

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



Defect Detection/Characterization Research

Government/Industry Pipeline R&D Forum

www.phmsa.dot.gov

Strategies & Goals

	<u>Program Elements</u>	<u>Program Element Goals</u>
1.	Damage Prevention	Reducing the number of incidents and accidents resulting from excavation damage and outside force
2.	Pipeline Assessment and Leak Detection	Identifying and locating critical pipeline defects using inline inspection, direct assessment and leak detection
3.	Defect Characterization and Mitigation	Improving the capability to characterize the severity of defects in pipeline systems and to mitigate them before they lead to incidents or accidents
4.	Improved Design, Construction, and Materials	Improving the integrity of pipeline facilities through enhanced materials, and techniques for design and construction
5.	Systems for Pipeline Mapping and Information Management	Enhancing the ability to prevent and respond to incidents and accidents through management of information related to pipeline location (mapping) and threats definition
6.	Enhanced Operation Controls and Human Factors Management	Improving the safety of pipeline operations through enhanced controls and human factors management
7.	Risk Management & Communications	Reducing the probability of incidents and accidents, and mitigating the consequences of hazards to pipelines
8.	Safety Issues for Emerging Technologies	Identifying and assessing emerging pipeline system technologies for opportunities to enhancing their safety

Detection/Characterization Research

#	Goal	Type	Location	Project ID	Contractor	Project Title	PHMSA	Co-Share	Pct Cmpl
1.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS5 6-05-T- 0002	Northeast Gas Association	<i>"Validation and enhancement of long range guided wave ultrasonic testing: A key technology for DA of buried pipelines"</i>	\$531,331	\$622,750	100
2.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS5 6-05-T- 0004	CC Technologies , Inc.	<i>"Evaluation and Validation of Aboveground Techniques for Coating Condition Assessment"</i>	\$130,988	\$621,000	100
3.	Safety	HazLiq GasTrans	Onshore Offshore	DTPH5 6-06-T- 000008	Acellent Technologies , Inc.	<i>"Real-time Active Pipeline Integrity Detection (RAPID) system for Direct Assessment of Corrosion in Pipelines"</i>	\$67,202	\$67,816	100
4.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS5 6-04-T- 0001	Southwest Research Institute	<i>"Nonlinear Harmonic-based Mechanical Damage Severity Criteria for Delayed Failures in Pipelines"</i>	\$333,230	\$354,000	100
5.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTR57- 06-C- 10004	Intelligent Automation, Inc.	<i>"In-Line Nondestructive Inspection of Mechanical Defects in Pipelines with Shear Horizontal Wave EMAT"</i>	\$100,000	\$0	100
6.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS5 6-02-T- 0002	Battelle Memorial Institute	<i>"Mechanical Damage Inspection Using MFL Technology"</i>	\$410,000	\$380,000	100
7.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS5 6-02-T- 0003	Southwest Research Institute	<i>"Feasibility of In-Line Stress Measurement by Continuous Barkhausen Method"</i>	\$80,000	\$80,000	100

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8.	Safety	HazLiq GasTrans Dist-Steel	Onshore Offshore	DTRS56-02-T-0007	PetroChem Inspection Services	<i>"Enhancement of the Long-Range Ultrasonic method for the Detection of Degradation in Buried, Unpiggable Pipelines"</i>	\$655,564	\$633,325	100
9.	Safety	HazLiq GasTrans	Onshore	DTRS56-03-T-0006	FINO AG, Hildersheil Germany	<i>"NoPig Metal-Loss Detection System for Non-Piggable Pipelines"</i>	\$387,818	\$340,000	100
10.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS56-03-T-0012	Edison Welding Institute, Inc.	<i>"Improved Inspection and Assessment Methods for Pipeline Girth Welds and Repair Welds"</i>	\$356,674	\$460,000	100
11.	Safety	HazLiq GasTrans Dist-Steel	Onshore Offshore	DTRS56-03-T-0013	Southwest Research Institute	<i>"High-power, Long-range, Guided-wave Inspection of Pipelines"</i>	\$272,420	\$332,935	100
12.	Environmental Stewardship	HazLiq GasTrans Dist-Steel Dist-Non-Metal	Onshore Alaska	DTPH56-05-T-0004	Electricore, Inc.	<i>"Use of Unmanned Air Vehicle (UAV) for Pipeline Surveillance to Improve Safety and Lower Cost"</i>	\$457,361	\$625,416	100
13.	Environmental Stewardship	HazLiq GasTrans	Offshore	DTPH56-05-T-0004	Electricore, Inc.	<i>"Use of Unmanned Underwater Vehicle (UUAV) for Pipeline Surveillance to Improve Safety and Lower Cost"</i>	\$405,358	\$285,000	100
14.	Safety	HazLiq GasTrans Dist-Steel	Onshore Offshore	DTPH56-05-T-0005	Shell Global Solutions (US) Inc.	<i>"Cathodic Protection Current Mapping In-Line Inspection Technology"</i>	\$401,000	\$450,000	100
15.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTPH56-05-T-0006	CC Technologies , Inc.	<i>"Pipeline Assessment and Repair Manual"</i>	\$76,000	\$75,000	100

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16.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS56-04-T-0002	Southwest Research Institute	<i>"Determining Integrity Reassessment Intervals Through Corrosion Rate Modeling And Monitoring"</i>	\$350,000	\$350,000	100
17.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTRS56-04-T-0008	Olympus NDT	<i>"Stage 2 Phased Array Wheel Probe for In-Line Inspection"</i>	\$161,000	\$160,000	100
18.	Environmental Stewardship	HazLiq GasTrans Dist-Steel Dist-Non-Metal	Onshore	DTRS57-04-C-10012	Prime Research	<i>"Intrinsic Distributed Fiber Optic Leak Detection"</i>	\$99,706	\$0	100
19.	Environmental Stewardship	GasTrans Dist-Steel Dist-Non-Metal	Onshore Alaska	DTRS57-04-C-10016	Midé Technology Corporation	<i>"Piezo Structural Acoustic Pipeline Leak Detection System"</i>	\$100,000	\$0	100
20.	Environmental Stewardship	GasTrans Dist-Steel Dist-Non-Metal	Onshore Alaska	DTRS56-01-X-0023	LaSen and U.S. Air Force Research Laboratory	<i>"Airborne LIDAR Pipeline Inspection System (ALPIS) Mapping Tests"</i>	\$2,245,204	\$0	96
21.	Safety	HazLiq GasTrans	Onshore Offshore Alaska	DTRS56-03-T-0008	Engineering Mechanics Corporation of Columbus	<i>"A Comprehensive Update in the Evaluation of Pipelines Weld Defects"</i>	\$361,419	\$544,405	96
22.	Environmental Stewardship	HazLiq GasTrans Dist-Steel Dist-Non-Metal	Onshore Offshore Alaska	DTRS56-04-T-0012	ITT Industries Space Systems, LLC	<i>"Hazardous Liquids Airborne Lidar Observation Study (HALOS)"</i>	\$553,114	\$555,115	92

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23.	Safety	GasTrans Dist-Steel	Onshore	DTRS56 -05-T- 0002	Northeast Gas Association	<i>"Design, Construction and testing of a segmented MFL sensor for use in the inspection of unpiggable pipelines"</i>	\$814,292	\$829,400	92
24.	Safety	HazLiq GasTrans	Onshore	DTPH56 -06-T- 000009	EMAT Ultrasonics Inc.	<i>"Enhancing Direct Assessment with Remote Inspection through Coatings and Buried Regions"</i>	\$222,170	\$255,262	84
25.	Safety	GasTrans Dist-Steel	Onshore	DTRS56 -02-T- 0001	Southwest Research Institute	<i>"Application of Remote- Field Eddy Current Testing to Inspection of Unpiggable Pipelines"</i>	\$1,612,806	\$87,500	83
26.	Safety	GasTrans Dist-Steel	Onshore	DTRS56 -05-T- 0002	Northeast Gas Association	<i>"Design, construction and demonstration of a robotic platform for the inspection of unpiggable pipelines under live conditions"</i>	\$1,281,525	\$2,136,109	76
27.	Safety	HazLiq GasTrans	Onshore	DTPH56 -05-T- 0001	Electricore, Inc.	<i>"Understanding Magnetic Flux Leakage (MFL) Signals from Mechanical Damage in Pipelines"</i>	\$111,770	\$109,770	74
28.	Environmental Stewardship	Dist-Non- Metal	Onshore	DTPH56 -06-T- 000007	Northeast Gas Association	<i>"Ultra-Low Frequency Pipe and Joint Imaging System"</i>	\$327,500	\$327,500	45

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29.	Safety	Dist-Non-Metal	Onshore	DTPH56-06-T-000002	Edison Welding Institute, Inc.	<i>"Define, Optimize and Validate Detection and Sizing Capabilities of Phased-Array Ultrasonics to Inspect Electrofusion Joints in Polyethylene Pipes"</i>	\$556,381	\$715,500	44
30.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTPH56-06-T-000006	Northeast Gas Association	<i>"Long Term Monitoring of Cased Pipelines Using Long-Range Guided-Wave Technique"</i>	\$500,000	\$506,400	42
31.	Safety	HazLiq GasTrans	Onshore Offshore	DTPH56-06-T-000003	Intelligent Optical Systems, Inc. (IOS)	<i>"Characterization of Stress Corrosion Cracking Using Laser Ultrasonics"</i>	\$500,000	\$616,809	42
32.	Safety	HazLiq GasTrans Dist-Steel Dist-Non-Metal	Onshore	DTRT57-07-C-10004	HD Laboratories, Inc.	<i>"MEIS System for Pipeline Coating Inspection"</i>	\$99,305	\$0	38
33.	Safety	HazLiq	Onshore	DTRT57-07-C-10006	Solers Inc.	<i>"Pipe Disbondment Detection and Coating Assessment Using the Dynamic Wavelet Fingerprinting Technique"</i>	\$99,992	\$0	38
34.	Safety	HazLiq GasTrans	Onshore	DTRT57-07-C-10005	JENTEK Sensors Inc.	<i>"High Resolution Electromagnetic Imaging and Decision Support for Pipeline Life Management Delivery"</i>	\$100,000	\$0	35
35.	Safety	Dist-Non-Metal	Onshore	DTPH56-06-T-000004	Gas Technology Institute	<i>"Plastic Pipe Failure, Risk, and Threat Analysis"</i>	\$494,838	\$495,000	25

#	Goal	Type	Location	Project ID	Contractor	Project Title	PHMSA	Co-Share	Pct Cmpl
36.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTPH56-06-T-000016	Pipeline Research Council International	<i>"Development of Dual Field MFL Inspection Technology to Detect Mechanical Damage"</i>	\$503,000	\$2,626,167	25
37.	Safety	HazLiq GasTrans	Onshore Offshore	DTPH56-06-T-000016	Pipeline Research Council International	<i>"Investigate Fundamentals and Performance Improvements of Current In-Line Inspection Technologies for Mechanical Damage Detection"</i>	\$255,109	\$703,791	25
38.	Safety	HazLiq GasTrans Dist-Steel	Onshore Offshore	DTPH56-06-T-000019	Battelle Memorial Institute	<i>"Augmenting MFL Tools with Sensors That Assess Coating Condition"</i>	\$249,919	\$261,100	19
39.	Safety	HazLiq GasTrans Dist-Steel	Onshore	DTPH56-06-T-000020	Gas Technology Institute	<i>"Phase Sensitive Methods to Detect Cathodic Disbondment"</i>	\$248,175	\$256,437	19
Totals:							\$16,512,171	\$16,863,507	

Project information found at
<http://primis.phmsa.dot.gov/matrix/>

Defect Detection/Characterization Research

“Generating Innovation”



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- **Technology Improvements**

- **Guided Wave Ultrasonics hardware & software**
- **Magnetostrictive/Guided Wave Ultrasonic**
 - *Long-term cased crossing monitoring*
- **Robotic Platforms capable of traversing many obstructions seen in unpiggable gas lines**
 - *MFL & RFEC sensor technology*
- **Technology for finding disbonded coatings**
 - *EMAT*
 - *MFL*
- **Magnetic Flux Leakage sensors**
 - *Augmenting for mechanical damage*

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- **Technology Improvements**
 - **Leak Detection**
 - *Aerial (helicopter/fixed wing/UAV)*
 - *Area around pipe*
 - **Internal cathodic mapping via in line inspection**
 - **Joint imaging for plastic pipes**
- **General Knowledge**
 - **Technology for inspecting plastic pipes**
 - *What threats?*
 - *What technology matches threats?*
 - **Severity of defects**
 - *Corrosion defects*
 - *Welding flaws*
 - *Joining flaws (plastic)*



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Mechanical Damage (MD) PHMSA Study

- **Awarded to Michael Baker Jr. – Fall 2006**
- **Project Scope**
 - **Define MD**
 - **Identify technology and relevant standards**
 - **Peer report publicly**
- **Expected Impacts**
 - **Common definition of MD**
 - **Raise knowledge**
 - **Consensus Standard revisions**
 - **PHMSA regulatory clarity for MD**



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Next Steps

- **Monitor technology demonstrations that are part of the work scope**
- **Organize and hold separate tech demos if necessary**
- **Report all impacts on R&D website**
- **Some modifications requested adding more scope and time.**
- **Look at completed efforts addressing technology about further developments**

PHMSA R&D Homepage
<http://primis.phmsa.dot.gov/rd/>