30TH ANNIVERSARY
PIGGING PRODUCTS & SERVICES ASSOCIATION

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Pigging Industry News

the newsletter of the Pigging Products & Services Association

THE PRESIDENT'S LETTER

By Felix Schmidt, 3P Services, Germany

It is a great honor to serve the PPSA as President this year. Mike Kirkwood of T.D. Williamson will serve as Vice President during this period and I would like to welcome our new Directors Scott Greig, Halliburton and Jan Frowijn, ROSEN Group. I would also like to thank Michael Rapp and Graham Jack for their time on the board as well as Jessica Nichols for her leadership as President during the past year. A special thanks goes to Diane Cordell, for her ongoing commitment and her contribution to the success of our association.

We are celebrating the 30th anniversary of the PPSA this month (you may have realized our special logo). It is bad luck that this is happening during times when COVID-19 is significantly affecting the day to day life and business of most of us. The virus leaves limited possibilities to adequately celebrate or to raise one's glass in a toast to the PPSA.

Prior to the lock-downs in most countries, the golf tournament took place in February in Houston followed by the Annual General Meeting. Thanks to our sponsors and all the players. PPSA exhibited at the PPIM conference. It was great to meet with members and everyone in the industry.

At the AGM members suggested that PPSA should become a thought leader by focusing on key areas in the industry with input from our members, developing these topics and creating a repository of useful information.

Following the meeting, the topic the members voted to focus on was 'Challenges in day to day pigging - difficult to pig lines, unusual products (e.g. ammonia, ethylene, hydrogen, high H2S etc.), lodged pigs, pig tracking etc. We will be calling for presenters to give webinars on the topic and members are invited to submit articles and papers. The main theme of the newsletter is Challenges in day to day pigging.

In March PPSA attended the PTC online conference. It went online at very short notice due to COVID-19 and was very well organized.
Also our plans for the future are evolving. We are planning to attend the IPC conference in September (in Calgary or online depending on developments) and will be organizing the annual PPSA seminar in November, which we are currently reorganizing to fit into the new world in which we find ourselves these days. No matter how significant the travel restrictions or negative oil prices may affect our international industry, there certainly will be a big demand for our association and members to enable safe operation of pipelines worldwide for the next 30 years. In this spirit, three cheers for the PPSA and stay healthy.

NEW Members

Full

Cokebusters ,USA

PT Tri Mulya Gemilang, Indonesia

Individual

Lawrence Imonigie, The Netherlands

Thank to all the golf sponsors!

Pipeline Total Strain Assessment - does strain demand exceed strain capacity?

Authors: J Dawson, I Yablonskikh, M ElSeify Baker Hughes

The as-laid position of pipelines is not always constant and movement can occur for several reasons including; settlement, wash-out/flooding, subsidence, landslides, earthquakes and human activity adjacent to the line. Pipeline movement or deformation redistributes the axial force along the pipe, increasing axial tension in some locations and compression in others. It can also give rise to pipeline curvature, which induces tensile bending strain in half of the pipe cross-section and compressive bending strain in the other half. The tensile strain can lead to pipeline leak or rupture, particularly at girth welds and compressive strains can lead to wrinkle/buckle formation.

While the measurement of the bending component of the longitudinal strain is well understood and can be derived from routine IMU (Inertial Measurement Unit) in-line inspections, the pure axial part of the longitudinal strain has been a recognised gap in the knowledge of the strain condition of a pipeline. Now, the inline axial strain inspection tool (AXISS™) can be used to measure the pure axial strain component. The measured axial strain can originate from many sources, such as geotechnical hazards (land movement in the direction of the pipeline axis), thermal (due to temperature increase vs installation) as well as from the combination of soil restraint conditions and internal pressure effect.

Both IMU and AXISS technologies provide information regarding the presence of strain due to geotechnical events but neither can independently provide the full total strain information. Indeed, the technologies complement each other and the real benefit comes from using both technologies (in the same inspection) to i) identify geohazard threats acting in both transverse and longitudinal directions respective to the pipeline, and ii) determine the total longitudinal strain demand along the entire pipeline including at particularly susceptible locations such as girth welds, geometric anomalies and other pipeline defects. Strain demand is the magnitude of strain acting on the pipeline and comprises of both the bending and pure axial components.

The strain demand information is a required input into an engineering criticality assessment of a pipeline section that is subject to a tensile or compressive strain (from an external load). The other input that is

Example images (from left to right) showing movement induced pipeline curvature/bending strain, tensile rupture failure caused by landslide and pipe wrinkle/buckle caused by compressive strain

needed is the strain capacity of the pipe in question. Strain capacity is a measure of the pipeline's capability to resist failure. In strain-based design and assessment, failure is associated with tensile fracture (ultimate limit state) or compressive local buckling (serviceability limit state). The strain capacity will vary along the length of a pipeline as it is influenced by material properties, pipe/weld geometry and the presence of cracks or other defects. Tensile strain capacities as low as 0.2% and as high as 2 to 4% have been obtained from experimental tests. The tensile strain capacity of pipe body material is expected to be relatively high; but at girth welds (even welds compliant with API 1104) it can be low. To obtain realistic strain limits, the strain capacity should be determined on a pipeline by pipeline basis using testing and/or appropriate modelling of the specific pipeline characteristics to predict the maximum amount of strain that the pipe can sustain before failing at a girth weld. Several tensile strain models have been published and this is an area of on-going research.

A strain-based pipeline integrity assessment involves comparing the strain demand with strain capacity. In locations where strain demand exceeds strain capacity further investigation of the cause is needed. Mitigation can involve stabilization of the geotechnical situation to reduce strain demand or remediation of the pipeline to repair/replace the defective pipe to improve strain capacity. To add a degree of conservatism, a safety factor (resistance factor) should be applied to the strain capacity. CSA-Z662 provides a range of tensile and compressive resistance factors applicable for different load cases.

In summary, Baker Hughes provides a single inline inspection strain measurement tool-based solution designed to support operators' geohazard risk management programs. Utilizing both ILI AXISS and IMU strain measurement technologies allows for better understanding of the strain condition of a pipeline. Comparison between the two streams of strain measurement data supports the discrimination between real strain acting on the pipeline and (relieved) strain calculated based on the pipe curvature from intentional construction bending. In addition, deviation between the two data streams will indicate areas where plastic deformation has occurred. There are many advantages of combining multiple inspection technologies to effectively build a picture of the pipeline condition and how it changes over time. A new total strain demand reporting option is available from Baker Hughes based on the combination of the axial strain tool and IMU bending strain results. Our next step is to provide a strain-based fitness for service integrity assessment involving the comparison of pipeline strain capacity with the strain demand to support the management of pipelines subject to geohazard threats.

Vitzrocell continues battery supply without disruption despite pandemic

The spread of the coronavirus has greatly worsened the business conditions of many companies world-wide. However, Vitzrocell is continuing business as a provider of essential products at the same time as improving their health and safety program to include pandemics. By doing so at the earliest stages of the spread of COVID-19 into South Korea, Vitzrocell has been able to prevent the spread of this virus to its employees, customers, and colleagues.

Vitzrocell, a manufacturing company that produces lithium primary batteries used for smart pigging tools, has implemented an emergency management system since February 19, 2020. Before COVID-19 could settle in, all executives and employees made the company's emergency response manual a priority, to keep all employees and those who interact with them, safe and healthy.

Included in their plan is increased awareness when an employee seems unwell. If an employee presents with symptoms similar to COVID-19, Vitzrocell has an immediate isolation process, to remove the potentially infected employee from others, and provide separate isolation areas for those who work closely with that individual. There is also a process by which the HSE team immediately contacts the local health center and the Center for Disease Control and Prevention to notify them of a possible case. Vitzrocell helps maintain the health of its employees by providing masks, educational material, exercise equipment, and even special meals once per week designed to boost immunity.

Mandatory temperature measurement has been key for determining if employees remain symptom free from COVID-19. Before entry into the buildings, Vitzrocell's executives and employees are screened for elevated temperatures. Five thermal imaging cameras and fifteen body thermometers have been deployed at all workplaces to establish a real-time measurement system for screening for possible infected individuals.

When possible, Vitzrocell allowed for some employees to work from home, particularly those who could be at higher risk, such as those who take public transit, pregnant women, and other factors. Vitzrocell conducts frequent disinfection and ensures that all the employees follow all social distancing guidelines carefully. Clearly, Vitzrocell shows great care for its employees, but it doesn't stop there. Vitzrocell was and continues to be very concerned about the health and continued reliable supply to the pigging customers it serves globally. By taking such preemptive measures, Vitzrocell has been able to continue battery supply without disruption, despite the pandemic.

ROSEN Group vice president answers commonly asked questions about COVID-19

Erik Cornelissen is an Executive Vice President of the ROSEN Group and the spokesperson for the Global Business Continuity Management Team, a global task force dedicated to ensuring the safety and well-being of customers and company staff, and minimizing the negative impact on the company. We sat down with him to address the most commonly asked questions regarding safety, business operations, customers and employees.

First of all, on a personal note, I just want to say that I understand that this pandemic has negatively affected so many around the world, and my heartfelt sympathy is with all those impacted. I think that amid this tragedy, however, we have an opportunity to do some self-reflection as well as collect some valuable learnings, such as how to improve the environment we live in and how to better serve the industry we work for. It is my hope that we seize this moment as an industry to collaborate and get through these challenging times together.

How can a company best respond to a crisis like the coronavirus pandemic?
In crisis situations, like what we are facing with the current pandemic, early identification and recognition of potential impacts is key. For this, we at ROSEN strictly abide to our own Company Crisis Management Concept, which clearly dictates responsibilities, defines communication and ensures fast decision-making. In the early stages of this pandemic, we also established a Business Continuation Team to define actions to ensure business operations. This preparation gave us good insight and a clear way forward through the uncertainty.

We believe that in the current situation, now more than ever, sharing knowledge, expertise and best practices with not only our customers, but also the entire industry, is very important to successfully enduring this difficult time together. As a service provider, it is important that we stay flexible so that we can best support the industry through this crisis and ensure its continuity afterwards as well.

How are you mitigating the risks for employees, customers and community?
Safety is our first priority. We have extensive preventative safety measures in place to protect the health of our employees, our customers and the surrounding community. By collaborating closely with our customers, we will determine the appropriate solution for the specific circumstances and will only proceed with a service if we mutually determine it to be safe and in alignment with necessary guidelines. We also follow the guidance of various global, as well local, health organizations to ensure specific regional safety aspects are taken into consideration.

How is ROSEN prioritizing safety vs. business operations?
We believe the question can not be asked as such, since we will not prioritize between safety and business opportunities. Safety will always be most important.

The bottom line is that we will not perform a service that we, or our customers, are not convinced is safe. That being said, we do have a lot of experience in operating during difficult situations and in harsh conditions all across the globe, and we know how to support our customers in ensuring the safety of all those involved.

How do your business operations vary between the different geographical locations?
Of course, compliance requirements with local governmental and health authorities will vary depending on the location of the project, and this is where our vast global network comes in to play. Because we have trained and certified experts around the world, we are able to act in a uniform and scalable manner at all locations, while, at the same time, utilizing our global knowledge base. This enables us to remain flexible and ensure local compliance.

You have mentioned flexibility a few times, why does it have such an important role in the current crisis?
To us, flexibility means collaborating to develop, adapt, or even create solutions based on the current and near future needs of the industry — regardless of

the challenges present. For example, in the areas where physical presence has become a temporary challenge, we have implemented integrity service solutions that help the operator ensure the safety and compliance of their asset.

We work to provide flexible support to help operators through this time of crisis and aid in the progression of our industry. Our agile global network of professionals and experts are standing by to support our customers in dealing with any challenges that come their way.

What are the next steps for ROSEN?
We will continue to closely monitor the situation and follow the guidance of the authorities; take care of the well-being of our employees, customers and their families; share our knowledge and experiences with the industry; and prepare for a phase of recuperation and catch-up after the pandemic has passed. Additionally, we are looking to learn from this current crisis and optimize our service quality and offerings by identifying areas of opportunities and improvements. Ultimately, our goal is to create even more value to our customers, post-crisis.

How can customers communicate with ROSEN during the COVID-19 pandemic?
We are available through the usual channels of communication, with the temporary exception of visiting of our offices in person. We have also initiated an extended webinar series to support the exchange of knowledge between industry stakeholders and keep you up to date on our latest portfolio developments during these challenging times.

Can ROSEN still perform work that an operator needs to have executed?
We understand the burden operators have to ensure the safe operation of their assets and to remain compliant with regulations. We accept our responsibility in supporting this effort and are committed to providing the industry with the necessary services on critical infrastructure. As I mentioned before, we will closely collaborate with our customers to help ensure the safe operation of their assets within the guidance of local governmental and health authorities. The bottom line is that when the need is there and safety can be ensured, we will provide our services.

What do operators need to do or change in order to facilitate a ROSEN inspection service at their premises?
Our project managers are at the operator's disposal to help prepare for each individual service and ensure that the necessary requirements are fulfilled. These preparations depend of course on local situations and therefore have to be discussed individually.

What do you think will happen to the industry after the crisis? Can operators still count on ROSEN services?
It is very hard to give an exact prediction of how our industry will look or operate in the post-crisis time, when the pandemic is under control. It is our expectation that for a number of years, we will still see the impact this pandemic had on our industry, and we think that certain behaviors and routines may be forever changed.

However, we do expect that the demand for energy will remain high or even increase, and that the requirements for safe operation of our industry's assets could increase as well. This means that we expect a growing global demand for our services, and we will be ready to fulfill this need and serve our customers.

So yes, the future in our opinion will be different and behaviors may have to be adapted, but our industry and our people are resilient. At ROSEN, we remain extremely positive and motivated to overcome the current challenges. Together with the good leaders, our industry has to offer, we will continue to help and support each other through this time.

FREE WEBINAR SERIES — INTEGRITY INSIGHTS

BREAKING THROUGH OUR INDUSTRY'S UNCERTAINTY FACING COVID-19

Our world is rapidly changing. Due to the COVID-19 crisis, we find ourselves in unfamiliar territory facing new challenges each day. As our industry is faced with the necessity of adapting to this new situation, we believe that now, more than ever, the exchange of knowledge is critical. That is why we invite you to join our free webinar series, Integrity Insights. In our extended webinar series, industry experts will examine a diverse range of topics relating to integrity management and the current crisis. Our aim is to help ensure the safety and progression of our industry, while helping operators successfully navigate this difficult climate. Find out more: www.rosen-group.com/integrity-insights

iNPIPE PRODUCTS™ receives RoSPA Gold Award for health and safety achievements

iNPIPE PRODUCTS™ based in Brompton on Swale, is celebrating after landing an internationally-recognised award for demonstrating high health and safety standards.

iNPIPE PRODUCTS™ has received a **RoSPA Gold Health and Safety Award** for working hard to ensure its staff get home safely to their families at the end of every working day.

Organisations receiving a RoSPA Award are recognised as being world-leaders in health and safety practice. Every year, nearly 2,000 entrants vie to achieve the highest possible accolade in what is the UK's longest-running H&S industry awards.

Staff from iNPIPE PRODUCTS™ will be presented with their award during a ceremony at ExCeL, London on Tuesday, September 8, 2020.

Simon Bell, Managing Director, said: "iNPIPE PRODUCTS™ is delighted to have continuously improved and to have achieved the RoSPA Gold Award this year. This is a testament to all of the hard work and attention to detail of every iNPIPE PRODUCTS™ employee to ensure that safe working practices are always implemented. This is especially important with the Pandemic embracing the world and yet again they have risen to the challenge."

Julia Small, RoSPA's head of qualifications, awards and events, said: "The RoSPA Awards scheme is the longest-running of its kind in the UK, but it receives entries from organisations around the world, making it one of the most sought-after global accolades in health and safety. RoSPA wants every employee, wherever they are, to work safe in the knowledge that they will be going home unharmed and healthy at the end of every day. The RoSPA Award winners are vital to help achieve this goal, as by entering they are driving up standards and setting new benchmarks for organisations everywhere."

Tracerco secures first baseline subsea inspection project for a new pipelay development

Tracerco, part of **Johnson Matthey Plc,** has recently been awarded a deep-water subsea inspection project to assess the integrity of a new pipelay in the Gulf of Mexico (GoM).

As a method of ensuring maximum value and profitability, whilst safeguarding operational personnel and the environment, the operator will deploy Discovery™, Tracerco's Subsea CT Scanner, to obtain critical baseline integrity data on the new pipeline system.

Via the use of corrosion modelling, multiple inspection locations will be identified by the operator along the pipe. Discovery™ will then be deployed to scan each pre-defined inspection area to obtain critical baseline data and identify and characterise any potential metal loss anomalies, defects or general wall loss. By obtaining this accurate integrity data on areas of future potential concern, the operator will ensure they have the data needed to be confident going forward, that the condition of their pipeline system meets all safety and regulatory requirements, whilst ensuring that maximum production is achieved.

After the initial inspection campaign, Discovery™ will be deployed annually to reinspect the new pipeline system to measure corrosion growth rates and identify any potential integrity concerns.

Discovery™, was deemed the most suitable technological solution for the inspection campaign, as it can provide real time data on a variety of integrity issues including pipeline corrosion, pitting and wall thinning, without interrupting production. Discovery™ inspections are also non-intrusive, meaning the risk of damage to the pipeline is minimised as there is no requirement to remove any protective coating - regardless of thickness and material.

To learn more about how you can obtain accurate wall thickness measurements, eliminate costly downtime and keep production targets on track during a subsea inspection campaign, visit tracerco.com/services/subsea/

ILI of small diameter ethylene pipeline network

Inspection (ILI) of an ethylene pipeline network in the south of France posed several unusual challenges. Geometric and metal loss inspections were required.

Challenges included: small diameter lines combined with rather long sections, the presence of a number of ID restrictions and the requirement to perform all pigging in a gas (N2) medium. Magnets and metallic components remained in the pipelines from a previous unsuccessful attempt at inspection. The gaseous medium meant the potential for substantial speed excursions. Special procedures and customised tool for both cleaning and ILI were developed. Several mobilisations imposed additional logistical requirements.

Planning for ILI had begun already in 2011, with focus on performing pigging operations while the lines were temporarily de-commissioned.

First pigging operations began mid-2013 with another vendor – unknown to **3P Services.** During the runs serious problems were encountered and the project ran into difficulties with damaged and stuck tools. Several factors were identified as causing the problems: the sections were too long, the N2 pressure was not high enough and the presence of heavy wall tee-pieces at valve stations. Since several attempts had been made using the same operational settings, it was decided to bring another ILI vendor to the project.

Pigging method
After consultation, the operator agreed with 3P Services to split the lines into shorter sections and increase pressure to achieve controlled tool runs. Several special pigging procedures as well as pipeline specific pumping procedures were developed with focus to achieve tool speeds as constant as possible. Customised cleaning tools were designed and built to recover the magnets and metallic components remaining in the lines.

The method, while seemingly complicated and laborious on site, did achieve the desired speed profile. Accelerations at the valve stations were unavoidable, but substantially mitigated and the distances where inspection data was impacted were reduced.

Results and experience
Timing was of critical importance due to plant shutdown periods and all inspections were successfully completed during the planned operational windows. While some cleaning issues were occasionally encountered, all ILI data was complete and good quality.

Even though the inspections were done at the specified high pressures, the tools stopped in front of and within valve stations at thick wall tee-pieces. Speed excursions resulted when tools exited the tees. The pigging method with temporary stops to shorten section length proved effective to reduce the length of the excursions and affected ILI data.

Physical performance of the tools was good. Only negligible and normal wear was observed on the PU components and tools could practically immediately be made ready for another run.

Already after the first pigging campaign, the operator performed some field investigations together with the responsible authority, which validated the findings of the inspection reports.

Mechanical parts collected during magnet hunter tool run

WSG are pleased to introduce innovative Leak Detection and Repair Services – LDAR

WSG are further growing their offering as a Leak Detection and Repair specialist (LDAR) with the addition of **WSG Enviro** to the **WSG Group**.

WSG already have an extensive track record as a leak detection and repair specialist, supplying services from the existing core business lines within WSG, such as nitrogen helium leak detection, flange management, onsite machining and WSG's valve service and repair business, WSG Provalve.

With the inclusion of WSG Enviro's market leading optical gas imagery, WSG can now offer clients the unique opportunity to assess and inspect their assets up front of planned maintenance, or at agreed inspection intervals, to include any necessary repair work identified at the next scheduled maintenance interval.

Emerging regulatory requirements around fugitive emissions mean asset owners can partner with WSG to quantify and report emissions to atmosphere and meet and exceed regulatory requirements. Adoption of this upfront asset inspection and assessment will provide the plant owner with real time data on the integrity of their plant, simultaneously reducing downtime on their assets by efficient scheduling of repair works for leaks detected.

WSG OGI cameras, which are the world's most sensitive OGI camera, not only identify leak points, but also quantification of leakage within bespoke software, this allows customers to determine criticality of the leaks reported for remedial work at client discretion. The cameras are certified to EPA regulations and are ATEX and UL certified for operation in hazardous environments and WSG can provide a wide and ranging inspection service complimented with a final leak report tailored to customer requirements.

WSG capabilities are further supported by their in-house and specialist valve service and repair business, WSG Provalve. WSG Provalve offer state of the art testing, machining and ball grinding equipment, aimed at servicing high integrity pipeline valves, in particular ball valves, large bore isolation valves, control valves and safety relief. Coupling both the WSG Joint integrity and flange management services with WSG Provalve, WSG are able to offer bespoke solutions for leak remediation works identified during the Leak Detection campaign.

WSG Asset Integrity Management (AIM) Software further supports the service with an integrated and comprehensive software solution for management and record keeping of all WSG work fronts, including leak identification and reporting, onsite flange management and valve service and repair, offering a true Blind to Blind solution.

WSG also recognise the importance of verifying the leak repair implemented has been successful, ensuring the client has peace of mind when they successfully restart their asset and eliminating potential future downtime.

To do so WSG are able to offer a secondary leak test, either by reuse of the primary optical gas imaging camera or by implementation of specialised pressure testing. WSG are able to offer a wide range of pressure testing services from within the core WSG business, ranging from hydrostatic, pneumatic or nitrogen and helium leak detection. WSG industry specialists would work with the client to select the most suitable application to suit the asset

A step change in the development of real-time pig tracking

Removing the challenges of Pigging by knowing exactly where they are

November 2019 saw the dawn of a new era in real-time pig tracking when Halliburton Pipeline and Process Services successfully validated a live pig tracking method based on patented transient wave theory, the foundation of their unique InnerVue™ suite of services.

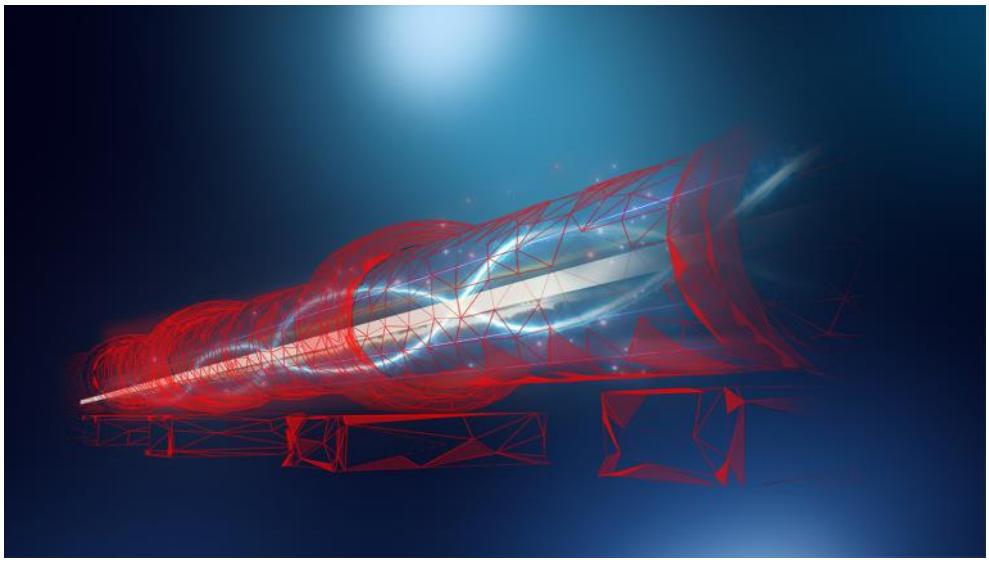
A negative pulse InnerVue™ Survey is best described as being similar to a sonar response technique. A controlled hydrodynamic wave is induced into a pressurised pipeline system and the position of a significant flow impairment such as a blockage or pig can be determined by identifying reflexes visible in the recorded data trace. This method is suitable for use in both fluid and gas systems, though the analytical approach for either is very different.

With a focus on this application in gas systems, it is imperative that the acoustic velocity of the medium being transported in the pipeline is known as accurately as possible. Largely based on ideal gas theory and adiabatic propagation, unrestrained acoustic velocity is calculated and thereafter extrapolated into a restrained velocity profile specific to the pipeline. Characteristics are adjusted to reflect the operating parameters of the pipeline at the time of surveying; flow, pressure, and temperature all impact the density and compressibility of the gas. This has a direct effect on relative bulk modulus and the equivalent speed of sound at any given point in the system, which in turn, in addition to the considerations taken toward the specific shape of the wave generated, render the transit of any pulse within the pipeline as totally unique.

Throughout the latter half of 2019 **Halliburton Pipeline and Process Services** successfully executed an extensive pipeline precommissioning campaign in the East Mediterranean . During the proceedings a lost pig occurrence prevented completion of the dewatering workscope of an 18” pipeline. Halliburton Pipeline and Process Services were hired by the **EPC** contractor to carry out an InnerVue™ survey to locate the lost pig. The successfully deployed survey provided critical information necessary to develop a pig recovery plan once discovering that the lost pig was located 16.5km from the platform. Working closely with the EPC and field operator, a reverse pigging operation, involving Halliburton managing a combination of specialist services onshore, offshore and remote deepwater, was conducted to recover the pig.

A foam pig was launched from the deepwater pipeline end and travelled towards the platform over the course of five days. The propellant was nitrogen gas supplied from a membrane spread transferring N2 gas via the twin gathering pipeline and a crossover at the subsea manifold which presented a serious challenge to accurate pig location which traditional methods were not able to overcome.

Pig tracking specific InnerVue™ surveying was performed on board the production platform throughout the reverse pigging operations. In live conditions, pressure waves were transmitted through the system allowing real time monitoring of the now-found-pig location. Once the foam pig reached this location, both pigs in unison began moving towards the platform. Surveying continued throughout and provided a real-time location, speed and estimated time of arrival. Upon pig receipt a final survey was performed to confirm that all pigs had been recovered. The survey results showed that there was still a pig in the line at the subsea isolation valve location, 364m from the platform. Flow resumed until the final pig was received allowing cessation of operations and removal of the temporary topside launcher / receiver.



The next phase of InnerVue™ Live Pig Tracking development is underway. It focuses on a commercialized practical solution deployable as an integrated offering with the flexibility to enhance pigging operations no matter the scenario or stage of the asset life. Halliburton Pipeline and Process Services are proud to bring a step-change in Pig Tracking Technology and confidence to pigging operations throughout the industry.

The key to success: Friction – Bypass - Velocity

In 2014 **Reinhart Hydrocleaning SA** (RHC SA) was asked to clean a 16" fuel pipeline. Based on pipeline geometry, such as a 10,500 m total length, 3D bends, two 16" tee pieces, no significant diameter changes and a height difference of app. 50m, the Mechanical Cleaning Tool (MCT) evaluation and construction seemed to be straight forward.

It quickly turned out that the solution to the pipeline integrity problem demanded innovation. The pipeline had been damaged at approximately the mid-point where it ran through a riverbed. Damage was such that unknown to the operator a significant volume of stones and gravel washed into the pipeline.

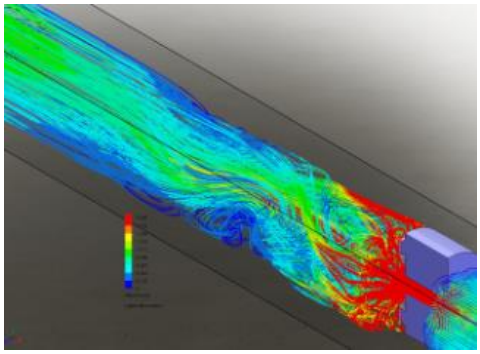
The pipeline damage was repaired with the stones still inside the pipeline. The problem was not identified until the operator started an ILI campaign. An initial BiDi pig got stuck and was reverse pigged out. Evidence about amount and sizes of stones could not be given and remained unknown.

RHC was required to remove all remaining stones out of the pipeline to guarantee the subsequent ILI inspection to be successful.

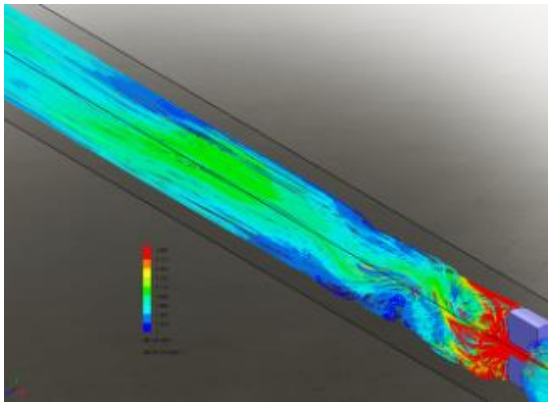
Key MCT parameters for a successful operation would require a 100% effective sealing during the cleaning run in combination with not just a high bypass but with a high velocity flushing effect in front of the MCT with the right size and angle of jets. The sealing disc arrangement used for propulsion was invented by RHC SA to provide 100% sealing in the line but requires a low "flip" pressure in the event of being reversed pigged.

Furthermore, as a crucial element of the MCT, the front nose of the tool is designed to bulldoze and prevent the tool riding over stones. The intention in combination with the jetting effect was to mitigate any risk of getting the tool stuck by a stone built-up. The evaluation had to be executed for a worst-case scenario.

After completing the MCT body set-up and propulsion disc configuration, the 3D model was tested with the in-house computer program in terms of bypass velocity.



After the flushing set-up was fine-tuned and completed, the individual 3D model pieces were converted to the in-house production machines to be constructed.



As a next step, the mechanical cleaning tool was assembled ready for testing. A 16" test pipe was built which consisted of an 18" one meter launching spool and a reducer piece 18"/16", three straight 16" spool pieces of each 3 meter length, divided by a 3D bend, a 16" Tee connected approx. 3.5 m upstream to an open ended and 1 meter end spool piece.

Bypass water was collected in a 10m^2 water tank and was pumped into the test facility system. In total 7 runs were executed and compared to each other.

A launching pressure of approximately 3 bar and a run pressure of approximately 2 bar, across the opened test pipe, resulted in a high velocity bypass flushing action which can be seen on the pictures.

The tests resulted in positive feedback results and a planned start date for the operations was agreed with the client.

The infield flushing operation included two runs. The aim of the initial run was to transport all remaining stones and any other potential debris out of the pipeline. The execution of the second run was to ensure that the pipeline is free of any stones.

The MCT was equipped with a transmitter set to a 22Hz pulsing frequency in order to locate it at certain checkpoints along the 10,500 m pipeline route. The MCT needed an approximately pressure of 6.5 bar to be launched and was pushed with an average of approximately 5.5 bar which led to an average velocity of 0.8m/s throughout the run. MCT location and flowrate was monitored constantly with the control room operator.

Whilst tracking the MCT on the first run, as the tool approached specified tracking points significant rattling and rumbling noise could be heard with increasing loudness on approach to the checkpoint up to seven minutes before it passed. The tool velocity was 0.8m/s indicating that we were pushing stone debris up to 340 m in front of the MCT.

The average bypass was recorded to be approximately 20%.

During tool tracking of the second run, no abnormal or significant noise was heard. This indicted that the first MCT run had been successful in removing the debris and there were no remaining stones inside the pipeline.

All debris brought out by MCT were diverted into the internal system. Debris which could be seen upon retrieval was a minor amount of black sand in front the tool on 6 o'clock position. The MCT was in good condition with minimal wear on the discs.

Thereafter, the ILI vendor was brought back on site to run another ILI pig. This inspection operation was executed with success.

Reinhart Hydrocleaning SA (RHC SA) is a family business based in Switzerland that has been providing a range of innovative, hydromechanical pipeline cleaning tools for over 65 years. Designed and manufactured in house, the unique technology for pipeline cleaning can be applied to a broad range of industries and includes pipelines manufactured from steel, cast iron, PVC, Flexibles, etc.

Despite the fact that RHC SA is known for challenging operations such as the above described, one has to keep in mind that maintaining pipeline condition by utilizing specialized mechanical cleaning tools on a regular basis as part of an operators ongoing production pigging and integrity management strategy keeps the pipeline in a clean condition throughout its operational life maximizing pipeline performance and corrosion management.

The use of high-quality mechanical cleaning tools will reduce the frequency of regular production pig runs required to maintain a higher level of internal cleanliness when compared to running off the shelf utility pigs. RHC SA focus on achieving the highest standard of internal cleanliness by using the best technology for the application.

The provision of specialized high-quality RHC mechanical cleaning tools designed and manufactured to suit the pipelines operational conditions are used initially to clean the line to the required level and thereafter when used as part of the regular production pigging strategy, they will maintain operating performance of the pipeline.

Due to its flexibility, RHC SA is a company that is able to adapt its cleaning technology to support and maintain
long-term pipeline cleaning and integrity management on a regular basis throughout its operational lifetime.

Quest Integrity's In-line inspection of challenging pipelines in West Africa

Project Overview
Quest Integrity has recently successfully completed the ultrasonic in-line inspection of four difficult-to-inspect dual-diameter pipelines for a major Operator in Nigeria, West Africa. The inspections were required to detect and quantify remaining wall thickness, internal and external metal loss, and deformations ensuring they were fit-for-service as any unplanned downtime would severely hamper production.

Challenge
The pipelines were constructed in the mid-1990's and had no pigging history due to the lack of pigging facilities. In addition, the pipelines had dual diameters with unknown ID restrictions, and presence of short radius bends.

Solution
A two-man team mobilized offshore hand carrying Quest Integrity's lightweight and compact inspection tools to the site. Inspection of the four pipelines were carried out as follows: prior to the inspection, pipelines were cleaned using a progressive non-aggressive pigging program. The InVista™ inspection tool was launched and upon retrieval, the UT measurement data was downloaded and prepared for initial field analysis. Within hours after the inspection, the customer was presented a site completion report indicating data quality, pipeline cleanliness and location(s) of debris. Quest Integrity delivered a level 2 fitness-for-service (FFS) final report in accordance with API 579 to the client within 45 days.

Conclusion
The Quest Integrity InVista™ technology overcomes challenges associated with traditionally difficult-to-inspect or unpiggable pipelines. The inspection delivered 100% axial and circumferential ultrasonic wall thickness measurements as well as geometry data. The client was pleased with the complete inspection of their pipelines. Some of the benefits that the client noted were:

- Improved safety and flexibility: tools are extremely lightweight and short; no lifting equipment was required.
- Simplified inspection process: high-resolution ultrasonic sensors acquire direct measurements providing geometry and wall thickness data in a single inspection run; no gauging and caliper pigging is required.
- 30% local collapsibility: collapsible design allows for full navigation of pipeline with a reduced local cross-section up to 30%.
- Reduced operational risk: InVistaTM tools are low friction, neutrally buoyant, un-tethered, and bi-directional.
- Secondary tool always available: a backup tool will be on-site and available at no extra cost to the client. This is in order to increase project efficiency and minimize delays
- Provides hard data: quantifiable direct UT measurements in wall thicknesses ranging from 1.2mm to 50.8mm

The inspection of non-metallic pipe

i2i Pipelines is a sensor technology company based in Manchester UK that has pioneered the integration of smart sensor technology with simple operational tools for the frequent in-line inspection of pipelines. i2i's objective is to provide low risk, low-cost in-line inspection tools that are operationally simple to use and can be deployed with high frequency in all mediums and geometries with little or no disruption to production operations.

Over the past 6 months, after listening carefully to their clients in Canada and the Middle East, the team at i2i has been working on new sensor technology to inspect the internal surface of a non-metallic pipeline to detect breakages or anomalies that might lead to a pipeline failure. i2i is now pleased to announce that a Pioneer for inspecting a 4inch non-metallic pipe is ready for operations. A 2inch tool will be ready in Q3 of 2020.

Details of the inspection method will not be released but trials have shown that the sensor technology is suitable for HDPE and fiberglass pipe. The sensor technology detected anomalies in all the non-metallic material tested during the trials. The Pioneer tools also have IMU technology to detect sharp elevation and deviation changes that might be occurring along the line. The Pioneer tools can be run with compressed air or Nitrogen and can be launched through conventional barrel launchers/receivers or pig valves (Argus or similar).

For a limited period, i2i will be running free operational trials to pipeline operators interested in inspecting non-metallic pipelines to assess the technology. If a pipeline operator would like to be part of the operational trial then please contact stevebanks@i2ipipelines.com.

Lack of Pigging Education

It's nobody's fault, but it's everybody's problem.

Pigging industry veterans have observed evolutions and innovations in the design and manufacturing process of pigs leading to great successes in the industry. Despite the innovations, an area that continues to challenge all players involved; Pig manufactures, operators and pipeline maintenance companies is the education and training of pigging

products, methods' and best practices.

Players have their own perspective on the value of education when it comes to pipeline pigging:
Manufacturers: Selling cleaning pigs to an educated customer who understands the style options available and how to use them is the "dream scenario". Using the right pig, at the right time, and in a specific application leads to positive results. Positive results make-happy customers. Happy customers will (theoretically) buy more pigs.

Operators: Typically, operators understand pigging basics, and likely have the most experienced personnel on-board, but they often contract pigging work to 3rd party maintenance companies. Operators are not in the business of educating contractors about pigging. Their priority is making sure that their pipeline carries the right amount of product to the right customer, as quickly as possible.

Maintenance Companies (3rd Party Contractors). Are in the business of providing capable and reliable field personnel with a broad range of experience to ensure safe and efficient pipeline maintenance. Field personnel with pigging program expertise varies greatly. In some cases, they may be responsible for pig selection and run frequency, but pigging is only one of many services they provide to Operators.

Why does education matter?
"If you think education is expensive, try ignorance." ~ Andy McIntyre

The old standard approach of running pigs until they stop bringing-out debris and then you "think line is clean", is outdated, yet still used in today's market. The "old school" approach leads to real uncertainty of line's actual condition. The condition of the line is critical to achieving the Operators primary goal. Can you see the disconnect?
Pigs are tools. Like any other mechanical trade, understanding the tools you use to accomplish a task is crucial. For example, just as you would not use a socket wrench to hammer in a nail, you would not use a 2 or 5lb foam pig to remove wax in a line. However, you would use a 2 or 5lb foam pig as Phase 1 of a cleaning program to evaluate a line is "good" to move to Phase 2 of the cleaning program.

Another next step in the pigging education process is understanding the different applications where pigs are used. Of course, every application is different, but there are general "rules of thumb" that can assist in developing an intelligent cleaning program.

Finally, understanding the "rules of thumb" such as pipeline characteristics, operating parameters, historical pigging records, and how to make data driven decisions on pig type and run frequency using this data is the crowning jewel of building an effective pigging program. The type of product present in the line is a big factor in your cleaning program. Liquid lines generally require a different style cleaning program than gas pipelines. Diesel or gasoline pipelines are generally clean products and might not require same style cleaning pigs than pipelines that transport Crude or other heavy products. Gas pipelines also vary with style of pigs required based on their product and terrain where many "high/low" areas might catch many liquids that might be in pipelines.

Can you create a pigging program without an understanding of some or all of the above? Yes. Will it be an effective and efficient pigging program? What do you think?

An educated approach to cleaning program development:
Once the "basics" of pigging education are covered, the next step to developing an "Intelligent" or "Smart" cleaning program is using tools to measure, monitor and record the effectiveness of specific cleaning pigs as well as the run frequency and the effectiveness of any chemicals being used.

Today, the "smart" approach to developing a pigging program consists of:

- Use of field level training and Qualification of personnel
- Pipeline characteristics and operating parameters
- Historical pigging records, if available
- Select/design cleaning pigs that are Fit-For-Purpose (FFP)
- Develop a cleaning program that satisfies the pipeline goal
- Monitor & measure the performance and effectiveness using the PET, PPT, SCP & PMS in conjunction with Pig Run Reports (PRR's).

Why is there minimal emphasis placed on education?
There is no clear-cut explanation, but factors that might influence the education process might be cost, time, lack of training resources, lack of training accountability and industry culture.

What does the future hold?
Although it may be obvious how more education can benefit all players involved, the issue is complex. We have observed regulations for pipelines and facilities increase almost every year. Pipeline integrity regulations are currently in place and appear to become tighter in all aspects. So, it is also conceivable that regulations will require the same training and qualification for cleaning pigging programs as currently required for other pipeline maintenance operations. If this happens, it could be the catalyst for more change in the Pipeline Industry. With increased regulations comes the issue of accountability, which is a separate discussion altogether.

STATS Group expands operations in Oman

STATS Group has strengthened its presence in Oman with the opening of a new workshop, storage and testing facility in Muscat.

The expansion comes after the Aberdeenshire pipeline technology specialist secured a two year extension to a Master Services Agreement with **Petroleum Development Oman (PDO)** to provide pipeline isolation and hydrostatic testing services. Also in the Middle East, STATS have trebled the size of their operation in Abu Dhabi in a move to a larger workshop and office facility in the Mussafah district.

STATS Group are market leaders in the supply of pressurised pipeline isolation, hot tapping and plugging services to the global oil, gas and petrochemical industries. Headquartered in Kintore near Inverurie, the company also has operations in Edmonton in Canada, Houston in the USA, Abu Dhabi and Qatar in the Middle East and Kuala Lumpur in Malaysia.

STATS Group Middle East director, Angus Bowie, said: "The PDO Master Service Agreement is an important contract and we are delighted it has been extended further. The new facility in Oman will help support this contract and having a local presence gives us a platform to extend our footprint in the Sultanate and wider Middle East region. "With our commitment in Oman and further investment in larger facilities in Abu Dhabi, it should open up new opportunities and underlines how much we value our existing clients in the region."

Last year STATS signed an exclusive partnership agreement with **Saudi Arabia's Safari Oil & Gas,** one of the Kingdom's top 50 listed companies, and longer term plans to open a permanent base in KSA.

Inline Services now offering pipeline intervention services through recent acquisition of First Call Enterprises, LLC.

In March 2020 the Parent Company of **Inline Services, LLC.** (Tomball, Texas) completed the acquisition of **First Call Enterprises, LLC.** (Tulsa, Oklahoma), a provider of pipeline intervention services including hot tapping and plugging services, pipeline freezing services, and a provider of pipeline fittings for hot tapping and plugging.

Inline Services CEO Phil Morrison stated, "The First Call acquisition immediately compliments Inline Services' strategy of serving the oil and gas pipeline industry through a portfolio of services and manufacturing businesses."

First Call President Bryan McDonald stated, "We are delighted to join forces with Inline Services and grow our combined presence in the pipeline market. We will immediately rebrand First Call Enterprises into Inline Pressure Services and build the Inline Brand into a leading services provider to oil and gas pipeline operators."

To support the demand for the newly added, Inline has expanded their sales and service staff in Tomball, Texas and Tulsa, Oklahoma. The additional Houston-based staff will reside in a newly leased office/ warehouse space in Tomball, Texas. Inline will maintain a lease on the office/warehouse/shop space in Tulsa Oklahoma to service that region.

Additional information regarding Inline's new suite of pipeline intervention services and hot tap fittings is available at www.inlineservices.com .

Inline Services expands Speed Control Pig operations to new facility in Tomball, TX.

Since its introduction in late 2018, **Inline Service's** reengineered Active Speed Control Pig has seen unprecedented success in the field and is subsequently seeing a full schedule of runs for the entire fleet of tools through the end of 2020 despite the COVID-19 pandemic. As a result, Inline are expanding its fleet of 30 inch – 48 inch 1.5D Active Speed Control cleaning/gauging pigs. April 2020 marked the completion of over 4,500 miles in successful Speed Control Pig runs from West Virginia to Oregon.

Cameron Randall, Field Services Manager for the Speed Control Pig operations stated, "There was no doubt in my mind that customers would be excited about how our technology allows them to thoroughly clean their lines to reduce ILI tool run failures and maintain compliance without sacrificing pipeline velocity and gas volume. However, I was genuinely surprised by the speed of customer interest and support we received immediately after our first few runs. It is exciting to think about what is to come when we've achieved so much in just over a year." With this success, Inline quickly realized the need for more trained personnel, equipment, and shop space. To accommodate these needs, Inline leased additional warehouse/office space in Tomball, TX to house 3 new members of the Field Services team along with a designated manufacturing, storage and development area for an expanded fleet of Speed Control Pigs ranging from 30" to 48". Inline is planning to double the size of its Speed Control Pig fleet by Q1 2021, including adding a 24" pig to the fleet.

i2i Pipeline's ship run return model

i2i have been developing their Pioneer and SmartFoam tools to be run without specialist personnel onsite for the past 3 years with great success. Given the recent travel restrictions due to the Covid19 pandemic, this method of deployment has begun to gain some wider traction within the industry. The ease of mobilization and the fact you don't need to have external contractors or specialist personnel onsite to operate the tools fits in well with the new norm of restricted travel and social distancing. The additional benefit of low cost, when compared to conventional ILI technology, is a bonus when many pipeline operators have reduced operational budgets due to the low oil price.

i2i has shipped tools to North America, Europe, and SE Asia during the restricted international travel period and local teams have been successfully running the tools and collecting some great inspection data. The process is very simple.

1. The Client sends i2i a complete PQ.
2. i2i ships a tool out to the client's field location. The Pioneer smart pigs can be run on NiMH batteries so there are no hazardous goods issues with shipping the tool. The tools can be in the USA, SEA, or the ME within a week of PO acceptance.
3. The tools are easy to Operate and local technicians have no issues in safely running the smart pigs. They are run as you would a cleaning pig, in all mediums and complex geometry without disrupting production operations. The Pioneer tools can mass restrictions and dents up to 30% of ID making them a low-risk alternative to conventional ILI tools
4. Once operations are complete the client then cleans off the smart pig and ships it back to i2i. The PU sensor heads and sealing disks can be thrown away after use if heavily worn or contaminated.

Note: i2i's subscription charge out model is so cost-effective that many clients are keeping the tools onsite for a full 12 months to be used for monitoring the line

3X Engineering repairs cracks on huge column in Libya

The objective of the repair, carried out at the end of December 2019 by **3X ENGINEERING (3X)** and its local distributor **AL MAIDA**, was to reinforce 3 circumferential welds suffering from cracks, situated on a huge column.. The column is a 264 inch MDEA regenerator column with acid gas and a maximum operating temperature of 90°C. The **design pressure is 1 bar**.

According to ISO 24.817 and 3X repair calculations, 4 composite layers of REINFORCEKiT® 4D HT+ (specifically dedicated to high temperature) were determined to reinforce the defects.

Scaffoldings and surface preparation were already managed before 3X team arrival. The surface preparation was made according to 3X requirements to get a good surface roughness and ensure a good bonding between the steel of the column and the composite of the repair. Upon arrival, 3X specialists checked the surface profile and the hygrometric conditions and cleaned the surface using acetone before starting the wrapping procedure (steps described below – the procedure is the same for the 3 welds to be reinforced).

1. F3XS1 filler was applied on the weld to smooth the shape and improve the Kevlar® tape fitting on the column.
2. R3XHT+ resin was applied on the surface to ensure the perfect impregnation of the Kevlar® tape.
3. Composite wrapping was completed using Kevlar® tape impregnated with R3XHT+ resin → 4 layers and 1270mm repair length for each defect. During the process, tape impregnation was checked on both sides to ensure the expected performance.
4. Finalization of the repair. A layer of R3XHT+ was applied all over the repair to ensure good wetting and improve the visual aspect. Reference plate was installed on each repair for traceability purpose.

For each repair, samples of filler and resin were taken during application for quality control.

Hardness measurements were performed 3 days after job completion and concluded the good achievement of the repairs. This project was challenging because of the large column diameter and the time frame for completing the job. The column was successfully reinforced on the weakest areas and is now protected from leaking issues.

Column overview with welds location

Europe's leading Pipeline Conference and Exhibition ptc for the first time virtual

- The first ever online ptc 2020 was successfully held from 30 March to 2 April 2020.
- The digital version of the renowned Pipeline Technology Conference (ptc) was put in place on short notice by the organizer EITEP Institute, after the Corona-Pandemic led to a global shutdown.
- Despite the short preparation time, the ptc-team managed to provide an alternative version, which attracted more than 550 participants and 80 exhibitors, while also enabling more than 100 technical presentations to be shared with the global pipeline community.
- The organizer announced the creation of upcoming online events after the remarkable success of this unique pilot project.

"We were convinced that our innovative concept would be well received by the global pipeline community, but the success surprised even us. This shows that crisis situations not only present challenges, but also lead to meaningful innovations. We will build on this success and work out new offers that take up the advantages of digital services, such as online ptc 2020", says Dr. Klaus Ritter, President of the organizing EITEP Institute.

The three-day-event took place at the same time as the original Pipeline Technology Conference was planned, therefore allowing many of the already registered participants, sponsors and exhibitors to shift smoothly to the digital edition. The core feature of the online ptc 2020 were the technical presentations, that were accessible as full papers or video files as well as the opportunity to connect and chat with other participants and exhibitors. The central activity feed allowed for the real-time posting of questions or information, contribution to an overall success of the digital event.

"We know of course that this kind of online event cannot replace the face-to-face contacts of a real conference with exhibition in Berlin, but we are very grateful that the whole ptc community made it possible to keep the spirit of the Pipeline Technology Conference alive by attending an intense exchange of experience between the participants and by gathering a global audience from all over the world, once again solidifying ptc's standing as the most international pipeline event worldwide", expresses Dennis Fandrich, Chairman of the ptc and Director Conferences at EITEP Institute, his gratitude to the many participants.

During the first day of online ptc video presentations were available to the audience along with the full papers of all presenters, totaling in more than 100 topics that were presented and discussed during the event. The second day was dedicated to networking, enabling all participants to connect with each other and have their private chat conversations with their business partners and potential clients. The last day was under the motto Throwback Thursday. Highlight video presentations from previous ptc-events were available that day and up for discussion.

A challenging aspect of this innovative project was the exhibition-part. The traditional ptc, recognized as Europe's leading pipeline event, is attracting every year more and more exhibitors, who would like to share their technologies and solutions to the global pipeline community in general and to the high number of representatives from pipeline operators in particular. "Exhibitors want to be seen and want to be able to present themselves and their capabilities to their clients and potential customers. Therefore, we have established a special section within our conference app, giving every exhibitor the opportunity to be seen by the participants and to describe their services. Of course, this lacks the personal aspect of a trade fair, but it was a good compromise as company representatives were available for questions and requests from their digital visitors." says Marian Ritter, Director Exhibitions at EITEP Institute.

An additional service for the presenters and exhibitors of online ptc 2020 is the publication of all the conference papers in several special issues of the Pipeline Technology Journal. The digital journal is also capable of including the video presentations, thus enabling its readers to consume all relevant information delivered by the online event.

Like the original ptc event in Berlin the online ptc 2020 was preceded by a series of seminars on Monday, this time held as online seminars. The topics were "Pipeline Defect Assessments" and "In-Line Inspection of Pipelines and Difficult to Inspect Pipelines". Both the lecturers and the participants appreciated this format, especially in a time were professional training programs are limited by the current pandemic.

"Online ptc 2020 was an overall success, but the upcoming Pipeline Technology Conference 2021 of course will return to the established and accepted physical format our participants and exhibitors appreciate the most. The opportunity to engage in intense exchanges of experiences with pipeliners, face-to-face, with people from all over the world, is what defines our ptc and what makes it one of the world's leading pipeline events", says Dr. Klaus Ritter. "We are very grateful for the overall support our community gave to us in such challenging times. This encourages us to deliver an even greater event experience next year", he added. All papers and videos from the online ptc 2020 will be available for free via the ptc Pipeline Open Knowledge Base on the official ptc website shortly. The 16th Pipeline Technology Conference will take place from 15-18 March 2021 at the Estrel Congress Center in Berlin, Germany.