REPAIR

Rapid Encapsulation of Pipelines Avoiding Intensive Replacement

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INDUSTRY CHALLENGE

- Cast iron and bare steel pipes, collectively referred to as legacy pipes, account for 3% of the 2 million miles (3 million km) of utility pipes
- Account for a disproportionate number of leaks and failures
  - Cast iron pipes are held together by mechanical joints which are prone to leaking
  - The brittle materials leading to circumferential cracks
  - Bare steel pipes are prone to pitting and general corrosion/wall loss.

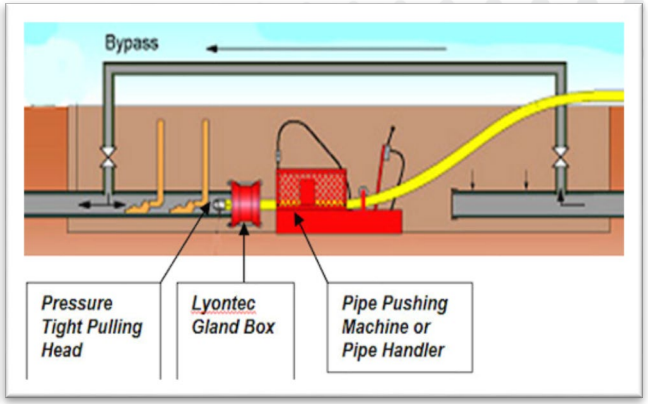
- Methane leaks and pipe failures create operating risk and legal liability for utilities
  - negatively impact the financial performance of system owners
  - cost burden to gas consumers

COMMERCIAL SOLUTIONS AND TECHNICAL GAPS

Clamps

Wraps

Pipe Bursting

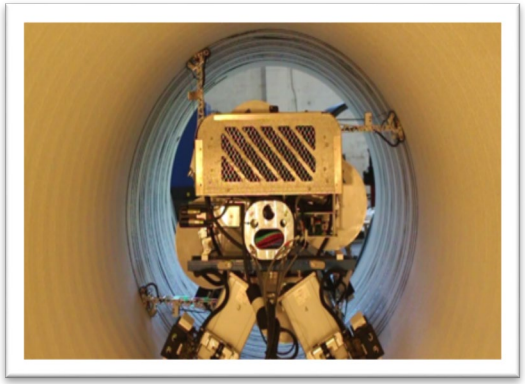


Slip-lining

Keyhole encapsulation

CISBOT

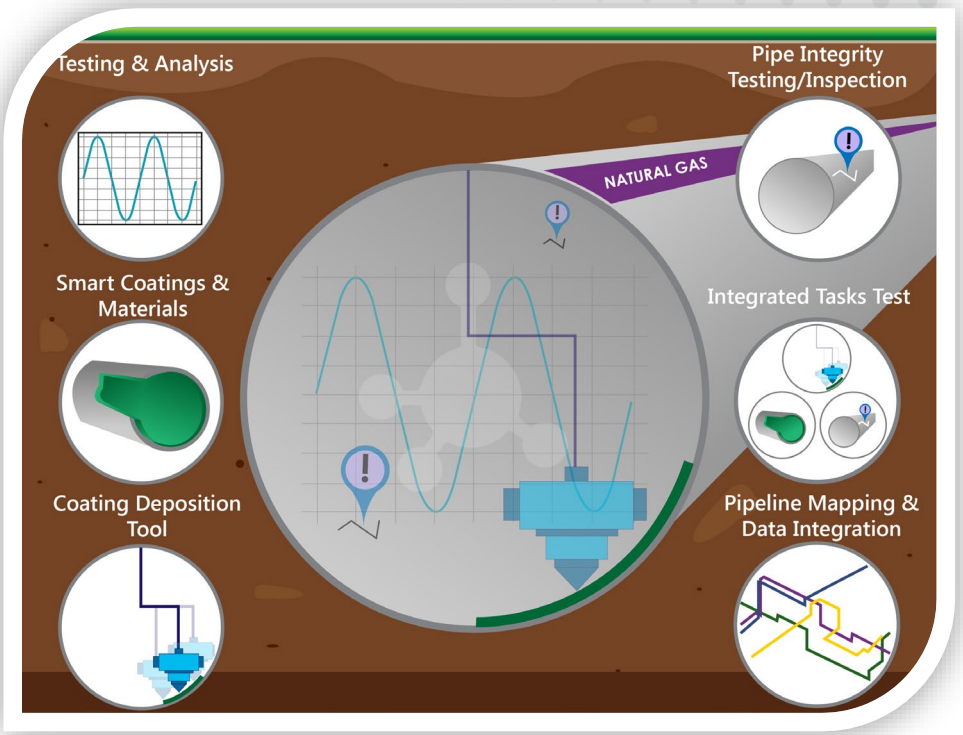
CIPP liner

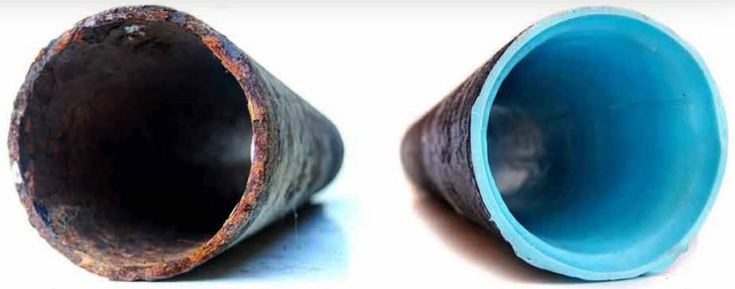


MICP

SOLUTION: REPAIR

- Fabricate a new, “smart” pipe inside the old pipe
  - Leverage advances in materials, robotics, and inspection tools
  - Minimize gas service disruption
- Real-time 3D map/inspection with data visualization
- Demonstrate rehabilitated pipe is “better than new”
- Qualify rehabilitated pipe as a new assets in the utility rate base





https://www.nuflowmidwest.com/70-east-cedar-street/

STATE OF THE ART INNOVATIONS

INTEGRATED COATING DEPOSITION TOOL WITH INTEGRITY INSPECTION CAPABILITIES

- Composite pipes
  - Water systems
- Advanced composites -- Fabrication techniques -- QC testing
  - Aerospace
  - Automotive
- Robotics
  - Defense

3-D MAPPING

- LIDAR mapping
- DOD tools for unexploded ordinances and IEDs
- 3-D visualization from gaming industry

https://techcrunch.com/2019/06/24/this-robot-crawls-along-wind-turbine-blades-looking-for-invisible-flaws/?renderMode=ie11

Questions