PIGGING PRODUCTS & SERVICES ASSOCIATION

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Pigging Industry News

the newsletter of the Pigging Products & Services Association

THE PRESIDENT'S LETTER

By Iain Shepherd, Halliburton, UK

Firstly, I wish you a Happy New Year, welcome our new members who have joined the PPSA and thank our existing members for their continued support. I hope that 2017 will be a good year for all of us; it's encouraging to see some signs of improvement in the Oil & Gas industry which has gone through a significant downturn recently.

2016 was a very busy year for the PPSA, attending more events than ever. Most recently we held the PPSA Commissioning and Operational Pipeline Pigging seminar in Aberdeen, back in November. The event was a success and a great opportunity to network with contacts old and new. Nine very interesting and varied papers were presented at the seminar, along with an exhibition and reception. This year, for the first time, 3 pigging tutorials were run the day before the event. The papers, along with abstracts from the tutorials, are available on the PPSA website http://www.ppsa-online.com. I'd encourage you all to visit the website; personally I use it on a regular basis, particularly the Buyers Guide and Members Directory which provide quick and easy links to our member contact details.

Looking forward, the PPSA annual golf tournament is taking place at the Black Horse golf club in Houston Texas on Monday 27th February. I'd like to pass on thanks to all our sponsors for their support of the event. All players are welcome - teams or individuals. It's a fun event to take clients to, with great team rivalry, beverage carts to visit and food cooked at holes to sample on the way round.

The golf tournament is followed by the PPSA Annual General Meeting on Tuesday 28th at 3pm, at the Pipeline Pigging and Integrity Management (PPIM) event. We are also looking forward to exhibiting at the PPIM exhibition at the George R Brown Convention Center, within the Marriot Marquis Hotel. If you are there, please come and visit us at booth 716.

This is my last President's Letter, although I will remain as a PPSA Director for a further year. I'd like to say thanks for the opportunity to hold this position and welcome Chuck Harris as the new President, following the AGM on the 28th February.

NEW Members

Full

CEPS a.s, Czech Republic

Associate

Excell Battery Corporation USA, USA

Innotech Electronic GmbH, Germany

Many thanks to all our golf tournament sponsors:

The PPSA golf tournament is taking place at the BlackHorse Golf Club on Monday 27th February.

Sponsorship opportunities and player places are still available. Everyone is welcome to take part.

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

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Sub-sea markers detect ILI tools through heavy wall pipe-in-pipe

Project Overview
In April 2015 **3P Services** completed the in-line inspection (ILI) of a rather special 16" x 10km pipeline configuration offshore China. It consisted of two sections looped together (~5km of 16" water injection line and ~5km of 16"/20" pipe-in-pipe oil production line) and inspected in one shot. The pipelines are located on the Zhao Dong Block in the Bohai Bay and are operated by **Dagang Zhaodong Oil Company of PetroChina.**

Since commissioning in 2008 these pipelines had not been cleaned or inspected. 3P Services' task was to deliver high-resolution integrity data for both pipelines regarding metal loss and mechanical features. Special focus was to collect accurate inertial data by means of 3P Services' "XYZ" system to refine the existing base of geographic pipeline data.

The challenges
XYZ data collected on board an ILI vehicle must be aligned to reference locations along the pipeline. Sub-sea markers that detect and record the passage time of the ILI tool are deployed at those reference locations. This allows integration of the data collected by the ILI tool with the geographic references.

The main challenge in this project was to make sure reliable communication between the ILI tool and the sub-sea markers in the pipe-in-pipe section. This was difficult since the signal from the ILI tool had to escape through the 16" product pipe having 25.4mm wall thickness and another 12.7mm of the 20" external casing pipe.

There were other challenges that required special attention. The product pipe in the pipe-in-pipe section was expected to be out of center, possibly to a significant extent. This was to be measured and compensated for in the MFL data analysis.

Solution
From its large inventory of ILI tool components 3P Services assembled, tested and applied customized 16" high resolution GEO and MFL/DMR tools suitable to meet the challenges. Special tool transmitters and subsea markers were purpose designed and manufactured and confirmed performance in heavy wall pipe-in-pipe tests. These were deployed by divers at the reference points every approx. 1km on the pipelines.

Sub-sea marker (top) & high output transmitter carried on board the ILI tool (bottom)

This was effectively a tailored project with a number of unique project specific developments required in all phases: tool preparation, field execution and finally data analysis and reporting.

Conclusion
The inspection delivered high quality and reliable GEO, MFL and DMR data including geographic coordinates over the entire length and circumference of both pipelines. The communication between ILI tool and sub-sea transmitters worked as planned, also in the pipe-in-pipe section. Further, highly accurate vertical profiles of the lines were obtained. Based on 3P Services final inspection report the client has created a detailed maintenance and repair plan.

3P
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STATS Group performs 42” dead leg isolation and abandonment

STATS Group were approached by a national oil company in the middle east which had a requirement to isolate a 42” subsea pipeline dead leg housed within an oil storage tank. The operator had identified some irregular flow characteristics which made them suspect the integrity of this 42” dead leg. The operator was concerned that over time the problem would worsen, with the potential of water contamination of the oil export.

The 42” dead leg is connected to a 96” Pump Plenum housed within the oil storage tank which supplies suction to three topside pumps and the main 36” NB feed transfer line. STATS Group were commissioned to engineer a solution to provide a secure isolation which could be deployed subsea via divers into the 42” dead leg through an open flange entry point. The isolation plug would be required to negotiate two mitre joints and travel up a five-degree incline before reaching its final isolation position 38 metres away, directly ahead of the Plenum weld. A triple seal mechanical isolation plug was chosen and provided the option to remove the plug at a later date if required.

The project presented several challenges. Firstly, as the pipeline was constructed of thin wall pipe, consideration was given to ensure the weight of the isolation plug would not pose a risk of rupturing the pipeline during the deployment process. Additionally, the isolation plug is required to provide leak-tight isolation for at least 25 years so suitability of seal material for long term deployment was essential. STATS also had to ensure that the subsea deployment, setting and testing of the isolation plug could be conducted by divers within a strict 14-day window, allowing the storage tank to remain in a fully operational state throughout the workscope.

STATS proposed the use of a modified Tecno Plug™. These non-intrusive inline isolation tools have an extensive track record of providing pressurised isolation of onshore and subsea pipelines in sizes from 3” to 48” and in a variety of applications. Due to the thin wall pipe of the dead leg a standard Tecno Plug™ would be too heavy to deploy safely on this occasion, therefore, the plug was re-engineered to reduce the overall weight.

As standard, STATS Tecno Plugs™ feature two elastomeric seals, the dual seal configuration providing an annulus void which is pressure tested to verify both seals are leak-tight. However, as a contingency measure a third seal was incorporated into the design, this additional seal provided a facility to fill the seal annulus with grout if additional sealing was required.

Once the Tecno Plug™ was deployed and set at location, each seal was leak tested at 110% of the maximum potential isolation pressure in turn and once the seal integrity was proved the annulus was then vented to ambient to create a zero-energy zone, providing effective double block and bleed isolation. The large section elastomer seals are highly compatible with poor pipe surfaces, particularly corroded pipework, ensuring a leak-tight seal even in ageing assets. Due to the sealing capabilities of the Tecno Plug™ the additional contingency measure of grout filling the seal annulus was not required during the workscope.

As an additional fail-safe feature, a mechanical locking mechanism was incorporated into the plug design. Once the Tecno Plug™ was hydraulically set and following the successful seal integrity tests, the plug was locked in the set position with the aid of a ratchet mechanism, providing a further mechanical lock in place of the hydraulics to permanently set the plug once abandoned in the pipeline.

To allow the Tecno Plug™ to reach the desired isolation location, STATS engineered a hydraulically actuated deployment frame to allow stem bars to be installed in sections, pushing the Tecno Plug™ to location in a controlled manner. Flexible control lines attached to the rear of the Tecno Plug™ provide communication to set the plug, test and monitor the seals.

Once the Tecno Plug™ was at location and successfully set and tested, the stem bar deployment system was attached to a specially adapted blind flange and bolted to the open flange, successfully completing the isolation and abandonment workscope within the tight deadline.

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Prior to the offshore deployment, STATS conducted a client witnessed Factory Acceptance Test at their operational base in Musaffah, Abu Dhabi, which also included two-days of diver familiarisation training on a full-scale replica pipe fixture.

Abandonment tecno plug deployment

NDT Global's custom engineered solution for offshore success

BP required a highly accurate baseline in-line inspection (ILI) for a deepwater flowline and riser system offshore South West of Africa. After a detailed review of requirements for this special project, **NDT Global** engineered a custom Ultrasonic UMp tool configuration which gives a true high-definition picture of the pipeline including any corrosion features, pittings or mid-wall flaws such as laminations or inclusions.

However, during the pipeline cleaning phase, a huge problem occurred: the gauging pig returned showing a reduced minimum diameter, i.e. smaller than tested and qualified during the onshore testing phase. The challenge was now to engineer a solution to run the ILI tool below its current design limit and at the same time keep risks within acceptable levels. The NDT Global engineering group and the operator's flowlines team conceived a plan in record time to "put the pig on a diet", for a safe passage through the smaller inner diameter of the pipeline. The inspection had to be completed during the planned shutdown window to avoid costly production delays.

After 96 hours of re-modeling, design assurance and risk assessments, the modified ILI tool was launched and returned safely to the FPSO. The new flexible tool achieved a First Run Success!

NDT Global has a long track record of offshore projects and understands the key requirements for success. One of these is enabling excellent open communication between the operator and NDT Global's engineering team when critical issues arise.

First run success due to a reliable and flexible tool

NDT Global announces CEO of the Middle East Operating company

In October 2016 **NDT Global** announced the appointment of Andreas Haindl as CEO of the Middle East Operating Company. Mr. Haindl will be based in their Dubai office which services the needs of their customers in both Middle East and India.

Andreas Haindl joined NDT Global in 2012 and was most recently responsible for managing their key account management function in Germany. Prior to joining NDT Global he worked for 10 years in the telecommunications services industry, in senior account and program management roles. Mr. Haindl received his Master in Engineering and Economics from the Karlsruhe University.

"The appointment of Andreas Haindl to lead the operations in the Middle East is an important step in growing our service delivery capability in the region", commented Andy Bain, COO, NDT Global Corporate.

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T. D. Williamson's pipeline isolation holds for 70 days, keeping Tokyo Bay safe

Operating a subsea crude pipeline in the environmentally sensitive Tokyo Bay region of Japan involves unique challenges, including complying with the rigorous safety and marine preservation regulations of the nation's Coast Guard. And those same restrictions can make the complex job of pipeline repair even more daunting.

When a typhoon damaged the elbow joint of a 24-inch subsea crude pipeline located 4 km (2.3 miles) offshore Tokyo Bay in May 2015, the operator acted immediately to mitigate the situation. In addition to clean-up, the operator took the line out of service and made a temporary repair. However, that was just a stop-gap measure: the next step was evaluating how to remove and replace the damaged elbow joint and pipeline end manifold (PLEM) under the Coast Guard's watchful eye.

Because the pipeline connects the loading single buoy mooring to the 40-inch main subsea crude pipeline supplying an onshore refinery, keeping the system in service during the replacement project while ensuring zero spillage in the highly environmentally-controlled waters were priorities.

To achieve those goals, the operator contracted global pipeline solutions provider **T.D. Williamson (TDW)** to create a safe subsea work zone using its proven hot tapping and STOPPLE® isolation system. The STOPPLE system provides a temporary isolation of the damaged section so that repairs and maintenance can be performed effectively even under the most demanding environmental and safety conditions.

Any subsea intervention is demanding, but in this case, there were additional challenges, chiefly the Coast Guard limiting diver access to the work zone to daylight hours and mandating the use of an air diving wand rather than the preferred method of saturation diving. That restriction meant daily set-up and close-out of diving equipment took nearly 90 minutes out of a short, six- or seven-hour work day. Combined with inclement weather, the Coast Guard requirements extended the project to 70 days, about three times the duration of a typical hot tapping and plugging (HT&P) operation.

First subsea application of STOPPLE isolation technology in Japan.

To ensure a safe and efficient isolation without additional delays, prior to deployment TDW prepared and tested the subsea tapping machines and STOPPLE isolation equipment, conducted divers' training, and completed a mock-up to confirm the STOPPLE machine would be completely compatible with the subsea mechanical clamp. According to Project Manager Rakesh Shetty, those steps safeguarded performance and helped the operator avoid cost overruns. "All equipment is specified and tested for each unique STOPPLE isolation," Shetty says. "Because the equipment, the vessel, and the diving teams are all on standby, the isolation has to be flawlessly executed to avoid huge standby charges."

Using the STOPPLE methodology, TDW achieved a successful first-time isolation just 5 meters (16 feet) from the damaged elbow. The isolation remained secure for the entire 70-day project timeframe, allowing the operator to safely complete the replacement with no product loss or interruption of service.

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iNPIPE PRODUCTS™ reveal new logo and website

The new brand identity is part of the company's continuing effort to provide its clients with reliable turnkey solutions based on 30 years experience in the pigging industry. The new sophisticated logo represents iNPIPE PRODUCTS™ progressive and global capabilities of engineering excellence, quality products and reliable on time delivery.

With the client in mind, the new website focuses a lot more on technical content including a range of products videos highlighting benefits and key features. Take a look at www.inpipeproducts.com.

Moving forward it is the intention to develop the case history section to enhance the "go for advice first contact". This will also include product developments such as the 90" pipeline cleaning system and pigs, one of the largest pigging systems ever produced. Proving size is everything.

NDT Global identifies girth weld cracking threats in a CRA cladded pipe

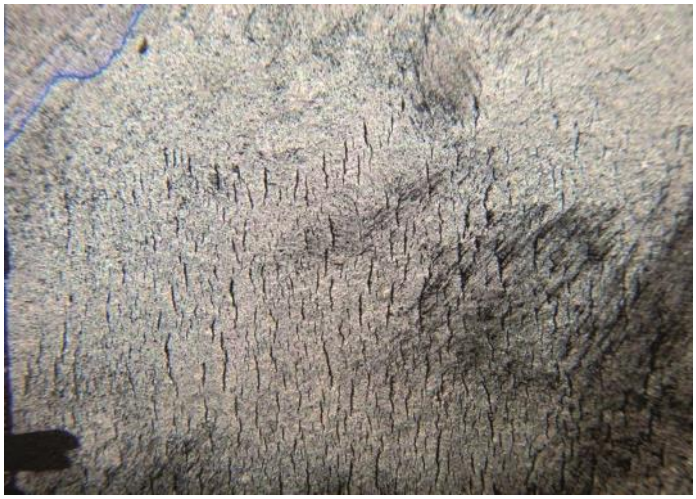
In 2013, a new gas line with internal stainless steel CRA cladding experienced a failure. This 16" pipeline was commissioned early in 2013 and occasionally used. The failure consisted of circumferential cracking in a girth weld at a pipe bend. The investigation team recommended a complete inspection of all weld joints on this 10 km (6 mile) line.

Ultrasonic ILI was the only feasible means to inspect this line, doing so required that a liquid coupling medium be introduced. Due to the importance of the pipeline, a sequence of two inspection runs was selected. The first run was completed using an **NDT Global** ultrasonic circumferential crack (UCc) tool to address the detection of circumferential cracks and crack-like anomalies. The second tool selected was the ultrasonic metal loss with pitting resolution (UMp) tool to detect metal loss anomalies, pitting, laminations and inclusions.

Associated risks were reduced by NDT Global taking full responsibility to prepare and clean the line along with a complete re-establishment procedure. All inspection results were independently verified to be highly accurate.

This gas line is a critical asset, express reports were delivered within 5 days of each run and full reports within the agreed timelines. Express reporting has been instrumental in bringing back the pipeline to normal operation.

Case Study Download: **https://www.ndt-global.com/resources/verifying-emerging-pipeline-threats-using-ut**



Circumferential crack field detected with ILI results using UCc

NDT Global Test Yard

Inline Services' Speed Control Pig cleaning tool

It is commonly accepted in the pipeline industry that ordinary cleaning pigs do not effectively clean a pipeline when run in many of today's elevated gas flow volumes and velocities. Gas lines are prone to experience velocity surges or speed excursions due to the compressibility of gas. When run at the higher gas flow velocities, cleaning pigs tend leave liquids and debris behind in the pipeline.

There is also considerable concern that at elevated speeds, cleaning pigs tend to jump over or across internal circumferential girth welds and spiral weld areas thus leaving residual liquids and debris in the pipeline at the weld areas. Therefore, it is necessary to decrease the speed of cleaning pigs by reducing gas flow in order to achieve maximum cleaning effectiveness. Consequentially, reducing gas flow and throughput while cleaning a pipeline can result in a significant loss of gas flow revenue for a pipeline operator, as well as disrupt gas delivery reliability to the downstream client base.

Inline Services, Inc. has the answer for this dilemma with their Speed Controlled Pig (SCP). The SCP will effectively clean pipelines without the need to sacrifice reliable gas delivery to the downstream client base or losing transportation revenue by reducing normal gas flow volumes or gas velocity.

The SCP tool was designed to provide a method to safely by-pass natural gas while simultaneously controlling tool speed. The tool can clean effectively at speeds of 6 to 10 mph while the natural gas velocity in the pipeline continues to flow at normal rates of anywhere from 15 to 35 mph. The use of the SCP not only facilitates effective cleaning but also optimizes gas transportation revenue for the pipeline operator by not having to reduce gas flow and throughput while lowering pig speeds to assure effective cleaning of the pipeline.

The SCP tool is equipped with a number of features such as a transmitter for ease of tool tracking. Dual odometers provide accurate distance measurement to points of interest. A state-of-the-art data logger records pipeline slope, pressure, temperature and tool orientation. An Inertial Measurement Unit (IMU) detects Roll, Pitch, Yaw and Vibration. Pressure differential across the tool is continuously recorded and can be used to calculate drag. Condition of the internal surface of the pipe, the presence of liquids, debris and Black Powder can be inferred from the changes in ride characteristics, tool dynamics and drag [Pipelines 2 Data Ltd. control units].

Therefore, the SCP is not just a speed controlled cleaning pig; it is a smart cleaning tool that can provide a vehicle or platform on which to accomplish other tasks. It can be used to focus inspection resources where they are needed. SCP is an integrated pipeline cleaning and inspection tool on which sensors can be mounted to monitor changes in operating conditions and gather other useful data points.

Speed Control Pig

ROSEN CGA$^{pro:}$ Exposing active threats

Corrosion growth rates (or CGRs) – defined as the rate of increase of corrosion depths over time – are far more complex than their definition suggests. Corrosion is governed by an intricate set of electrochemical, kinetic and metallurgical processes, meaning CGRs can fluctuate greatly. In fact, growth of a corrosion pit can initiate, arrest, accelerate or decelerate at any time due to small changes in the local environment. This complexity has compelled inspection vendors and integrity engineers alike to continually advance technology, improve knowledge and build experience in corrosion growth prediction.

The real skill lies in understanding how to properly use CGRs within integrity management processes, such as generating repair plans, scheduling mitigation activities, defining re inspection intervals and estimating remaining life. **ROSEN's** premium consulting service "CGA^{pro}" supports pipeline operators by offering these critical analyses.

The first stage of CGA^{pro} is a thorough investigation of all available pipeline data. This is conducted by ROSEN's experienced specialists in Integrity and Corrosion Management, Risk & Reliability and Flow Assurance. After analyzing the likely corrosion causes, the goal is to define robust pipeline segmentations, which accurately reflect the variation in internal and external corrosion susceptibility. This is followed by the estimation of historic CGRs within each of the defined segments. While there are several options for estimating CGRs (for instance corrosion modelling or coupons & probes), it is now widely accepted that a comparison of repeat in-line inspection (ILI) data provides the most complete description of historic corrosion growth in a pipeline.

Traditionally these comparisons have relied on a rudimentary "box matching" process, where two pipe tallies are aligned using fixed reference points. The reported features are then "matched" between the two inspections. Afterwards, a CGR is estimated for each feature based on the change in reported depth. The accuracy of depth changes determined by box matching is heavily influenced by the accuracy of the matching algorithm and the depth sizing accuracy of the inspection tools.

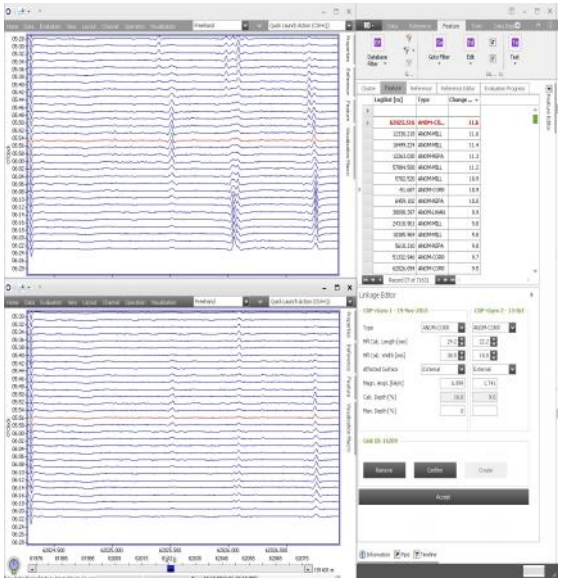
With the industry demanding a more accurate solution to the problem of detecting and quantifying corrosion activity, techniques have been developed that use ILI signal comparisons and detailed feature resizing.

ROSEN has responded with its own software – "AutoSCAN™" (Automated Signal Correlation and Normalisation). With AutoSCAN™, ROSEN can precisely match metal loss indications between two axial field magnetic flux leakage (MFL A) inspections, using pattern recognition algorithms. By normalising the magnetic response, depth changes are then estimated directly using the change in signal amplitude and shape. In comparison to traditional methods, AutoSCAN™ provides a significant step change in the accuracy of historic CGRs.

With reliable CGRs now readily available, a common misconception is that the best predictions will be achieved when each feature is assigned its own historical CGR. In reality, however, the future growth of a specific feature cannot usually be inferred from the historic behavior of the feature itself.

Instead, local corrosion behavior must be determined by examining corrosion behavior on a wider scale. In fact, the application of a single characteristic CGR to the features reported within each of the defined segments is considered to be the optimal solution. This finding is supported by comprehensive decision theory and statistical research conducted by the ROSEN Group in recent years.

The key output of CGA^{pro} is thus a set of recommended CGRs which enables the minimization of remediation costs, without compromising on safety. With CGA^{pro}, operators therefore gain unparalleled insight into the location, severity, and cause of active corrosion threats, leading to a better-than-ever understanding of the implications for the future of their pipeline.



Rosen AutoSCAN™ software

MACAW Engineering Ltd. and ROSEN Group services to be provided as one

On 16 January, 2017, **MACAW Engineering Ltd.**, a member of the **ROSEN Group**, started providing its services under the ROSEN brand.

MACAW and the ROSEN Group have been working together very effectively since 2006 and have built a strong relationship based on providing integrity services for industrial assets. With a common goal to provide the best possible support to operators, the decision was made to integrate all services under one brand. There will be no personnel changes, and the services will continue to be provided by the trusted experts.

Operators will still have access to an integrated worldwide team. Experts in all areas of asset integrity are available to provide everything necessary for high-quality, safe and efficient asset integrity management.

Roland Palmer-Jones, ROSEN global business line manager for integrity services, said, “Aligning all our services under one brand will simplify our customer relationships and demonstrate our commitment to making ROSEN the world’s leading specialist for ensuring the integrity of industrial assets.”

For further information please visit:
http://www.rosen-group.com/CombinedCapabilities

ROSEN’S integrated approach to circumferential cracking

Failure investigations have identified strain and a corrosive environment as being major contributors to the development of stress corrosion cracking (SCC). Also often cited are stress raisers such as dents, areas of corrosion, and weld toes. Although most cases of SCC result in axial cracking due to internal pressure, there have been a number of pipeline failures attributed to circumferential cracking in recent years. These failures remain rare but are often unexpected, either because the hazard had not previously been identified or because it was included in any risk assessment. Nonetheless, they can create a major hazard with sig-

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nificant disruption to pipeline operations. Thus, any comprehensive integrity management program should consider the possibility of this type of cracking.

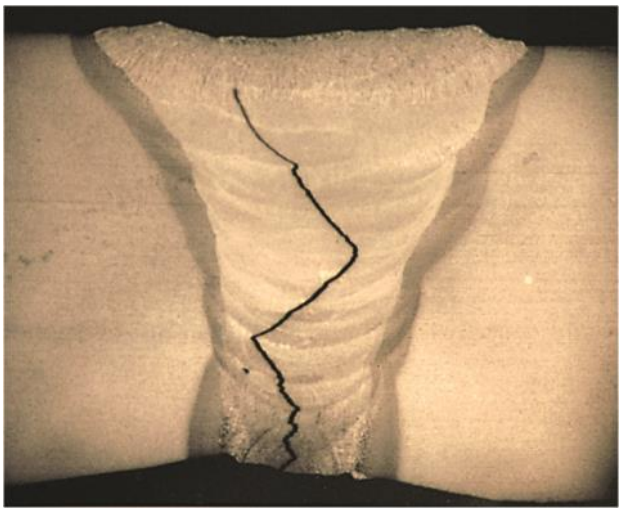
Circumferential SCC can occur when there is significant axial stress, usually attributed to some form of ground movement. Other sources of locally high axial stress can be dents caused by rocks in the trench, residual stresses from pipe bending, and thermal contraction. In 2015, the Canadian Energy Pipeline Association (CEPA) published detailed guidance on the management of stress corrosion cracking, including a section about CSCC. Among the factors considered relevant for a pipeline's susceptibility to CSCC are pipeline design and condition, construction year and season, coating type and condition, soil type and moisture, and terrain. It is clear from the very broad basic susceptibility criteria given in the CEPA guidance that many pipelines will have some susceptibility to CSCC. Therefore, most operators will require a rational method for improving their understanding of the likelihood of CSCC.

Answering to the diversity of the susceptibility criteria, ROSEN's RoCD services effectively manage CSCC threats with a structured process. This process is based on readily-available information on pipeline design, construction, and routing, publically available spatial information including terrain models, soil data, and rainfall records, combined with proven in-line inspection technologies for coating disbondment detection and bending strain estimation.

In a first step, susceptible coating locations are identified. The RoDD EMAT service details the extent and the type of coating disbondment, allowing a reliable assessment of the pipe susceptibility for corrosion and cracking. Additionally, ROSEN's RoCorr services provide detailed data on metal loss, indicating both coating type and condition from representative patterns or distributions of features. In a second step, areas of high axial strain are determined using inertial monitoring in-line inspection (ILI) data combined with stress analysis where needed. Inertial measurement units (IMU) allow every change in direction of the pipeline to be identified, and hence curvature and bending strain to be calculated. The bending strain will often give a good first indication of absolute strain level, particularly if pressure and temperature effects are taken into account. Then data will be aligned in order to highlight critical locations. Factors such as soil types, location on slope, and rainfall levels contribute to the potential for coating damage and soil movement induced stresses. This data is often available in the public domain in digital map form, or may be included in original pipeline design information.

Where CSCC is considered credible, there are several options for inspections. In general, there are a limited number of locations where the full combination of factors is present, so that excavations may be cost-effective. However, in cases where there are several possible locations, in-line inspection is preferable. ROSEN's UT-A and MFL-A technologies provide reliable circumferential crack detection based on ultrasonic shear wave generation and axial magnetic flux leakage, respectively. The proven tool configurations maintain data quality while simultaneously supporting individual operational pipeline requirements.

Considering that circumferential cracking, and specifically circumferential SCC, has caused a number of pipeline failures, neglecting it in integrity management planning may have serious consequences for operators as well as for the public and the environment. ROSEN's crack detection services help operators identify cracks, both axial and circumferential, at a very early stage, thereby reducing failure risks to a minimum.



Circumferential crack associated with a girth weld

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TDW's Pig tracking in Australia

When a new liquefied natural gas (LNG) project in Western Australia called for pre-commissioning pigs to be pre-loaded inside a subsea launcher nearly two years in advance, a critical requirement was for the pig tracking system to retain its battery life over such a long period. The new LNG plant will gather and partially process gas and associated condensate from various offshore fields and deliver it to an onshore facility. There, two trains with a combined annual capacity of 8.9 million tonnes (9.8. million tons), will make the LNG commercially viable. The site also includes a domestic gas plant. First delivery of LNG is expected in 2017.

In 2014 — well before the pipe connecting the onshore and offshore infrastructures was scheduled to be laid — the operator fitted the TDW's SmartTrack equipment into the bodies of eight bi-directional pigs intended for use in dewatering, drying, and purging the two 24-inch production lines, and two 14-inch utility lines. The pigs were then loaded into the subsea launcher connected to the pipes, and the entire assembly was transported to Australia. After the lines were laid and the transponders successfully reactivated, pigging operations commenced. The pigs were retrieved from the lines in 2016, 21 months from the 2014 start date.

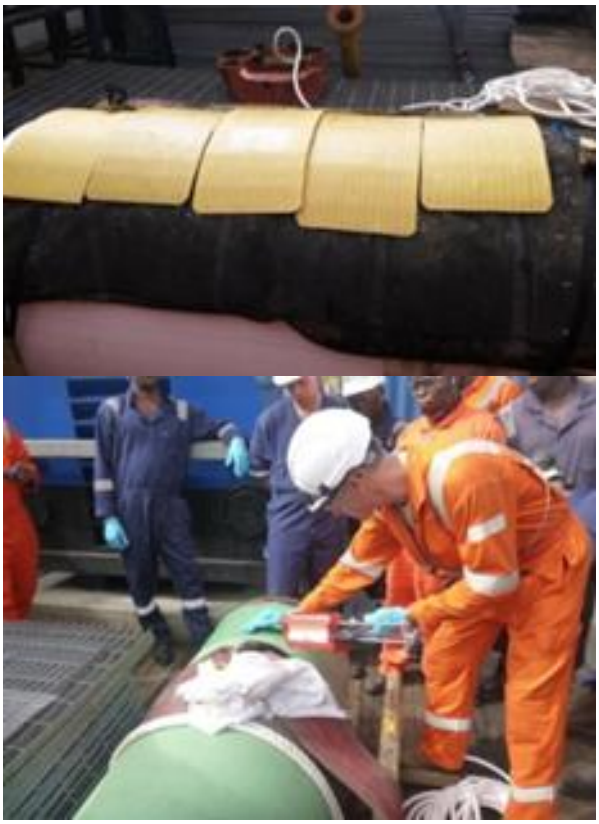
3X Engineering repairs subsea dent with zero visibility

The objective of the repair performed in September 2016 by **3X ENGINEERING** and its local distributor **SAVIC** was to reinforce a 2.5m length of damaged subsea pipeline. The dent defect (13,1 % dented depth) was situated at 16m depth with zero visibility on a 36 inch diameter pipeline Offshore Nigeria.

After Finite Elements Analysis (FEA), 50 composite layers of REINFORCEKiT 4D SUBSEA (R4D-S) were used to perform a reinforcement designed to last for 5 years. Underwater, several preliminary operations (sediments excavation, removal of concrete and existing coating, marking of the surface to be wrapped) were performed before the essential step of surface preparation to get a good surface roughness (60µ minimum surface profile). 3X wrapping reinforcement was performed following several stages :

1. A foot print of the dent was made in order to manufacture appropriate composite rigid plate.
2. Primer (P3X32) was applied to the defect, using a dispensing gun, providing a good adhesion of the composite materials.
3. Five rigid composite plates covered with F3XSS filler were positioned over the dent and strongly fixed with ratchet belts for a curing time of 3 hours *(illustration picture)*.
4. 82 rolls of Kevlar® tape, pre-impregnated with R3X1050-S resin, using a special 3X device called BOBIPREG) were wrapped around the pipe.
5. Finally, a neoprene soft cover was applied to protect the repair from shells and other elements.

Divers and 3X worked together to repeat each step of the implementation with zero visibility.
Zero injury, schedule respected and repair design controlled concluded this job. A special thanks to Mobil Producing Nigeria representatives and ADS team (divers) for their precious help to complete this project successfully.



Composite plate manufacture on the foot print of the dented area & primer application (training picture).

Inside Iraq: Stringent security required for first inline inspection at new oil field

Minimizing risk to personnel and preventing incidents is a daily priority in the oil and gas industry. Sometimes, though, location or logistics mean a pipeline project requires extraordinary safety measures. Case in point: the first inline inspection (ILI) of gathering lines in an oil field 65 km (40 mi) north of the port city of Basra, Iraq. This is the one of the largest oil fields in the world, with recoverable oil reserves totalling approximately 13 billion barrels.

The project proved the integrity of the pipelines and allows the operator to modulate maintenance schedules, keeping the pipelines running with minimal disruption to production or effect on the environment. But its implementation called for such security efforts as transportation convoys and protective vests—precautions that helped keep the field crew safe and enabled the work to be completed ahead of schedule.

ILI provides baseline assessment

Construction of the main production facilities at the massive oil field began four years ago, with first production coming two years later. Within months, the field's Russian operator decided to take a proactive approach to integrity management, and conduct an initial inspection that would provide a baseline assessment of the field's new pipelines.

The engineering firm working with the operator contracted global pipeline solutions provider **T.D. Williamson (TDW)** to gauge, clean if necessary, and inspect the field's 20- and 24-inch gathering lines. The targeted pipeline sections ranged in length from 3.8 km (2.3 mi) to 6.6 km (4.1 mi).

The ILI runs included the KALIPER® 360 tool, which provides geometry inspection; and gas magnetic flux leakage (GMFL) technology, responsible for identifying corrosion and pitting. TDW performed 15 tool runs—five gauging, five KALIPER 360, and five GMFL—with 100 percent success. The field work was completed within five weeks, ahead of schedule.

Among other factors, TDW Project Manager Fadi Taha credits the diversity of the company's workforce for the project progressing so efficiently. Specifically, the TDW team included a Czech national, Ales Kaderábek, who speaks Russian and could communicate with the operator's field personnel in their native tongue. According to Taha, this avoided miscommunication and confusion, and helped keep everyone on track.

Security regime ensures personnel safety

And what about the extreme security measures? TDW ILI Operations Manager Matthew Wicks describes the overall security situation in Iraq as precarious. Yet, he says, the multi-layered measures instituted by the engineering firm safeguarded TDW personnel on and off the job site. That included an elaborate private security regime for transporting TDW personnel from Basra International Airport to the oil field.

"Transportation is always in convoys," he says. "The presence of armed guards and restrictions on personal movement are constant reminders that you're working in Iraq. However, the large contingent of foreigners who've been at this field for a long time testifies to the efficiency and effectiveness of the security regime in place. Soon enough, one gets comfortable with the security protocol and gets along with the task at hand."

T.D. Williamson uses KALIPER® 360 tool and gas magnetic flux leakage technology to prove pipeline integrity