

Innovations in In-Service Robotic Inspection of Unpiggable Natural Gas Pipelines at River Crossings for Which There are No Existing Launching and Receiving Capabilities



PPSA Seminar
20 November 2024

River-Crossings are Critical

With the critical role natural gas plays in our energy infrastructure, ensuring the integrity of transmission and distribution pipelines is paramount as these river crossing pipelines ensure infrastructure connectivity and energy availability to a vast array of communities and businesses worldwide.

River-Crossing Pipeline Failures

Impact to the Community

- Contamination of local ecosystem
- Supply disruptions to households or businesses
- Build-up of combustible gas / Explosion

Impact to the Operator

- Legal / Regulatory repercussions
- Damage to public image / valuation
- Closure of the business



Alternative Inspection Techniques

External Corrosion Direct Assessment (ECDA) via Diver

- Visibility Challenges
- Limited access to the line (buried)
- Time constraints from equipment
- Dangerous (current/flow)

Sonar Survey via Boat

- Low-resolution / poor detection of anomalies
- Only general features
- Debris/rock/coverage can distort signal



Alternative Inspection Techniques



Free-swimming Inline Inspection (ILI)

- Piggable vs unpiggable
 - Lack of Launcher/Receiver
 - Inability to shut down the line
 - Unknown pipeline conditions
 - Difficult to track tool underwater
 - Potentially costly retrieval

Pipe Explorer Robotic IRI Summary

Non-tethered

Self-propelled

100% controlled

Constant 300 m/hr, no speed excursion

Bi-directional

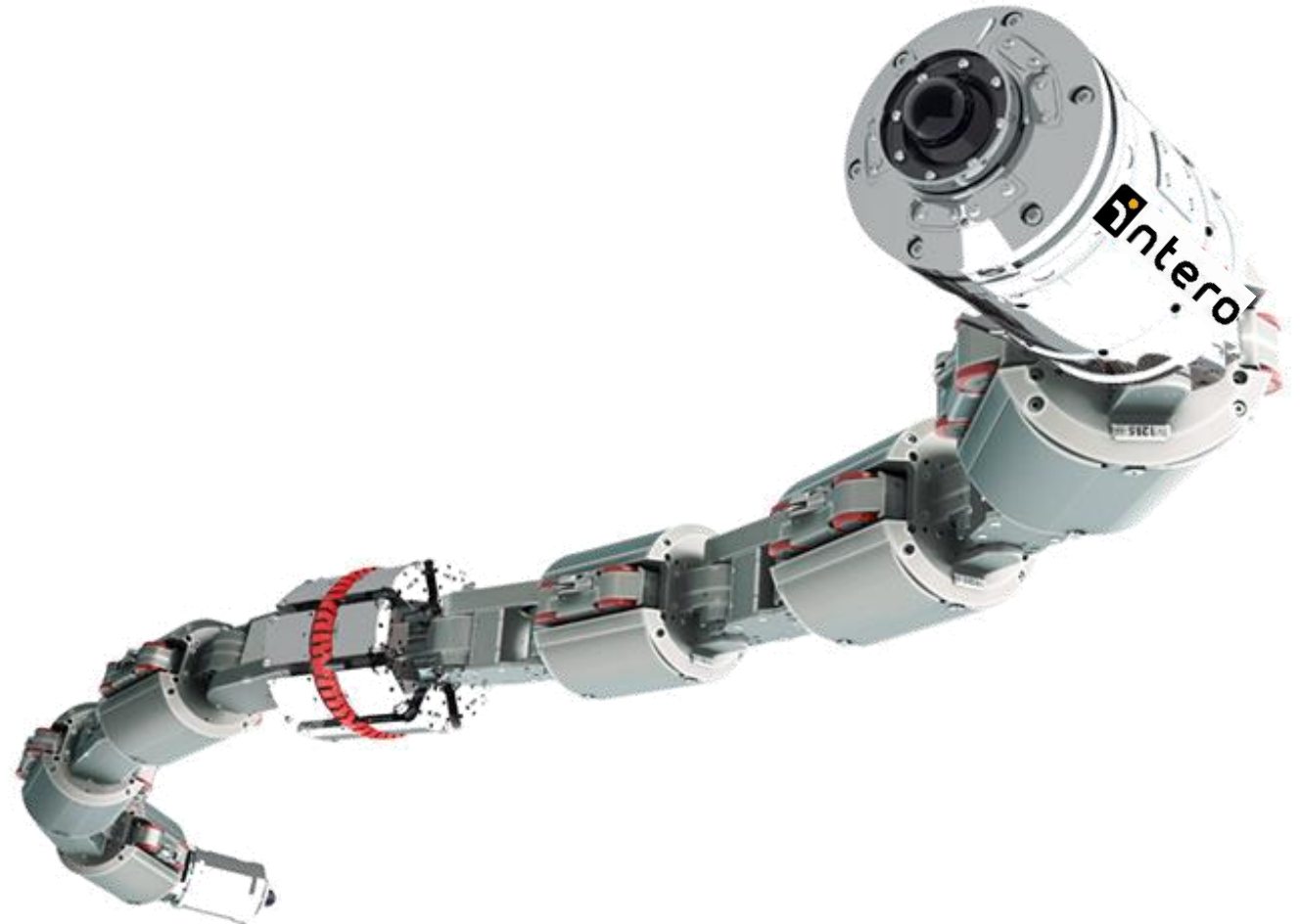
Up to 50bar in-service inspection

Mitered elbow (no radius)

Barred/Unbarred tee navigation

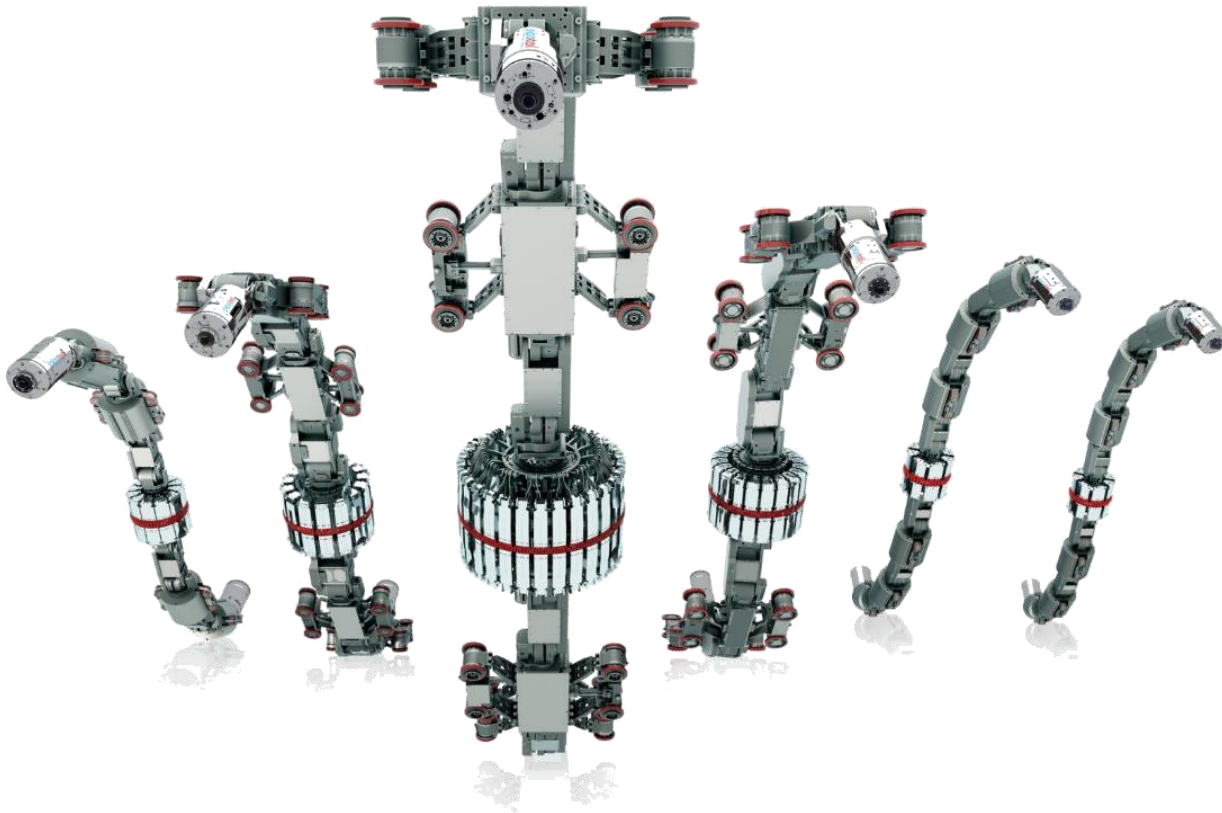
20% bore reduction

Camera, MFL, and Laser sensors



Pipe Explorer Robotic Fleet

Pipe Explorers available in sizes from 6" (DN150) to 36" (DN900):



Pipe Explorer 6

Pipe Explorer 8

Pipe Explorer 10/14

Pipe Explorer 16/18

Pipe Explorer 20/26

Pipe Explorer 30/36

Track Record

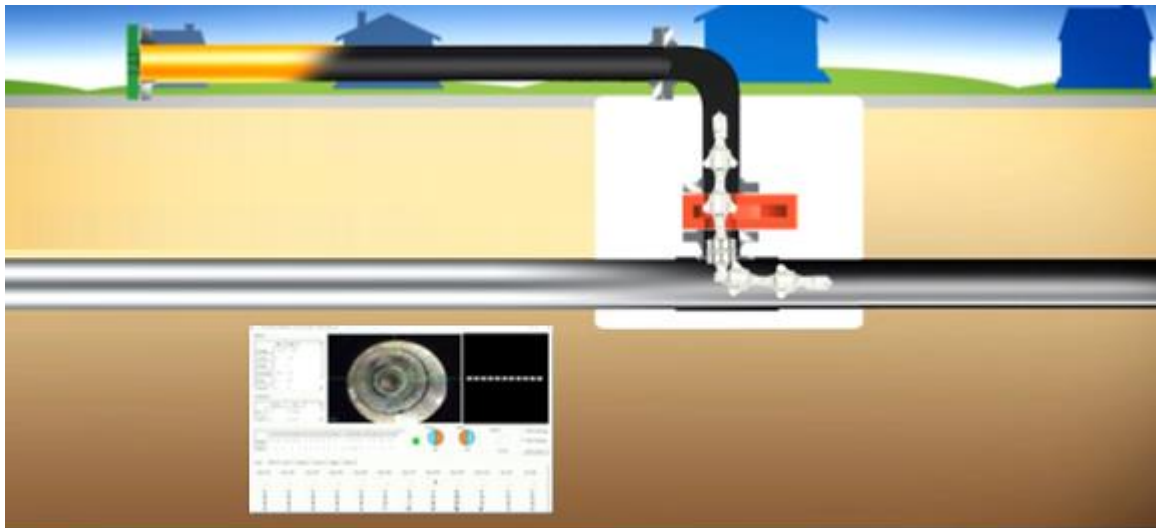
- Successfully deployed since 2010
- More than 1,600 inspections completed
- 99% success rate
- Shortest inspection 20 meter
- Longest continuous project: 6.1km
 - Live gas conditions
 - Inline charging technology



Brooklyn (NYC), NY - 20", 24", 30" pipeline inspection

Live Gas Launching

Pipe Explorer entry and exit through hot tap fitting



Datatel Software Package

Datatel 0.9.10.2 - C:/Data Analysis/SampleData2/SampleData2.save2 -

File View Project Scan Feature Data Help

Video

File Path: C:/Data Analysis/SampleData2
File Name: log-video-20220825-090230.mp4
File Exists: YES
Frame Number: 66817

Projects / Scans

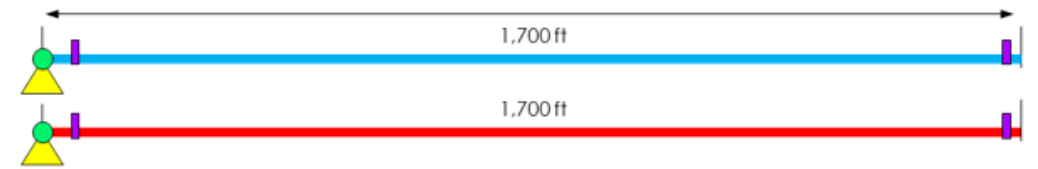
- SampleData2.save2 []
 - 20220825-090750-001**
 - 20220825-085059-002
 - 20220825-110652-003

Inspection X1014_G2020 12
20220825-090750-001
Note:
Total Samples: 428189
Start Position: -0.0137258 metres
End Position: 543.785 metres
Total Distance: 543.799 metres


Axial MFL Signal

Type	Sub-Type	Name	Odometer (m)	O'Clock (hh:mm)	Depth (%wt)	Depth (%OD)	Length (mm)	Width (mm)	WT (mm)	SMYS (KPa)	Pipe Type
Weld	Weld	W013	90.141	--	--	--	--	--	6.35	206843	ERW
Installation	Tap	I011	92.447	11:43	--	--	50.8	50.8	6.35	206843	ERW
Feature	Metal Loss	A012	92.691	09:00	15%	--	13.9	25.8	6.35	206843	ERW
Feature	Metal Loss	A013	92.767	00:06	10%	--	24.4	35.5	6.35	206843	ERW
Installation	Tap	I012	93.228	11:52	--	--	53.3	56.5	6.35	206843	ERW
Feature	Metal Loss	A014	93.647	00:28	10%	--	27.4	31.3	6.35	206843	ERW
Feature	Dent	D016	103.350	08:55	--	0.5%	87.8	83.8	6.35	206843	ERW
Other	Manufacturing ...	O042	104.252	06:34	--	--	15.2	14.1	6.35	206843	ERW
Weld	Weld	W014	105.440	--	--	--	--	--	6.35	206843	ERW
Other	Manufacturing ...	O043	108.336	01:55	--	--	30.5	21.2	6.35	206843	ERW


Case Study – 24” River Crossings



 24in TDW #600 Stopple fitting

 2in TDW TOR or Mueller SAV fitting installed 4-5ft from Stopple

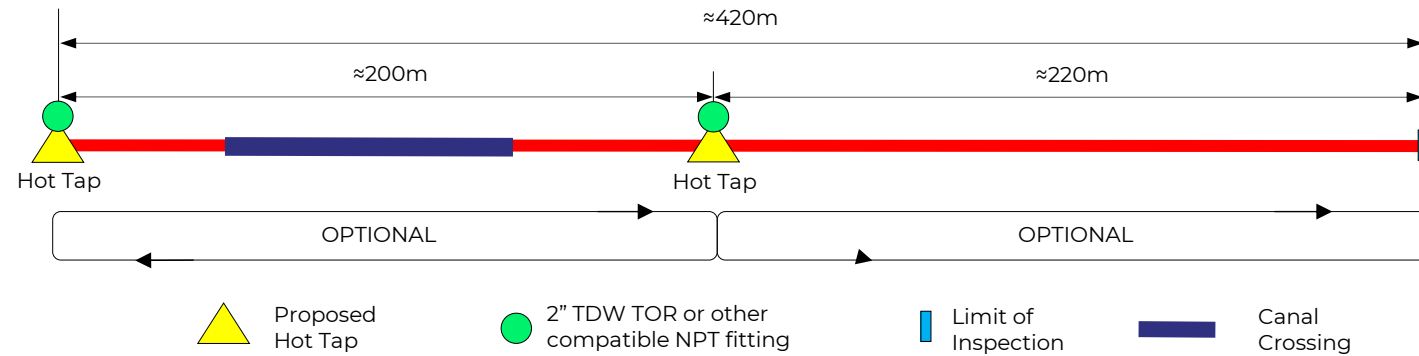
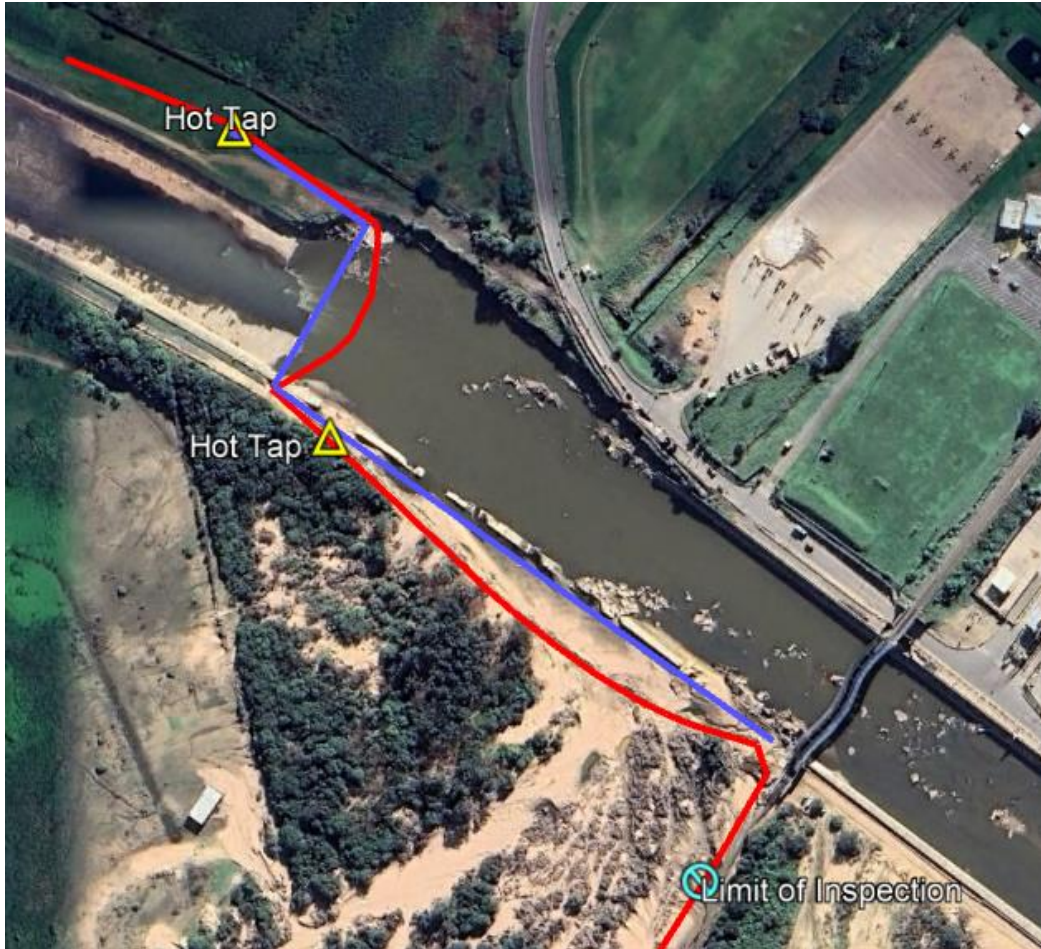
 24in pipe
 24in pipe

 Above Ground Marker (AGM)

Case Study 1 – 24” River Crossing Results

- Installed in the 1950's, but never inspected
- Took approximately 6 hours (each)
- Zero downtime
- Pipeline remained in service (50% bypass)
- 40bar operating pressure
- Redundant data scan

Case Study 2 – Concept



Thank you.

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