



PHMSA RESEARCH & TECHNICAL PERSPECTIVES



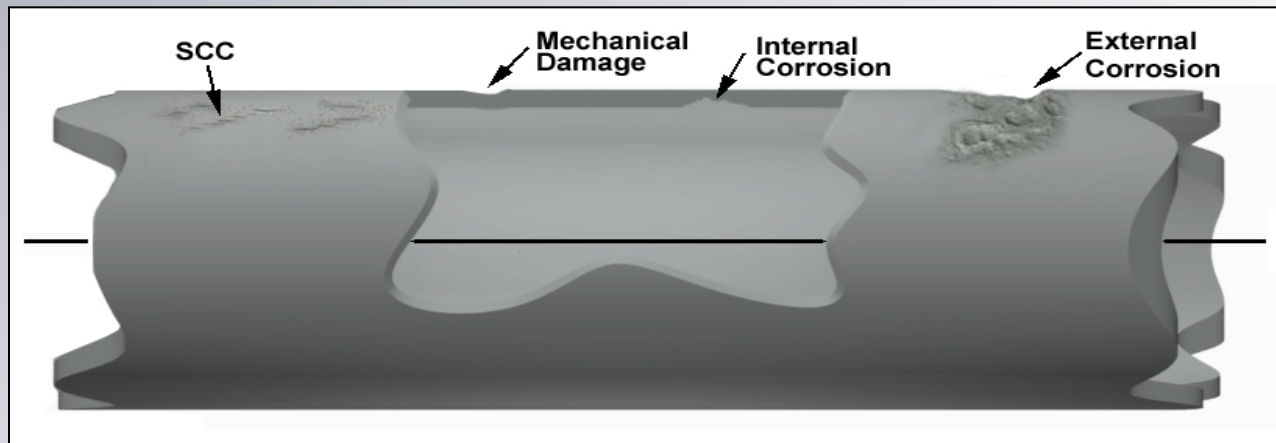
Working Group 3 – Anomaly Detection/Characterization
Gov/Industry Pipeline R&D Forum

August 6-7, 2014



Anomaly Detection/ Characterization Research

- Stakeholder input sought/generated for detection/characterization research at 5 Pipeline R&D Forums and other public events
- Solicited for related topics in 8 research solicitations since 2002
- Related Investment: 88 tech development, product development & Direct Assessment improvement projects using \$33.1M (PHMSA)





Notable Outputs/Impacts

Software/Hardware improvements to guided wave used to inspect cased crossings

- Farther inspection distances
- Improved accuracy in characterizing defects



First ever In-Line Tool to map cathodic current demand

- Key in finding complex corrosion defects and coating disbondments



Courtesy: Baker Hughes

Courtesy:
Pipetel Technologies

Innovative tool to inspect unpiggable natural gas pipelines

- Untethered, 6"/8" & 20"/26" up to 800 psi

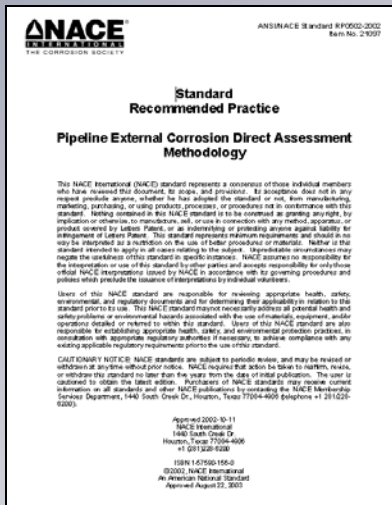




Notable Outputs/Impacts

Strong focus toward Direct Assessment in all threat areas. Influencing several NACE DA standards beginning with External Corrosion Direct Assessment.

Threat	Pipeline Type	DA Method
External Corrosion	Natural Gas Hazardous Liquid	ECDA
Internal Corrosion	Dry/Wet Natural Gas & Hazardous Liquid	ICDA
Stress Corrosion Cracking	Natural Gas	SCCDA
Excavation Damage	Natural Gas Hazardous Liquid	MDDA

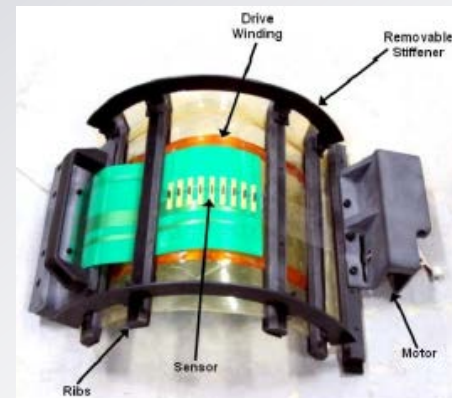




Current Research

MWM-Array Characterization of Mechanical Damage and Corrosion

- This ongoing program is aimed at advancing JENTEK's magnetic field-based eddy current technology to provide **quantitative assessment** of damage – mechanical damage and corrosion – in pipelines. There is also limited focus on SCC and weld inspection.
- For mechanical damage, the focus is on quantitative characterization of geometric variations and multidirectional residual stresses, as well as crack detection at mechanical damage sites.
- For corrosion, the focus is on enhanced high resolution imaging of both external and internal corrosion through coatings/insulation and weather protection.
- JENTEK is building on demonstrated magnetic field-based eddy-current detection capabilities to deliver substantially enhanced characterization of damage and practical means of inspection.



Current Research

Above-ground Detection Tools Including Disbondment and Metal Loss for all Metals Including Cast-Iron Graphitization

The project will develop, test, and then commercialize a mobile platform for detecting coating disbondment and external corrosion by measuring magnetic fields from above ground. Alternating current is injected into the pipe being tested. The current creates magnetic fields around the pipe. These fields are affected by corrosion and disbondment.





Current Research

Utilization of a Test Facility for Qualifying Processes for Inline Inspection (ILI) Technology Evaluation and Enhancements

This project will support the evaluation and improvement of ILI technology to identify and characterized pipeline features. This project will draw upon expertise of ILI technology development, pipeline operating company and mechanical damage assessment SME's to develop a testing protocol and modular pull test facility, at the PRCI Technology Development Center. The project will complete ILI tool pull tests considering through a set of pipe samples containing well characterized defect features.

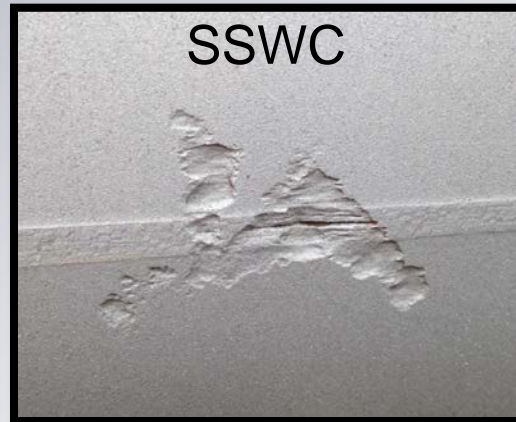
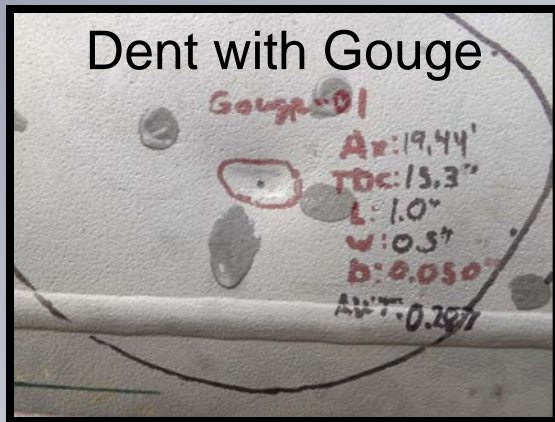




Current Research

Improve and Develop I LI Tools to Locate, Size, and Quantify Complex/Interacting Metal Loss Features

This project will improve in-line inspection tools to better locate, size, and quantify complex and interacting anomalies. This technology will help pipeline operators improve safety performance and more effectively address regulatory requirements while controlling maintenance costs by reducing excavations.



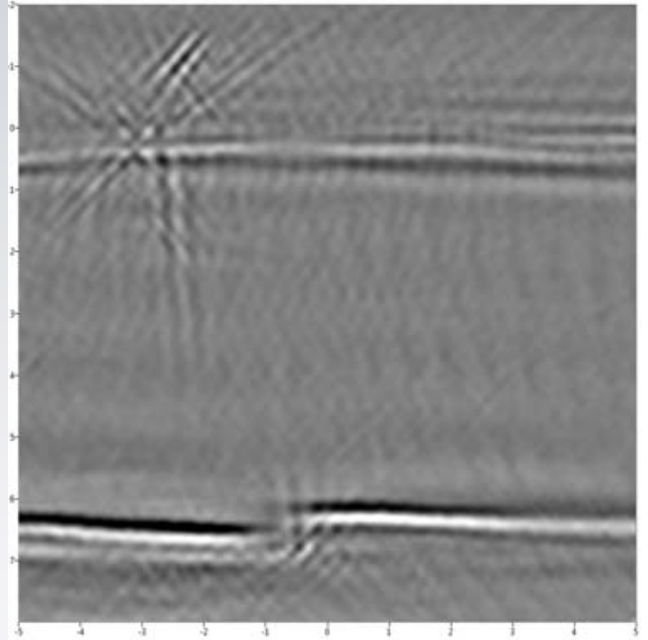


Current Research

In-Ditch Validation Methodology for Determination of Defect Sizing

The project will develop, improve and demonstrate a robust technology for accurate and reliable sizing of complex crack like anomalies by adopting an existing, proven technology for the purpose. The tool will discriminate closely spaced defects and accurately size cracks irrespective of their orientation.

Project is investigating Inverse Wave EXtrapolation (IWEX) to image defects ultrasonically. Similar to medical imaging and seismic exploration imaging.





Current Research

Consolidated Project Full Scale Testing of Interactive Features for Improved Models

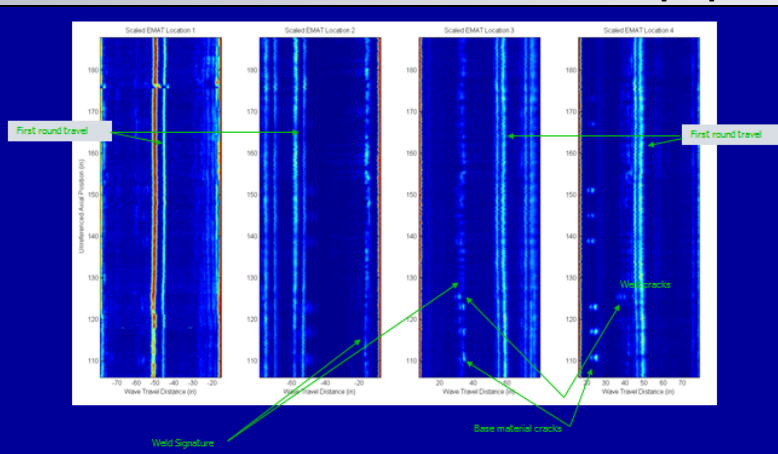
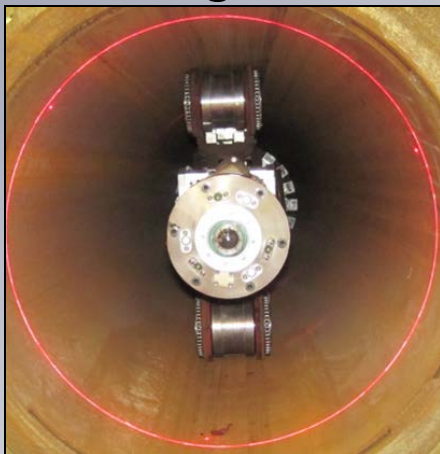
The primary goals of this project are to generate data and promote new knowledge for strengthening industry consensus standards. Through full scale testing, the project will create a database which will improve knowledge on the influence of complex loadings on both mechanical damage exposed to environmentally assisted cracking or to combined pressure and high axial strains, and on crack growth dynamics of stress corrosion cracking.



Current Research

Development, Field Testing and Commercialization of a Crack and Mechanical Damage Sensor for Unpiggable Natural Gas Transmission Pipelines

This project will complete development of a crack and a mechanical damage sensor. It will undertake the technology transfer tasks necessary to integrate these sensors into the commercial offering through Pipetel Technologies, a company that provides commercial service offering for the Explorer family of robotic devices and addressing the inspection of unpiggable natural gas transmission and distribution pipelines.





Current Research

EMAT Sensor for Small Diameter and Unpiggable Pipe

This project will develop Electromagnetic Acoustic Transducer (EMAT) sensors that can be used to detect cracks and assess welds in unpiggable pipe segments. The work will develop an EMAT sensor independent of any specific platform to allow integration with multiple unpiggable pipe inspection platforms and for use by multiple vendors.