Pipeline and Hazardous Materials Safety Administration
Office of Pipeline Safety

Pipeline Safety Research & Development Program

Sentho White

October 20, 2021

U.S. DOT Strategic Pillars

STRATEGIC PILLARS

- Safety
- Economy
- Equity
- Climate
- Transformation

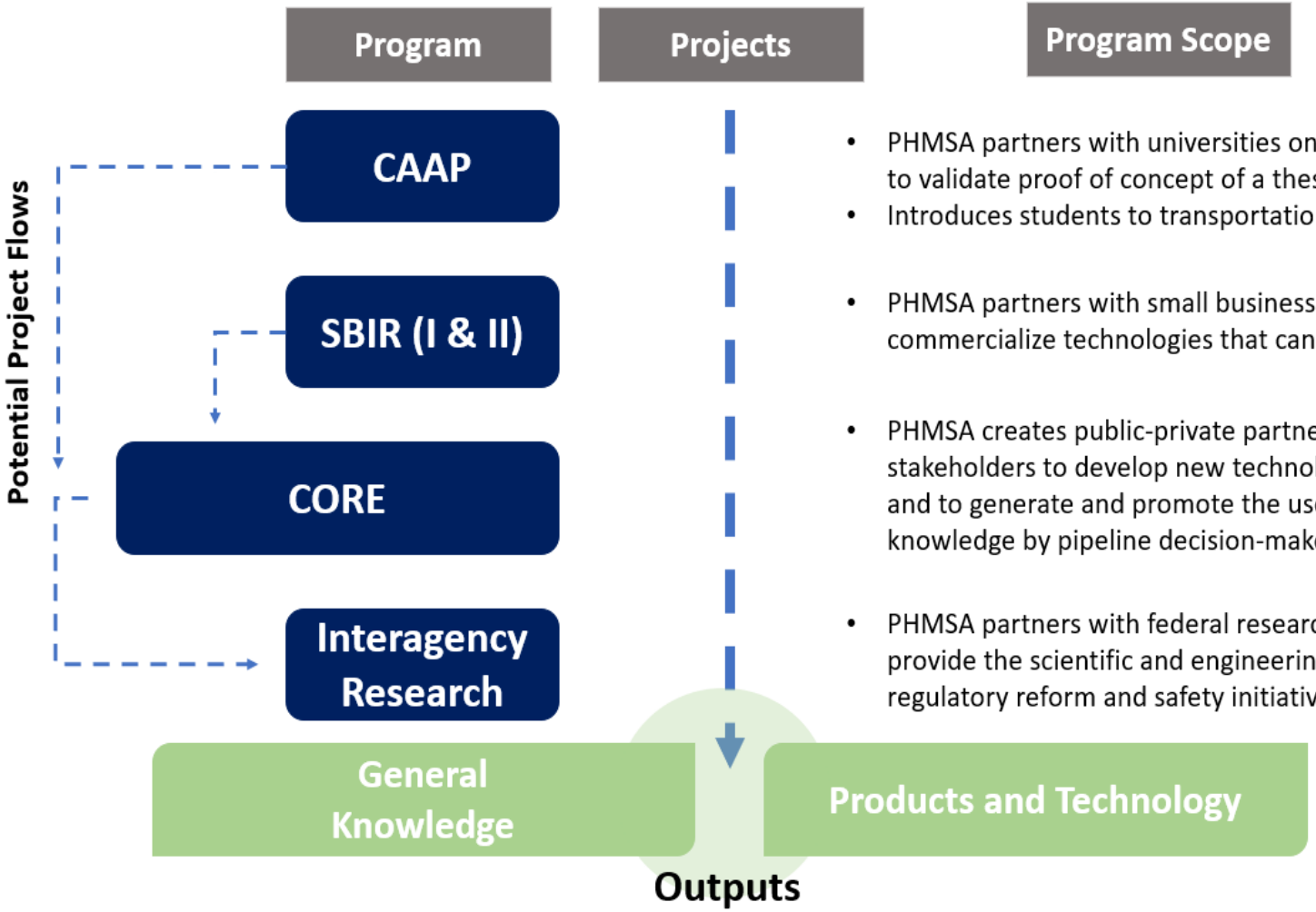
Goals reflect Administration's Priorities: American Jobs Plan, Reauthorization, Executive Orders, etc.

Pipeline Safety Research Program Mission

To sponsor research and development projects focused on providing **near-term solutions** for the Nation's pipeline transportation system that will improve **safety**, reduce **environmental impact**, and enhance **reliability**.

Research Program Strategy Development

Research & Development Program



- PHMSA partners with universities on pipeline safety research to validate proof of concept of a thesis or theory.
- Introduces students to transportation of energy by pipelines.
- PHMSA partners with small businesses to commercialize technologies that can advance safety.
- PHMSA creates public-private partnerships with stakeholders to develop new technology or products and to generate and promote the use of new knowledge by pipeline decision-makers.
- PHMSA partners with federal research entities to provide the scientific and engineering basis for regulatory reform and safety initiatives.

Pipeline Safety Research Outcomes

- Providing knowledge in support of managing risk and removing barriers for transportation of hydrogen and other renewables by pipelines. (Safety, Climate)
- Providing performance-based risk reduction for design, construction, operations, maintenance, and fire protection of LNG facilities. (Safety, Climate, Transformation)
- Improving safety systems for underground natural gas storage facilities. (Safety, Climate)
- Improving identification of small leaks to limit environmental harm and reduce the likelihood that the leaks lead to catastrophic ruptures. (Safety, Climate)
- Developing new technologies to mitigate the risk posed by excavation damage. (Safety, Climate)
- Seeking to reduce pipeline accidents and incidents. (Safety, Climate)

Total Investment History Since 2002

Name	Amount	Number of Projects
Core	$128.5 M	252 Projects
CAAP*	$15.1 M	61 Projects
SBIR	$15.8 M	48 Projects
IAA	$7.4 M	19 Projects
Total	**$166.8 M**	**380 Projects**

**CAAP launched in 2013*

Performance History Since 2002

Technology

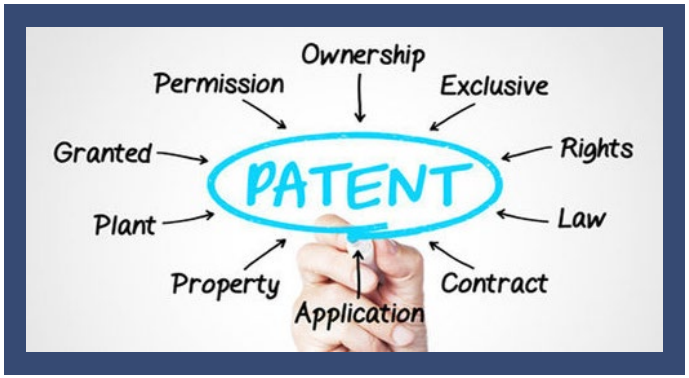
Category	Technology Projects	Technology Demonstrations	Patent Applications (U.S. + Other)	Patents Granted (U.S. + Other)	Tech-Transfer/ Commercialized Technologies	PHMSA ($M)	Cost Share ($M)
Threat Prevention	25	16	3	3	5	$12.57M	$12.73M
Leak Detection	17	12	2	0	6	$ 9.39M	$ 7.02M
Anomaly Detection	44	33	25	9	16	$30.28M	$30.87M
Anomaly Characterization	9	3	0	0	1	$ 4.32M	$ 2.80M
Anomaly Repair	1	0	0	0	0	$ 0.99M	$0.00
Materials	10	2	3	2	1	$11.15M	$ 7.98M
Welding/Joining	10	7	1	1	0	$6.27M	$7.48M
Alternative Fuels	3	2	1	1	2	$ 1.09M	$ 0.56M
Underground Natural Gas Storage	2	1	0	0	0	$ 0.99M	$ 0.99M
Totals:	**121**	**76**	**35**	**16**	**33**	**$77.10M**	**$70.48M**

Data as of 10/1/2021

Performance History Since 2002

Knowledge Development/Dissemination

Website Metric	Measure
Total Hits	41,178,605
Average Hits/Month	185,489
Downloads Since 2008	2,016,763



Knowledge Promotion Metric	Count
Final Reports	265
Conference or Journal Papers	237
Public Events	44
Annual Peer Reviews Held	14

Data as of 10/1/2021

FY 2021 R&D Awards

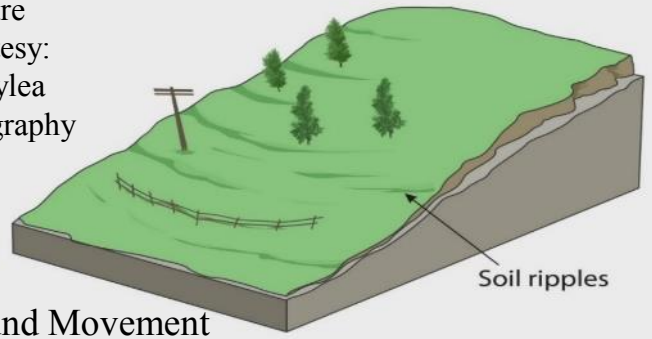
FY 2021 Investments

Name	Amount	Number of Projects
Core	$5.8 M	10 Projects
CAAP	$1.9 M	3 Projects
SBIR	$3.9 M	4 Projects
IAA	$1.0 M	2 Projects
Total	**$12.6 M**	**19 Projects**

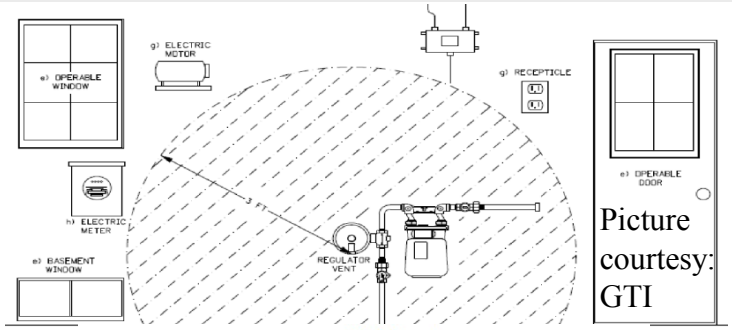
Core Research Projects in FY 2021

Threat Prevention Project Title	Details
Development and Validation of a Probabilistic Method for Estimating Accumulated Strain and Assessing Strain Demand and Capacity on Existing Pipelines	Gas Technology Institute $1,437,508
Design and Placement of Compact Service Regulators	Gas Technology Institute $383,725
Development of Corrosion/ Erosion Threat Assessment Methodologies and Enriched Preventive and Mitigative Measures to Promote Safety of Gas Gathering Pipelines	North Dakota State University $377,830

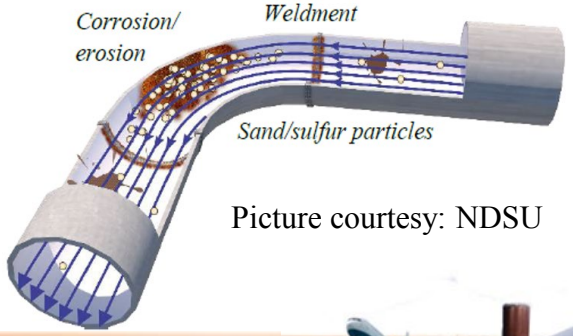
Picture courtesy: Currylea Geography



Ground Movement



Picture courtesy: GTI

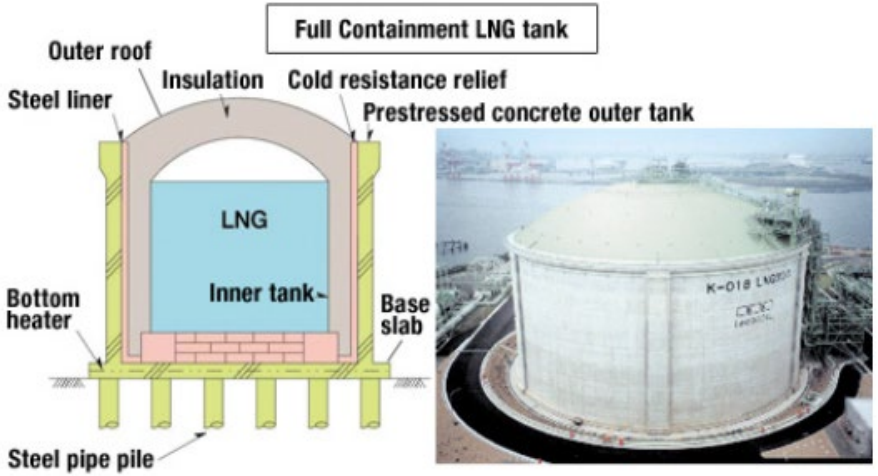


Picture courtesy: NDSU

Core Research Projects in FY 2021

LNG Project Title	Details
Liquefied Natural Gas Tanks Without Bottom Fill	Blue Engineering & Consulting Co.
	$331,760
Developing Performance Criteria for External Loading Factors on External Steel Shell Tanks	Simpson Gumpertz & Heger
	$383,725

Picture courtesy: Roy Luck/Flickr

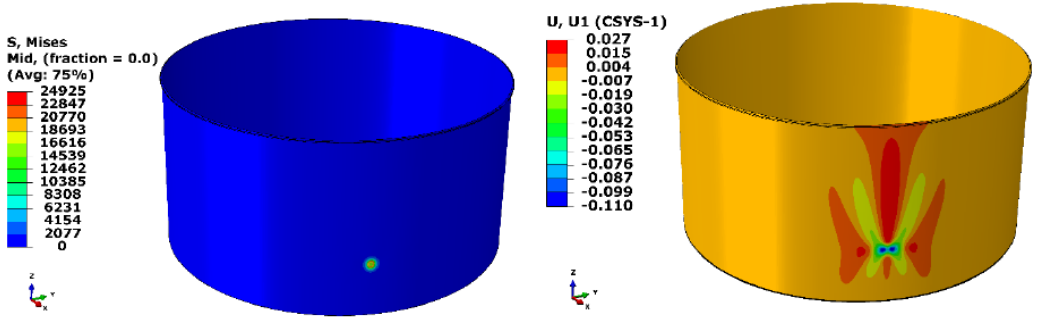


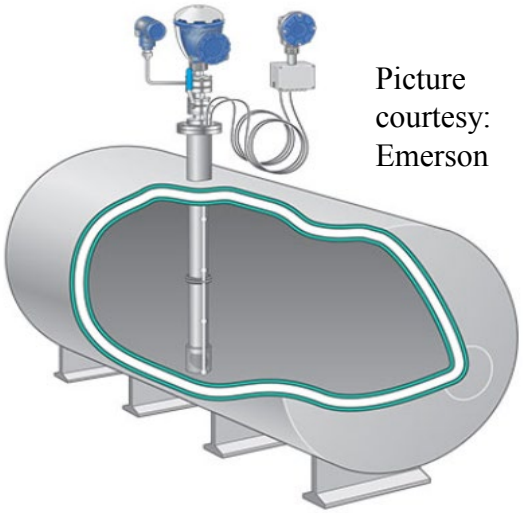
Picture courtesy: Osaka Gas

Core Research Projects in FY 2021

LNG Project Title	Details
Determine the Maximum Permissible Temperature Drops for Steel when Exposed to Cryogenic Liquid	Purdue University
	$270,907
Developing Periodic External/Internal Inspection Requirements to Assess Low Temperature and Cryogenic Storage Tanks	PEMY Consulting
	$165,000

Picture courtesy: Purdue University



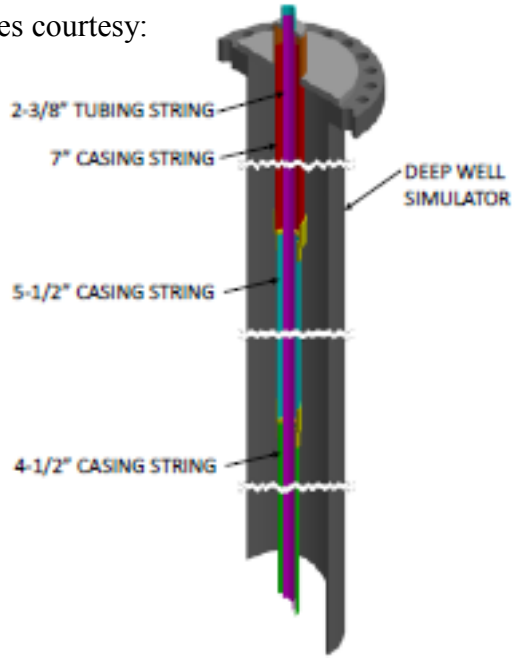


Picture courtesy: Emerson

Core Research Projects in FY 2021

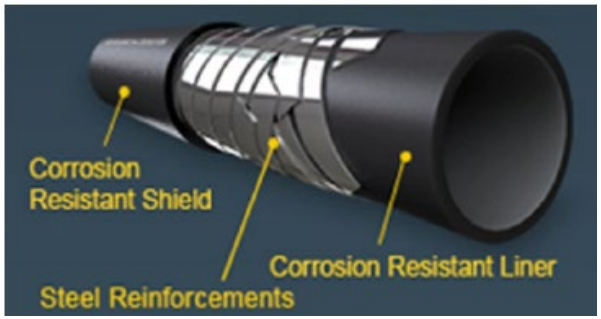
UNGS Project Title	Details
Advancement of Through-Tubing Casing Inspection For Underground Storage Wells	Pipeline Research Council International
	$788,594

Pictures courtesy:
PRCI

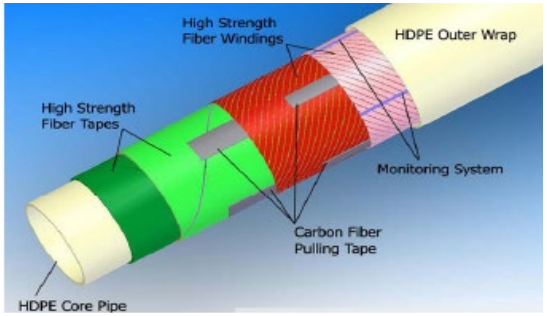


Core Research Projects in FY 2021

Materials Project Title	Details
Feasibility of Using Alternative-Steel and Composite Material in Gas and Hazardous Liquid Pipeline Systems	Gas Technology Institute
	$873,320
Assessment of Nondestructive Examination (NDE) and Condition Monitoring Technologies for Defect Detection in Non-Metallic Pipe	Edison Welding Institute
	$728,450



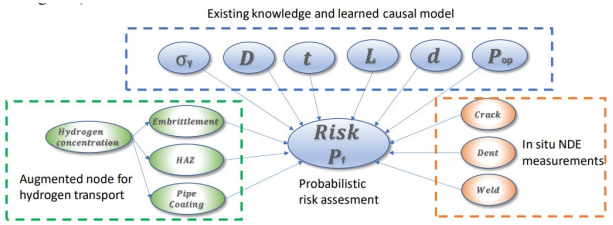
Picture courtesy:
Olympus IMS



Pictures courtesy: GTI

CAAP Research Projects in FY 2021

CAAP Project Title	Details
Knowledge-guided Automation for Integrity Management of Aging Pipelines (KAI-MAP) for Hydrogen Transport	Arizona State University $844,726
Pipeline Risk Management Using Artificial Intelligence-Enabled Modeling and Decision Making	Rutgers, The State University $349,328
Easy Deployed Distributed Acoustic Sensing System for Remotely Assessing Potential and Existing Risks to Pipeline Integrity	Colorado School of Mines $665,370



Picture courtesy: Arizona State University

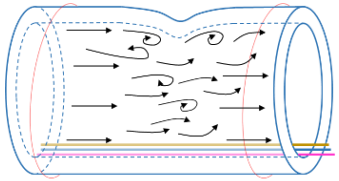


Fig. 12. Eddies induced by Dent/Deformation

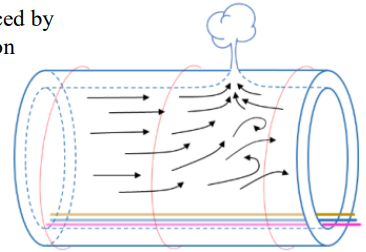
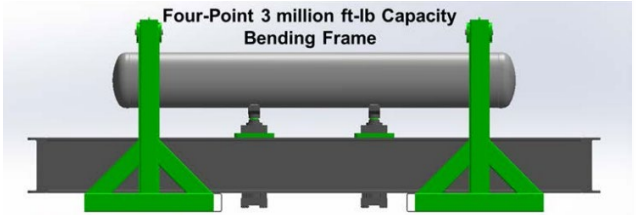


Fig. 14. Vortex Induced by Leakage

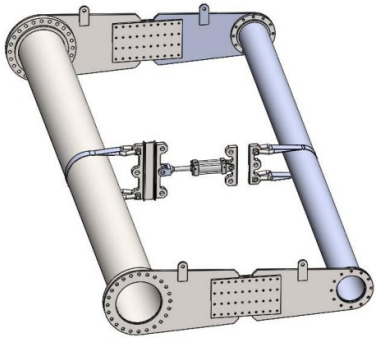
Picture courtesy: Colorado School of Mines

SBIR Research Projects in FY 2021

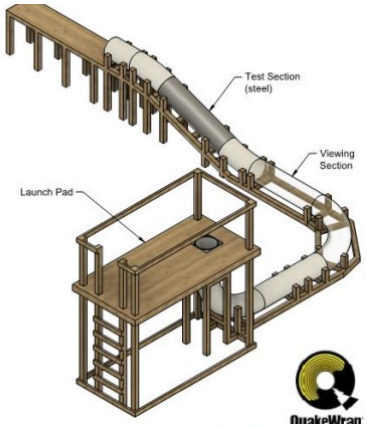
SBIR Phase II Project Title	Details
No-Dig Point Repair Technology For Steel Oil & Gas Pipelines	QuakeWrap, Inc.
	$998,456.58
Robust, Field-Ready, Inline Tool for the Accurate Measurement of Pipe Bending Stresses and Crack Detection	Creare, LLC
	$984,395.82
Meandering Winding Magnetometer-Array Bending Stress and Crack Detection In-Line Inspection Module	JENTEK Sensors Inc.
	$985,365.25
Fiber Optic Sensors for Direct Pipeline Monitoring Under Geohazard Conditions	Paulsson, Inc.
	$991,124.00



Picture courtesy: Paulsson, Inc.



Picture courtesy: JENTEK Sensors Inc.



Picture courtesy: QuakeWrap, Inc.

IAA Research Projects in FY 2021

IAA Project Title	Details
Detection of Buried Plastic Pipelines	National Energy Technology Laboratory
	$504,126.49
Ensuring Oil and Gas Pipeline Safety Following a Geomagnetic Disturbance event Pipeline Safety Research Project	Sandia National Laboratories
	$508,000

Picture courtesy: Sandia National Laboratories

Picture courtesy: Sandia National Laboratories

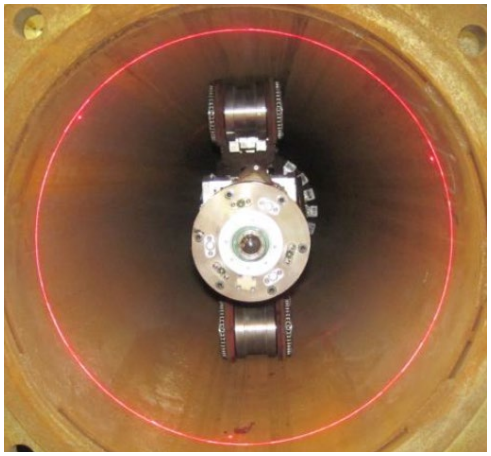
FY 2021 Technology/Knowledge Transfer

Technology Transfer

Tools to Improve Safety

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

Researcher:	Northeast Gas Association (NGA)
PHMSA Costs:	$840,396
Main Objective:	To develop a combined mechanical and crack sensor for use on robotic inspections of unpiggable natural gas pipelines.
Net Improvement:	The research supported the launch of the Laser Deformation Sensor (LDS) on the Pipetel Explorer line of robotic inspection tools. The LDS is a laser-based sensor that allows the identification of any mechanical damage or ovality issues in a challenging to inspect or unpiggable natural gas transmission pipeline.



Pictures courtesy of Northeast Gas Association

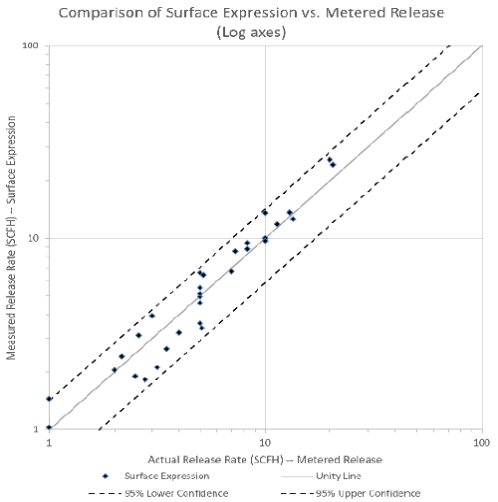
https://primis.phmsa.dot.gov/matrix/PrjHome.rdm?prj=496

Knowledge Transfer

Knowledge to Improve Safety

Emissions Quantification Validation Process

Researcher:	Northeast Gas Association (NGA)
PHMSA Costs:	$144,670
Main Objective:	To identify, apply and test a methodology or methodologies that validate quantified methane emissions rate measurements in gas distribution systems.
Net Improvement:	After project completion in March 2019, Northeast Gas Association pipeline operator member companies continued to use this developed methodology successfully. In 2021, NGA and member companies were working with the American Society for Testing and Materials Committee on Air Quality to develop a nationally recognized standard methodology based on this research.



Pictures courtesy of Northeast Gas Association

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FY 2022 Research Focus

PSRP FY22 Program Areas

Alternative Fuels Research to Address Climate Change Solutions	PHMSA will invest in research gaps that enhance the safe transportation of hydrogen gas and/or for various hydrogen blends in the nation's pipeline network.
Pipeline Leak Detection	PHMSA will invest in research gaps identified during the Spring 2021 Leak Detection public meeting as well as technologies identified to address Sections 113 and 114 of the PIPES Act of 2020.
Liquefied Natural (LNG) Gas Safety	Research will focus on new technologies and alternative designs for LNG storage and piping systems. Research will also address performance-based risk reduction for construction, operations, maintenance of LNG facilities.
Underground Natural Gas Storage (UGS) Facilities Safety	Research will focus on improving the integrity of surface wellheads and UGS facilities, thereby mitigating the risk of natural gas releases into the environment.

PSRP FY22 Program Areas (cont.)

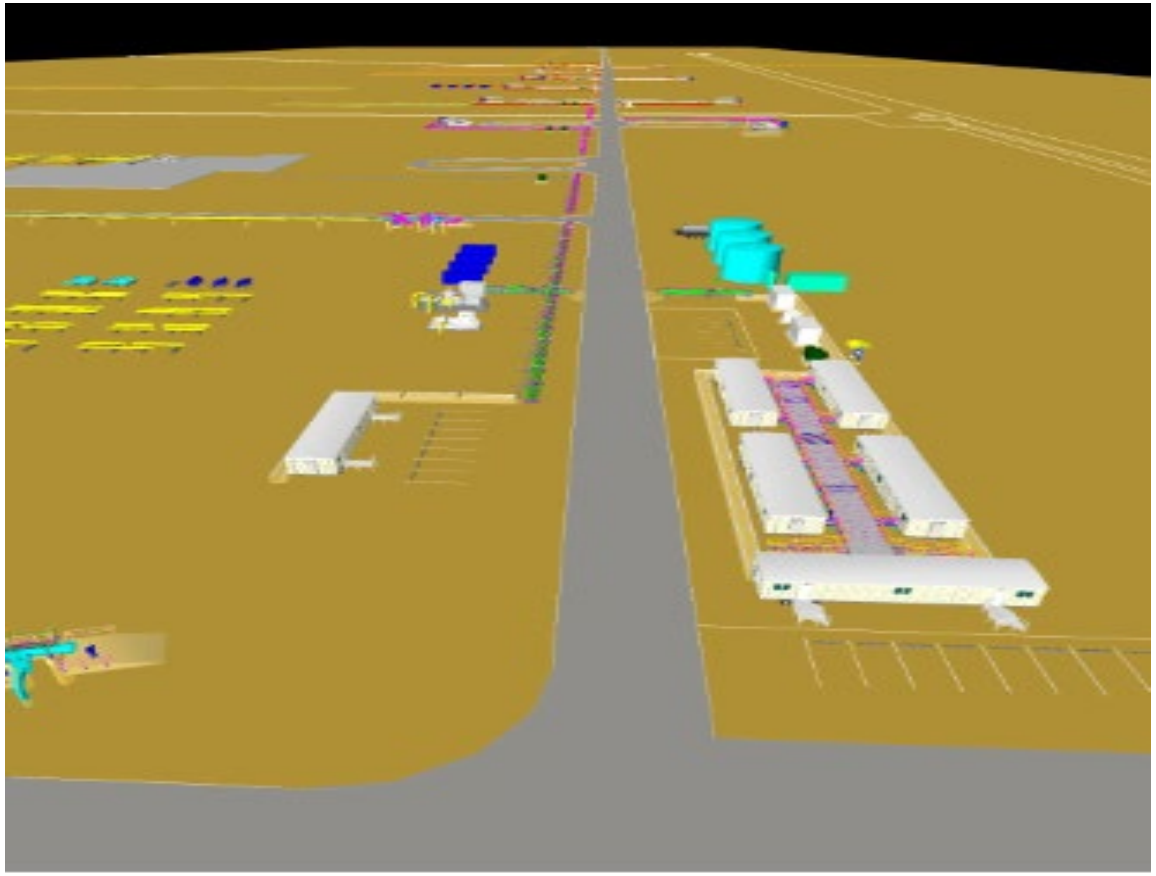
Pipeline Anomaly Detection/Characterization	Develop new or improved tools, technology, and assessment processes to identify and locate critical pipeline defects and to improve characterization of their severity.
Repair/Rehabilitation	Research will focus on the development of enhanced repair materials, techniques, processes, tools, and/or technology.
Pipeline Threat Prevention	Research investments will develop new or improved tools and technology to aid in the prevention and reduction of damage to pipelines, thereby enhancing safety and preventing or limiting methane releases into the environment.

Transportation Technology Center

TTC Short Term Research Projects

Project Title	Status
Fatigue Testing on Pipe Transported by Rail	Testing Plan Developed & Pipeline Samples Procured
	Project on hold pending new contract vehicle
Technical Testing of Pipe Subjected to Railroad Loading	Testing Plan Developed
	Project on hold pending new contract vehicle

Research Development and Testing Facility



Relevant Statutes
Pipeline Safety Testing Enhancement Study - Section 105 of the PIPES Act of 2020
Updated Research Plan – Joint Explanatory Statement, PHMSA 2021 Appropriations

Future R&D

Future R&D Program Actions

- Tackle climate change by furthering R&D into the safe and environmentally friendly transportation of emerging fuels by pipeline
- Advance equity by conducting further outreach to Minority-Serving Institutions on the CAAP program
- PHMSA will be hosting a virtual R&D forum on Nov 30-Dec 2, 2021, to gather stakeholder input
  https://primis.phmsa.dot.gov/meetings/MtgHome.mtg?mtg=153

R&D Links

R&D Program Website: https://www.phmsa.dot.gov/research-and-development/phmsa-research-and-development

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

R&D workshops, forums, & briefings: https://primis.phmsa.dot.gov/rd/workshops.htm

Thank You

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