

Wireless Robotic MFL Inspection of In-Service Natural Gas Pipelines Using Inlin Charging Technology

PPSA Seminar
16 November 2022

What is Challenging?

Physical Attributes

- Unbarred tees
- Mitered elbows
- Short-radius elbows
- Valves
- Diameter changes
- Obstructions
- No records

Infrastructure

- Lack of Launcher/ Receiver

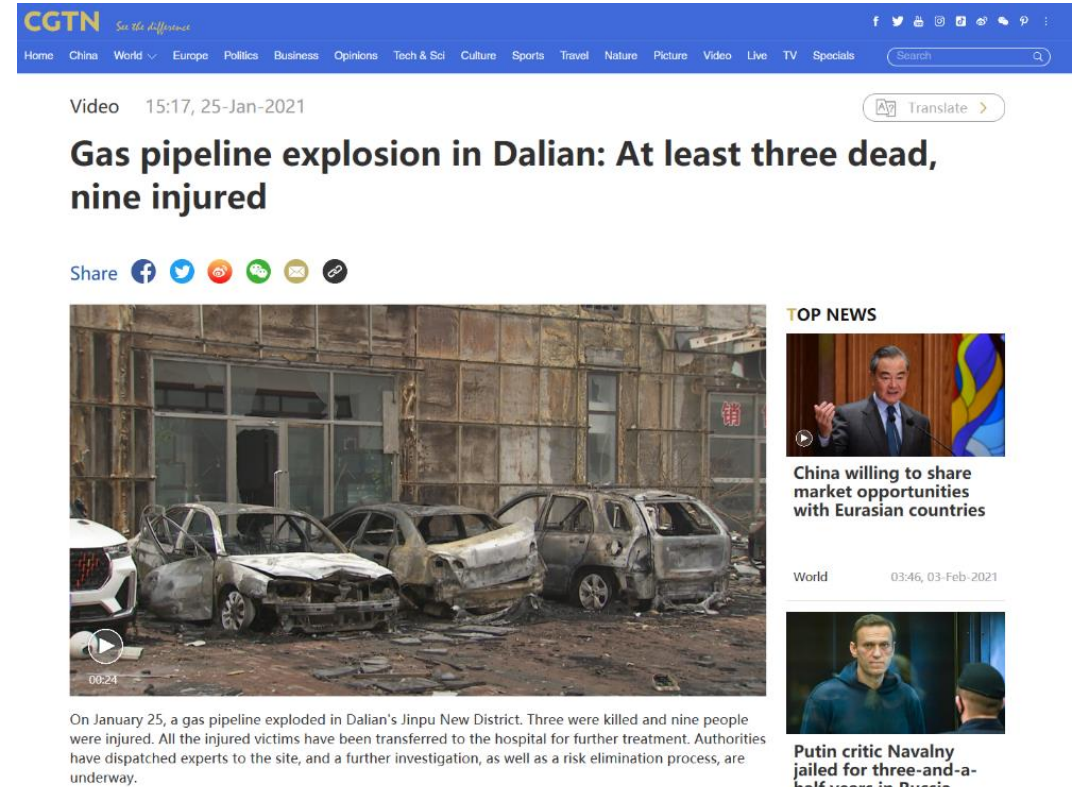
Operating Conditions

- Pressure
- Flow rate
- Disruption to gas services

“Challenges don’t come alone, they like to arrive in groups”

Benefits

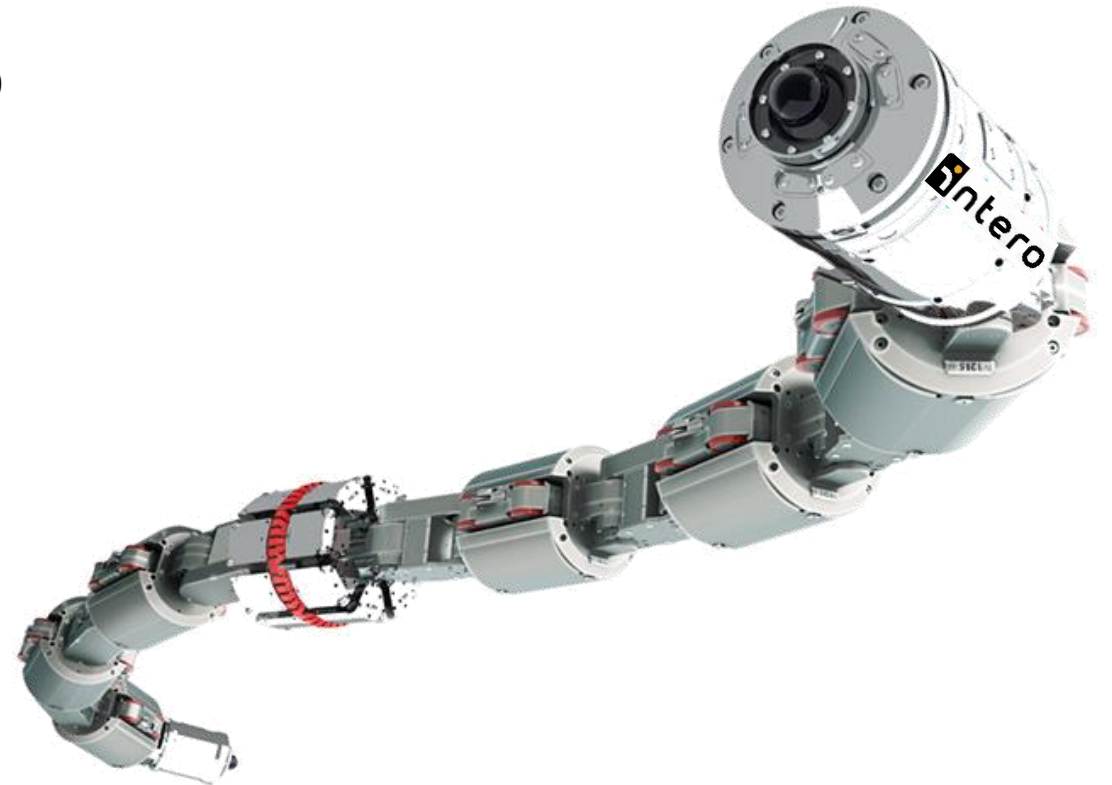
- Certainty and reduce risk in “challenging-to-inspect” pipes
- Peace of mind on safety and integrity of pipes
- Data driven decision making
- Planned maintenance
- Ensure product delivery
- Confidence to increase throughput
- Towards zero incidents



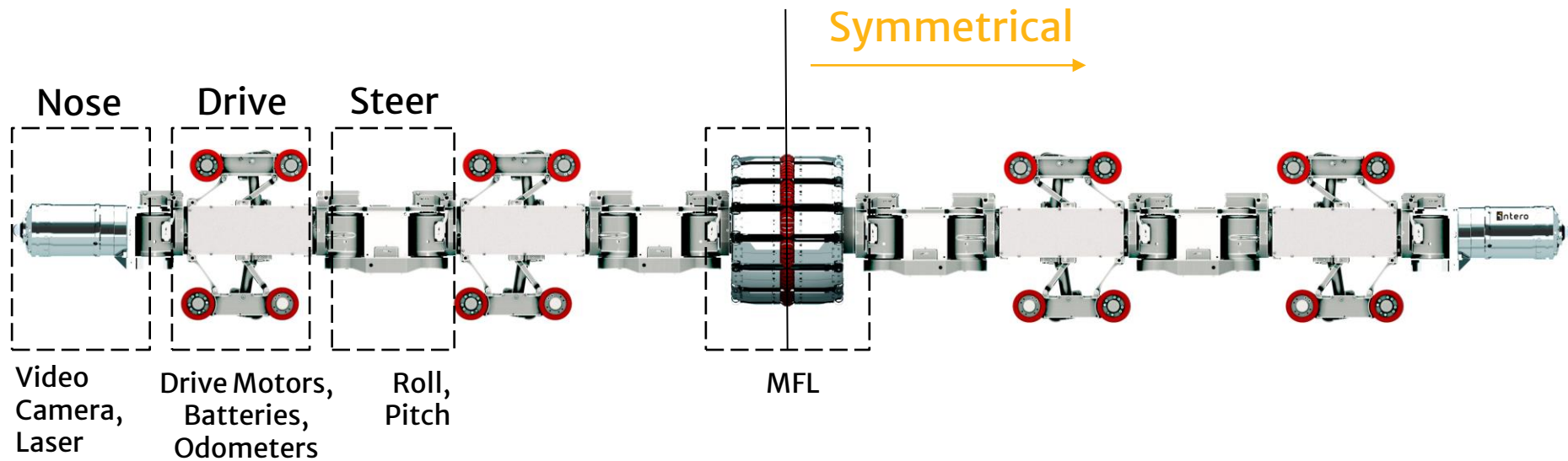
The screenshot shows a news article from CGTN. The main headline is "Gas pipeline explosion in Dalian: At least three dead, nine injured". The article includes a video player showing the aftermath of the explosion, with several damaged cars in front of a building. The text below the video states: "On January 25, a gas pipeline exploded in Dalian's Jinpu New District. Three were killed and nine people were injured. All the injured victims have been transferred to the hospital for further treatment. Authorities have dispatched experts to the site, and a further investigation, as well as a risk elimination process, are underway." To the right of the main article, there is a "TOP NEWS" section with two other news items: "China willing to share market opportunities with Eurasian countries" and "Putin critic Navalny jailed for three-and-a-half years in Russia".

Robotic Inline Inspection

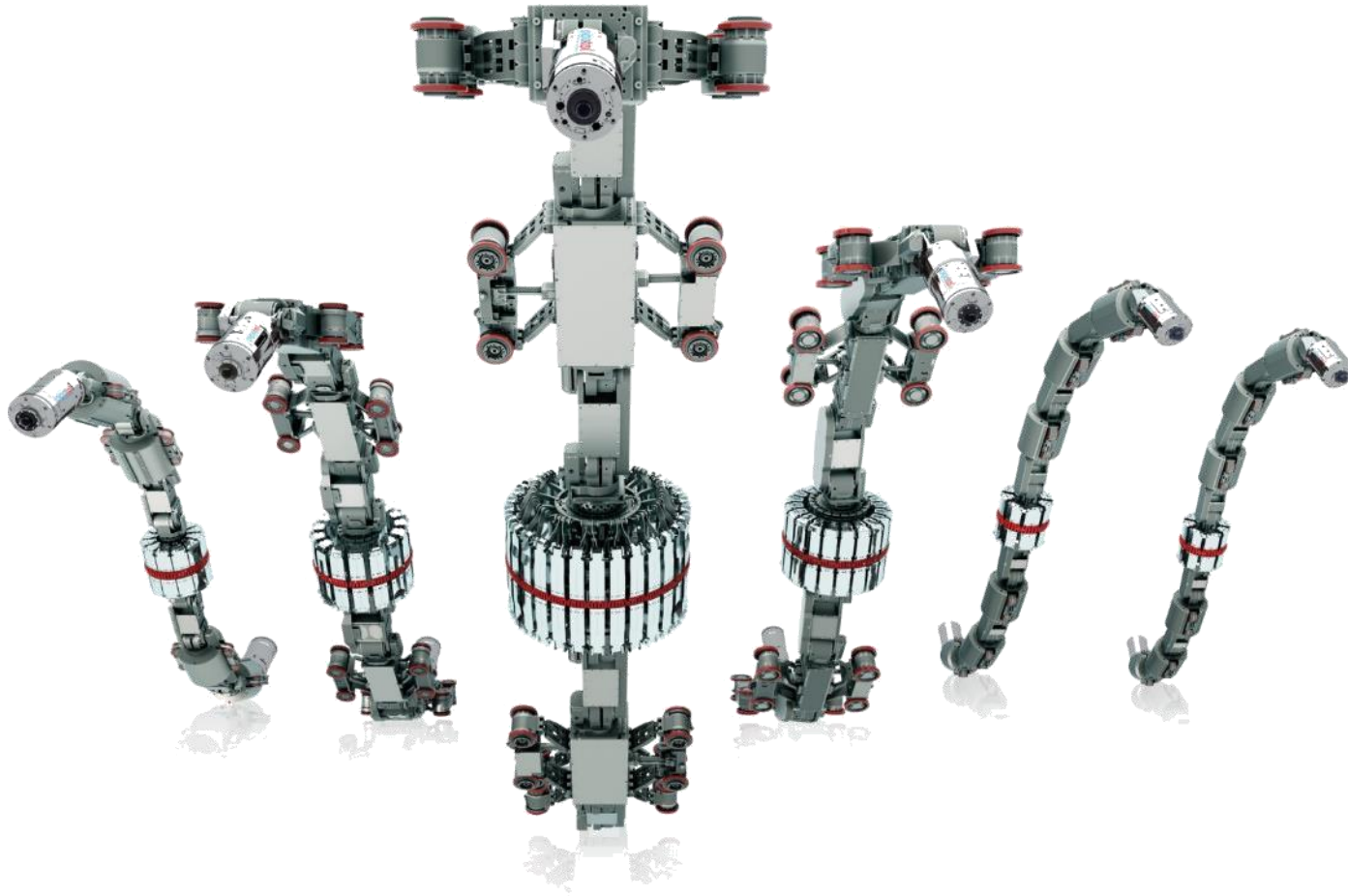
- Pipe Explorer has been commercially available since 2010
- More than 1,000 inspections completed
 - MFL Sensing
 - LDS sensing
 - Video inspection
- 99% success rate, > 90% FRS
- Can be recharged with Inline Charging (ILC) technology



Pipe Explorer Robotic ILL



Pipe Explorer Robotic ILI Fleet

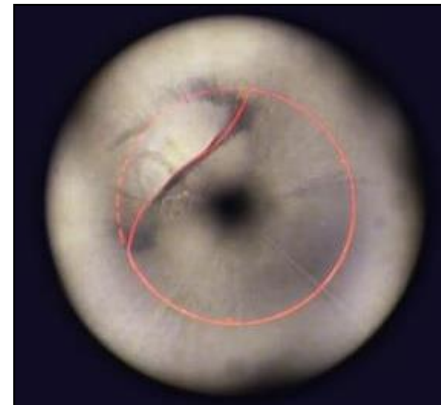


Pipe Explorers are available in sizes from 6 to 36 inch:

- Pipe Explorer 6
- Pipe Explorer 8
- Pipe Explorer 10/14
- Pipe Explorer 16/18
- Pipe Explorer 20/26
- Pipe Explorer 30/36

Pipe Explorer Robotic I/I

- Non-tethered
- Self-propelled
- 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



VIDEO

Visual
Inspection

MFL

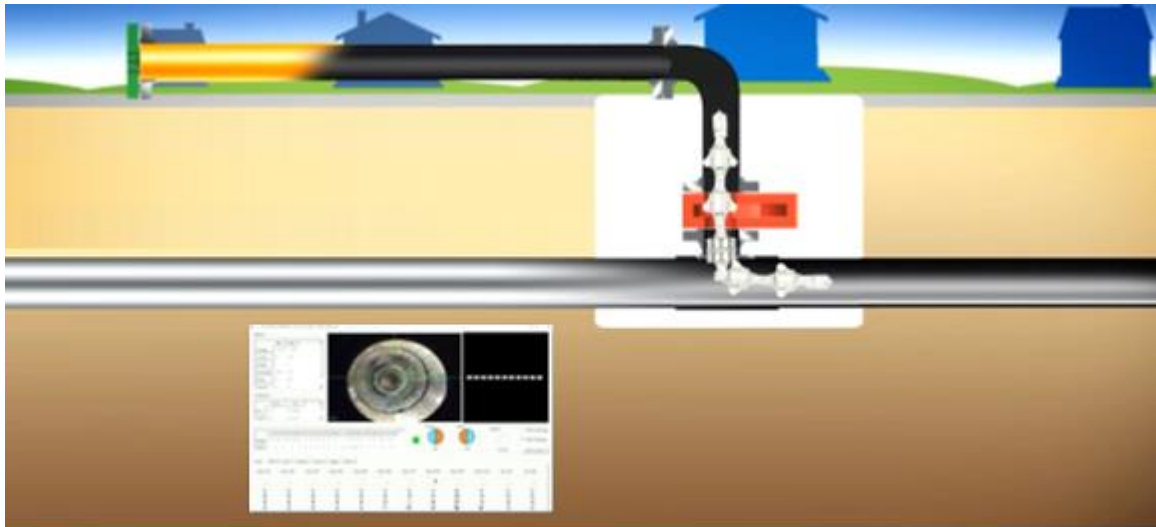
Internal &
External
Metal Loss

LASER

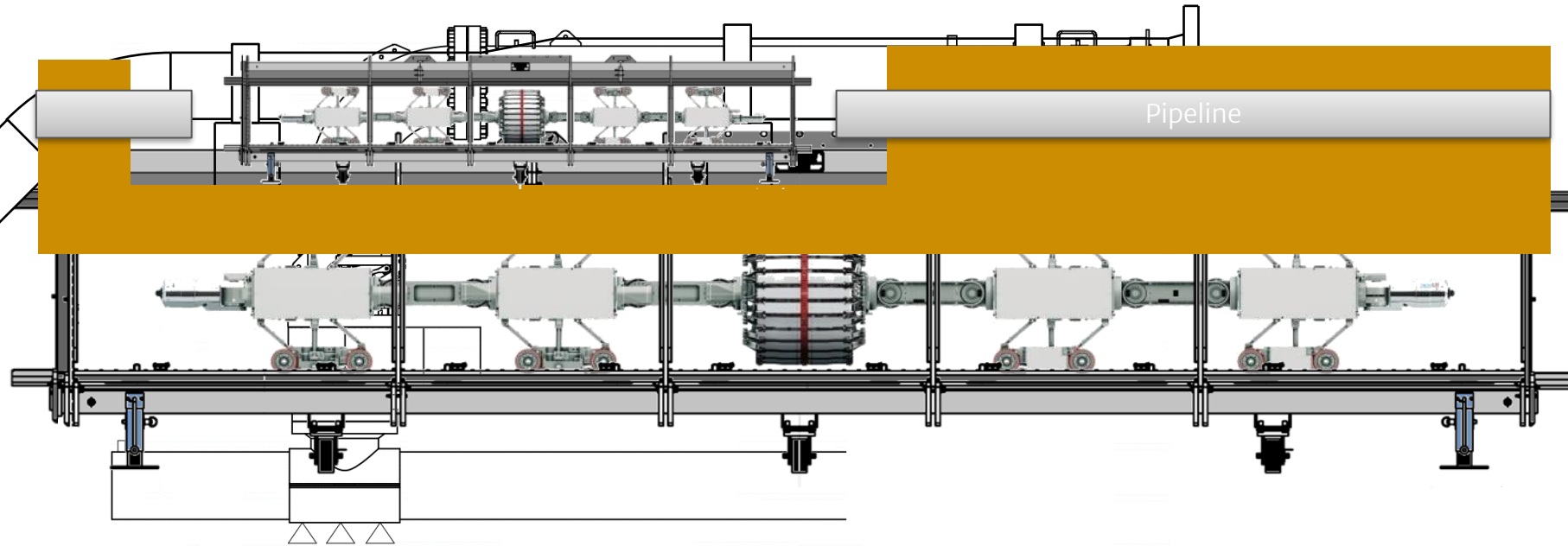
Dents and
Mechanical
Damage

Pipe Explorer Robotic I/I

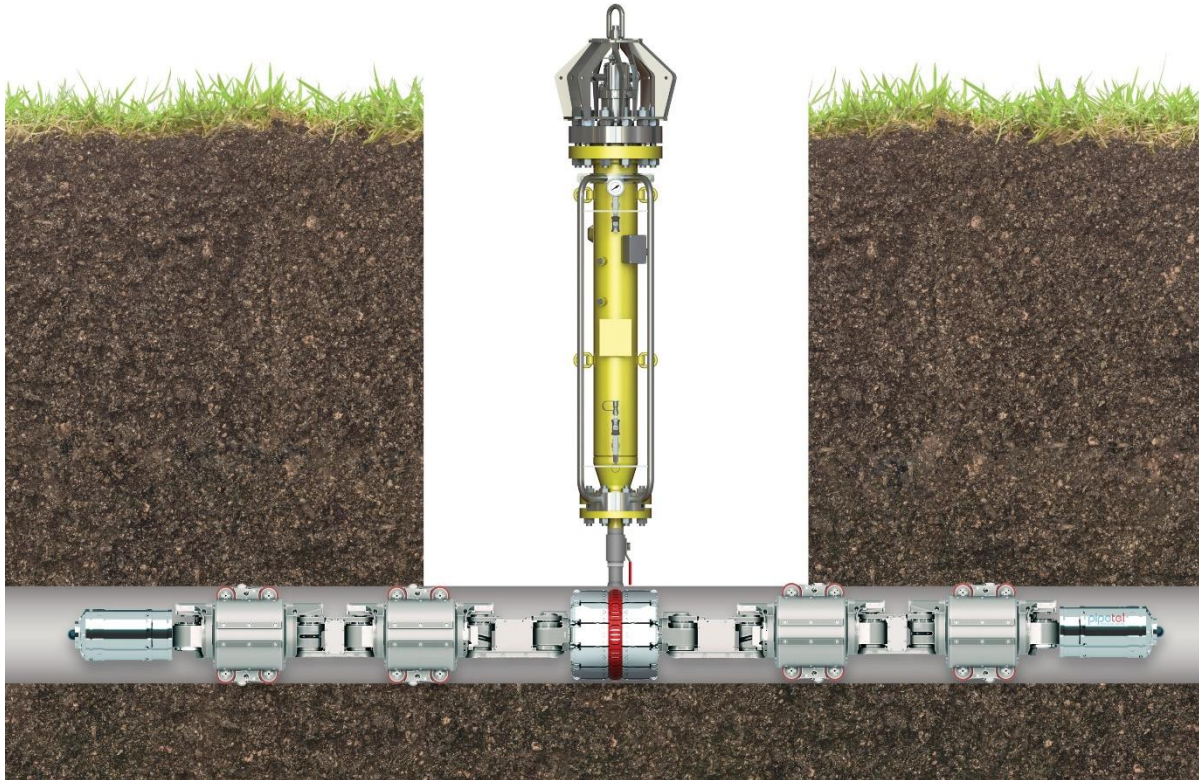
Pipe Explorer entry and exit through hot tap fitting



Our service offering



Range and Inline Charging



Pipe Explorer ILI Range

- Able to inspect up to 750m on a single launch (one direction)
- Recharging capabilities extend the range to suit the specific project requirement

Case Study

The inspection is for a natural gas and electricity supplier based in Canada with more than 580,000 electrical and 284,000 natural gas customers.

The scope of inspection covered 8.3 km of 10", unpiggable pipeline in Central Canada.



Main Customer Challenges

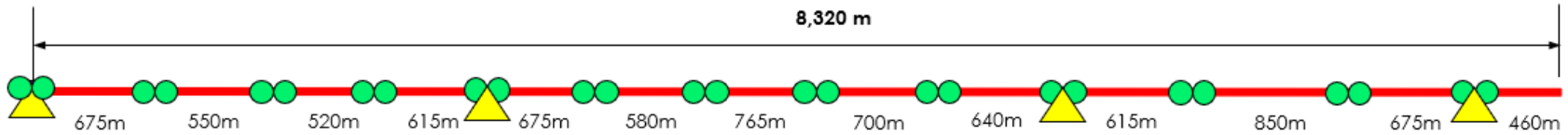
- Built in the 1950's, never been inspected
- Plug and valve station unsuitable for traditional pigs
- Unknown pipeline geometry, fittings, wall thickness, cleanliness
- Lack of records
- Possibility of different diameters
- Lack of existing launching receiving infrastructure



Solutions and Inspection Options

Propulsion	Sensor
<ul style="list-style-type: none">• Non-tethered, propelled by product (free swimming)• Tethered, non-self propelled• Tethered, self-propelled (robotic)• Non tethered, self-propelled (robotic)	<ul style="list-style-type: none">• MFL• EMAT• UT• Eddy Current• Caliper• ID/OD• Laser• Video• IMU

Pipe Explorer 10/14 - 8 km Inspection



▲ 10inch #600 Hot Tap Fitting
 ●● 2 x 2 inch TOR fittings
 — Pipeline (250 mm | 10 inch)

Pipe Explorer 10/14 - 8 km Inspection



Pipe Explorer 10/14 - 8 km Inspection



Pipe Explorer 10/14 - 8 km Inspection

- Four launch and receive sites used to extend range from 750m to 8,300m
- Inspection completed in 9 days
- Over 99% MFL and LDS data coverage
- Identified previously unknown taps and bottom out fittings



Summary

- Provide certainty and reduce risk in “challenging-to-inspect” pipes
- Planned maintenance
- Aid decision making
- Ensure product delivery
- Confidence to increase throughput
- Towards zero incidents



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ntero

Ever-evolving solutions

