Natural Gas Infrastructure Methane Mitigation Research

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NATIONAL ENERGY TECHNOLOGY LABORATORY

Methane Mitigation

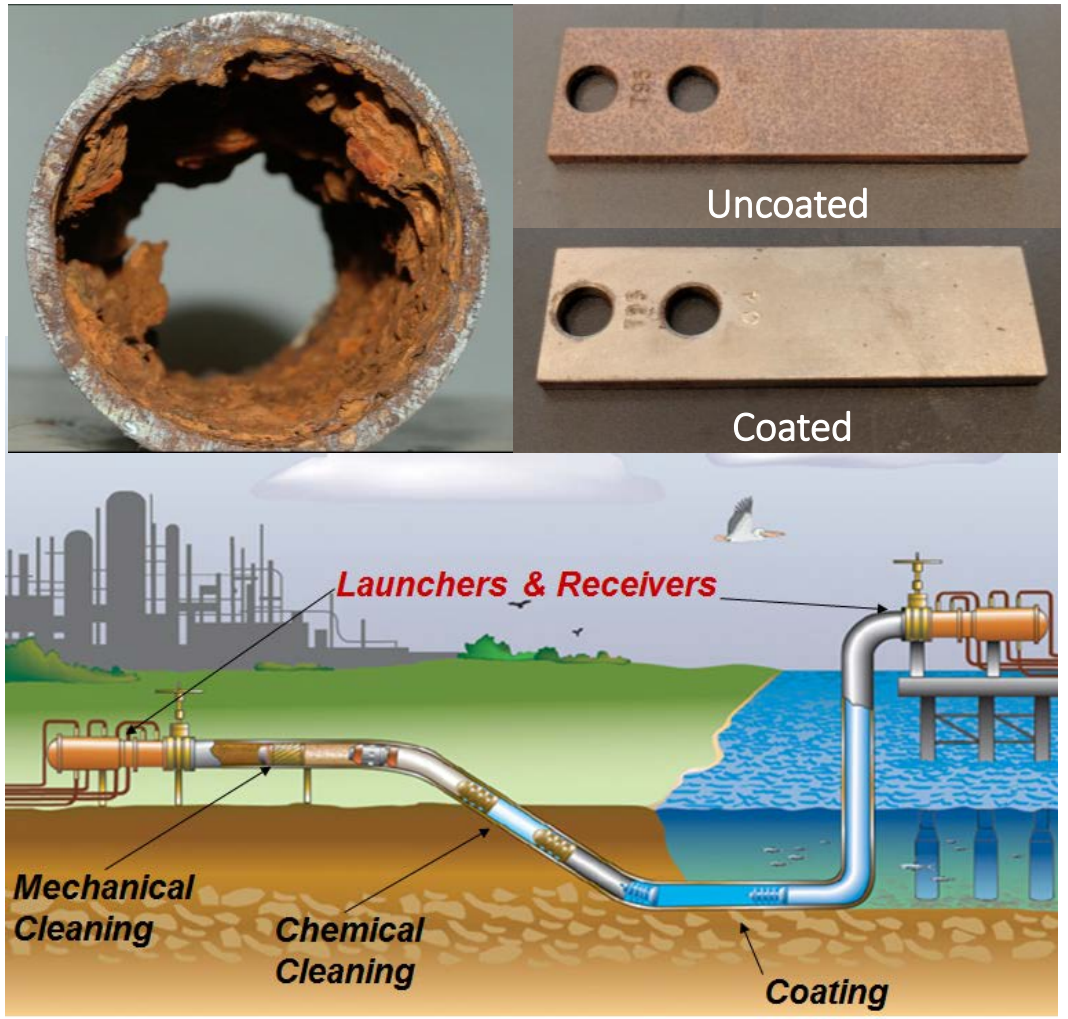
Awards Announced Sept. 8, 2016 -- DOE Funding Only

Oceanit (Hawaii)	Develop multifunctional coating to prevent corrosion and deposits requiring pipeline refurbishment and repair	$1,200,000
Southwest Research Institute (Texas)	Develop and demonstrate an optical-based methane leak detection system for midstream infrastructure	$629,517
PPG Industries, Inc. (Pennsylvania)	Develop and demonstrate three technology platforms which will be combined as a remote monitoring system for natural gas pipeline conditions	$876,639
Princeton University (New Jersey)	Develop and deploy advances in chirped laser dispersion spectroscopy (CLaDS) to make an airborne-based sensor for remote detection of leaks	$1,188,735
Southwest Research Institute (Texas)	Develop a seal design for reciprocating compressor piston rods that mitigates the highest contributor to methane emissions from midstream machinery	$797,517
Gas Technology Institute (Illinois)	Develop and test an integrated Thermoelectric Generator/burner system in a field pilot for oil and gas field operations	$1,199,353
University of Pittsburgh (Pennsylvania)	Develop an advanced distributed optical fiber technology optimized for natural gas infrastructure monitoring	$1,200,000

Pipeline Corrosion Protection

Oceanit

- Demonstrate the capability of Oceanit's EverPel™ nano-composite coating to limit methane emissions via *in-situ* pipeline refurbishment and corrosion protection
  - Hydrophobic & oleophobic nanocomposite coating
  - Chemical and corrosion resistance
  - Bio-fouling resistance
  - Drag reduction
- Pilot test *in-situ* application system
- Field trial planning and tool refinement

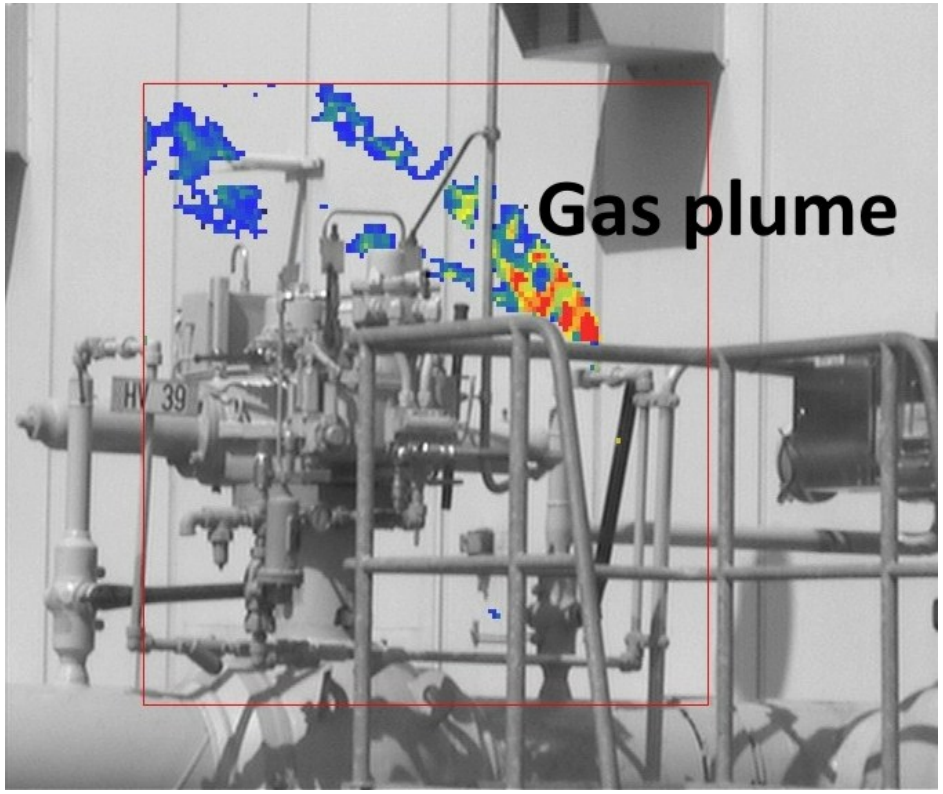


Optical Leak Detection System

Southwest Research Institute (SwRI)

SLED (Smart methane Leak Detection system)

- Autonomous, real-time methane leak detection technology that applies machine learning techniques to passive optical sensing tools to mitigate emissions through early detection.
  - Prototype system with integrated optical sensors and embedded processing unit. Mid-Wave Infrared (MWIR) cameras are being utilized as the transducers to capture frames in search of methane gases.
  - Phase 2 will field test and demonstration the prototype system.



Pipeline Monitoring System

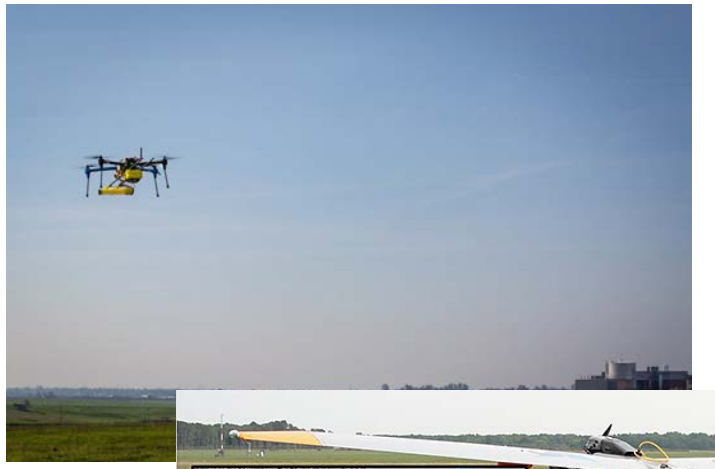
PPG Industries

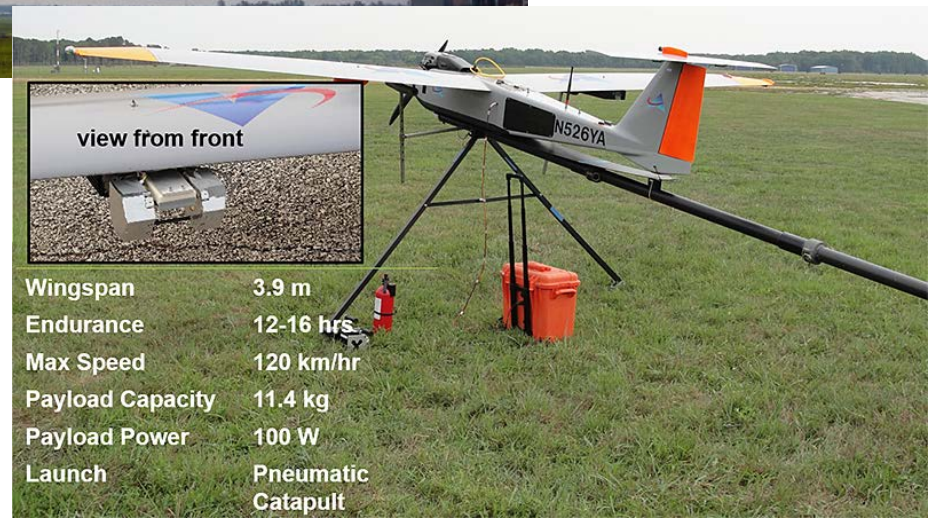
- System to provide remote monitoring of natural gas pipeline conditions, and early detection of factors leading to a potential for unintended methane release.
  - Integrate an organic pipeline interior coating, embedded RF sensors and in-line interrogation equipment capable of coupling with the sensors to communicate information.
  - Correlate sensor response with environmental factors such as moisture ingress and pipeline corrosion.

Airborne Sensor System

Princeton University

- Develop, test, and demonstrate a remote sensing methane detector for use on aircraft and vehicles to detect leaks along natural gas pipeline infrastructure.
  - Employ a heterodyne enhanced chirp modulated chirped laser absorption spectroscopy (HE-CM-CLaDS).
  - Convert field-based, range-resolved CH_4 concentrations into leak rate measurements.
  - Test on micro-drone systems and on light manned aircraft.

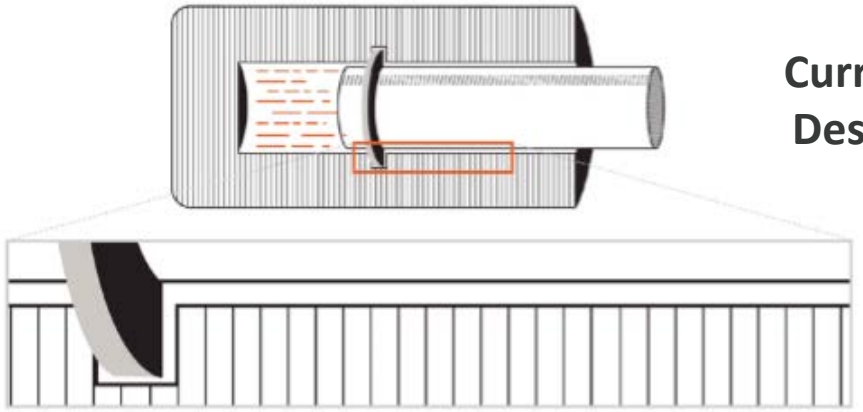




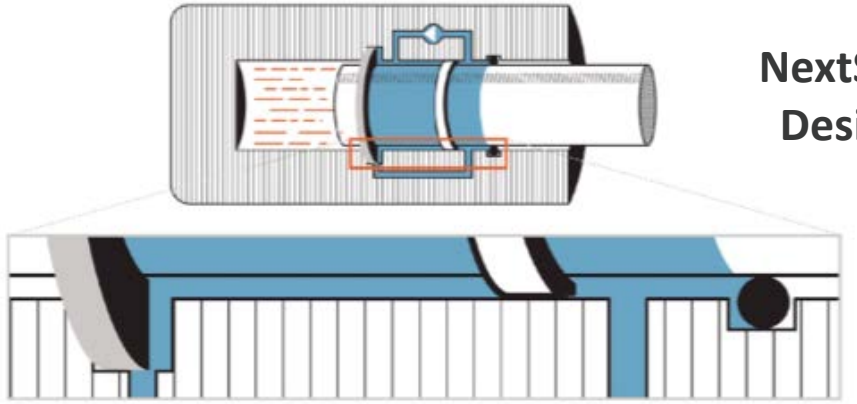
Recip. Compressor Liquid Seals

Southwest Research Institute

- Develop a liquid seal for reciprocating compressor rod packing system
  - Design, manufacture and test novel seal
  - Demonstrate operability and verify performance
  - Target is a 95% reduction of methane emissions from packing
  - Joint effort with patent holder *NextSeal*
  - Operations support from *Williams Pipeline*



Current Design

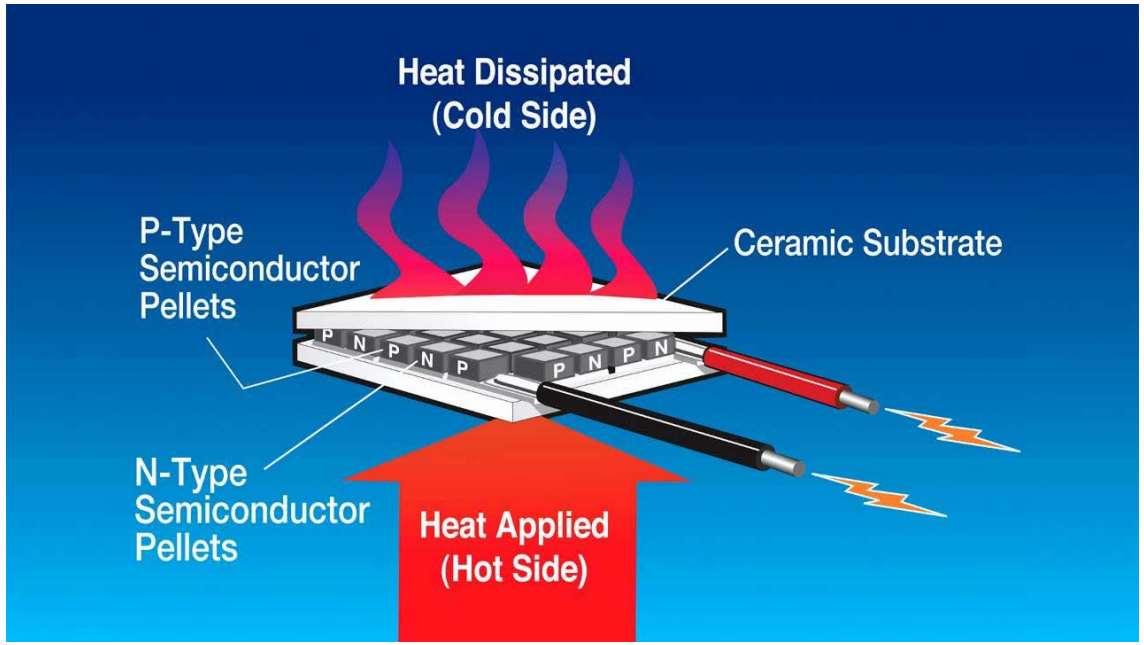


NextSeal Design

Thermoelectric Generator

Gas Technology Institute

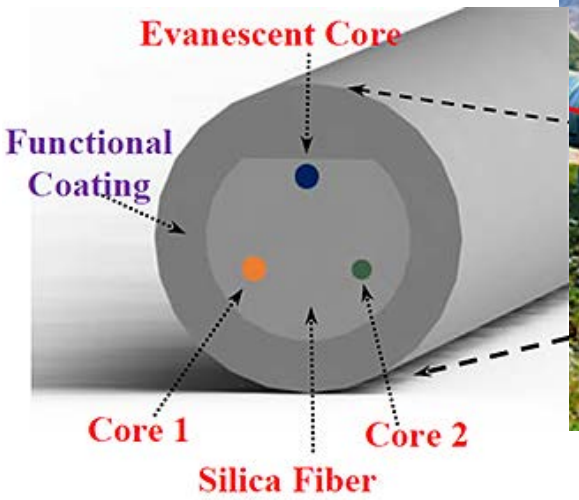
- Develop and test an integrated thermo-electric generator (TEG)/burner system that can utilize captured methane emissions. Complete the design for a field pilot for oil and gas field operations.
  - Employ advanced thermoelectrics to provide higher system efficiency over commercially available TEGs
  - Integrate burner-heat exchanger to achieve a low-cost system.



Distributed Optical Fiber Sensor

University of Pittsburgh

- Develop a new distributed fiber optical sensing technology that can perform multi-parameter, real-time measurements on pipeline systems, including methane concentration across long distances (e.g., up to 100 km) at a spatial resolution of 1 meter.
  - Develop a multi-core fiber
  - Develop new polymers
  - Fabricate and test



THANK YOU!

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