

INNOVATING PIPELINE INTEGRITY

***ULTRASONIC AND
ACOUSTIC RESONANCE
TECHNOLOGY INSPECTIONS***



INSPECTION INTELLIGENCE IS OUR PHILOSOPHY

NDT Global is the leading supplier of ultrasonic pipeline inspection, acoustic resonance technology (ART), and advanced data analytics. A state-of-the-art inspection fleet provides the entire inline inspection (ILI) service spectrum for gas and liquid pipelines.

The full range of services includes crack, metal loss, geometry, and mapping inspection, in combination with data analysis and integrity assessments.

A commitment to continuous technical improvement, innovation and excellence is NDT Global's unique approach *"Inspection Intelligence"*.

NDT Global's key benchmarks are first run success, best data quality and on-time report delivery. All inline inspection projects are completed by skilled engineering and project management teams, complemented by the most experienced data analysis team in the industry.

OUR PURPOSE

*"TO ENSURE A SAFE ENVIRONMENT THROUGH
PRECISE MEASUREMENT AND ASSESSMENT."*



OUR CORE VALUES

At NDT Global, we believe that to be truly successful, we must always be honest and open with our customers, our partners and our employees. Seven core values define who we are. These values serve as our guiding principles and are integral to everything we do.

ACCURACY AND PRECISION

We strive to deliver the most accurate measurement possible, we take pride in being precise about the exact size and location of pipeline anomalies. The processes we utilize are repeatable, ensuring that our findings are always highly accurate.

ALWAYS DEPENDABLE

We do not make promises we cannot keep. Our customers can always rely on us to deliver on our commitments.

ENABLE AND TRUST OUR PEOPLE

We enable our people through training and encourage them to act independently. We trust our people to make good decisions that align with our core values.

HONESTY AND TRANSPARENCY

We strive to always be honest and transparent with each other and with our customers. We do not hide uncomfortable truths or mistakes that are made.

IMPROVEMENT THROUGH INNOVATION

We continuously look for new ways to improve what we do. We embrace innovation in ideas, technology, and processes to make this a reality.

PASSION FOR EXCELLENCE

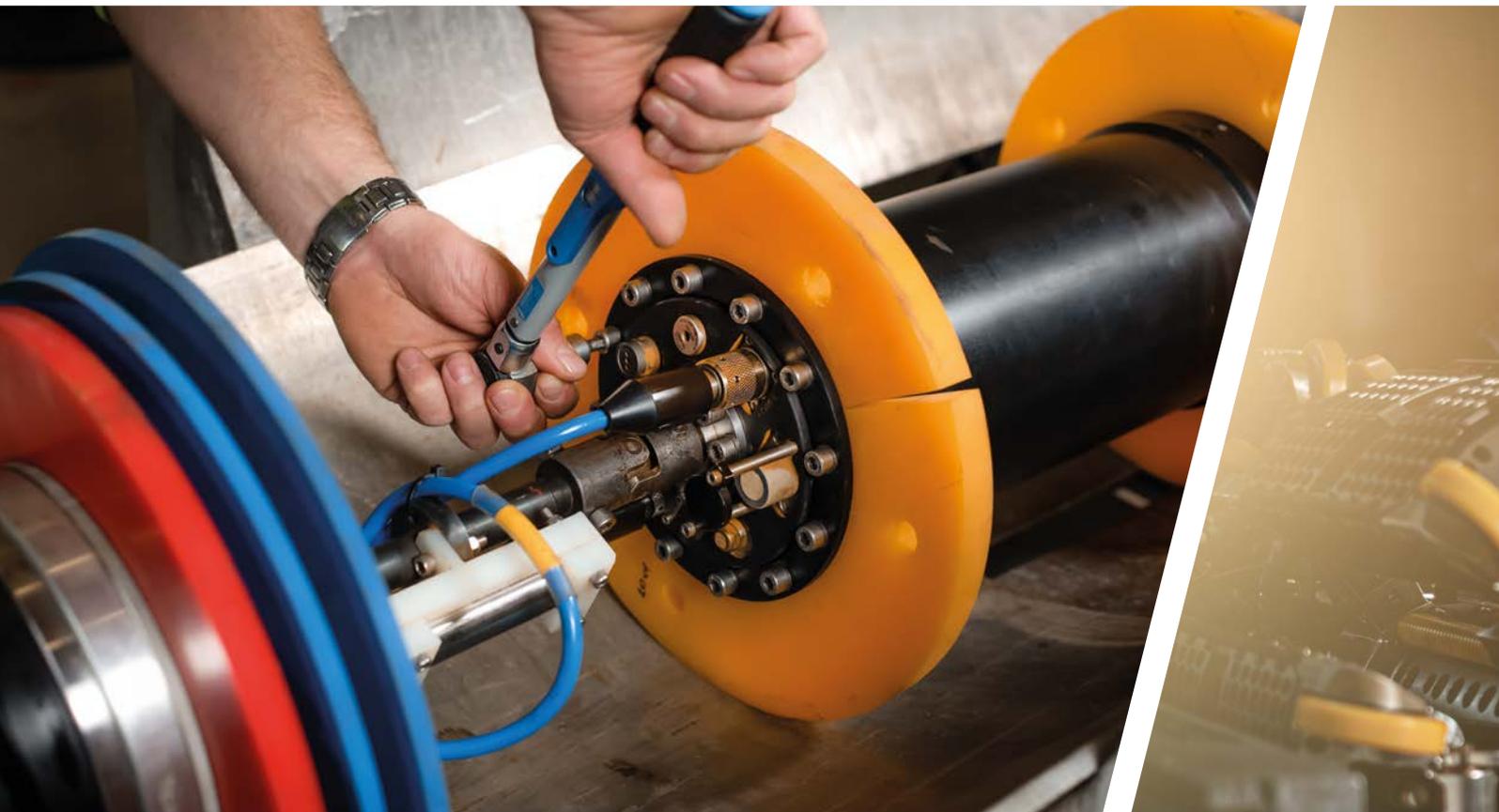
We strive to be the best and always offer an excellent service to our customers. We go above and beyond our commitments and actively seek opportunities to excel at what we do.

SAFETY THROUGH MEASUREMENT

Pipeline safety can be significantly improved by enhanced measurement and assessment. This knowledge drives us to find more accurate measurement and reporting techniques for our customers.



TECHNOLOGIES



ENHANCED SERVICES PORTFOLIO

Guaranteeing the safe operational conditions of pipelines is paramount to any integrity management program. Intelligent inline inspection (ILI) systems are widely used throughout the industry to guarantee such safe operations.

By offering pipeline operators both ultrasonic technologies (UT) and acoustic resonance technologies (ART), NDT Global is delivering the most accurate and reliable iteration of ILI technology available to both gas and liquid lines. By taking advantage of the highly accurate data offered by NDT Global, operators can avoid unnecessary remediation costs and improve pipeline safety.

We partner with pipeline operators to solve what were previously thought to be un-solvable challenges, ultimately pushing ILI technologies to new heights.

BETTER DATA THROUGH DIRECT MEASUREMENT

Ultrasonic wall thickness measurements and acoustic resonant technology provide absolute measurement, requiring no calibration. Both are highly versatile, meaning they are suitable for challenging inspections such as thick-walled pipe or CRA clad pipe.

The absolute measurement data provides excellent input for accurate pressure calculations, e.g., river bottom and crack depth profiles, or even 3D finite element analysis.

Both technologies provide greater accuracy than other non-destructive methods in determining the depth of metal loss or cracks and remaining wall thickness. Apart from standard pipeline steels, ultrasonic technology can also be applied for special pipeline materials including high-alloy steels or combined structures (e.g., clad pipe).



ACOUSTIC RESONANCE TECHNOLOGY (ART)

ART is an ultra-wideband acoustic measurement technology that delivers highly accurate pipeline wall thickness data. The direct nature of the ART inspection technique improves defect detection, classification, and sizing. This applies to internal, external, and mid-wall defects and equally for metal loss as well as deformation. With this data, pipeline operators have all the information they need to take precise corrective action to maintain their asset integrity.

The ART Scan™ tool performs ultrasonic inline inspection of pipelines using gas or liquid as a coupling medium. Using acoustic resonance technology, the tool provides sub-millimeter accuracy wall thickness measurements. Beyond wall thickness the non-contact sensors also provide a full geometry survey of dents, buckles, out-of-straightness and ovality. ART Scan tools are short and light-weight, and currently available for collection of wall thickness, ultrasonic geometry, and INS data sets.

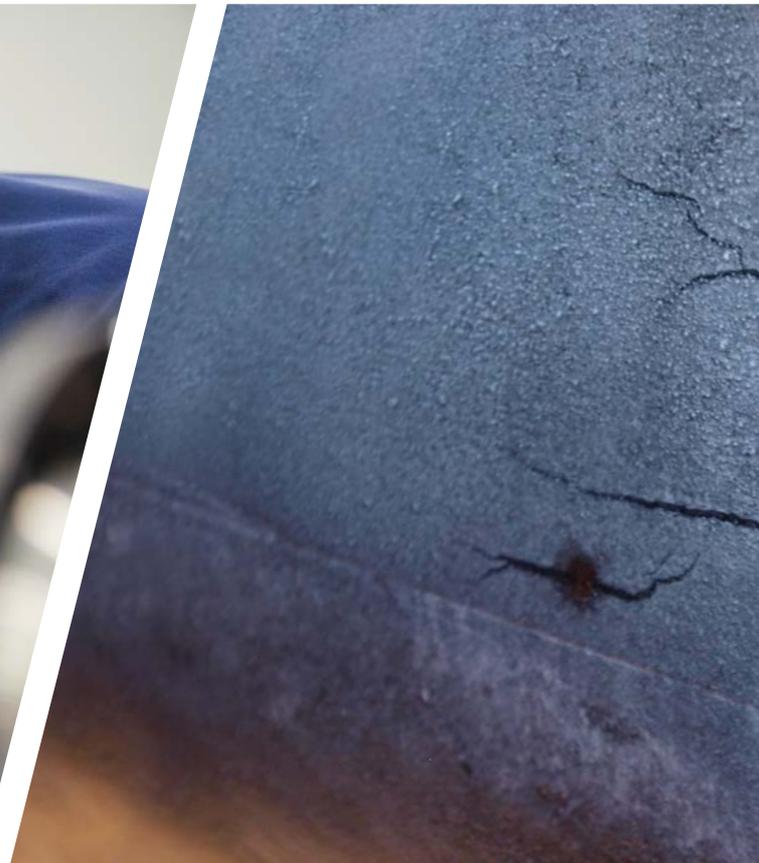
ULTRASONIC TECHNOLOGY (UT)

NDT Global's UT technology provides an industry leading probability of detection, sizing and characterization delivering peace of mind to pipeline operators about the condition of their assets. We then transform this accurate data into information providing valuable insights about the condition of the pipeline asset. The Evo 1.0 robot fleet provides versatility in configurations to best accommodate the operational conditions of pipelines avoiding service disruptions.

The Evo 1.0 robots offer inspection velocities of up to 4 m/s (9 mph), removing the need to reduce flow rates during inspection.

Available for pipeline sizes 6" to 48" diameter, these robots deliver the highest circumferential and axial resolution available in the market.

PIPELINE CRACK INSPECTION



ULTRASONIC CRACK DETECTION

Cracks and crack-like features can develop during pipe manufacture, pipeline construction or operation. Whatever the origin, these flaws can seriously compromise the integrity of a pipeline, making it essential to detect, size and locate them before severe damage occurs.

Most cracks are invisible to the naked eye and can weaken a pipeline leading to harm to the environment, reputation damage and operational consequences. NDT Global's range of ultrasonic crack detection ILI tools ensure accurate detection and identification of crack anomalies in both the base material and welds.

In order to detect and size cracks, our ultrasonic crack detection tools use the proven 45° shear wave method. NDT Global was the first to introduce Enhanced Sizing for UT crack inspection. This service provides a direct crack sizing assessment for depths above 4 mm (0.16 in).

ECLIPSE UCx — DETECTING AND SIZING TILTED AND SKEWED CRACKS

By including additional sensors on the Eclipse UCx sensor carrier, NDT Global outperforms all other crack detection tools, achieving sizing and detection performance in the pipe body, and the long seam weld.

Eclipse UCx includes all the advantages from UCx Enhanced Sizing and additionally has the ability to overcome the tilt and skew limitations for long seam weld, by including a pitch and catch sensor configuration.

Eclipse UCx delivers superior detection capability with tighter depth sizing tolerances. To accomplish this, the sensor carrier is modified to increase the number of sensors.



Axially-oriented crack colony



Circumferentially-oriented crack field



Eclipse UCx offers a sensor configuration that provides the ability to identify and accurately size tilted and skewed cracks, e.g., hook cracks or cracks at the bevel of typical DSAW seams.

- Reliable detection of axial cracks in the pipe body and the long seam
- Designed for high-precision inspection of axial cracks in long seam welds and base material
- Detection and sizing of tilted and skewed cracks (hook cracks) for long seam welds
- Supports the replacement of hydrostatic testing with ILI critical feature detection
- Combined crack, metal loss and geometry inspection

Eclipse UCx represents the ultimate crack detection ILI technology, with the best specifications, backed by the most experienced data analysis team.

EVO 1.0 UCc

Circumferential cracking defects can be addressed with dedicated ILI solutions, utilizing the same ultrasonic technology used for axial crack inspection. NDT Global's solutions for circumferential crack detection offer industry-leading precision for circumferentially oriented cracks and is available in all common pipe sizes. We offer more experience in this field than any other ILI operator and continue to push boundaries.

Ultrasonic ILI robots play an important role in the integrity management of circumferential cracks. This inspection technology has a proven POD of $\geq 90\%$ for crack fields and crack-like indications as well as a depth sizing tolerance of ± 1 mm (0.04 in). Circumferential crack inspection technology is a reliable and accurate technology that assists with the overall integrity program for pipeline operators.

- Precise inspection of circumferential cracks
- Absolute crack sizing for full range of crack depth
- Higher robot speed avoids flow rate reduction
- Available for diameters for all common pipe sizes

PIPELINE WALL THICKNESS INSPECTION



DETECTING AND SIZING METAL LOSS

Metal loss is one of the most common threats to a pipeline, and managing this plays a critical role in the overall success of an operator's business.

Metal loss by corrosion or gouging can critically reduce pipe wall thickness. Precise measurement of the wall thickness provides superior input data for the integrity assessment. This information is used to determine the safe operating pressure, which is of the utmost importance.

When each project commences, NDT Global identifies which solutions best fit with an operator's need. The pipeline location, medium, steel type, coating condition, cathodic protection as well as operating parameters, will influence a pipeline's integrity. Over time, these factors can cause flaws and anomalies to appear in pipelines. They can grow on the internal surface, or its exterior, and may appear during the manufacturing process or during operational life.

ART SCAN

Using NDT Global's acoustic resonance technology, ART Scan was the first ILI tool providing sub-millimeter accuracy wall thickness measurements in gas pipelines. ART Scan offers:

- Direct wall thickness measurement in gas lines, with sub-millimeter accuracy
- Inspection of heavy-wall pipelines up to 75 mm (2.95 in) at full production without compromising measurement specifications
- Single inspection run for metal loss, ID/OD, geometry and IMU data
- Highly suitable for large diameter changes (>6") and bi-directional applications



3D model pittings



Girth weld defect



EVO 1.0 UMp

Innovative ultrasonic technology offered by NDT Global's Evo 1.0 significantly improves robot performance by enhancing speed, resolution, and reliability. Evo 1.0 UMp offers:

- Metal loss inspection with quantitative wall thickness measurement and pinhole / pitting resolution.
- Circumferential sensor spacing of 4 mm (0.2 in)
- Minimal axial sampling distance of 0.75 mm (0.03 in)
- Inspections for diameters from 6" to 48"

PINHOLE AND PITTING INSPECTION

Pipeline operators have long recognized pinhole defects as a significant risk factor in their integrity management programs.

NDT Global offers high-resolution metal loss inspection, allowing reliable detection and sizing of metal loss defects even in the pinhole sizing region. High-resolution robots detect and size corrosion pinholes with dimensions ≥ 5 mm (≥ 0.20 in).

The data will pinpoint the true deepest point of a pinhole morphology within a larger area of corrosion with an overall shallower depth. The service offers a depth sizing accuracy of ± 0.4 mm (± 0.02 in), and is generally accepted to outperform magnetic technologies.

CORROSION GROWTH ASSESSMENT

The measurement of minute corrosion changes enables pipeline operators to safely plan and manage the integrity of their asset. The corrosion growth assessment process is based on the correlation of metal loss anomalies detected by several inspections. Often, the number of reported anomalies increases between inspections. Possible reasons are corrosion growth but also improved inspection resolution (higher POD) or different reporting thresholds.

For newly reported features, NDT Global's integrity team analyzes the corresponding locations from the initial inspection data and compares them to the latest data. Based on this data comparison, the team concludes whether these new locations represent new corrosion anomalies or if they were previously not detected/reported due to other reasons (e.g., resolution, reporting threshold, and limited data quality).

The team then calculates the corrosion growth rates from the change in depth of metal loss features detected in both compared inspections and from the depth of newly identified corrosion anomalies.

PIPELINE DEFORMATION AND MAPPING INSPECTION



PRECISE MEASUREMENT THROUGH COMBINED INSPECTION

Mechanical deformation of a pipeline can occur in a variety of different ways - during installation or through third-party influence during operation

If undetected, the resulting flaws can seriously damage pipeline coatings and initiate cracks and corrosion. The safe operating pressure of a pipeline is impacted significantly by the presence of a dent, which acts as a stress riser itself. Both, the UT and ART technologies ensure precise and direct measurement of dents with sub-millimeter accuracy.

Coincidental and interacting threats in a pipe segment can result in an increased chance of pipeline failure. Although an individual threat may not be of major concern, the condition might be critical if multiple threats are present and interacting at the same location.

Multiple inspection technologies combined for a single inspection run enables better evaluation of interacting threats.

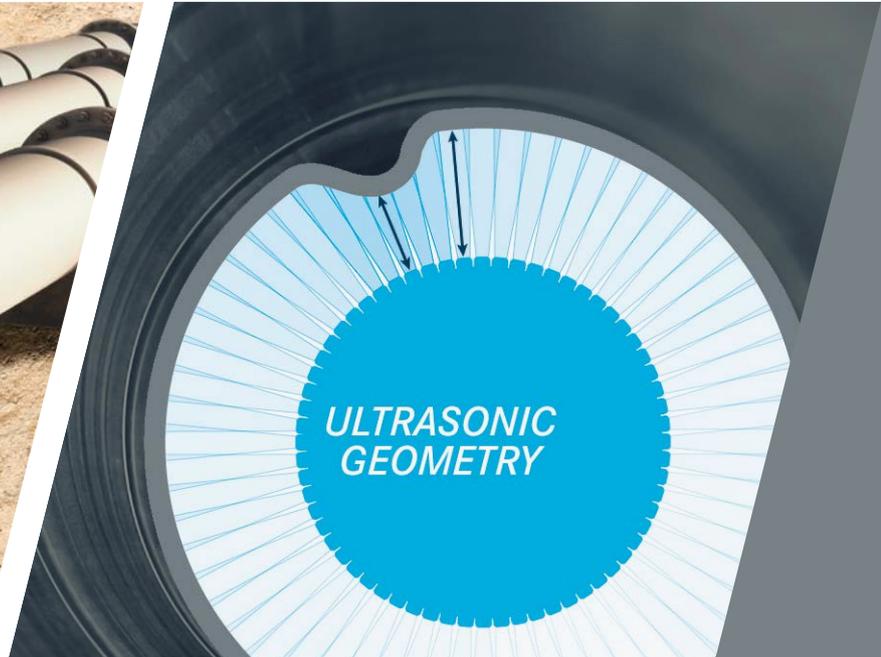
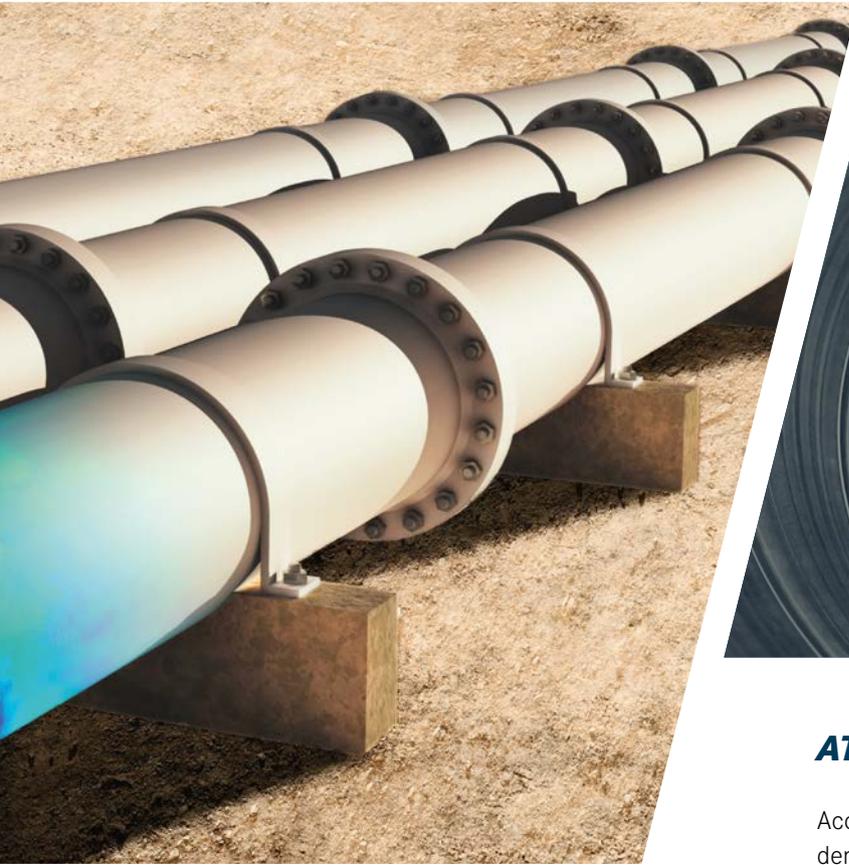
PINPOINT INSTALLATIONS, WELDS AND ANOMALIES

By having precise location information, operators can save valuable effort and resources with less disruptions to their management processes.

Regulations require pipeline operators to systematically register the specific location information of their assets. For older pipelines there may not always be legacy documentation available, highlighting the need for the creation of this data.

Leveraging high-end exploration technology and leading-edge software products allows NDT Global to pinpoint installations, welds, and anomalies in pipelines at the preliminary reporting stage.

All data can be exported to a geographic information system (GIS), to better understand and visualize identified anomalies.



ATLAS INS

Atlas INS inspection gives a true picture of the current location of a pipeline and provides a sound basis for decision making. High-accuracy GPS information presents a reliable reference to relate pipeline data and at the same time, reduces verification costs. Atlas INS delivers:

- 3D coordinates with sub-meter accuracy
- Bend quantification like deflection angle, direction, and bend radius
- Direct GIS input and flexible output formats, including ESRI SHP files, spreadsheets, and Google Earth compatible files
- Essential components of any baseline assessment and integrity management plan
- Available in liquid or gas lines and can be integrated in all NDT Global's ILI technologies

ATLAS UG

Accurate pipe geometry measurement and detection of dents are essential for pipeline integrity management. Using UT or ART technologies ensures precise direct measurement of dents. NDT Global's geometry survey ensures complete coverage of the pipe wall. This coverage is maintained in bends with no loss of data. Atlas UG delivers:

- Contactless sensing - no risk of damage to pipeline
- Detection, identification, and sizing capabilities of deformation anomalies
- No calibration required before/after the run
- Inspections for diameters from 6" to 48", larger sizes on request
- Available in liquid or gas lines and can be integrated in all NDT Global's ILI technologies

Combined inspections enhance the identification of combined defects as the data is fully aligned. Data analysis now uses this data to provide improved identification of features interacting with dents.

SPECIALIST INLINE INSPECTION



TAILORED SOLUTIONS

Not all pipelines are designed and constructed to suit existing ILI tools. Sometimes lines are built to accommodate longer distances, deeper water, existing infrastructure, or corrosive products. As a result, pipelines can become challenging to inspect based on run duration, wear, wall thickness or pressure.

Within NDT Global, we noticed that operators of such lines are drawn to ART Scan tools which overcome these limitations. ART Scan effectively pushes the envelope of what we consider challenging, more than any other tool in the market today.

OFFSHORE GAS TRANSMISSION LINES

Increasing demands for natural gas has led to the construction of longer and larger gas transmission systems. A clear increase can be seen in the number and capacity of offshore gas transmission systems, for which the ART Scan tools were initially developed.

Ever-increasing wall thickness, high flows, and criticality of internal coating push these pipelines out of the operational envelope of magnetic ILI technologies. Through using the resonance characteristics of the pipe wall, ART Scan is able to provide a direct wall thickness measurement of the pipe wall using gas as a coupling medium. We are able to deliver superior wall thickness and geometry data, at higher flows without risk of damage to the internal coating.



WAX RICH LINE INSPECTION

Wax in crude oil pipelines is a common phenomenon, causing serious problems for the ability to perform ILI. As offshore crude oil lines often operate in low ambient temperatures, they may develop a high presence of wax which deposits on the pipe wall.

The presence of this wax can seriously affect the performance of traditional ILI technology and can lead to a strong deterioration of the quality of the inspection data, endangering the success of the inspection.

Using ART, we are able to overcome these limitations. The lower-frequency signal of ART is not susceptible to signal loss, and is able to measure wall thickness through wax layers. We have a strong track record of measuring wall thickness through paraffin (wax).

CORROSION RESISTANT ALLOYS

The use of corrosion resistant alloys (CRAs) for pipelines is steadily increasing. When compared to carbon steel, CRA materials can prevent internal corrosion under certain conditions. Their effectiveness depends on the selection of the most suitable alloy for the expected operational conditions of the pipeline.

Clad and lined pipes typically consist of a low-cost carbon-steel backing substrate and an inner CRA material metallurgically (clad pipe) or mechanically bonded (lined pipe) to it. These types of pipes usually show a good balance of material costs, mechanical properties and corrosion resistance.

NDT Global offers the full range of inspection services in CRA pipelines. More notable, this means gas pipelines with CRA liner can also be inspected using the ART technology.

SPECIALIST INLINE INSPECTION

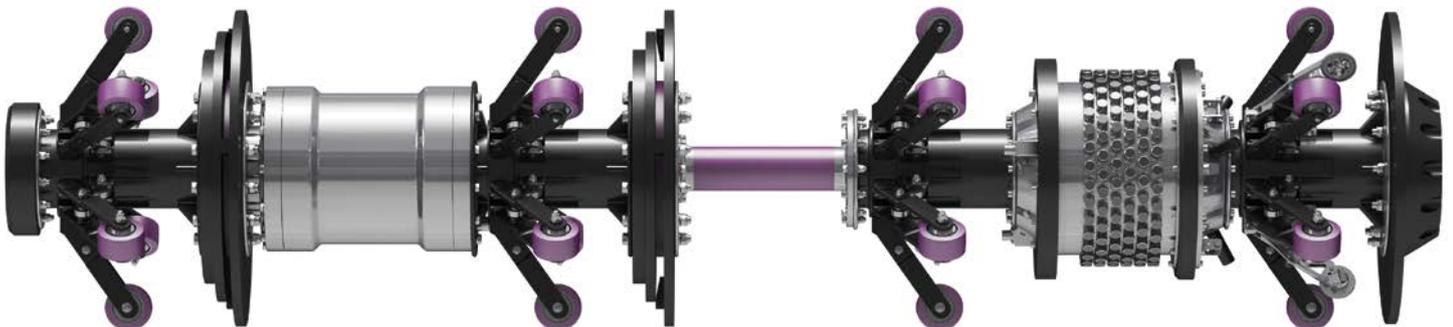


MULTI-DIAMETER PIPELINES

Pipelines traversing the world have a multitude of lengths and diameters. Some even have multiple diameters in a single segment. These multi-diameter lines pose unique challenges for operators when trying to achieve a successful ILI.

Such lines can have a single step diameter change, or a multistep diameter change. For example, a single step change would be a pipe variant of 22" to 24" while a multi-diameter change would be a pipe variant of 24" to 28".

To address these multi-diameter lines, NDT Global has developed purpose-built inspection tools with these unique and challenging pipelines in mind. These can not only navigate, but also fully inspect multiple diameters in a single inspection, saving operators considerable costs in performing multiple inspections.





ULTRA DEEP WATER

Inspecting deep water pipelines can be challenging and brings many unique problems commonly associated with working in these remote environments, such as accessibility and high pressure.

To overcome these challenges, NDT Global has developed a range of inspection technologies and strategies with the aim of simplifying the process. We operate a range of inspection tools optimized for high-pressure operations, for small diameter deepwater pipelines. The expertise shown in designing such bespoke ILI technology highlights NDT Global's knowledge of what is required for offshore inspections.

Our experienced team understands that tackling offshore ILI issues early on significantly reduces risks, and any potential impact they may have on project schedules and costs.



PIPELINE INTEGRITY ASSESSMENT



STRUCTURAL INTEGRITY INSIGHTS

Pipeline inspection is the cornerstone of the pipeline integrity management process. Accurate and up-to-date insights into a pipeline's structural integrity affords operators the opportunity to prioritize maintenance tasks, helping to optimize costs.

Our dedicated in-house assessment team that has extensive experience and knowledge of assessment methods, can deliver precise and reliable integrity assessments. NDT Global provides accurate information to clarify any issues operators may have with their pipelines and offers the following assessments, depending on the requirements of the customer:

Fitness-for-purpose assessment: Achieve the most comprehensive overview of the integrity of your pipeline under current and future operating conditions

Immediate integrity assessment: Easily translate results from an inline inspection into mitigation and repair needs

Feature growth assessment: Compare features across multiple inspection runs which accurately measures growth of features over time

Future and fatigue life assessment: Gain insight into the remaining life of your pipeline and determine ideal reinspection intervals

Finite element assessment: Receive the most accurate estimate of failure pressures

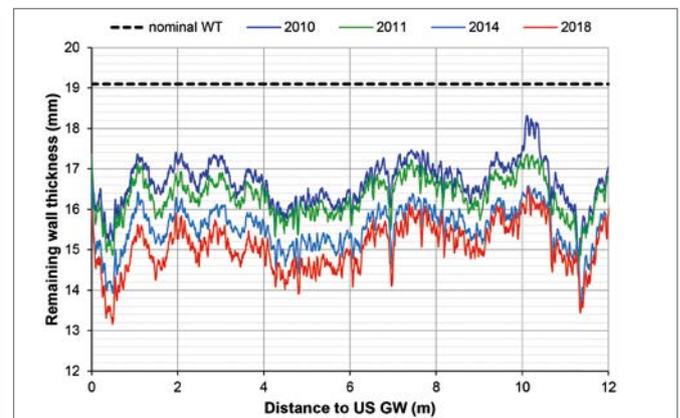
Pipeline movement: Prioritize repairs appropriately with insight into potential-to-fail areas due to external forces

Dent assessment: Get the most accurate input related to pipe dents and localized strain

ACCURATE INSPECTION DATA IS FUNDAMENTAL

NDT Global provides:

- Metal loss inspections that offer quantitative wall thickness measurements with pinhole and pitting resolution
- High-resolution crack inspections which deliver precise crack assessments to include full wall thickness depths
- Advanced crack technology which accurately identifies and sizes tilted and skewed cracks at the seam and in the pipe body
- Data that can be exported to your geographic information system to enable at-a-glance visualization
- Integrity assessments that enable visualization of current pipeline performance and identification of potential problems for future decision making
- Insight at an early stage means better planning and prioritization of maintenance



Example of accurate corrosion growth assessment

ASSESSMENTS



FITNESS-FOR-PURPOSE ASSESSMENT

Fitness-for-purpose (FFP) assessment is an engineering study by which the capacity of a pipeline is determined under current and future operating conditions. FFP is one of the fundamental tools of an integrity management program.

FFP assessment is used to assess the integrity of pipelines that contain anomalies. The most common types that affect the current and future capacity of pipelines include metal loss, geometric variations or deformations, laminations, cracks, and crack-like anomalies, all of which are detectable with NDT Global's inline inspection solutions.

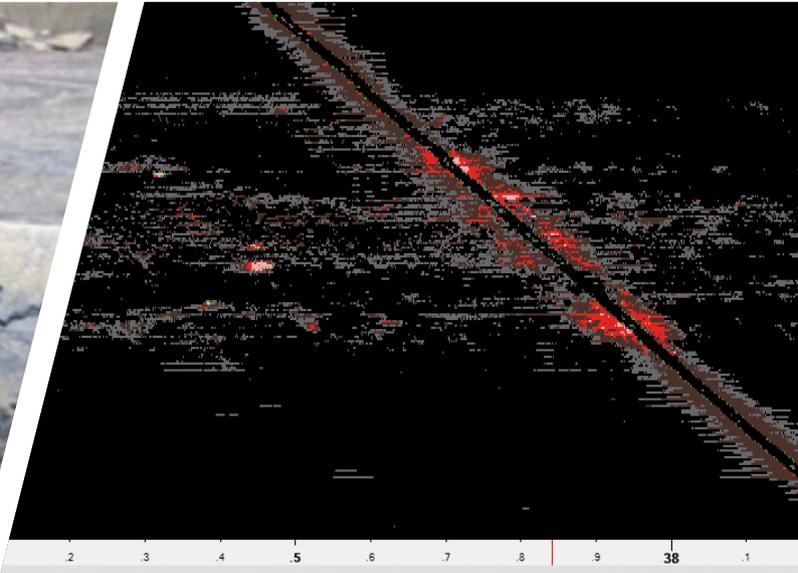
Anomalies are assessed according to accepted codes, standards, or recommended practices. Combining the most advanced assessment methods, e.g., finite element assessment (FEA), with precise high-resolution ILI data enables precise anomaly assessment and reduces conservatism, avoiding unnecessary repairs or pressure restrictions.

Once anomalies are detected and sized, their mechanical effect must be determined by calculating the remaining resistance of the pipeline. These analytical methods determine whether the affected pipelines can acceptably remain in service.

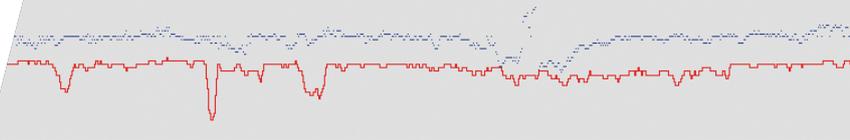
Results are expressed in terms of failure pressure, safe pressure or stress level. The different evaluation methods are described in industry standards.

The assessment results are documented in a technical report that describes the evaluation parameters, the type and dimensions of the analyzed anomalies, methodologies used, results, conclusions, and recommendations.

ASSESSMENTS



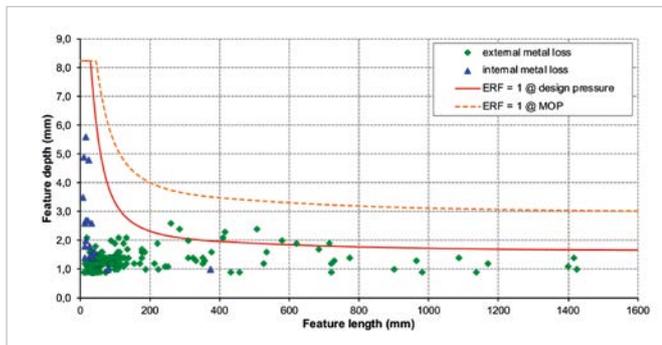
Run comparison & corrosion growth



IMMEDIATE INTEGRITY ASSESSMENT

An immediate integrity assessment determines the current pipeline condition (at the date of the latest ILI).

For all reported anomalies, the safe working pressure P_{safe} is calculated and compared to the selected assessment pressure (e.g., pipeline design pressure, MAOP, or MOP). This allows a priority-based ranking of all anomalies. Critical features with P_{safe} below the assessment pressure are identified and suitable remedial actions are recommended.



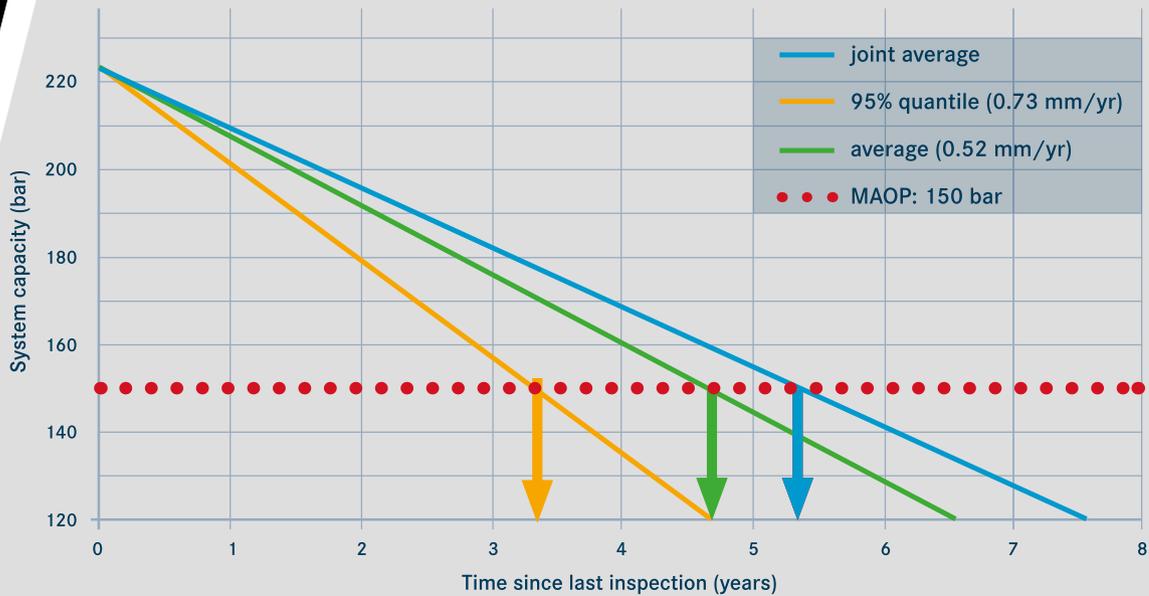
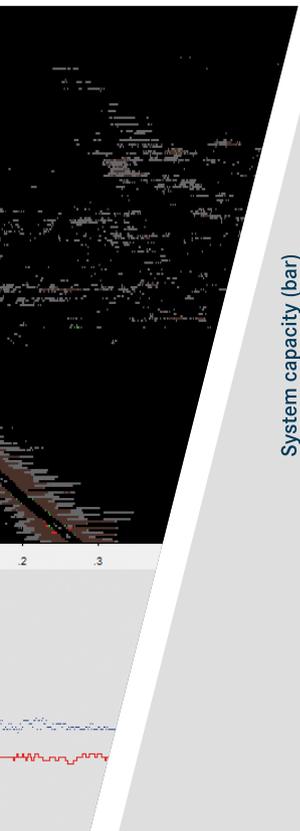
ERF pressure-sentenced plot

FEATURE GROWTH ASSESSMENT

To assess growth behavior over time, a feature growth assessment will deliver a comparison of features across two or more inspection runs.

Inspection data of several inspections are then analyzed and compared to investigate whether features show growth and if new anomalies have developed after the previous inspection. The depth sizing accuracies of the inspection robots are considered to deduce statistical significance of corrosion and crack growth.

A growth assessment delivers detailed information about growth rates and new corrosion or crack anomalies. This information helps you better understand the remaining life of the pipeline. These results serve as a basis for a future integrity assessment, re-inspection intervals and long-term maintenance expenses.



FUTURE INTEGRITY AND FATIGUE LIFE ASSESSMENT

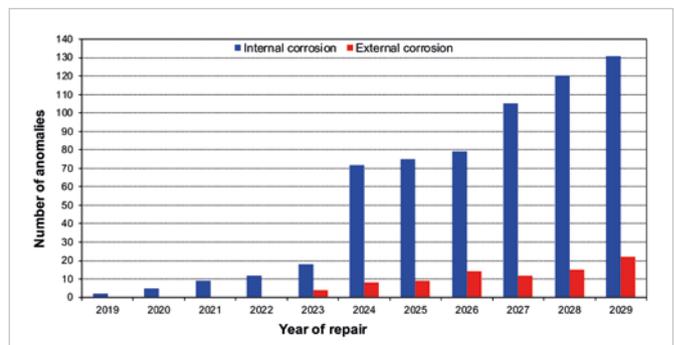
Mechanisms such as corrosion growth and fatigue crack growth, may pass an immediate integrity assessment, yet row to critical mass during pipeline operations. NDT Global compares the results of consecutive inspections to determine corrosion or fatigue growth, assessing the impact of change through future integrity or fatigue life assessments. Crucial input for a future integrity assessment is the rate at which anomalies deteriorate. Corrosion growth rates are ideally determined by comparing results of consecutive inspections.

Fatigue crack growth strongly depends on cyclic variations in the operating pressure. Fatigue crack growth rates are calculated from pressure variations recorded over a sufficient time or can be estimated based on assumed load cycles. Pressure cycling can also lead to fatigue failure of dents. NDT Global will use the results of a future integrity or fatigue life assessment to predict the estimated remaining life of the pipeline and deliver specific corresponding repair dates for all anomalies. This is an important input for future maintenance and repair strategies and optimization of re-inspection intervals.

FINITE ELEMENT ASSESSMENT

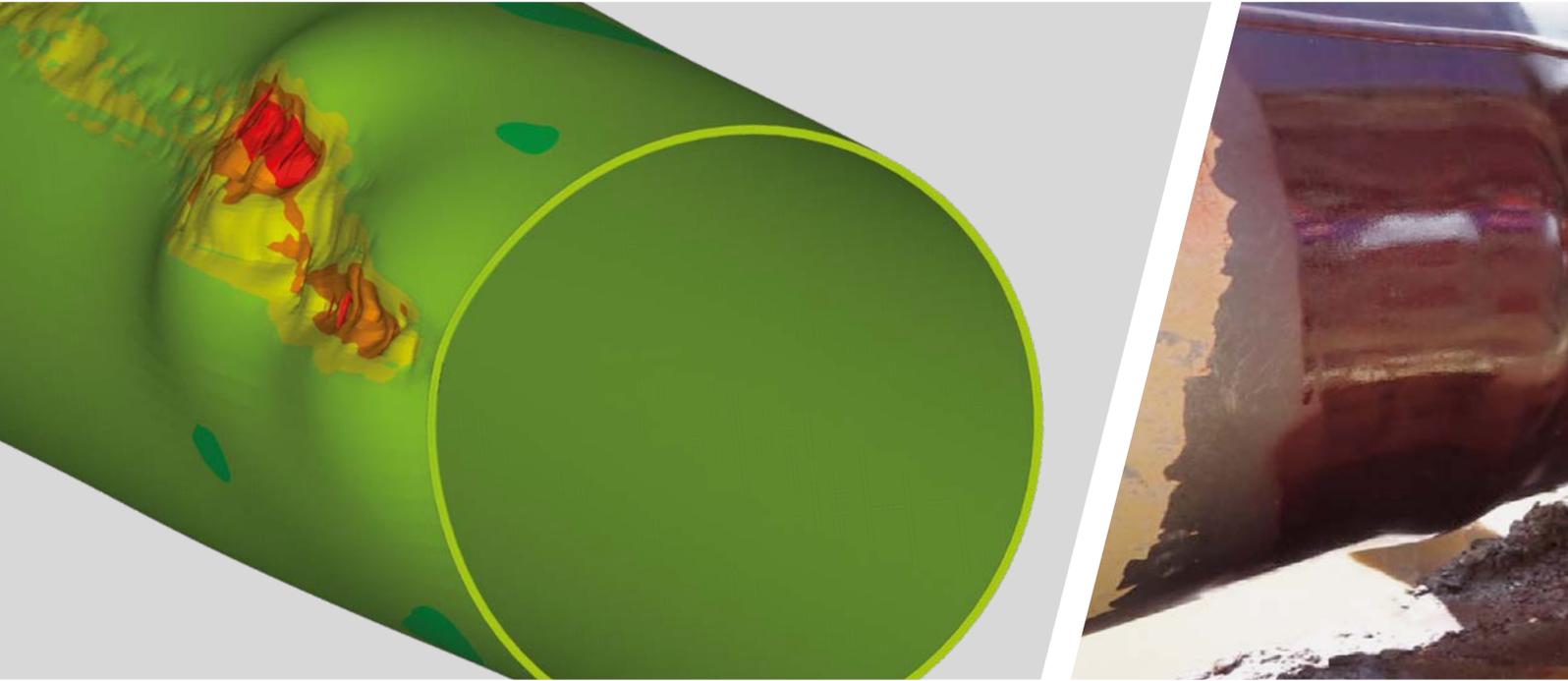
NDT Global uses state-of-the-art computational Level 3 assessment methods, including FEA. These assessments provide precise and accurate predictions of the failure pressure of anomalies.

Conventional assessment methods are widely used and accepted, despite their well-known conservative results leading to decreased throughput and unnecessary pipeline repairs.



Extrapolated repair dates

ASSESSMENTS

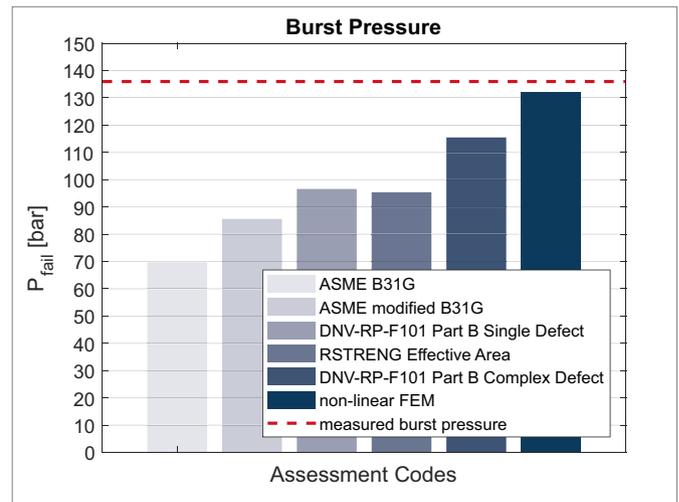


Although these methodologies have been refined, assessing the severity of defects by simplified rectangular boxes (peak depth, maximum length) or depth profiles yields too conservative predictions for the maximum allowable safe working pressure.

FEA is based on the actual 3D geometry of the damaged pipe (anomaly + pipe joint) and can account for specific material properties, if available. This reduces the degree of conservatism and helps avoid costly excavations and repairs in difficult to access locations. FEA is also well suited to assess combined anomalies (e.g., dents with cracks or dents with metal loss) which is not possible with standard assessment methods.

NDT Global’s high-resolution inline inspection robots accurately and reliably detect and size metal loss anomalies and crack-like flaws, and our ultrasonic geometry (UG) technology provides detailed geometry and deformations of pipe joints (e.g., out of roundness) and deformations. Combining such detailed information yields an ideal input for an accurate 3D modelling and FEA assessment.

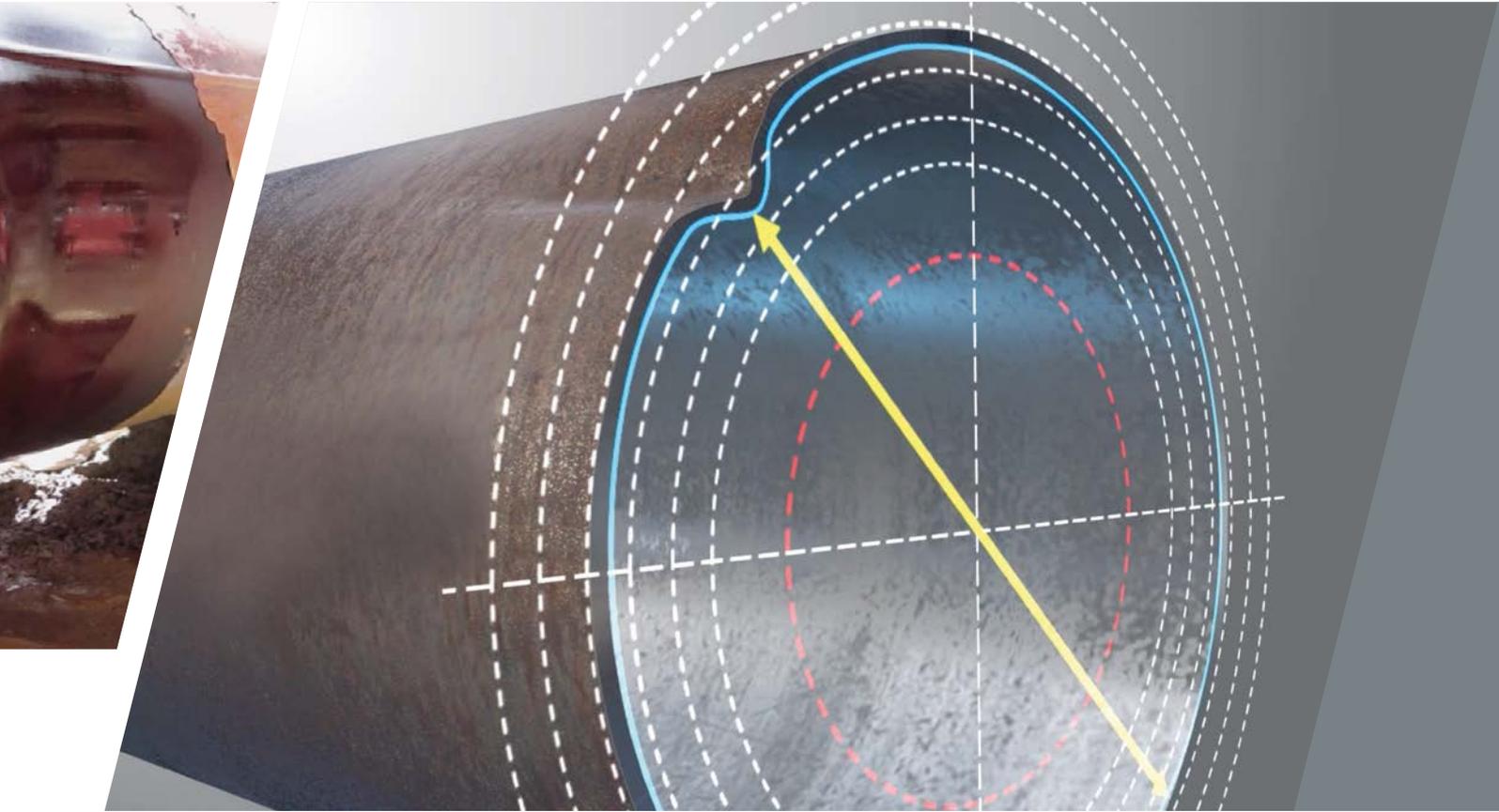
Results of Level 3 assessments based on a non-linear FEA have shown the most accurate estimation of the pipeline failure pressure.



Method/Code	P_{fail}
ASME B31G	69.7 bar (1011 psi)
ASME modified B31G	85.6 bar (1242 psi)
DNV-RP-F101 part B single defect	96.6 bar (1401 psi)
RSTRENG effective area	95.4 bar (1384 psi)
DNV-RP-F101 part B complex defect	115.5 bar (1675 psi)
Non-linear FEA	132 bar (1914 psi)
Measured burst pressure	136 bar (1972 psi)

Assessment results: Level 1 to Level 3 compared to measured burst pressure

PIPELINE MOVEMENT



PIPELINE STRAIN COMPARISON

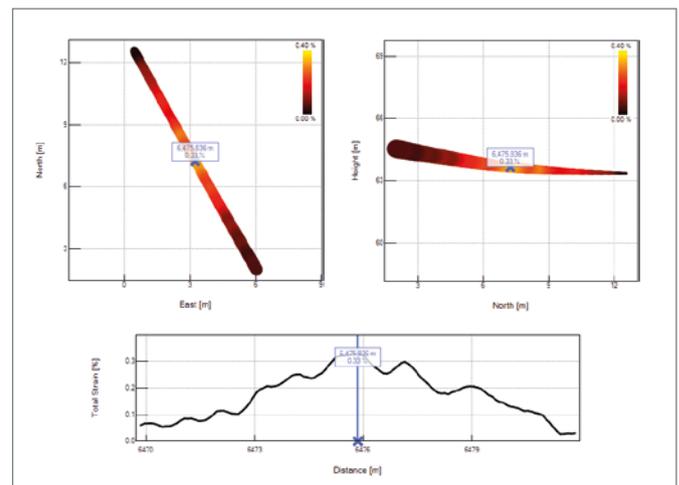
Displacement caused by natural phenomena such as ground movement and elevation changes, compromises a pipeline's integrity. Excessive tensile strain can cause a direct rupture of a pipeline, while excessive compressive strain can cause local wrinkling, and often buckling. Such deformations ultimately cause pipeline failures that results in lost product and environmental damage.

Due to its use of high-resolution INS data acquisition and leveraging of leading-edge software products, NDT Global's Atlas INS is the most reliable means of measuring changes in the shape of a pipeline caused by external forces. With a single Atlas INS inspection, a potential high-strain area can be located, delineating field bends.

Performing Atlas INS inspections periodically protects against the pipeline threats caused by displacement, and the alignment of two inspections (odometer distance adjustment) and direct run-to-run comparison of curvatures and strain enables accurate pinpointing of the displacement location. The pipeline displacement between the two INS inspections is obtained by

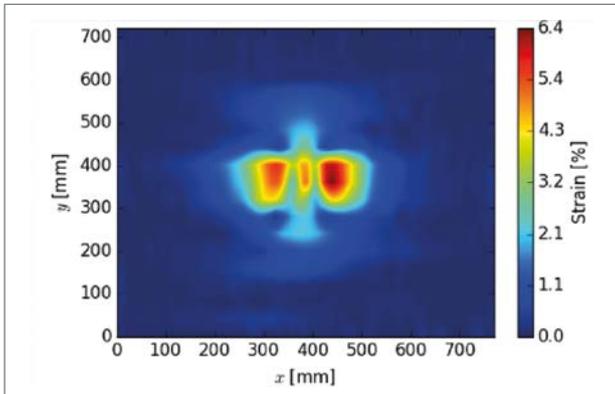
comparing the vertical and horizontal strain at the same points on the pipe.

NDT Global aligns two inspections to detect slight changes ($\geq 0.10\%$) in the strain over time, and accurately pinpoints pipeline movement locations.

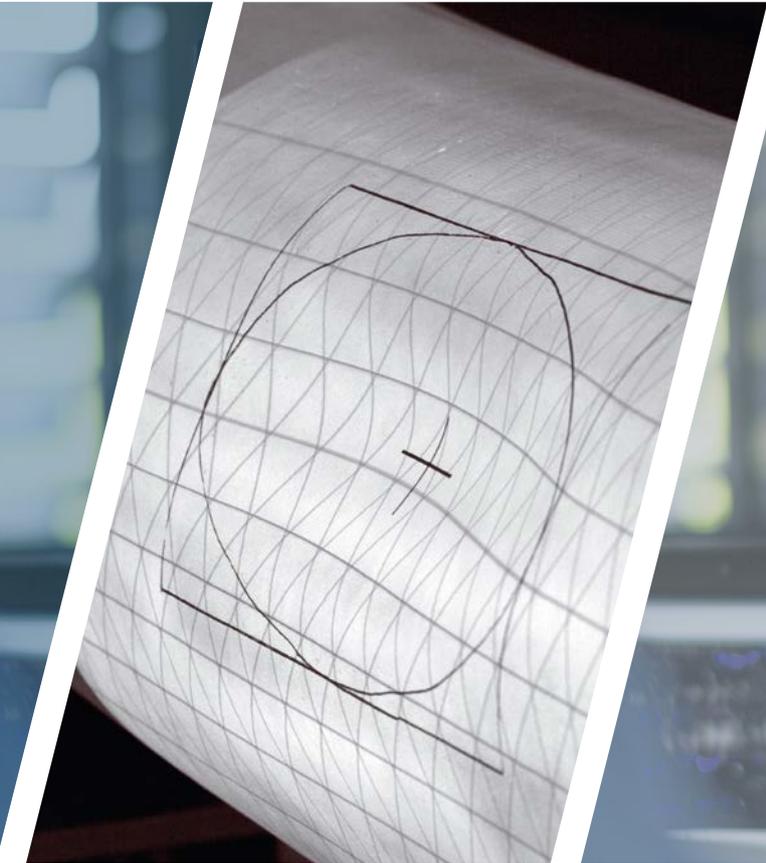


Pipeline strain in a pipe section

DENT ASSESSMENT



Combined strain components in a deformed pipe



DENT STRAIN

A dent strain assessment shows material performance in deformed zones such as a dent, allowing a better measure of the dent severity compared to the traditionally used, simple depth criteria.

The strain at the dent peak, which is affected by the overall distribution and shape of the deformation, is considered a measure of the material performance. The data collected by NDT Global's robot offers the most accurate input information related to pipe and dent geometric shape to apply the assessment based on strain-criterion.

Using cutting-edge software, NDT Global implements a pointwise method of calculating strain by calculating the membrane and bending strains in the longitudinal and circumferential directions. Using the recorded geometric shape of the pipeline, we deliver the calculated inner and outer strains on a point-by-point basis. Taking advantage of Atlas UG's axial resolution and overlapped sensors, we use a very detailed and accurate geometry of the deformation to estimate the levels.

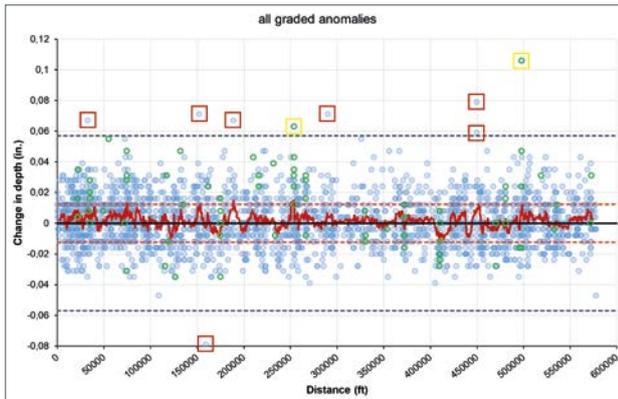
DENT PROFILE CHARACTERIZATION

API 1183 geometry characterization for dent assessment relies on the accurate acquisition of the axial and traverse profiles from ILI data.

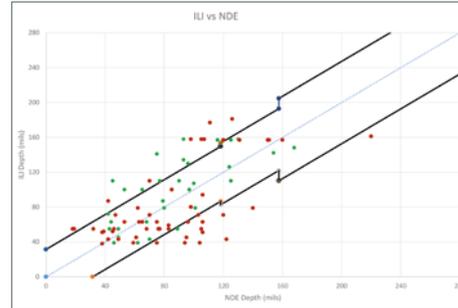
The inherent sensor calibration in mechanical calipers and noise in the data (due to vibration or tool decentralization) needs to be filtered out before the profiles are extracted. The most challenging part of this process is the use of different smoothing techniques to correct the data, while preserving the original shape of the profile and the depth of the dent.

Taking advantage of the direct measurement method offered by the Atlas UG, each ultrasonic beam travels through the same medium properties to reach the internal wall of the pipeline. Every ultrasonic sensor working as one allows the faithful reconstruction of the internal shape of the pipeline. A true axial and circumferential profile of any dent can be directly extracted from the Atlas UG data without the risk of altering the dent profile due to smoothing techniques.

SUPPORT AND CONSULTING



Unity plot considering performance specification, tolerances, feature complexity and NDE bias



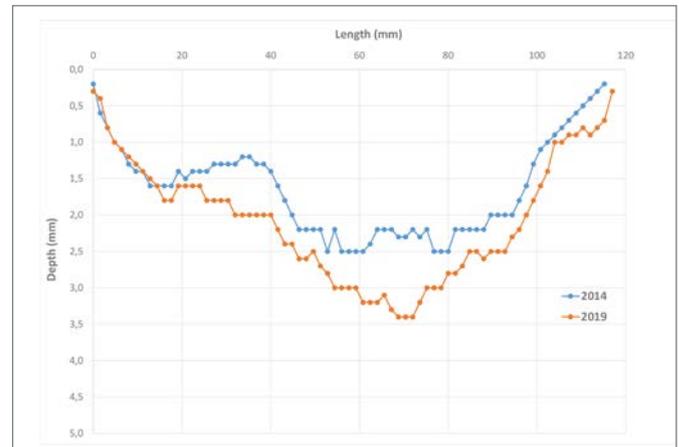
Run-on-run comparison identifying statistical outliers and specific changes across a pipeline

ENSURING LONG-TERM PIPELINE OPERATIONS

Pipeline inspection is the cornerstone of any pipeline integrity management program. Delivering first-class customer and consulting services is embedded in NDT Global's core values and culture.

Using high-resolution data collected by our ILI technology, NDT Global delivers the best of integrity services and data analysis to pipeline operators. The effective use of data is key for operators worldwide when trying to understand specific mechanisms, enhance integrity assessments, while defining the best approach for a specific challenge not addressed by common industry methodologies.

Our team of experts will find a solution and the best fit for any integrity management program (IMP).



Crack-like depth change throughout the years

OUR CUSTOMER COMMITMENT



FIRST RUN SUCCESS

Pipeline inspections are major undertakings involving significant time and resources. Failure to collect all the information required for analysis in a single run can have a huge impact on operations and, ultimately, on profitability.

To ensure a successful inspection, we meticulously plan every project and continuously monitor and evaluate our own performance through external verifications.

NDT Global currently has a first run success rate of over 90%, placing us firmly among the leaders in our field. In keeping with our philosophy of continuous improvement, we have set the long-term goal to increase this figure to 100%.

ON-TIME REPORTING

NDT Global understands the importance of on-time report delivery to pipeline operators. As pipeline inspection data is paramount to integrity management procedures, we commit to on-time report delivery.

To achieve on-time reporting of quality pipeline information, our data services department adheres to strict project management procedures. A team of dedicated project leaders oversee the entire data analysis process. To ensure ongoing service improvements, project cycle times are regularly reviewed and analyzed to identify areas that may require further development.

At NDT Global we are constantly striving to achieve on time reporting and first run success rate goals. Please visit our website for a copy of our latest verified KPI assessments.



BEYOND ZERO HARM

NDT Global are committed to the safety, health and wellbeing of our employees, the protection of the environment and providing customers with the highest possible level of service quality. We achieve this through the implementation of robust and ISO accredited HSEQ management systems; strong training and audit programs, with a relentless focus on continuous improvement based on best practice, industry, and customer standards.

Our transition from a “Zero Harm” approach to “Beyond Zero Harm”, reflects not only maintaining an industry leading TRIR (Total recordable injury rate), but also to drive ambitious, sustained improvements in our HSEQ performance, elevate employee wellbeing and reduce our carbon footprint, with Net Zero by 2030.

These commitments ensure the safety of our people; sustainable and resilient operations over the long term, for the benefit of our customers and the communities in which we operate and serve.

PROTECTING THE ENVIRONMENT

NDT Global is aware of its responsibility to protect the environment. Protecting people, preserving the environment and surrounding communities, serves as our core purpose for continuous innovation and precision. For this reason we have established the following principles:

- We incorporate all relevant environmental legislative and regulatory requirements into our strategic planning
- We adhere to our stated aim of minimizing our ecological footprint
- We give preference to environmentally friendly products
- We use raw materials efficiently and energy sparingly
- We give waste reduction precedence over recycling
- We forgo the use of environmentally harmful raw materials in production processes
- We take precautionary measures to minimize or avoid environmental damage from any incidents which may occur



Please note: Measurement performance specifications depend on inspection and pipeline conditions.
Please contact your local NDT Global representative for further information.

NDT Global reserves the right to introduce modifications and changes without prior notice.

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