

PII Pipeline Solutions
a GE Oil & Gas and Al Shaheen joint venture

Metal Loss

Pipeline inspection and assessment services





Protect the future of your pipeline

We provide a comprehensive range of metal-loss detection services for pipeline operators. Our inspection tools draw on an unparalleled history of technological innovation and in-field success. They have accurately and consistently identified anomalies of every type and size, in every kind of pipeline. The information they gather helps you move beyond detection — to enhanced long-term safety and productivity

The nature of metal loss

All engineering structures contain defects, and pipelines are no exception. Metal loss anomalies can be introduced at any stage of a pipeline's life – during manufacturing, in construction or while in service through material defects, gouges, corrosion, etc. Metal loss anomalies are characterized by an area of pipewall with a measurable reduction in its thickness.

Our inspection capabilities

Specialized inspection capabilities are essential in order to identify and accurately describe metal loss anomalies, and PII Pipeline Solutions, a GE Oil & Gas and Al Shaheen joint venture, offers several proven in-line inspection services for this critical task. The best choice for your situation will depend on the application, type of corrosion mechanism, medium being transported and the nature of the pipeline steel.

Since the inspections generate a variety of data forms, special consideration should also be given to your integrity program requirements. Our tools use advanced ultrasonic and magnetic technologies to obtain precise descriptions in the widest range of pipe diameters and wall thicknesses for gas and liquid pipelines.

Any type of metal loss in a pipeline can be characterized by considering its dimensions. The Pipeline Operators Forum (POF) has established a graphical representation of a number of common metal loss features. PII's worldwide fleet of in-line inspection tools has an unmatched breadth and depth of data-collection and analysis capabilities to address all types of metal loss threats to your pipeline.



Axial Gouge

Mechanical or forceful removal of metal, parallel to the pipe axis, that may work harden the pipe and make it more susceptible to cracking.



General Corrosion

A measurable reduction in the pipewall thickness over a large area, caused by an electrochemical reaction between the pipe metal and its environment.



Shallow Pitting

Caused by imbalances between the pipe metal and an electrically conductive environment; occurs at points of electric discharge.



Deep Pitting

Pitting occurs in proportion to the magnitude and duration of electrical current; it also contributes to NAEC.



Narrow Axial External Corrosion (NAEC)

Associated with pitting, caused by failure of the pipeline wrap at the seam weld.



Erosion Wall Thinning

Usually associated with localized turbulence effects (e.g., high flow conditions just downstream of a girth weld). Entrained solids such as sand can accentuate this form of attack.



Laminations

Internal separations that create layers usually aligned parallel to the worked surface of the metal.



The right tool for every challenge

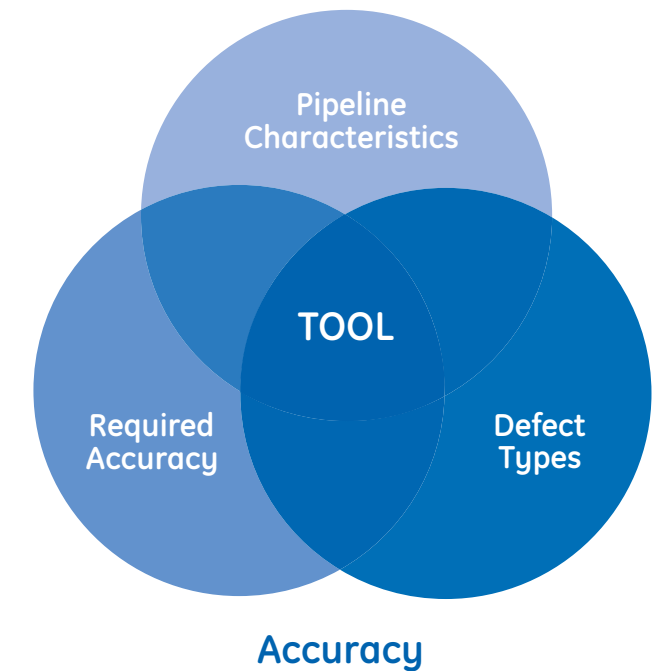
In order to determine the best tool for the job, operators need to consider three things:

- The level of accuracy required
- Defect types to be identified
- Pipeline characteristics and operational conditions

The benefits beyond inspection

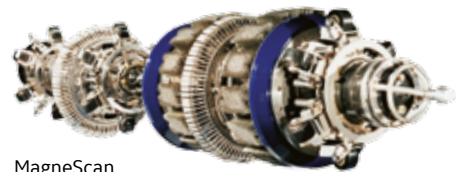
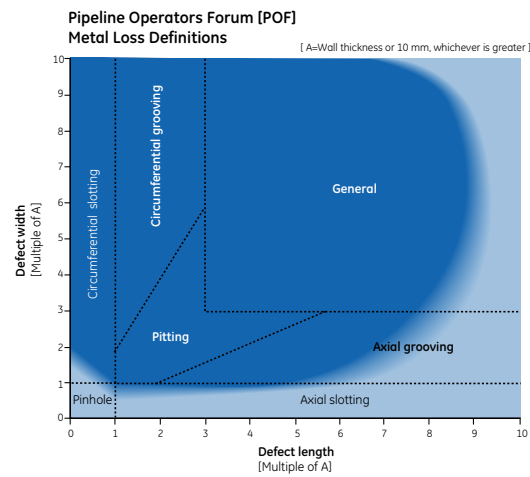
The value of these tools does not simply end with data collection. The level of information provided, combined with our advanced analysis capabilities, will help you more accurately determine the risks involved in each case and substantially reduce the number of excavations necessary for direct assessment and repair.

We can perform ongoing data analysis services or provide you with the advanced, user-friendly software tools to complete the work internally - giving your staff more access to complete information, and more control over the future integrity of your pipeline.



Motor size	MagneScan 12-56"		MagneScan SHR 6-10" / 12-36"		SmartScan		UltraScan WM	
Media	Liquid and Gas		Liquid and Gas		Liquid and Gas		Liquid	
Max. pressure	220 bar		150 bar/220 bar		100 bar		120 bar	
Max. speed	5.0 m/s		5.0 m/s		4.0 m/s		1.0 m/s	
Min. speed	0.3 m/s		0.1 m/s		1.0 m/s		0.1 m/s	
Min./Max. temperature	0 to +60°C		-20 to +70°C		0 to +60°C		-10°C/+60°C	
Min. bend radius	1.5 D		1.5 D		1 D		1.5 D	
Min./Max. wall thickness*	4 mm to 35 mm		3-12 mm / 5-29 mm		6.35 mm to 12.7 mm		5 mm to 45 mm	
Inspection Specifications**	Pitting	General	Pitting	General	Pitting	General	Pitting	General
Depth sizing accuracy	±10%		±8%		±15%		±0.5 mm	±1.0 mm
Length sizing accuracy	±10 mm	±15 mm	±4 mm	±7 mm	±20 mm	±20 mm	±6 mm	
Width sizing accuracy	±20 mm		±12 mm		±20 mm		±12 mm	
Min. det. depth (gen corrosion SW/ERW)	5%		5%		10%		1.0 mm	
Min. det. depth (pitting SW/ERW)	8%		8%		20%		1.0 mm	
Min. det. pitting diameter	7 mm		2 mm		7 mm		5 mm	
Min. sizable pitting diameter	7 mm		5 mm		7 mm		10 mm	

Specifications may vary for individual tools and specific applications
 * Specifications for greater WT can be provided on request
 ** Detection @ 90% and Sizing Accuracy @ 80%



MagneScan inspection tool

MagneScan

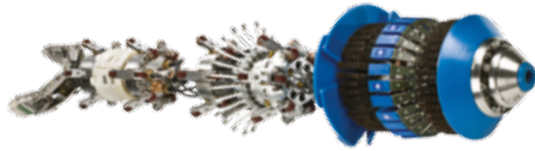
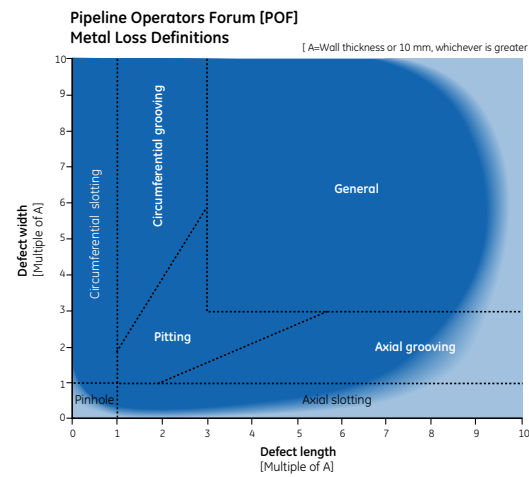
Versatile, reliable and well-proven

Drawing on PII's advances in Magnetic Flux Leakage (MFL) technology, MagneScan™ sets the standard for reliable metal loss inspection results. Designed to withstand extremely harsh operating conditions, it has proven its versatility in a wide range of applications in every type of pipeline – dry or liquid, overland or subsea. PII Pipeline Solutions can provide a tailor-made program to fit the requirements of your system. Specialized adaptations provide high accuracy data even in low operating pressures, thick walled pipe, multi-diameter pipelines and challenging pipeline configurations.

MagneScan delivers the detailed data and high confidence levels essential for a productive integrity management program. RealSpec detection specifications draw on PII's unparalleled inspection experience to bring the highest levels of accuracy to data analysis and interpretation. MagneScan detects: internal and external pitting and general corrosion; hard spots in the pipewall; metal loss associated with dents and under casings, repair shells, metal objects, and girth weld anomalies.

Ideally suited to:

- General corrosion
- Small pitting
- Girth weld anomalies
- Detection of hard spots
- Harsh operating conditions



New MagneScan Super High Resolution inspection tool

MagneScan SHR

Super High Resolution/Triax capability

Class-leading metal loss detection (POD), identification (POI) and sizing accuracy are achieved through a 4-in-1 sensor technology that incorporates three main Hall Effect corrosion sensors oriented in axial, radial and transverse vectors, combined with an ID/OD sensor for internal/external discrimination.

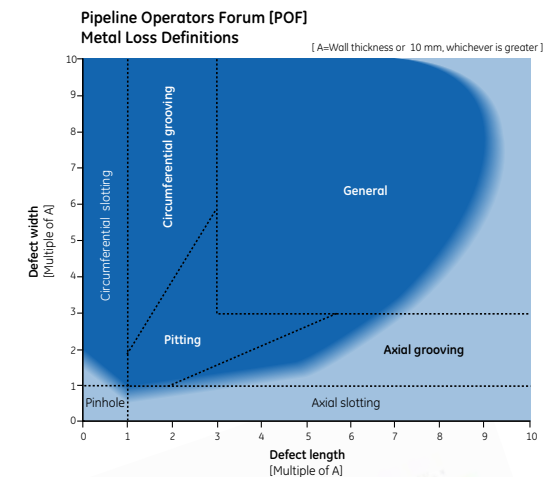
This 4-in-1 sensor technology, sampling every 2 mm along the pipe, makes it possible to identify linkages between individual pits/pinholes and the formation of NAEC as well as circumferential slotting and grooving. Improved defect detection, identification and sizing accuracy for depth, length and width makes MagneScan SHR particularly well suited to critical pipelines with extensive complex corrosion, lines with high consequences of failure and lines that are likely to suffer from axial defects or pinholes.

In addition to delivering outstanding detection and sizing for general/pitting corrosion and axial/circumferential grooves, the system has demonstrated the capability to detect 2 mm diameter pinholes, axial slots as narrow as 1 mm, and circumferential slots including girth weld cracks open by as little as 0.25 mm.

Integrated geometry & mapping

In addition to class-leading metal loss detection capabilities, New MagneScan includes a fully integrated high-resolution caliper array to detect and profile the smallest dents for accurate assessment of severity (PIDA) and FEA analysis.

There is also the option of an integrated Inertial Measurement Unit (IMU) for accurate and reliable feature location, centerline mapping in 3D and identification of curvature/strain. This combination of technologies makes the system an outstanding tool for advanced integrity assessment to better understand the condition of your pipeline, and a superior solution for mechanical damage assessment in particular. The flexibility to process and analyze as much or as little of this Super High Resolution data as is required also ensures a cost effective solution.



SmartScan inspection tool

SmartScan

Inspecting unpiggable pipelines

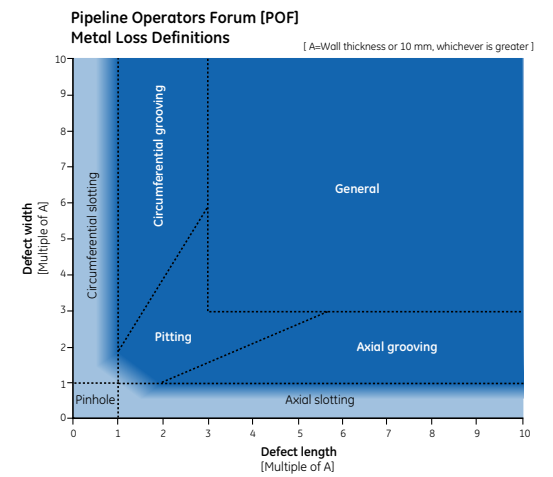
One third of the world's pipelines are currently unpiggable because of access and valve restrictions, multi-diameter designs, impassable fittings and a myriad of other configuration issues. While regulations demand more rigorous compliance criteria, operators have limited, expensive options for integrity assessment. Now, for many of those pipelines, this no longer has to be the case.

SmartScan™ is an advanced in-line inspection tool – capable of affordably navigating previously unpiggable pipelines. The tool can be deployed from our innovative new angled entry system with mobile launchers and receivers (process patent pending) through a hydraulic chute that is attached over a smaller-bore hole in the pipe. The fitting remains as part of your asset, providing easy access for future inspections and cleaning requirements. It can also traverse multi-diameter lines with existing taps.

With lower costs and higher confidence than DA or hydrostatic testing, SmartScan gives pipeline operators the potential for multi-million-dollar savings.

Ideally suited to:

- In-line inspection of previously unpiggable pipelines
- 1D single bends
- Multi-diameter lines
- Entry and exit between restricted valves
- Continuous long-distance inspection with valve bypasses
- Specific inspection of High Consequence Areas



UltraScan WM inspection tool

UltraScan WM/UltraScan Duo

Precise, direct measurement of defects

UltraScan™ WM (USWM) now uses PII's Advanced Echo Processing (AEP) technology to further enhance data quality and help reduce the required number of digs and inspections. AEP delivers the most accurate metal loss detection – even with a remaining wall thickness of just 1 mm. USWM is also unique in its ability to detect and measure laminations, inclusions and other midwall manufacturing defects, regardless of shape, location or orientation. USWM can inspect pipelines with varying diameters, and its reliability is ideal for baseline surveys and run comparisons. The tool can also inspect dry pipelines when run in a liquid batch.

Duo – expanded capabilities

UltraScan Duo is the first tool capable of inspecting for cracking and metal loss at the same time. This pioneering two-in-one benefit is a result of Phased Array Technology adapted from GE Healthcare's MRI technology. Whether running in WM or Duo mode, the tool's advancements include superior pitting identification and wall thickness measurement.

Ideally suited to:

- General corrosion
- Grooving corrosion
- Laminations and Hydrogen Induced Cracking (HIC)
- Erosion wall thinning
- Narrow Axial External Corrosion (NAEC)

Case Study: Z-Sight Automated Well Surveillance

Certification in 8 months with tailor-made inspection reporting

A North American customer wanted its gas pipeline re-certified at a higher operating pressure – from 1,100 psig to its maximum pressure of 1,219 psig. We had just 8 months to get the line ready.

Background

The 650 km pipeline transports more than 1,100 MMscfd (million standard cubic feet per day) of dry natural gas from the United States through Mexico. It comprises 10 trap-to-trap sections of 42" and 48" diameter pipe. Only two of the sections had been inspected before – in 1997 by another supplier.

Inspection

Our high-resolution MagneScan in-line inspection (ILI) tools were launched in each of the pipeline segments. The most prevalent features were external and internal corrosion, with additional dents and girth weld anomalies in some sections. Case-by-case feature assessments involved Modified B31.G (0.85dL) and detailed RSTRENG methodologies using our LAPA™ software.

Internal corrosion was found to be inactive, having occurred years earlier when the flow originated, or during pipe storage before construction. External corrosion, however, was still active in several parts of the system. Therefore, the corrosion assessment not only estimated corrosion growth rates for future integrity management, but also identified precise strategies for mitigation and repair.

Future integrity

Based on corrosion characteristics, operating parameters and PII Pipeline Solutions best practices, optimized re-inspection intervals were established. For the two sections inspected in 1997, we used our proprietary RUNCOM™ software to compare MagneScan's raw inspection signals to those from the previous supplier's tools.

This unique feature enabled unambiguous identification of corrosion growth, new corrosion and the growth rate of each feature.

Decision tree analysis (DTA) was used to analyze growth rates and develop future repair plans. Compared with alternate methods, the DTA approach would reduce the number of repairs by half over a five-year period. Girth weld anomalies with significant crack-like or metal loss characteristics underwent further analysis and field investigation, and were subsequently repaired with epoxy sleeve devices – an outstanding type of repair even in very tough conditions.

Global Positioning Surveys

In order to speed-up the location of defects for direct assessment and repair, the MagneScan tools were outfitted with our Inertial Mapping Units. PII's IMU technology is based on high-performance aerospace and military navigation systems and is more precise than any other in the industry. IMU measures angular and linear velocity changes on three axes to give a precise depiction of pipeline route and profile – enabling precise synchronization with GPS coordinates and reliable defect location within 1.5 m.

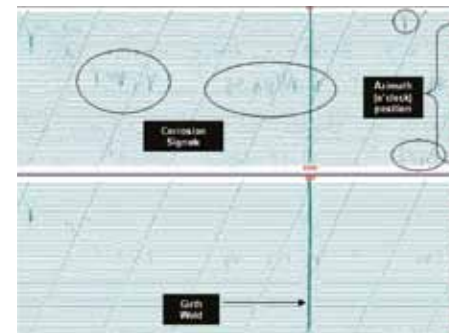
Analysis of the IMU-GPS data identified extraordinary curvatures and isolated several areas that are now being compared with original alignment sheets and as-built specifications to confirm ground movement.

Integrity assessment

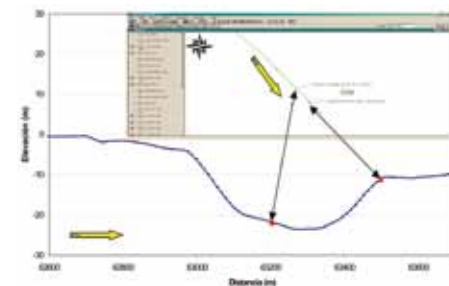
Because of the short re-certification timeline, the initial Integrity Assessment was required within 75 days of ILI completion. All assessments were customized to the operator's needs, eliminating format conversions and significantly reducing delivery time.

Conclusions

After the Integrity Assessment was approved, we coordinated the activities of multiple GPS, excavation and repair crews, integrity engineers and certification officials in order to complete the entire project in less than eight months. The operator was granted certification to increase its operating pressure by 119 psig and will benefit from years of increased throughput, reduced repair costs and higher confidence in its pipeline's integrity.

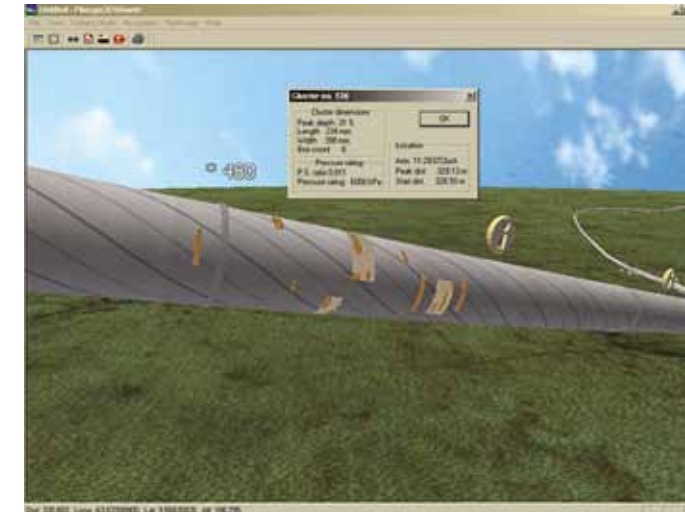


Raw signal comparison with RUNCOM.



IMU data enables detailed assessment of potential ground movement.

PipeImage data analysis



Click on any defect cluster and all relevant data is displayed on screen.

Get the most vivid picture of pipeline integrity

PipeImage™ is the most technologically advanced, yet user-friendly data visualization software available in the pipeline industry. It enables users to process, view, navigate and annotate high-resolution magnetic inspection data – and investigate alternative repair scenarios for critical defects.

A point-and-click interface lets users view inspection data with easy scaling, magnification and data-enhancement options. Key locations can be labelled and quickly accessed by means of navigation and annotation tools.

Simple, flexible and resourceful

Pipeline operators, engineers and managers alike can analyze integrity data quickly and easily – without the need for specially trained IT or software technicians to process information requests. Wizard functions enable users to perform non-destructive queries of the dataset.

Multi-level query strings enable the user to request complex combinations of features in a single step – the compound query results are presented just as quickly as other programs would take to complete a single-parameter search.

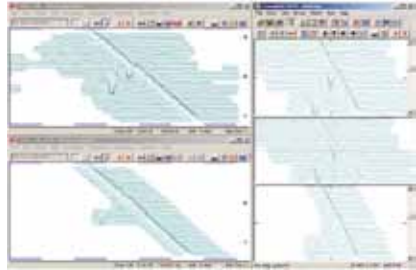
The latest PipeImage features include:

- Area/Volume Histogram (available via Graphics Toolbar, Reporting menu and Wizard) providing users with a more visible means of data distribution
- Improved Depth Based Reporting
- Inspection Summary Window – a new Graphical User Interface that is an active link between Wizard, 3D and Standard View
- Smart Query enables the client to define criteria to select features of interest
- Lite View enables features to be displayed on the line stripped of signal data
- 3D Pipe Viewer allows the user to take a virtual journey along the pipeline
- Pipeline GIS, an affordable add-on, operates independently of all third-party products to display pipeline route and features along maps, imagery and satellite images



Software tools to enhance the long-term value of your pipeline

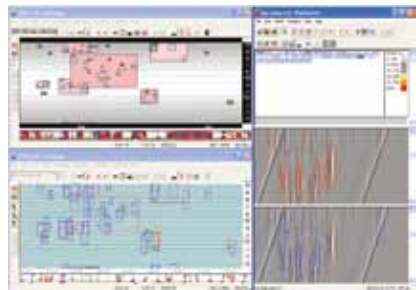
Calculating corrosion growth rates with RUNCOM



RUNCOM™ is our suite of run-comparison software designed to analyze data from multiple in-line inspections. It eliminates sitematching errors by comparing raw inspection signals side-by-side, instead of using data that has already been processed by other software. This allows 100% accuracy in matching corrosion sites. RUNCOM has signal scaling tools to adjust for tool repeatability and maintains consistent sizing methods to minimize other error sources. This approach has proven to be up to three times more accurate than feature comparisons without RUNCOM.

Take control and leverage your ILI data with PVi Lite

PVi Lite is a stand-alone program that delivers smart filing of ILI data, fitness-for-service and corrosion growth assessments.



PipeCatalog

Provides 'smart filing' to store and relate all ILI records, reports and other associated documents

PipeFFP

Assesses the significance of ILI-reported features on the immediate integrity of the pipeline and develops remediation schedules to manage longer-term integrity

PipeRuncom

Enables automated comparison of two ILI data sets to find and evaluate defect-to-defect corrosion growth along an entire pipeline

Coordinate all activities with PipeView Integrity

PipeView™ Integrity provides the most advanced, risk-based approach to pipeline integrity management – and enables an optimal balance of safety and regulatory compliance.

Why choose PII?

Best solutions

Every technological innovation we offer is firmly grounded in the reality of your business. We don't sell static tools. We are continually evolving the science of pipeline integrity, and the benefit to you is the most comprehensive suite of solutions available.

Total service

A successful inspection is just the beginning. The real objective is to enhance the long-term integrity of your pipeline. The breadth of our expertise is always at your disposal – from Fitness-for-Purpose assessments and mapping surveys to remediation services and long-term integrity planning. Different tools with different specifications can be used depending on different situations.

Unmatched experience

Our teams have inspected more pipelines than any other company, and we maintain the industry's most extensive and detailed database of pipeline defects. We've inspected over 1 million kilometres of pipeline and documented every known type of pipewall anomaly. This experience, combined with a steadfast commitment to technological advancement, enables us to identify and predict changes in pipewall condition with the utmost accuracy.

Global support

PII Pipeline Solutions has the global infrastructure and local presence to deliver advisory, technical and support services 24 hours a day. Whenever and wherever you need us, we'll be there – equipped with the highest level of experience and technology every time.

Continuous improvement

A triumph in one area can lead to remarkable enhancements in the next, so we leave no stone unturned. As we transform in-field discoveries into new software utilities, we use other programming innovations to increase our data resolution and inspection efficiency. Because so many environmental and operational factors are beyond your control – our job is to maximize control everywhere it is possible. And we've been doing just that for over 35 years.

Integrity services

Our pipeline services go far beyond data gathering. We have the experience and resources required to offer complete pipeline integrity solutions from a single source. All our inspection services are grounded in the most advanced technology and statistically significant procedures available. The information provides a solid, highly detailed foundation upon which future pipeline integrity can be monitored, maintained and improved.



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