

Research Technology Transfer Success Stories

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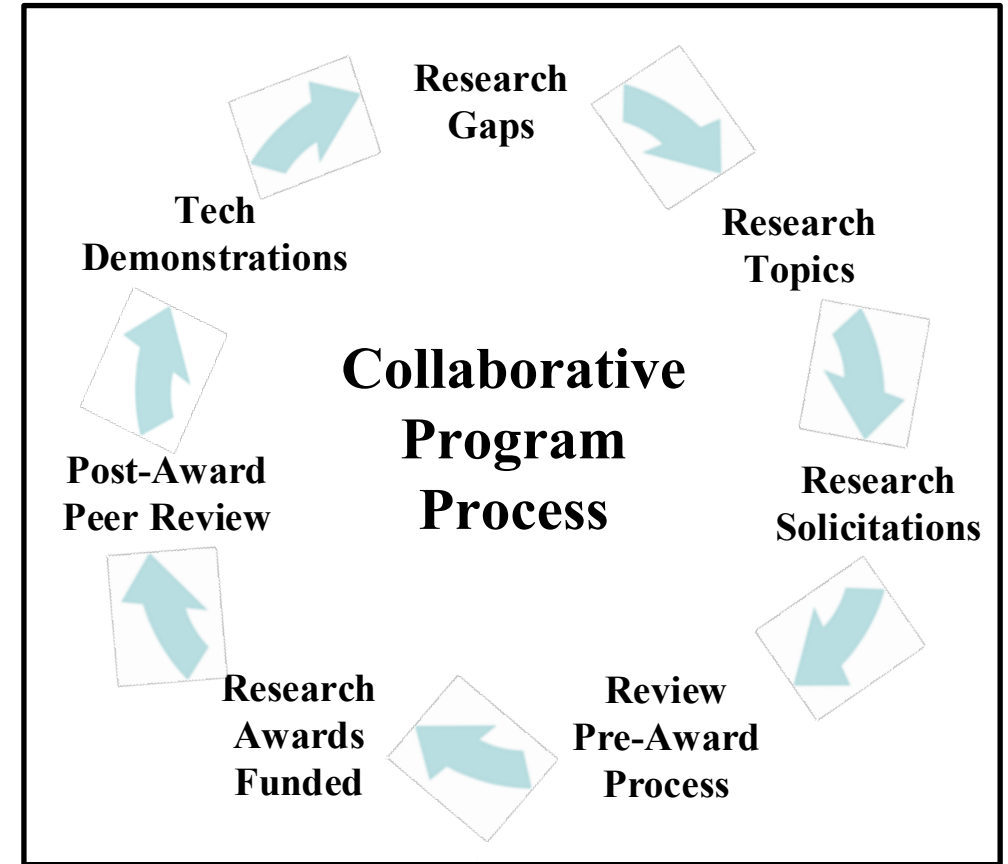
U.S. Department of Transportation
**Pipeline and Hazardous Materials
Safety Administration**

PHMSA: Your Safety is Our Mission



Collaborative Program Process

1. Stakeholder driven research gaps
2. Development of non-duplicative research topics
3. Issue research solicitations
4. Review of competitive pre-award process
5. State-of-the-art research awards funded to improve pipeline safety
6. Post-award peer review on final reporting
7. Technology demonstrations, commercialization, and tracking results



Frequent Demonstration & Deployment

■ Private Facilities

- Operating pipelines or flow loops
- Pipeline rights-of-way
- Pipe samples

■ University or Government Labs

- Test frames
- Analytical equipment



Research Technology Transfer

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Electro Magnetic Acoustic Transducer (EMAT) Sensor for Small Diameter and Unpiggable Pipes; Prototype and Testing

Researcher: Operations Technology Development

Project Cost: \$2,158,190 (\$1,070,690 PHMSA Funding + \$1,087,500 cost share)

Public Page: <https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=653>

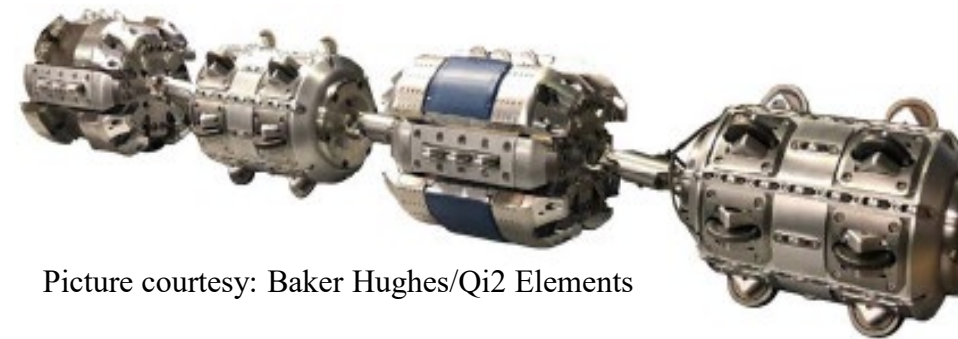
Main Objective: To build a field-ready EMAT sensor prototype and perform controlled field tests to assess its performance requirements and capabilities in identifying and characterizing pipe defects. The field-ready prototype will be designed for 8” diameter pipes.

Net Improvement: The project developed and then demonstrated the ability of the EMAT crack tool to detect tight/closed cracks down to 2 mm deep for 8” diameter pipes in traditionally difficult to inspect pipelines. The Intellectual Property from this research and from the prior research project under PHMSA contract # DTPH56-13-T-000007 evolved into a free-swimming tool that operates at 2 m/s, navigates 1.5 diameter bends, and can be pressurized to 2,200 psi. The EMAT Crack In Line Inspection tool is now being offered by Baker Hughes/Qi2 Elements.



Pull testing performed by Q-Inline at testing facilities in Texas

Pictures courtesy: Operations Technology Development



Picture courtesy: Baker Hughes/Qi2 Elements



Improved Tools to Locate Buried Pipelines in a Congested Underground

Researcher: Gas Technology Institute

Project Cost: \$1,002,000 (\$502,000 PHMSA Funding + \$500,000 cost share)

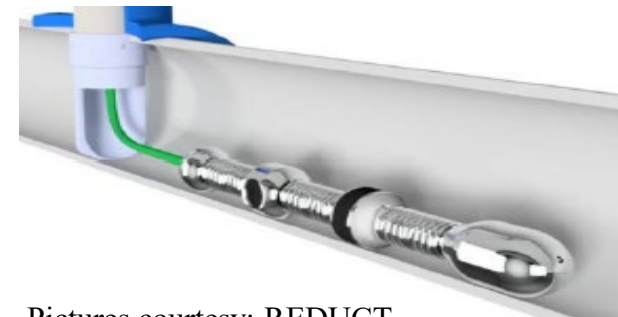
Public Page: <https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=734>

Main Objective: To mitigate third-party pipeline damage at the earliest stages through the development and commercialization of a geospatial probe to map existing buried utilities through insertion into live gas pipelines. This probe will be capable of mapping live underground pipes 3-dimensionally and provide accurate locations of utilities.

Net Improvement: The project developed and validated a geospatial probe to map existing buried utilities through insertion into live gas pipelines. The resulting technology transfer led to the Live Gas Mapper (LGM-2) tool by REDUCT. The LGM-2 can map buried live gas pipes with an Internal Diameter range of 50 mm up to 100 mm (2" to 4"). From a single hot tap entry point it can map a gas pipe up to 300 meters/1,000' length in each direction, thus capturing data and the geographical location of 600 meters/2,000' of live gas pipe.



Prototype Testing of Pneumatically Driven Duct Rod Pusher Propelling Duct Rod into a Pipeline.
Picture courtesy: Gas Technology Institute.



Pictures courtesy: REDUCT



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

Researcher: Northeast Gas Association/NYSEARCH

Project Cost: \$1,199,708 (\$840,369 PHMSA Funding + \$359,312 cost share)

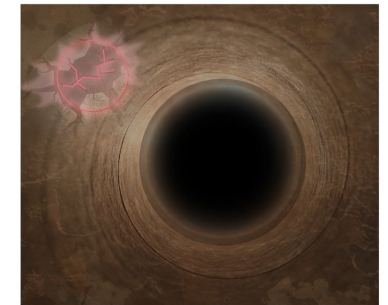
Public Page: <https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=496>

Main Objective: To further develop and thoroughly demonstrate a cracking and mechanical damage sensor in the inspection of unpiggable natural gas pipelines. The sensors will be integrated into the Explorer family of robotic devices, though only the mechanical damage sensor reached commercial success.

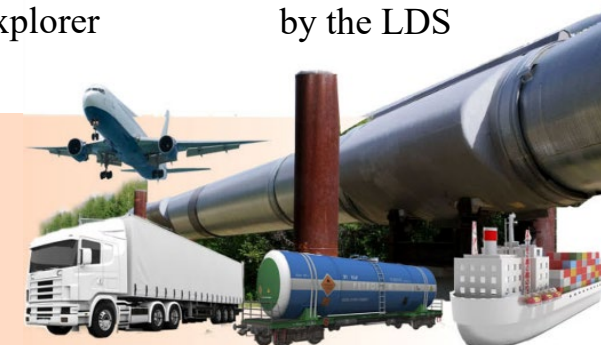
Net Improvement: The research supported the launch of the Laser Deformation Sensor (LDS) on the Explorer family of robotic inspection tools. The LDS is a laser-based sensor that allows the identification of any mechanical damage or ovality issues in hard to inspect/unpiggable natural gas pipelines. Unlike traditional caliper-based mechanical damage sensors found on smart pigs, this sensor has no moving parts, requires minimal power to operate, is very light, and occupies very little space. These are all important attributes for effectively operating in unpiggable systems. LDS identifies mechanical damage or ovality issues at an accuracy level comparable to or better than traditional calipers.



A dent observed by the camera on Explorer



The same dent measured by the LDS



In-Ditch Validation Methodology for Determination of Defect Sizing

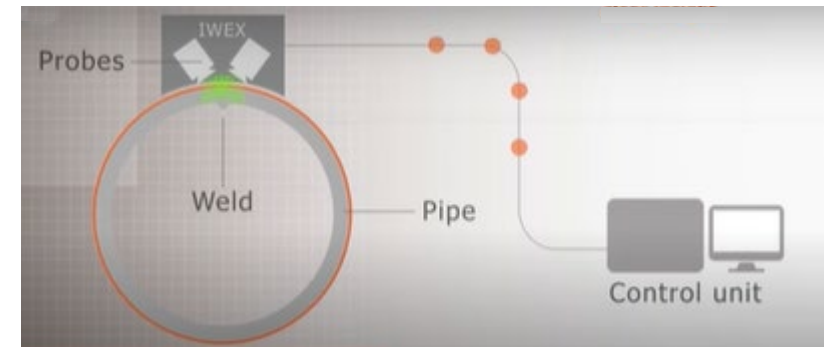
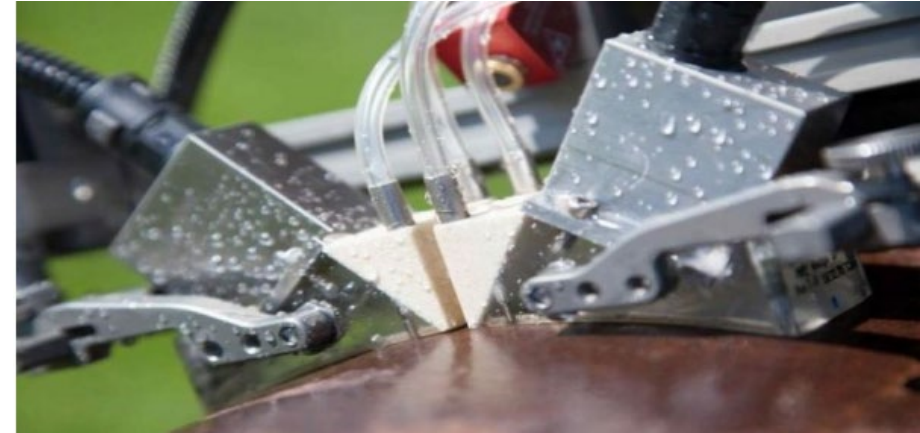
Researcher: Applus RTD USA, Inc.

Project Cost: \$2,800,373 (\$1,096,473 PHMSA Funding + \$1,703,900 cost share)

Public Page: <https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=503>

Main Objective: To 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.

Net Improvement: The research development and validation success in this project supported incorporating IWEX technology onto calibration tools, seam weld inspections, and magnetic crawlers for stress corrosion cracking inspections at Applus. IWEX is a next generation ultrasonic inspection technique with the ability to image flaws viewed as a 2D cross-section or displayed as a 3D image, allowing the user to get a better look at the flaw to determine if they are true defects or benign.



Pictures courtesy Applus



Natural Gas Pipeline Leak Rate Measurement System

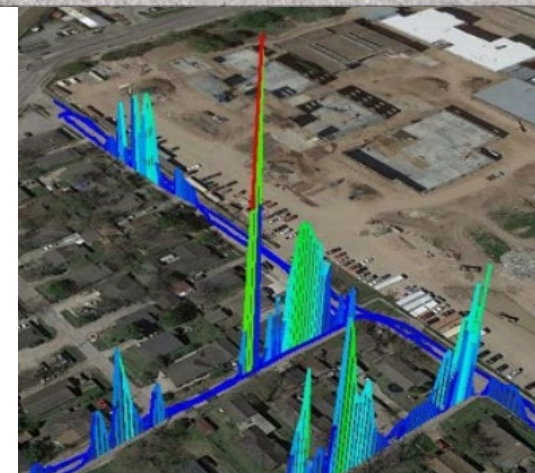
Researcher: Physical Sciences, Inc.

Project Cost: \$456,794 (\$226,794 PHMSA Funding + \$230,000 cost share)

Public Page: <https://primis.phmsa.dot.gov/matrix/prjhome.rdm?prj=734>

Main Objective: To develop survey technologies and methodologies to locate and quantify fluxes of non-hazardous natural gas leaks.

Net Improvement: The project supported development of the Heath MobileGuard™ gas leak detection system which consists of a methane/ethane analyzer, GPS, a sonic anemometer, and proprietary leak detection software that presents real-time geospatial maps of multiple gas concentrations. The MobileGuard™ laser-based sensor has a sensitivity and precision more than 3,000 times greater than legacy methods. This enables identification of leaks several hundred feet away from the source.



Pictures
courtesy
Heath
Consultants,
Inc



Next Steps?

- **Continue stakeholder engagement**
- **Conduct public meetings to highlight the program**
- **Work with field operators for feedback on the technologies**
- **Track the results of the commercialized technologies**



R&D Links

R&D Program Website:

<https://www.phmsa.dot.gov/research-and-development/phmsa-research-and-development>

About Research & Development

Congressional Mandates

Meetings and Events

Program Performance

Technology Success Stories

University Partnerships

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About Pipeline Research & Development

The mission of PHMSA's Pipeline Safety Research & Development Program is to sponsor projects focused on providing technical solutions that will improve pipeline safety, reduce the environmental impact of failures, and enhance the reliability of the Nation's pipeline transportation system.

The research program has the following objectives:

- Employ a coordinated and collaborative approach to address mutual pipeline challenges with a wide set of pipeline stakeholders
- Help remove technical and sometimes regulatory barriers on a given challenge
- Tell the research story by measuring our research results, outputs, and impacts
- Promote transparency by posting online R&D program/project actions and products.

R&D program awards and sortable features: <https://primis.phmsa.dot.gov/matrix/>

Submit a research gap suggestion: <https://primis.phmsa.dot.gov/rd/gapsuggestions.htm>

Join the R&D Program Alerts Distribution List: <https://service.govdelivery.com/accounts/USDOTPHMSA/subscriber/new>



Thank You

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