Development and Implementation of a Compact 36-inch Combination Ultrasonic ILI Tool for Enhanced Pipeline Integrity Management

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Abstract

Ultrasonic Inline Inspections (ILI) have been extensively utilized by liquid pipeline operators for many years, facilitating the accurate detection, sizing, and characterization of pipeline features. Over the past two decades, significant investments in the innovation of ultrasonic ILI tools have resulted in higher data fidelity, advanced analysis techniques, and increased detection and measurement capability. However, these advancements have also led to an increase in the length of ILI tools. While many pipeline operators can accommodate the extended tool length in order to leverage these advancements, trap extensions were not a realistic option for Colonial Pipeline. To benefit from these advancements in their Integrity Management Program, Colonial Pipeline required a novel solution that could provide high-quality ultrasonic crack and metal loss inspection data without exceeding the dimensions of their existing tray-style launching and receiving traps.

This paper explores the development, testing, qualification, and application of a 36-inch combination crack and metal loss detection tool, developed in collaboration with Colonial Pipeline. The new design not only meets the compact length requirement but also offers enhanced field reconfigurability, allowing it to adapt to a wide range of pipeline diameters (30” to 40”) and easily deploy multiple crack detection technologies. Engineers from both organizations collaborated from the initial problem statement and preliminary designs through to the assembly, testing, and qualification of the ILI tool. This paper addresses the unique challenges during the project. This case study illustrates how ILI service providers and pipeline operators can work together to continuously adapt emerging ILI technology to the benefit of pipeline safety.

Introduction

The safe, reliable, and efficient transportation of energy resources is essential to sustaining the modern lifestyle and economic stability on which the global population depends. Gasoline, diesel, and jet fuels are among the primary energy sources enabling the transportation of goods and people across vast distances. Pipelines represent one of the safest and most efficient methods of delivering these products from refineries to consumers (API-AOPL 2016).

Despite their reliability, pipeline operations are not without risks. While unplanned releases are statistically rare, they can occur, underscoring the need for rigorous safety measures. In the United States, the Federal Government, through the Pipeline and Hazardous Materials Safety Administration (PHMSA), enforces regulations to ensure the safe operation of pipelines.

Among PHMSA's requirements (PHMSA – CFR Part 195) is for operators to perform periodic integrity assessments for known, relevant pipeline safety threats. As part of the Integrity Management Program (IMP) (49 CFR 195.452) requirements, pipeline operators to must inspect liquid pipelines affecting High Consequence Areas (HCAs) at five-year intervals and non-HCA impacting pipeline segments at 10-year intervals (195.416). Integrity assessment methods include:

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1. Inline inspection tools (ILIs),
2. Pressure tests,
3. External direct assessment, or
4. Other technologies capable of providing an equivalent understanding of pipeline conditions.

Inline inspection, particularly ultrasonic ILI, has emerged as a cornerstone of integrity management and other pipeline assessment programs. By enabling the detection, sizing, and characterization of threats such as corrosion, cracks, dents, and metal loss, ultrasonic ILI tools provide operators with critical data to assess pipeline conditions and mitigate potential failures.

Background

Colonial Pipeline Company operates one of the most extensive refined product pipeline networks in the United States, spanning over 5,000 miles from Houston, Texas, to Linden, New Jersey. This critical infrastructure delivers over 100 million gallons of refined products consumed along the Eastern Seaboard, including gasoline, diesel, heating oil, and aviation fuels. The uninterrupted operation of this network is essential, as prolonged disruptions can adversely affect fuel availability and prices, impacting both consumers and the broader economy.

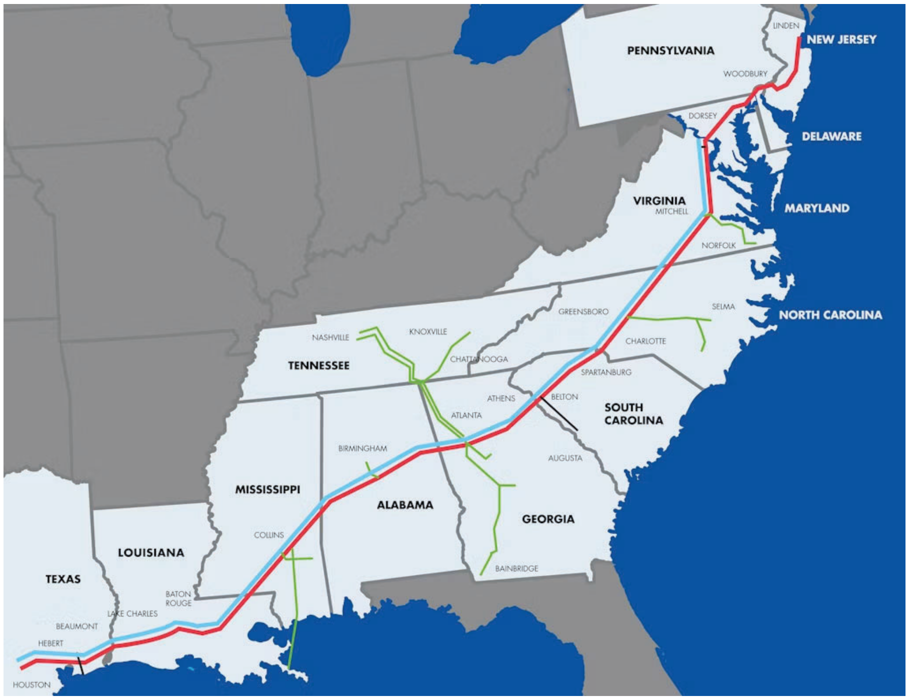

Figure 1. Map of Colonial Pipeline's System

Originally constructed between 1962 and 1964, and with major expansions between 1970 and 1980, the pipeline system includes several large-diameter segments, as detailed in Table 1. These mainline

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sections are predominantly constructed from Double Submerged Arc Welded (DSAW) and Electric Flash Welded (EFW) pipe. Like many pipelines of its vintage, the system is susceptible to anomalies such as axial cracks in the long seam and pipe body, internal and external metal loss, and deformations. These features, if unaddressed, could compromise pipeline integrity.

Table 1. Colonial Large Diameter Pipeline Mileage by Diameter

Diameter	Length (miles)
30"	195
32"	288
36"	1,810
40"	589

Colonial Pipeline has a long-standing commitment to maintaining the safety and reliability of its system. Beginning in 1985, long before promulgation of the IMP requirements, the company began systematically inspecting its pipeline system with ILI tools. Early on in this program, Colonial recognized the need to invest in advanced tools, techniques, and processes to ensure pipeline integrity, cosponsored development of a UT crack ILI tool for refined product service and made its first UT Crack ILI inspection in 1995. As such, inline inspection (ILI) tools have become indispensable. Technologies deployed include magnetic flux leakage (MFL), ultrasonic and mechanical calipers, and ultrasonic tools for crack and metal loss detection.

Pulse Echo Ultrasonic ILI tools have been particularly valuable for detecting, sizing, and characterizing crack-like features. These tools have enabled the identification of critical anomalies such as axial cracks in and near the long seam, cracks in the pipe body, and circumferential cracks in and near girth welds. Additionally, Colonial faces challenges with interacting features, such as cracks coinciding with metal loss or dents.

Ultrasonic ILI Options

Over the past two decades, ultrasonic inline inspection (ILI) technologies have undergone significant advancements, driven by the need for improved data fidelity, advanced analysis techniques, and enhanced detection capabilities. These innovations have enabled operators to address complex pipeline threats with greater accuracy, but they have also introduced challenges, including increased tool length. This increase in length stems from several design improvements essential for high-resolution data acquisition.

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1) Increased Sensor Density:

Conventional Pulse Echo ultrasonic crack (UC) tools typically have a circumferential resolution of 0.4 inches (10 mm), defined as the distance between the centers of adjacent sensors (Hennig & Guajardo, 2019). High-resolution tools (UCx) double the number of sensors, achieving a resolution of 0.2 inches (5 mm). This enhanced density enables more accurate detection and depth sizing of anomalies by ensuring that sensors are optimally positioned over critical features. However, the additional sensors require a larger physical footprint, increasing the overall length of the tool. The additional sensors also demand greater power. To meet this requirement, additional battery modules are integrated into the tool, further contributing to its extended length.

2) Increased Resolution:

High-resolution crack tools also achieve superior axial resolution by transmitting ultrasonic signals at shorter intervals. Conventional tools transmit at intervals of 0.12 inches (3 mm), while high-resolution tools transmit at 0.06 inches (1.5 mm). This doubling of the sampling frequency results in a high-definition "picture" of each crack and crack field. Similar to the additional sensors, increased axial sampling requires additional power and therefore the potential for increased tool length.

Table 2. Pipeline Threats and UT ILI Resolution Matrix

Pipeline **Threat**	**UT ILI Axial Resolution**	**UT ILI Circumferential Resolution**	**Conventional or High-Resolution**	**Service Name**
General Corrosion	0.12in / 3mm	0.32in / 8mm	**Conventional Resolution**	UM
Corrosion with Pitting	0.06in / 1.5mm	0.16in / 4mm	**High-Resolution**	UMp
Corrosion with Pinholes	0.03in / 0.75mm	0.10in / 2.5mm	**High-Resolution**	UMx
Axial Cracks and Crack-Like Features	0.12in / 3mm	0.39in / 10mm	**Conventional Resolution**	UC
Complex Axial Crack and Crack Like Features	0.06in / 1.5mm	0.20in / 5 mm	**High-Resolution**	UCx
Tilted (Hook) Cracks	0.06in / 1.5mm	0.20in / 5 mm	**High-Resolution**	Eclipse UCx
Circumferential Crack	0.12in / 3mm	0.39in / 10mm	**Conventional Resolution**	UCc
Complex Circumferential Crack	0.06in / 1.5mm	0.20in / 5 mm	**High-Resolution**	UCcx

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Like most operators, Colonial Pipeline is committed to obtaining the most accurate understanding of their pipeline assets' true condition. The company maintains a zero-tolerance policy for unplanned releases, recognizing that Inline Inspection (ILI) is a cornerstone of their integrity management program. Additionally, pipeline operators seek to maximize the efficiency of their programs by minimizing unnecessary remediations, making the deployment of high-resolution tools essential.

Improved Operational Efficiency:

High-resolution ILI tools offer enhanced sizing tolerances compared to their conventional counterparts, as shown in Table 3. These tighter tolerances reduce conservatism in burst pressure calculations, allowing operators to prioritize the remediation of truly injurious features, reducing unnecessary excavations. With improved accuracy, operators can improve remediation planning, allocate resources most effectively, and optimize future budgeting.

Table 3. Depth tolerance comparison between conventional UC and high-resolution UCx

	Conventional UC @ 80% certainty		High-Resolution UCx @ 80% certainty	
Crack Depth	≥0.04 in to <0.16 in	≥1 mm to <4mm	≥0.04 in to <0.12 in	≥1 mm to <3mm
Sizing Tolerance	±0.04 in	±1mm	±0.031 in	±0.8mm
Crack Depth			≥0.12 in to <0.16 in	≥3 mm to <4mm
Sizing Tolerance			±0.035 in	±0.9mm
Crack Depth			≥0.16 in	≥4mm
Sizing Tolerance			±0.04 in	±1.0mm

Improved Probability of Detection:

Advanced tools, such as the Eclipse UCx, achieve a 99% Probability of Detection (POD) for critical crack-like features—those ≥0.10 inches (2.5 mm) in depth and ≥1.58 inches (40 mm) in length. This performance nearly eliminates the risk of undetected critical cracks, significantly reducing the likelihood of a catastrophic failure.

Detection of Tilted Cracks at the DSAW Bond Line:

Colonial's mainline system features Electric Flash-Weld (EFW) and Double Submerged Arc Weld (DSAW) pipe, of which DSAW presents unique challenges for conventional Pulse Echo ultrasonic crack detection tools. Cracks along the bond line of the DSAW weld often have an off-radius tilt due to the weld's angle as it transitions into the parent material. Conventional Pules Echo tools tend to under-size such cracks. However, the UCx Eclipse tool, employing a pitch-and-catch technique, effectively detects and sizes tilted and hooked cracks with angles of up to 45° off-radius, providing more accurate assessments of critical anomalies.

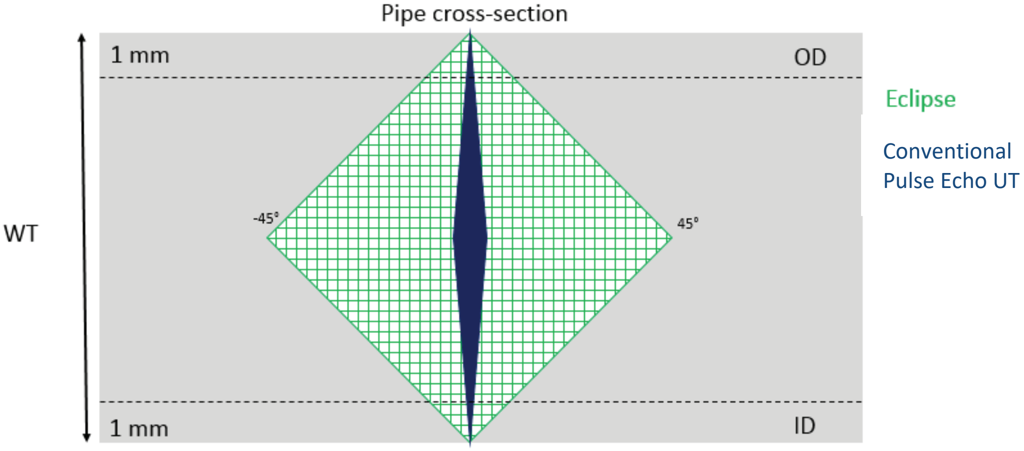

Figure 2. Conventional Pulse Echo and Eclipse off-radius capabilities

Launcher and Receiver Constraints

Colonial's efforts to deploy high-resolution Ultrasonic (UT) tools with exceptional performance specifications in their mainline system have faced challenges due to tool length. Launcher and receiver traps in Colonial's mainline pipeline system were constructed using a design that integrated a tray and the trap closure. This design, which allows the tray to slide in and out of the launcher and receiver barrels, was used to facilitate launching of batching spheres which are no longer used. Figure 3 below illustrates an ultrasonic ILI tool loaded onto a tray, prepared for insertion into the launcher. This tray-style launcher and receiver configuration imposes physical constraints that make trap extensions impractical for accommodating longer ILI tools. In the 36-inch sections of Colonial's pipeline system, the typical launcher and receiver lengths are approximately 21 feet, with the shortest being only 17 feet. In contrast, NDT Global's high-resolution UCx inspection tool measures 25.5 feet in length. The additional 4.5 feet required to launch or receive the tool exceeds the existing infrastructure's capacity, and modifying the launchers or receivers to accommodate the extended length was deemed an unfeasible solution for Colonial.

Figure 3. NDT Global UC tool in launcher with tray configuration

Challenge

While ultrasonic ILI technologies have improved over the past two decades, Colonial has been unable to benefit from all the advancements due to the length of the launchers and receivers relative to the length of the newest generation of ILI tools.

Given the criticality of their mainline system, it became abundantly clear to Colonial that deploying state-of-the-art high-resolution UT tools was imperative to achieve their goals of reliable, leak-free operation. As such, Colonial challenged NDT Global to develop a high-resolution ultrasonic crack and metal loss ILI tool capable of fitting in their existing launchers and receivers. The remainder of this paper will outline the process taken by NDT Global and Colonial to develop a solution that not only meets, but exceeds their needs, and brings to all pipeline operators a revolutionary solution with unparalleled flexibility, efficiency, and accuracy to inline inspections.

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Solution for a Novel ILI Solution

Development Process

NDT Global employed its standard development methodology, structured around eight critical milestones, to successfully deliver a groundbreaking ultrasonic in-line inspection (ILI) tool tailored to meet Colonial Pipeline's complex requirements. This robust framework ensured a systematic and iterative approach, promoting precision and minimizing risks throughout the development lifecycle (Figure 4).

M1 – Requirements Specification:
Development begins with a comprehensive collection of deliverables and client expectations. Activities include stakeholder interviews, analysis of historical data, and forecasting future needs, culminating in a User Requirements Document (URD). This document defines clear, measurable, and unambiguous expectations for the service.

M2 – Concept:
Concept generation explores potential development pathways, evaluated against key factors such as feasibility, environmental impact, alignment with standards, cost efficiency, and resource requirements. Concepts are ranked, with the most promising advancing to the Proof-of-Concept stage.

M3 – Proof of Concept:
Simulations and controlled testing verify the selected concept's ability to meet the outlined requirements, ensuring alignment with the URD before advancing further.

M4 – Functional Specification:
In this stage, the tested concept is evaluated against user requirements to ensure alignment with project goals. A full risk assessment identifies and mitigates potential challenges, while a Hazard Assessment addresses safety and compliance for new processes or procedures. The result is a clear and precise specification of the solution's capabilities, setting the foundation for detailed design and successful implementation.

M5 – Detailed Design and Qualification:
Here, all components undergo detailed design and initial testing. Updated hazard assessments and component qualifications (e.g., mechanical simulations, sound pattern tests, software unit tests, etc.) ensure the design is robust and aligned with the specifications.

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M6 – Verification:
Mechanical and electrical components are quality-controlled and assembled. Integrated system tests validate compliance with functional specifications, while software and firmware undergo rigorous verification for operational readiness.

M7 – Customer Acceptance:
Clients evaluate the tool's performance through test results or live environments. Successful validation transitions the service to rollout readiness.

M8 – Rollout and Training:
Final deployment includes personnel training, publishing operational and safety documentation, and ensuring infrastructure readiness.

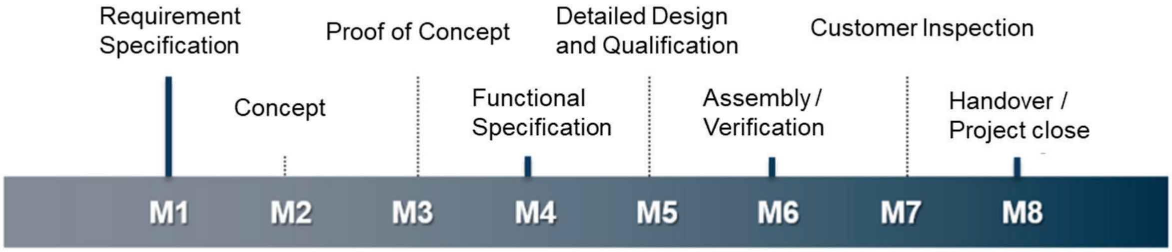

Figure 4. NDT Global development process milestones overview

Service Development Requirements and Challenges

Colonial Pipeline's requirements presented several design challenges:

- Maximum tool length of 220 inches
- Compatibility across all 36" line segments
- Highest resolution Crack Diagnosis (Eclipse UCx) and Metal Loss (UMx) services
- Scalability to inspect diameters from 30" to 40" to accommodate the entirety of Colonial's mainline system

Ideation and Concept Development

Once the user requirements were clarified, specialists from the Mechanical Engineering department conducted an in-depth analysis to identify potential challenges, leveraging their extensive knowledge of existing tools and sensor carriers. This analysis served as the foundation for the ideation process, where the department generated initial concepts. These ideas were subsequently refined in collaboration with other departments, encompassing the entire project lifecycle—from procurement to data analysis following a typical ILI inspection campaign.

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All proposed concepts were rigorously evaluated based on feasibility, risk assessments, cost implications, resource requirements, and success probabilities. This comprehensive review allowed the team to identify the most promising concept, which was then submitted to a specialist committee for an independent assessment. Upon receiving the committee's approval, the concept advanced to full development.

The team transitioned to solution design using 3D modelling software, including SolidWorks. This allowed them to not only create detailed designs of the tool but also simulate key operational parameters such as ultrasonic wave entry angles into the pipe wall and mechanical behavior through pipeline bends. Experts from various departments, including Data Management, Data Analysis, Sensor & Measurement Technology, and Assembly, Maintenance & Repair, contributed to this phase, ensuring all aspects of functionality were thoroughly validated. This collaborative approach facilitated early identification and resolution of potential issues, ensuring a robust and optimized design.

Initial Concept

The initial concept effectively addressed the project's critical requirements, particularly the challenge of reducing the tool's overall length. Learning from previous large-diameter combination technology developments (Seto, Hennig, and Sickinger 2014), the proposed design integrated the electronics modules within the sensor carrier frame (Figure 5), departing from conventional designs where these modules were cascaded between the battery and sensor carrier (Figure 6). Additionally, the use of elongated sensor plates (Figure 7) contributed significantly to minimizing the tool length.

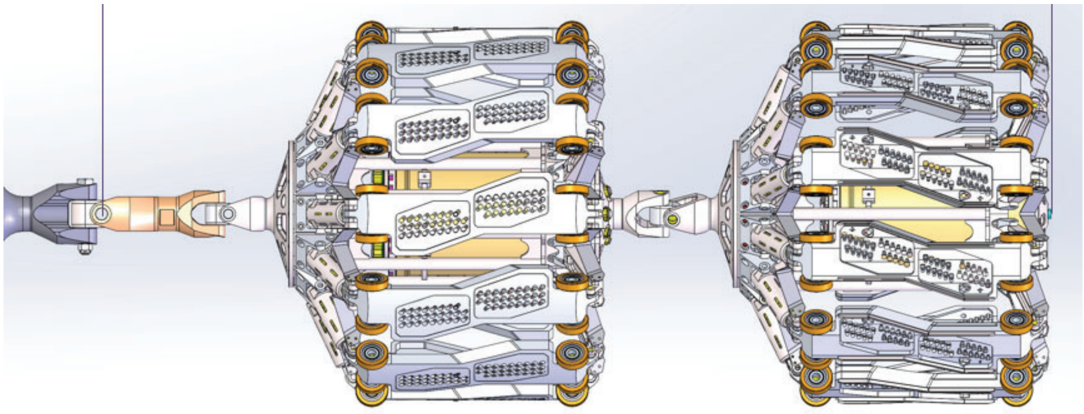

Figure 5. Initial tool design with electronics modules inside sensor carrier frame and long sensor holders.

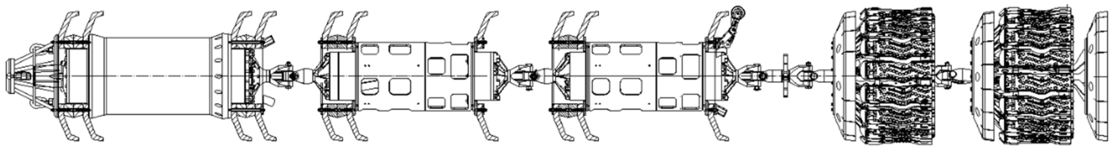

Figure 6. Conventional tool design with cascaded electronics modules.

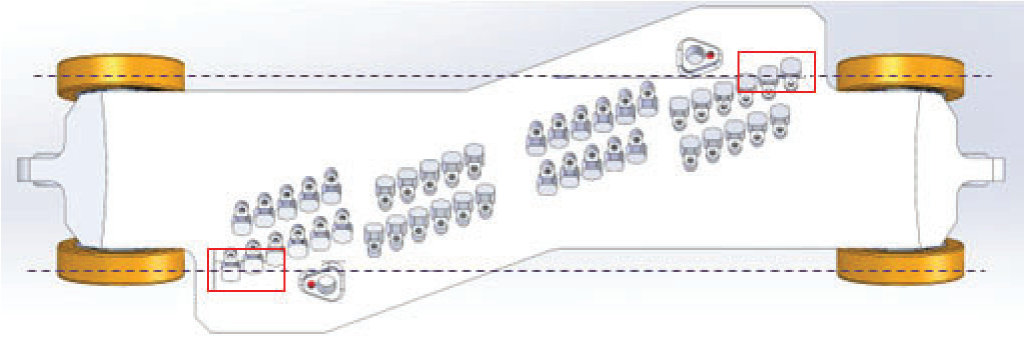

Figure 7. Elongated sensor plate on which a series of sensors are mounted on the sensor carrier.

A key innovation was the parallelogram sensor carrier chassis, which contacts the pipeline's inner wall via rollers. This configuration, adapted from the PROTON phased array tool design (V Haro, et al 2022), minimizes lift-off over girth welds, improving data quality. Furthermore, the tool's modular design supports seamless conversion between inspection techniques, including high-resolution crack diagnosis (Eclipse UCx), metal loss (UMx), and circumferential crack diagnosis (UCcx). By allowing back-to-back inspections without returning to the workshop for configuration changes, this design reduces operational downtime and increases efficiency.

The tool was also designed for versatility, enabling inspection of multiple pipeline diameters (30", 32", 34", 36", and 40") with minor adjustments. This flexibility makes the tool highly adaptable for various operational scenarios.

During the design review, the Data Analytics and Data Science teams identified an issue with the longer sensor plates. These plates, wider to accommodate additional sensors, positioned some sensors in line with the sensor carrier wheels (Figure 8). If the wheels traversed directly on the longitudinal seam, tilting of the sensor carrier could occur, changing the angle of incidence of the sensors inline with the wheels up to 1.83°, consequently degrading data quality.

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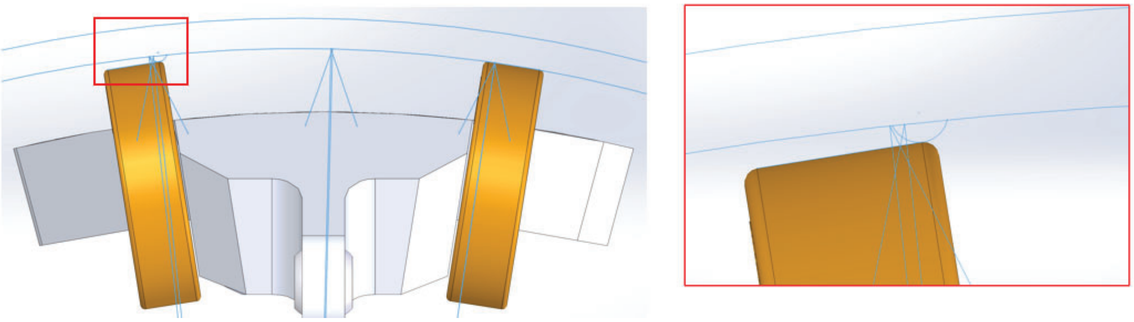

Figure 8. Schematic of sensor carrier with wheels running on the long seam and generating a tilt of the sensor plate.

A proposed solution to extend the wheel spacing was deemed impractical, as it would compromise the tool's ability to collapse for safe passage through pipelines with varying wall thicknesses and deformations.

The issue was therefore resolved by dividing the sensor carrier into two separate bodies, each carrying two rings of sensor arms. This adjustment reduced the plate length and width, ensuring no sensors align with the roller wheels while preserving the tool's overall compactness. The modified plates ensure that only the wheels contact the pipe wall, eliminating tilting and maintaining optimal sensor alignment over longitudinal welds.

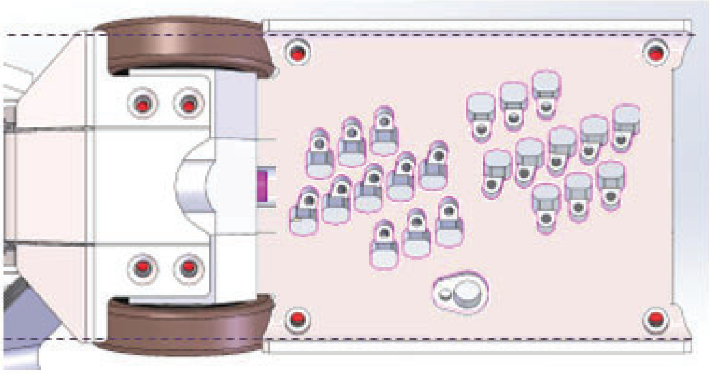

Figure 9. Schematic of redesigned, shorter sensor plate

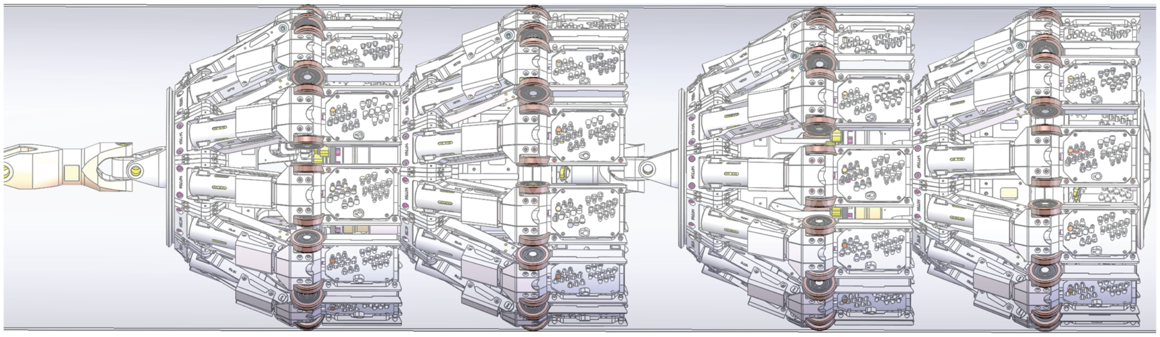

Figure 10. Schematic of the 30" sensor carrier design inside a pipeline

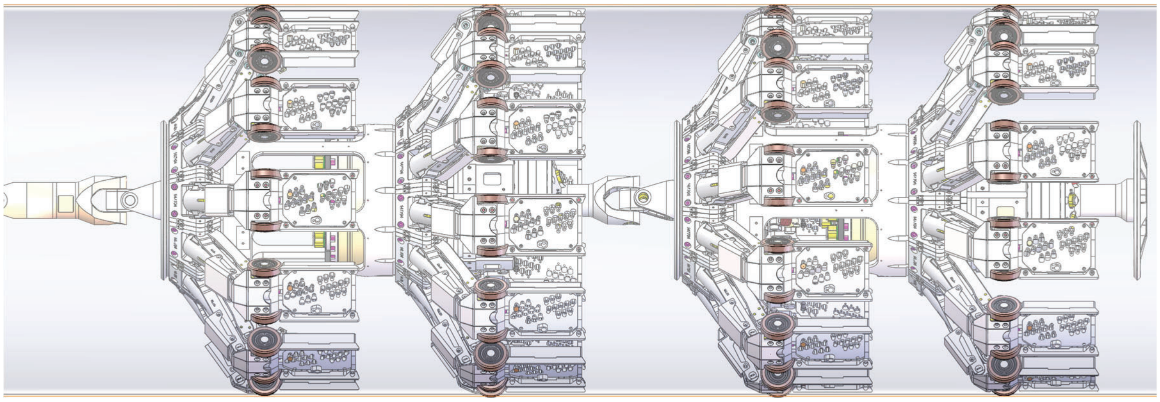

Figure 11. Schematic of the 36" sensor carrier design inside a pipeline

After completing design reviews and modifications, the tool's total length was reduced to 15.6 feet, achieving a 35% reduction from the conventional 25.4-feet design. This compact design meets all operational requirements and fits within Colonial's mainline system's launchers and receivers, exceeding initial project goals.

Proof of Concept Testing

Following the completion of the tool design, individual parts and components were procured and subjected to rigorous quality control processes. Additionally, key components underwent proof-of-concept testing to validate performance under expected operating conditions.

Given the need for the sensor carrier to collapse while traversing the pipeline, high-strength springs were integral to the design. These springs needed to withstand the substantial size and weight of the steel sensor carrier. To test their functionality, NDT Global collaborated with the Karlsruhe Institute of Technology (KIT) in Karlsruhe, Germany, which has advanced equipment for precise motion and force measurement.

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Synchronous Test

First, a synchronous test with five spring layers on each side was performed. This test simulates the collapsing of the sensor carrier when traveling through a reducer or some other kind of full-bore restriction. In this test, the reaction forces were measured on the arms of the sensor carrier to ensure proper functionality as visible in Figure 12.

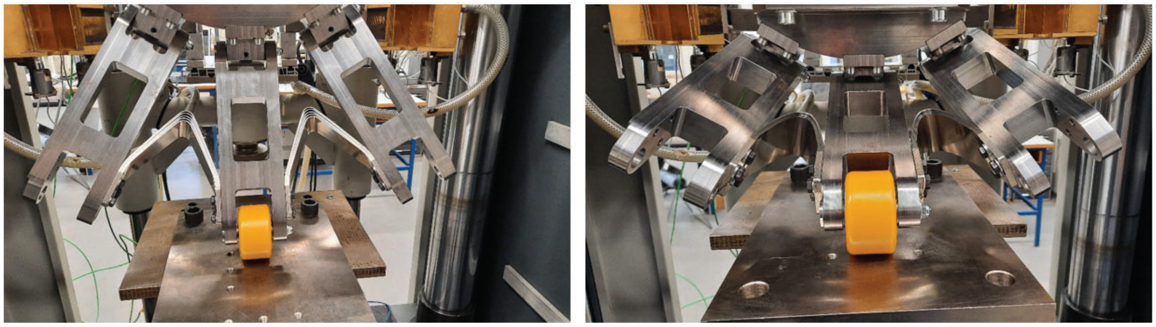

Figure 12. Synchronous tests of springs

Asynchronous Test

Second, an asynchronous test with five spring layers on each side was performed. However, this time, the two outer arms were held in a fixed position. This test simulates the sensor carrier passing a partial bore restriction such as a dent. Again, in this test the reaction forces were measured on the arms of the sensor carrier as visible in Figure 13.

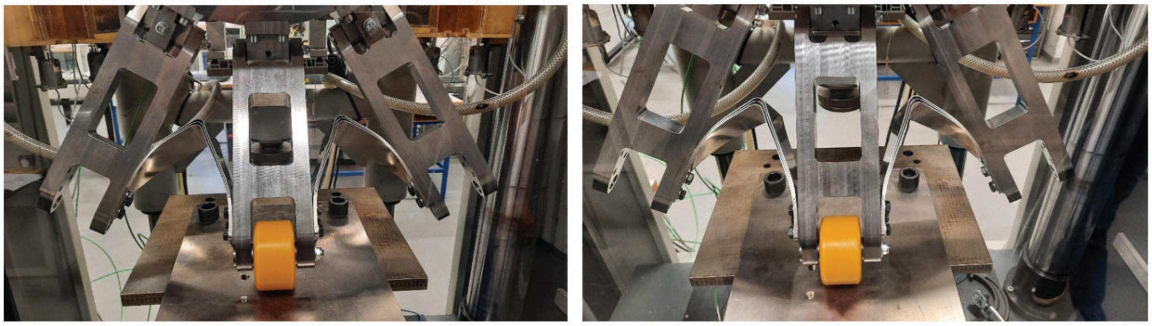

Figure 13. Asynchronous tests of springs

Both tests proved successful, demonstrating that the springs provided both appropriate collapsibility and rebound of the sensor carrier arms, ensuring the sensors remain in the ideal location relative to the pipe wall during an inspection.

Sensor Carrier Wheel Durability Testing

The sensor carrier wheels were another critical component requiring validation. Although the wheels have been proven effective and reliable on the Proton inspection system, it was determined that given changes in design, durability testing was warranted. A specialized endurance testing system (Figure 14) was designed to replicate the operational stresses of in-line inspections (ILI).

The test involved pressing the wheel against a rolling drum that featured a fabricated weld. Simulating pipeline conditions, and a girth weld in particular, the wheel passed over the weld every 6.2 feet. Over nearly 8 hours of testing, the system covered 48.5 miles. Considering an average pipe spool is 36 feet, this test replicated a 323-mile inspection, congruent with the longer line lengths in Colonial's system. Post-test inspections assessed the wheel's durability, while its thermal behavior was closely monitored. The polyurethane material demonstrated consistent performance without degradation, with the wheel temperature stabilizing at 204°C (399°F) during continuous operation (Figure 15).

Figure 14. Endurance test system for sensor carrier wheels

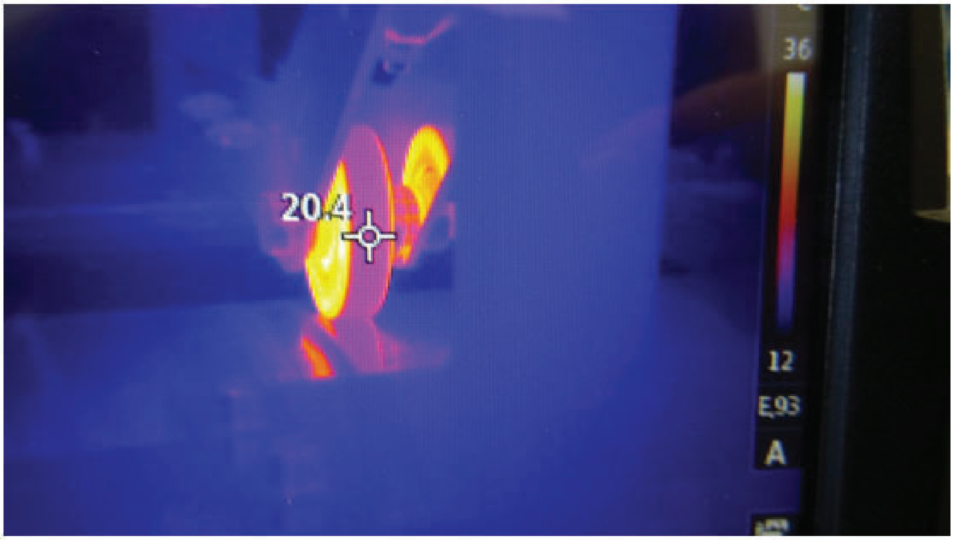

Figure 15. Thermal image of polyurethane sensor carrier wheel during proof-of-concept testing (°C)

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These proof-of-concept tests confirmed the mechanical integrity and performance of the critical components, ensuring they met the rigorous demands of the tool's operational environment.

Assembly and Testing

The next phase in the development process focuses on the assembly of the tool's primary components, including the sensor carrier, electronics modules, and battery bodies. This assembly is carried out in strict accordance with the tool assembly drawing, supported by a detailed checklist to ensure every step meets the design specifications. During this stage, several functional tests are also performed to verify the proper operation of each component. These tests include a "bolt" test to ensure each sensor is positioned correctly, a battery test to confirm proper installation and functionality, and an odometer test to verify that the odometer wheels accurately record the tool’s movement.

After assembly, the tool undergoes initial pull testing. This testing involves using pipes that match the minimum diameter specifications for the tool. The pipes also feature bends that meet the minimum design requirements. During the test, the sensor carrier is closely observed to assess the behavior of the sensor arms, ensuring there is no sagging or misalignment. The required pulling force is also measured to confirm that the tool can be effectively propelled through the pipeline at the minimum targeted pressure. These tests help ensure that the tool can successfully navigate pipelines with diameters and bends equal to or greater than those specified.

Following the initial pull tests, the tool proceeds to a more comprehensive evaluation in the 154-feet-long pump test line at NDT Global's facility in Stutensee, Germany (Figure 16). This pump test line is designed to replicate a real-world pipeline, complete with longitudinal and girth welds, 3D bends, and a custom set of artificial defects including axial and circumferential cracks and metal loss features. These defects are specifically created to validate the tool against its performance specifications and provide insights into potential improvements. The tool is loaded into the test line's launcher, and a pump propels it through the pipeline. The tool is then trapped in the receiver, removed, and the collected data is downloaded for analysis. This procedure is repeated eight times for each inspection methodology, including axial crack diagnosis, circumferential crack diagnosis, and metal loss detection.

Once the tool has completed all testing, the data sets from each of the inspection methodologies are carefully analyzed in compliance with NDT Global's standard analysis processes. The results are compared to the actual defect dimensions in the pipeline to verify the tool’s accuracy and performance relative to the published specifications. This thorough evaluation ensures that the tool meets all required standards and can be trusted for reliable pipeline inspections.

Figure 16. Pump test facility in Stutensee, Germany

Current State and Next Steps

As of publication, all necessary tool parts and components have been ordered and received, with over 90% having undergone a rigorous quality control process. The assembly of the tool has already commenced.

The next steps involve completing the quality control for the remaining components, finishing the assembly of the sensor carrier, and completing the final tool assembly. Once this is accomplished, the team will proceed with setting up the pull and pump test pipelines. After conducting these tests, the collected data will be analyzed, followed by a final validation to confirm the performance of the inspection system.

Collaboration

Throughout the development process, key personnel from both Colonial Pipeline and NDT Global have engaged in regular formal meetings at key milestones. This collaborative approach will continue through the completion of the project. It offers both parties opportunities for thorough reviews, ensuring that potential design and development issues are identified and addressed early. This proactive communication reduces the risk of costly and time-consuming rework later in the process.

Summary

Colonial Pipeline faced challenges in deploying high-resolution ultrasonic ILI tools in their mainline product system due to the mismatched lengths of the existing launchers/receivers and conventional high-resolution tools. Additionally, the system spans multiple diameters (ranging from 30" to 40") and is susceptible to various threats, including metal loss, axial cracking, and circumferential cracking. Colonial tasked NDT Global with developing a new high-resolution ultrasonic inspection

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tool capable of fitting into the existing launchers and receivers while addressing multiple diameters and threat types.

To exceed these requirements, NDT Global has developed an innovative tool design that reduces the overall length by 8.8 feet, ensuring compatibility with the launchers and receivers. This new design allows Colonial to utilize high-resolution ultrasonic tools to effectively manage the integrity of their mainline system.

In addition to the benefits of a shorter design, this versatile tool enables the inspection of multiple diameters and threat types using a single tool. On-site adjustments can be made easily to switch between axial crack diagnosis, circumferential crack diagnosis, and metal loss inspections, or to change diameters from 30" to 32", 36", or 40".

The system will undergo final testing and validation in early Q1 2025, with full operational use expected to begin in Q2 2025.

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