integrity assessments.

Tool description

"Following a well-proven high-resolution caliper tool design[1], the internal eddy current (IEC) sensor carriers are mounted on an ILI tool by spring-loaded arms for smooth guidance along the pipe's inner surface. The EC measurement method is essentially contactless. Mechanical displacements of the sensors in radial direction due to geometry changes of the line are additionally monitored by angle measurements of the individual suspension arms"[2]. Thanks to the use of two sensor planes, 100% coverage is guaranteed. An ILI tool that combines both IEC and MFL technologies is shown in Figure 1. The front unit consists of high-resolution MFL technology, the second unit utilizes a combination of high-resolution geometry sensors and IEC probes.

Tool performance

The IEC standalone tool always delivers an internal metal-loss and geometry evaluation with 100% coverage in one run. The metal-loss features are measured in absolute terms, which enables the tool to function regardless of the wall thickness. Pits with diameters of at least 10 mm and minimum depths of 1.0 mm can be detected. Internal shallow defects with a maximum depth of 10 mm are sized with high accuracy, i.e. +/- 1.3mm.

The tools are also very flexible (up to 80% ID passage) and create less friction than the MFL tools with magnetic yokes. Due to the touchless measurement, a coupling to the wall is not necessary, allowing for accurate measurements regardless of the medium

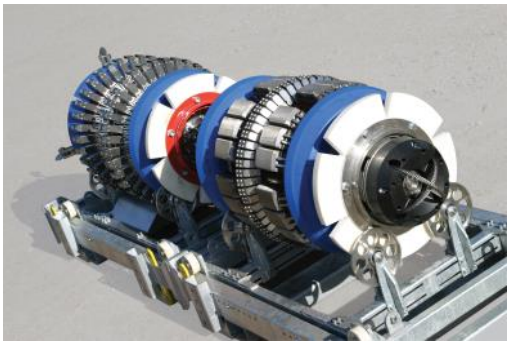


Figure 1: The combined-technology setup ensures that all internal and external corrosion, as well as geometry anomalies, can be accurately measured.

present in the pipeline. The RoCorr IEC Service is capable of coping with all pipeline diameters between 6" and 56", as well as multi-diameter pipelines.

Combination of IEC and standard MFL

Although the abilities of IEC depth sizing of shallow internal corrosion substantially exceed that of MFL, the combination of both technologies provides significant benefits, including:

- Absolute measurement and depth sizing of metal-loss defects
- Improved distinction of individual pits in dense clusters
- Determination of wall thickness / general thinning

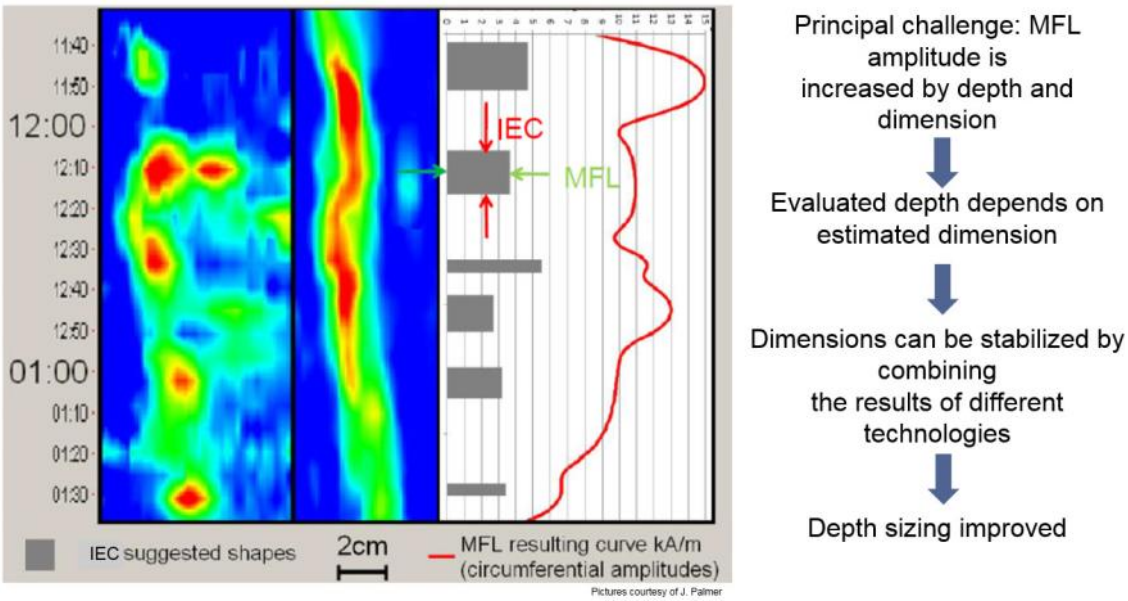


Figure 2: By combining IEC and standard MFL-A technology, the absolute measurement and depth sizing of metal-loss defects is possible.

IEC supplements the relative wall-loss measurements of the MFL technology by supporting defect identification and depth sizing thanks to its higher spatial resolution. Figure 2 provides an example of the advantages of combining IEC with standard MFL-A technology.

In addition, general pipeline thinning can be accurately measured by combining the caliper component of the IEC, which would reveal a general impression of the thinning, with the MFL component, which would measure the smaller indications within the general thinning area.

Recent improvements and customer benefits

Over the past eight years, ROSEN has been applying IEC technology in the inline inspections of more than 15,000 km (10,000 miles) of pipeline. The experience gained over the years has allowed for further optimization of the technology.

As a result of these IEC improvements, ROSEN's experts are now able to

- qualitatively discriminate between different materials within a pipeline, enabling operators to monitor the condition of internal coatings;
- clearly identify and discriminate ferromagnetic debris from corrosion; and
- assess pipelines with corrosion resistant alloys (CRA), i.e. identify defects within the stainless steel layer which is not possible when using stand-alone MFL technology.

In summary, the IEC technology offers several benefits:

- High accuracy in the absolute measurement of internal corrosion in both liquid and gas pipelines
- Applicable in pipelines with high wall thickness
- Suitable for pipelines with ID restrictions
- Dataset collected also includes pipe geometry information, allowing for dent strain/stress calculations
- Detection of general pipe wall thinning
- Inspection of pipelines with CRA cladding or internal flow coatings
- Combination of IEC with MFL-A allows for the assessment of internal/external corrosion and geometry features in a single ILI run.

1 In-Line Inspection of Dents and Corrosion using "High Quality" Multi-Purpose Smart-Pig Inspection Data. Beuker, T., Brown, B. and Paeper, S. 2006. International Pipeline Conference.
2 Shallow Internal Corrosion Sensor Technology for Heavy Pipe Wall Inspection. Stawicki, O., Ahlbrink, R., Schroeer. K. 2009. PPSA Conference.

New generation in-line geometry inspection

Continuous improvement of technologies is what most accurately characterizes all spheres of modern production, including in-line inspection (ILI). Designers of inspection equipment are focusing on the constant search for solutions to improve the performance of inspection tools, and they have achieved some success in this field.

In December 2017 the Russian company **Transneft Diascan, JSC** (a subsidiary of the largest oil pipeline company in the world **Transneft, PJSC**) has commissioned a multi-channel geometry tool of the new generation. This type of inspection equipment is designed to measure the internal flow section and the pipeline bend radius of various diameters. It allows detection of defects such as dents, ovalities, buckles, as well as determining radii, directions of bends and pipeline bend angles. The tool operates on the electromechanical principle of measuring the deflection angles of arms that are in direct contact with the inner wall of the pipe. To determine the spatial position of the pipelines, the in-line inspection tool is equipped with a high-precision strap down inertial navigation system.

Standard Performance Characteristics:

Tool's diameters	6" ÷ 48"
Product in the pipeline	Liquid, gas
Temperature Range	-15ºC ÷ +60ºC
Max. operating pressure	14 megapascals
Operating speed range	Up to 6,0 m/sec
Min. bend radius	1,5D
Min. flow passage	0,75 overall opening diameter
Max. length of inspected area	350 kilometers

The commissioned geometry tool 40-PRN.02-00.000 is part of a new generation of high-resolution multi-channel geometry tools equipped with a navigation system. It has a significantly increased number of measuring levers in comparison with previous generations of these tools. Unlike previous versions that were equipped with polyurethane cups in the basic version, the new tool has a system of rigid supporting wheels and disks. This enables to enhance centering of the tool in motion, which brings its accuracy of measuring the bend radius of the pipe and the coordinates closer to a specialized flaw detector determining the position of the pipeline. This technical solution also may be used for gas pipelines inspection.

The resolution of geometry tool is 2.5 times higher and brings interpretation of the inspection data to a new level compared to the results of the previous generations of geometry tools. Its design features, such as vents of small diameter, are clearly identifiable among the mass of welded attachments. Due to the fact that the measurement error of geometry defect's width decreased more than twice, it has become easier to classify the defect scale.

In addition to an increase in the number of measuring levers, the construction of the tool was redesigned. The weight of levers was reduced and polyurethane parts were replaced by hard-alloy ones. This will not only prolong the operational life of the tool, but reduce the lever arm effect while the geometry tool moves at a high speed that is typical for gas pipelines.

The range of the ILI tools equipped with navigation system and operated by Transneft Diascan, JSC amounted to 29 multi-channel geometry tools and flaw detectors able to determine the position of the pipeline. The navigation features of these ILI tools even exceed the performance characteristics of foreign analogues. A short time ago, navigation was an exclusive supplement to in-line inspection. Nowadays it is an integral part of the whole complex of works aimed at ensuring reliability of pipelines operation.

Transneft Diascan, JSC 's inline geometry inspection tool

Large diameter solid cast utility pigs: a comparison on different applications

This paper presents a case study by **4Pipe Engenharia Industrial** LTDA about two different pipelines in Brazil, that use the same model of utility pig but for different applications. To support this study, the paper will take an overlook through the operation conditions of each pipeline, the expected benefits of running this type of pig and what are the differences applied for each case in terms of technology and manufacturing.

Besides the variations in diameter and length, which would be merely dimensional adaptations, there are also variations related to: assembly configuration: discs and/or cups, type of polyurethane, hardness, performance additives and extra accessories.

Faced with all these possible combinations, the operator or manufacturer of pigs, when recommending a model, must know what is desired with this run and what are the limitations of the pipe.

The first operation was routine cleaning of an offshore oil pipeline operated by Petrobras in Campos Basin, located in the city of Macaé, Rio de Janeiro. It is a rigid submarine pipe, with nominal diameter of 22", which is 83.6km long. Client expectations while running a flex-pig in this line were:

- Energy saving - reduction of pressure drop in pipelines;
- Operational continuity - avoid the accumulation of deposits to mitigate corrosion and avoid the evolution of the corrosive process;
- Increase in pipeline life;
- Preservation of the environment - avoid leaks;
- Collecting samples for fluid analysis;

In general, the use of the solid cast model is recommended in its functions of cleaning, control of paraffin wax buildup and sweep debris along the almost 84 kilometers of pipe length.

To achieve the expected objective, the flex-pig was manufactured with a polyurethane of high hardness (approximately 85 shore A) to increase the scraping effect of its multiple discs against the wall, achieving a better cleaning performance. Also, two brushes with steel wire were assembled between the discs of the pig to promote higher aggressiveness in cleaning.

The second operation was batching in a 22inch, 97.3km onshore pipeline in Southern Brazil, responsible for transporting crude oil from a terminal to a refinery. During the operational stoppage in June 2016, the pipeline was requested to carry diesel. For this operation, it was necessary to use a model of pig that had excellent sealing capabilities and good resistance to abrasion due to long extension of the pipeline and the interface with diesel (more abrasive product when compared to crude oil).

The 22inch flex-pig used for batching was manufactured with a low hardness polyurethane (approximately 70 shore A) to maintain flexibility in the discs and cup and also greater durability of the polyurethane due to the smoother friction effort on the inner wall of the pipe. In addition, the formulation of the polyurethane counted on the use of anti-abrasive additive to avoid an accelerated wear of the polyurethane in the first kilometers of the run. This was essential for the pig not to lose its oversize, and thus, its ability to seal and separate the products.

The solid cast pig has a hollow core, allowing the pressure to expand the pig body, further pressing the discs and cups against the wall of the pipeline. This guarantees an excellent seal, which in this case was of utmost importance to provide an interface between two dissimilar products within the pipeline.

NDT Global announces Atlas UG service extension

NDT Global have announced the forthcoming upgrade of their Atlas UG service, in line with the recently presented Pipeline Research Council International's Dent Fatigue Life Assessment methodology.

This approach offers less conservative assessments, not only using the depth and length of the dent, but the actual shape of the dent giving pipeline operators resulting parameters for dent prioritization and dent fatigue life assessment.

NDT Global COO Andy Bain commented, "At NDT Global we are always looking for new ways to ensure we are delivering pipeline operators a complete data set. By introducing this new methodology, we can now assist our customers with ongoing pipeline integrity management, identifying the true risk of a feature and enabling the correct prioritization of maintenance."

This service extension is a great fit to the Atlas UG inspection, currently delivering accurate and reliable ultrasonic ILI data by combining a corrosion or crack assessment with an ultrasonic based geometry measurement. Using ultrasonic technology ensures precise, direct measurement of dents with depth resolution down to 0.1 mm (0.004 in). System upgrades will be available for all customers during Q1 2018.

3X Engineering reinforces reboiler

In August 2017 **3X ENGINEERING** (3X) and its local distributor **PETROENERTECH** performed a repair to reinforce a reboiler located on FPSO suffering from external corrosion. After analysis of the corrosion extent, calculations according to ISO 24.817 were performed, concluding that 4 layers were needed to reinforce the reboiler. Because of the specific reboiler design, it was decided to use REINFORCEKiT® PATCH product, specially designed for tank & vessel repair è i.e. 4 Kevlar®patches size 1032x1032mm for this case.

Surface preparation was completed, using Bristle Blaster machine, to remove coating and get a good surface roughness (between 60 µm and 100 µm anchor profile) to ensure a good bonding between the steel and the composite. Before composite patching, dew point, moisture and surface temperature were checked and the surface was cleaned and degreased.

Composite repair was performed as follows:

- F3XS1 filler was applied on the patch area (previously delimited) to fill metal loss and reshape the tank side.
- The surface was then covered with 3X specific epoxy resin (R3X1660) to ensure good wetting and impregnation of the Kevlar® tape.
- First Kevlar® patch was applied on the wet surface using paintbrush and making sure to remove all air bubbles. The Kevlar® patch was then impregnated with R3X1660 resin to create the wet surface for the next patch. This step was repeated until 4 layers/patches was reached.
- Final layer of epoxy resin was applied over the repair for protection.

Thanks to the efficient collaboration between 3X and its local distributor the corroded area of the reboiler was successfully repaired. The reboiler integrity is now restored.

F3XS1 filler application on patch area

STATS Group-plugging under pressure

STATS Group was contracted by a multinational oil and gas operator in Qatar to provide the isolation of a 120 km, 24" gas export pipeline operating at a pressure of 45 bar. STATS used a DNV-GL type approved Remote Tecno Plug to provide a fully monitored leak-tight isolation, which facilitated the safe replacement of an emergency shutdown valve.

Once the new valve was welded in position, a 52 bar reinstatement leak-test against the rear of the isolation plug was carried out to confirm the valve integrity. To provide an isolation and reinstatement test, the Remote Tecno Plug was configured in a four-module arrangement, which included an isolation module, two remote control modules and a leak-test module.

STATS has designed and incorporated a dedicated test plug for this purpose which ensures that any failure of the test and subsequent remediation action would not jeopardise the integrity of the isolation plug. The test plug is designed to not be self-energised by the test pressure, therefore it is capable of full code pressure tests without over-stressing the pipeline at the lock and seal location.

Using a separate leak-test module allowed the isolation plug to remain fully operational during the test and ensured a differential pressure was maintained across the isolation plug. This fail-safe design uses the differential pressure acting on the isolation plug to energise the locks and seals - referred to as self-energisation. When the isolation plug is self-energised the isolation is maintained independent of the control system; however, it is backed up by the hydraulic control system which maintains the isolation should the differential pressure drop below the self-energisation threshold.

Once offshore, a team of isolation technicians successfully deployed the Remote Tecno Plug and pigged it to the set location with Nitrogen. The isolation plug travelled 50 meters through three valves and around three 3D bends to the set location and accurately positioned using through-wall communication. Communication is achieved using an extremely low frequency (ELF) radio control system which sets and monitors the plug throughout the isolation.

When it reached the correct location, the isolation plug was hydraulically set to activate the locks and dual seals. The dual seals of the plug were then independently tested with full pipeline pressure in the correct direction to confirm leak-tight isolation. This allowed the pipeline to be bled down to ambient from the platform launcher to the rear of the plug. The annulus between the seals was then vented to ambient to create a zero-energy zone, and was then subject to a 12-hour isolation stability hold period before the 'Isolation Certificate' was issued.

With the double block and bleed isolation verified, the valve replacement workscope was safely conducted. The isolation plug was constantly monitored and remained stable for the full ten-day isolation period.

Once the valve replacement activities were successfully completed, the test plug was set using a second control module and a test boundary was created to perform a reinstatement leak-test of the new valve. This was achieved by raising the pipeline pressure on the launcher side against the seal on the test plug, creating a test boundary to confirm the integrity of the newly installed valve. Finally, the test plug was unset and the pipeline pressure was equalised, allowing the isolation plug to be unset and reverse-pigged back to the launcher for demobilisation.

STATS Group's tecno plug recovery

An isolation first for safe valve replacement

T.D. Williamson Combines Multiple Non-Intrusive Intervention Technologies, including First-Ever Use of SmartPlug ® Tool with Hot Tapping On-Shore in the Lower 48 States.

Liquids management is an ongoing challenge for natural gas operators in the Eagle Ford shale play. Pigging to displace pipeline liquids is essential to maintaining throughput, minimizing the potential for corrosion, and providing access to valuable condensates.

When leaking valves on both the launcher and receiver jeopardized pigging operations on two, 24-inch, 100 km (62 mi) natural gas pipelines located approximately 150 m (492 ft.) apart, the operator needed to intervene before the seals failed and it was no longer safe to open or close the trap doors.

Before the valves could be replaced, however, the operator needed to isolate the pipelines and connect them to a bypass system that would allow service to continue to three downstream gas plants.

After evaluating a variety of methods used to isolate pipelines during repairs and maintenance, the operator chose a non-intrusive isolation combined with a hot tap and bypass solution, provided by global pipeline solutions provider **T.D. Williamson (TDW).**

Rather than resorting to blow-down – which would have been expensive and time-consuming, especially considering the 75 bar (1100 psi) of natural gas inside the pipelines – TDW provided an alternative solution that combined hot tapping and its 24-inch SmartPlug® non-intrusive isolation system for pressurized pipelines. This was the first time the two technologies had been used together onshore in the lower 48 states. It was also the first time that TDW pigged a SmartPlug in and out of an autolauncher; although the autolauncher is designed to pig intelligent tools, it had been primarily used to allow multiple urethane pigs to be loaded at one time and released at predetermined intervals for the liquids management program.

Because the SmartPlug tool has bi-directional capabilities, it was used to isolate both the launcher and receiver sides. TDW also employed its proprietary SmartTrack™ communication equipment to track and monitor the SmartPlug tool during the pigging and pipeline isolation processes. In addition, TDW installed fittings to enable a permanent bypass between the two pipelines and a connection to a third 16-inch pipeline from the metering station.

“The two valves that were replaced were significantly leaking to the point that additional mitigations (valve sealant, air mover, venting) were required to insert the SmartPlug into the launcher and receiver,” Project Engineer Patrick Moran said.

“The innovative combination of TDW products and services enabled the client to avoid costly alternatives, such as blowing down the system, and to keep downstream customers online, without production delays,” Moran added.

Top honors for TDW’s MDS platform

TDW received the prestigious Global Pipeline Award, presented by the **American Society of Mechanical Engineers (ASME)** at Rio Pipeline 2017, Rio de Janeiro, Brazil. The annual award recognizes pipeline innovation and the value a company’s contributions bring to the pipeline industry.

ASME honored TDW for its ground-breaking Mechanical Damage Prioritization via the Multiple Dataset (MDS) Platform. The MDS platform is unsurpassed in its ability to detect, characterize, size, and prioritize interacting threats to pipeline integrity, such as mechanical damage. By integrating multiple inline inspection (ILI) technologies on a single platform and synchronizing the data they gather, MDS provides comprehensive information about features previously undetected by other ILI tools.

James Simek and the TDW Engineering team innovated and led development of the MDS Platform. As a participant in the design and data analysis of several generations of MFL tools, Simek had observed the strengths and weaknesses of each individual tool design and accompanying data sets. “Several incidents and subsequent regulatory initiatives focused on mechanical damage highlighted the need for an improved ILI process,” Simek said. “Existing ILI tools were generally capable of reporting some aspects of damage; however, limitations of tool designs and data sets limited prioritization.”

FlexIQ— flexible riser inspection and integrity assessment in Nigeria

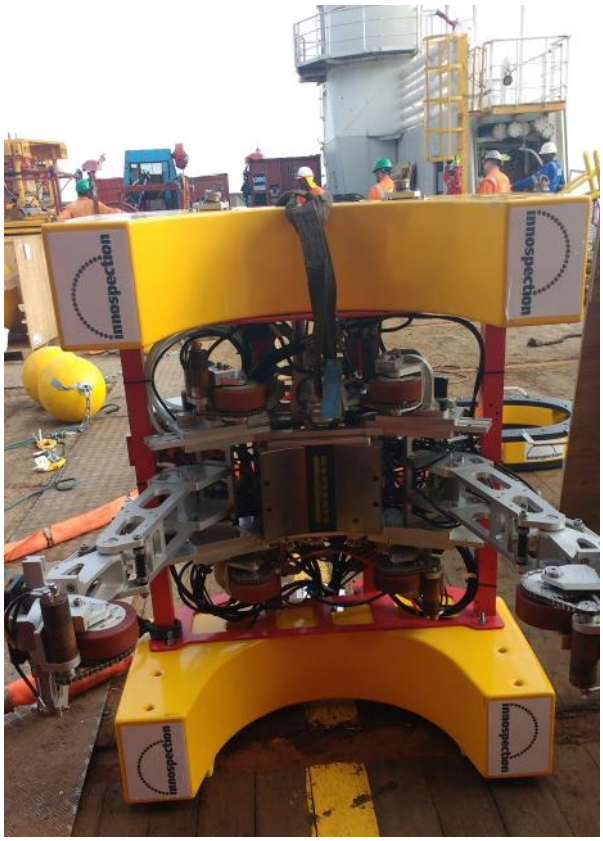
The FlexIQ team of **Innospection** and **INTECSEA** has been contracted by a major offshore operator to perform advanced inspection and analysis of dynamic flexible risers. Delivered through our Nigerian partner FADFAE Engineering Services, this project combines the advanced inspection capability of Innospection with the advanced analysis capability of INTECSEA.

Located in a production field offshore Nigeria, the flexible offloading risers connect the FPSO to the single point mooring (SPM) tanker loading system for oil offloading. Each riser section consists of many rough-bore unbonded flexible pipes with 18.75" inner diameter and 16.85mm thick coating. Installed in a continuous wave configuration, each line of the 2,240m long flexible pipes has a different amount of buoyancy to avoid interference between adjacent lines.

Innospection successfully completed ahead of schedule the simultaneous cleaning and inspection of approx. 2,600m of cumulative total riser length over four riser sections utilising the MEC-Hug Crawler tool with an integrated advanced cleaning system. On one of the dives, the tool was in operation continually for approx. 26 hours. As an inspection solution provider, Innospection has also designed and delivered a customised mechanical tool to address a riser clashing issue and spread the lines apart to enable inspection.

The inspection was performed with the technically advanced electromagnetic MEC-FIT™ technique. MEC-FIT™ not only enables rapid external scanning with the ability to penetrate into the various armour layers of the flexible risers, it is also capable of detecting single or multiple wire cracks and corrosion in the 1st and 2nd tensile armour layers and to some extent, damage and interlocking failures in the 3rd pressure armour layer. No annulus flooding is required for the inspection of the tensile armour wires, unlike for Ultrasonic techniques.

With the inspection complete, INTECSEA is conducting an integrity assessment using its state of the art simulation tool, FLEXAS™, to analyse fatigue loading on the tensile armour wires. The FLEXAS™ solver overcomes computational limitations of traditional solutions and allows dynamic riser simulation with detailed, multi-layered finite element models. This solution incorporates historical operating information and the latest inspection data from the MEC-Hug Crawler tool. FLEXAS™ enables detailed inspection data obtained from the field to be incorporated into high fidelity finite element models and simulated to understand the impact of existing anomalies on the fatigue response of the risers. Detection and incorporation of detailed damage/degradation data into real-world simulations of flexible risers to assess fatigue life impact is a capability unique to the FlexIQ team of Innospection and INTECSEA.



The customised MEC-Hug Crawler tool with an integrated cleaning system at the offshore jobsite in Nigeria

Halfwave lands inspection contract for Nord Stream 2

Norwegian inspection company **Halfwave** has been awarded a multi-million euro contract to design and build 48" ART Scan® in-line inspection tools for Nord Stream 2. The ART Scan® tools will be used to inspect the 48" twin gas pipelines in the Nord Stream 2 project. The length of each of the twin pipelines will be over 1,200 km, representing a challenge well-suited to Acoustic Resonance Technology (ART). The pipeline wall thickness, long range, and high accuracy capabilities of the ART Scan® tools were key factors for selecting this technology solution for the inspection. The ART Scan® tools will have the capability to inspect an entire pipeline in a single run and provide high resolution inspection results.

"This is one of the largest and most exciting contracts that we have been awarded, and we are pleased that Nord Stream 2 AG has recognized the added value the ART technology provides," said Halfwave CEO Paul Cooper. He believes this contract shows the value that Acoustic Resonance Technology provides and new market opportunities for the technology.

Figure 1 – Nord Stream and Nord Stream 2 pipelines (Photo courtesy from Nord Stream 2)

Inspecting low flow gas gathering lines

The recovery of natural gas is on the increase as it provides a clean form of energy that is attractive to energy companies and consumers alike. In many parts of the world there has been significant investment in the development of NGl refinery's and the gathering network that feed these plants. The east coast of Australia, often known as the gold coast, has for many years been a popular tourist destination. With the beautiful beaches and legendry Australian hospitability. Further inland the Queensland outback has been a great source of natural gas for the local as well as export markets.

Small diameter 4" – 8" gas gathering pipelines that collect and transport the gas from the wells to the collection and initial refining plants that supply the coastal LNG refineries can be challenging to inspect as:

- The majority only have launchers and receivers for utility/cleaning pigs. For conventional inspection tools to be used extra facilities are needed that can lead to greater disruption to operations and extra costs for the project.
- The majority of the lines have low flow, even when combining the flow from a number of wells, making pigging conventional MFL tools difficult.
- Natural gas lines would require the introduction of liquid slugs into the line for UT tools which adds to the level of disruption and cost of the inspection.
- Complex geometry in the form of tight bend radius can be difficult for multi module tools.
- The low flow gas is also problematic for MFL technology tools.

I2i Pipelines's electromagnetic Pioneer tools have been successfully carrying out the inspection of these low flow gas lines. The advantages of these simple smart tools can be significant, with up to 6 pipelines being inspected with the same tool in one day the and providing considerable cost saving and value to the pipeline operators. Some of the advantages include.

- There is no requirement to modify or change production flow to run the tools.
- Pioneer tools are single module units that are deployed from conventional short barrel utility launcher / receivers without modifications.
- The Pioneer tools operate in low flow or higher velocities (0.1 – 6 m/s) without loss of data.
- There is no requirement for prior cleaning programs.
- i2i tools can operate in all mediums i.e. gas and multiphase lines.
- The technology is not affected by velocity changes during the inspection run.
- There is no need for pre-deployment calibration of the tool.
- There is no requirement for specialist or i2i personnel to be onsite to run the tools.
- i2i tools use rechargeable batteries
- Ancillary attachments like DDMD and water detection disks can be attached if additional flow assurance data is required.
- Inspection data is analyzed in a short time and serious anomalies sized and reported within 24-48hrs.

Typical 8 inch I2i Pioneer tool after an inspection