

# ***Pipeline Research Council International, Inc.***

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## **DOE Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop**

### **-Industry Research for Pipeline Systems Panel**

**Mike Whelan  
Director, Research Operations**

**November 12, 2014**



# Pipeline Research Council Int'l. Overview

2

## ■ **Founded in 1952 – Current Membership**

- 39 Pipelines, over 350,000 miles of transmission pipe
  - *Natural Gas and Hazardous Liquids Pipelines*
  - *27 members are North American based*
    - Remainder: Europe, Brazil, China, Saudi Arabia, South Africa
- Energy Industry Associations: AOPL, OTD, EPRI
- 39 Technical Program Associate Members
  - *Key equipment and service providers to pipelines. Pipe mills, ILI vendors, Integrity mgmt service co's, Compressor engine mfr's*

## ■ **Funding**

- Annual subscription based on pipeline mileage
  - *2014 R&D program size: ~\$ 10 Million*

# PRCI Research Program Structure

3

## ▪ R&D Program Development Process

- Determined annually via a menu of potential projects provided by the six Technical Committees
  - Project ideas identified in winter/spring
  - PRCI Board votes over the summer – finalizes in September

## ▪ Technical Committees comprised of member reps

- Identify, screen & propose potential research projects
- Project teams select contractors & approve workscopes, provide general project oversight, provide peer review of results, and approve results on behalf of PRCI

# PRCI Technical Committees

4

- **Operations & Integrity**
- **Design, Materials & Construction**
- **Corrosion**
- **Compressor & Pump Station**
- **Measurement**
- **Underground Storage**

## 2012 EPA GHG Inventory – Gas T&S

5

<b>Activity</b>	<b>Methane Emissions (Mg)</b>	<b>Percentage of Inventory</b>
<b>Reciprocating Compressors</b>	<b>773,000</b>	<b>31.4%</b>
<b>Centrifugal Compressors (Wet Seals)</b>	<b>232,000</b>	<b>9.5%</b>
<b>Compressor Engine Exhaust</b>	<b>235,000</b>	<b>9.5%</b>
<b>Pneumatic Devices</b>	<b>221,000</b>	<b>9%</b>
<b>Pipeline Venting (O&amp;M)</b>	<b>184,000</b>	<b>7.5%</b>
<b>Sub-total</b>	<b>1,645,000</b>	<b>66.9%</b>

# PRCI Methane-Related program objectives

6

- **Keep the product in the line!!**
  - *Robust Pipeline Integrity Program*
  - *80% of current budgets*
- **Avoid blowdowns**
  - *Better integrity management practice and inspection technology improvements to improve understanding of exact pipe condition – avoid cutouts*
  - *Inspection methods for unpiggable lines*
- **Detect any product releases as soon as possible**
  - *Maximize safety along pipeline right-of-way*
  - *Minimize environmental impacts*

# PRCI Methane-Related program objectives

7

- **Continually improve practice to minimize gas releases**
  - **Welding Practices & Weld Inspection**
    - *Optimize hot tap welding on new steels to avoid blowdowns*
  - **Pipeline Repair Technology & Procedures**
    - *Enable composite repairs & sleeves vs. cutouts and blowdowns*
    - *Installation practices & Long-term performance*
  - **Assess the Structural Significance of Defects**
    - *Avoid blowdowns due to unnecessarily conservative repair practices*

# PRCI Methane-Related program objectives

8

- **Enable compressor station operators to comply with EPA GHG reporting at least cost**
  - *Identify leak sources & remediation options*
  - *Develop emissions factors that are statistically valid to enable resources to be directed to remediation vs. simply measurement*
  
- **Underground Storage Committee**
  - **Storage Field Integrity Program**
    - *Minimize casing leaks, optimize ILI effectiveness*



# PRCI Sample Repository

## (Technology Development Center in 2015)

9

- Established a facility in Houston that provides storage and working areas for full scale pipe samples.
- Currently ~700 pipeline damage samples – unique in the world
- A safe, accessible, working environment to enable independent trial, development and performance testing of NDE concepts
- Maintain custody & confidentiality key samples to ensure accuracy
- Reference standards, baseline samples & real-world samples



# TDC External Rendering

10

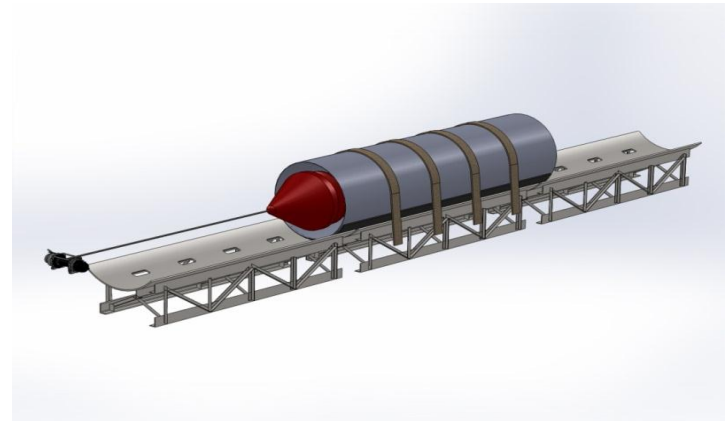


**30,000 sq.ft. building with 20,000 sq. ft. workshop area and ~10,000 sq. ft. of offices and meeting space**  
**Target opening date: May, 2015**

# PHMSA - ILI Enhancements Project

11

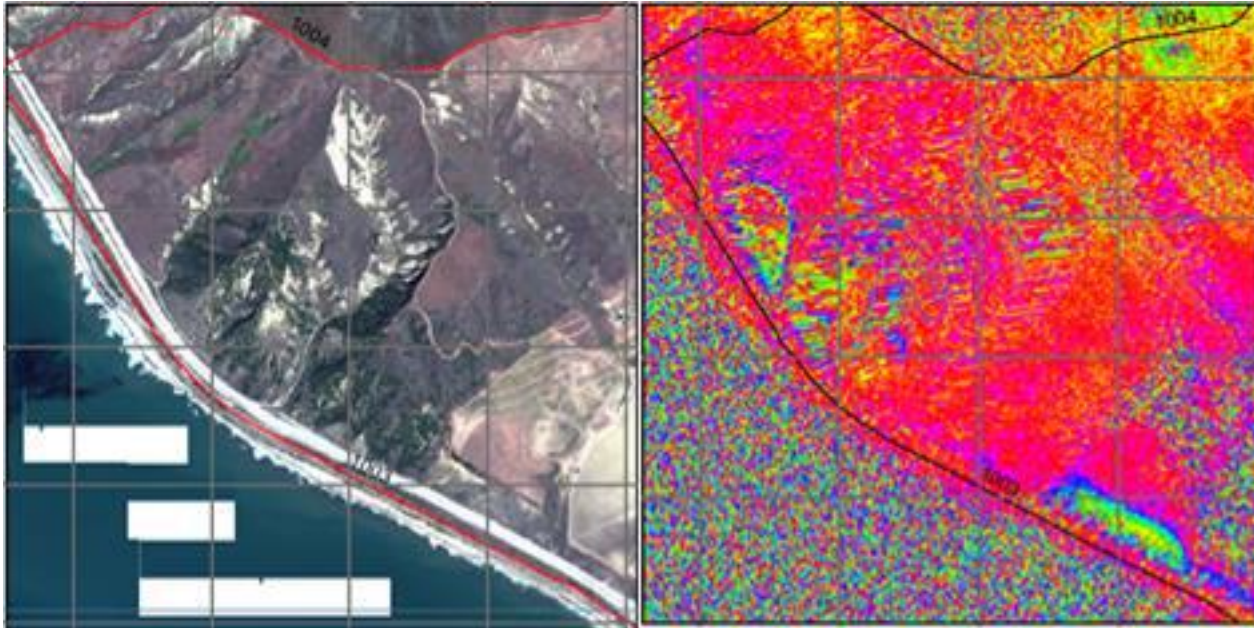
- **Development of Industry test facility and Qualification Processes for ILI Technology Evaluation & Enhancements**
- **Build Pull Test Rig – Develop ILI Verification Process (not develop an ILI tool specification)**
- **Use of Samples with known defects**
- **Conduct ILI tool runs with ILI vendor participation**
- **Responsive to NTSB Recommendation to assess ILI performance**





# Satellite Monitoring – Ground Movement

12



**Erosion and slumping images along a coastal highway generated from radar interferometric measurements from space that are processed through a sophisticated algorithm.**

# Local Monitoring – Ground Movement

13

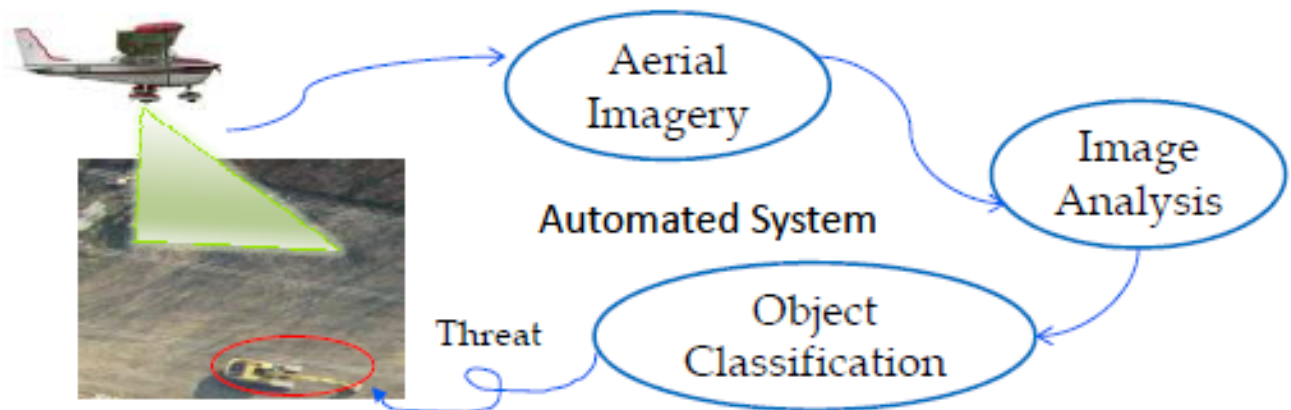


**Ground Based Synthetic Aperture Radar Monitoring of Slope Stability along Pipeline ROW**

# ROW: Right-of-Way Automated Monitoring

14

- **ROW-3A, 3B & 3C: Supplemental Testing of Full System Technology Packages for Automated Monitoring of Machinery Threats**
  - *Prototype Package (Integrated Hardware & Software Package) threat detection validation flights underway [Univ. of Dayton & AAI]*
  - *Leak Detection (hyperspectral/IR) sensors to be integrated for validation 2015*
  - *Leak Detection sensor selection building upon Vapor Plume Modeling (ROW-3E) work from 2013/2014*
  - *Current fixed wing package also suitable for long-range UAV platform*

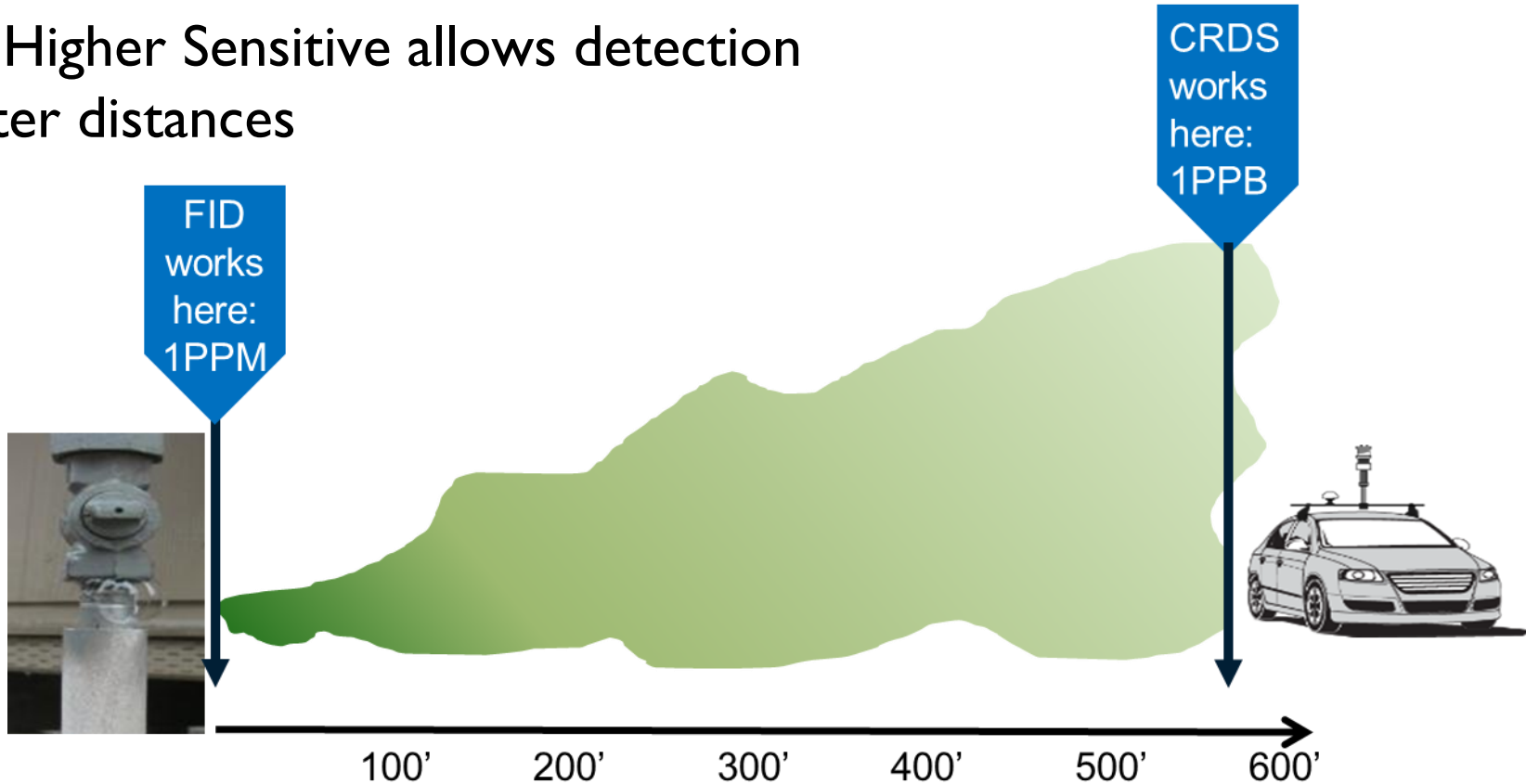


# ROW Research: Addressing Gaps

15

Gap between CRDS and traditional tools – main issues are time to identify and reach the leak

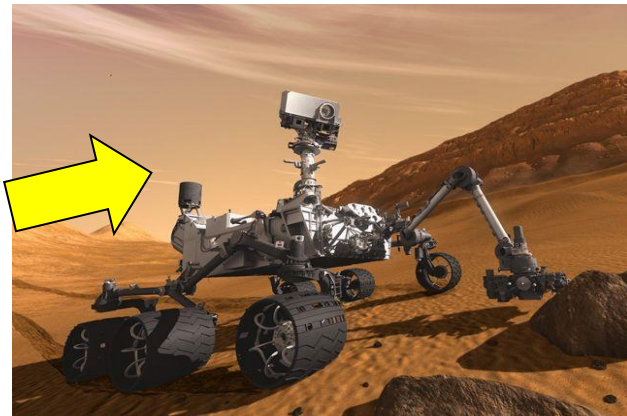
1,000x Higher Sensitive allows detection at greater distances





# ROW-3H: Technology Development

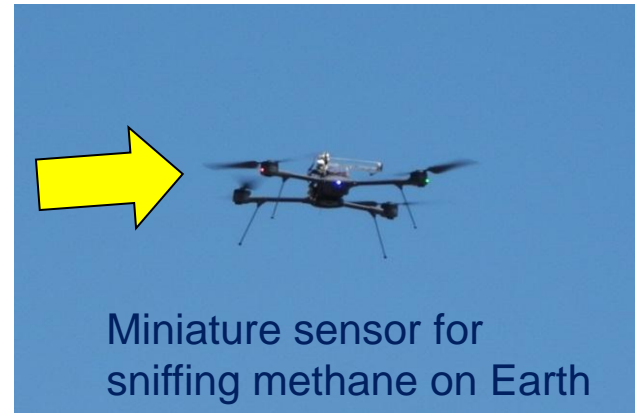
## NASA JPL Methane Detector Technology



**Miniature sensor for sniffing methane on Mars**

**Mars version is more sensitive:**

- 1 ppb in 1 sec
- Isotopes in methane



Miniature sensor for sniffing methane on Earth

**Specifications (Earth version)**

- 250 g (hand carried)
- 20 ppb 1 sec
- Measures CH<sub>4</sub> + water
- Open-path (quick response)



# ROW-3H: Miniature Methane Detection

17

## Open-path Laser Spectrometer (OPLS)

**Current validation for Hand-carry device to locate/verify methane hot spots.**

**➔ Operational Prototype ready for industrialization by the end of 2014**

Sniffer  
(OPLS)



Wireless  
↔

User Interface  
(touch-screen Tablet)



Wireless  
↕

External Control System  
(local desktop or server )



## 2015 Validation using UAV Platform



*Mounted on quadrotor*

# ROW-3K: Long Range UAS on a Pipeline Corridor in the National Airspace System

18

## Objectives:

- 1) Demonstrate operation of a long range/endurance UAS carrying the RAM Technology Package (ROW-3A/B/C) on a pipeline corridor in civilian airspace – safely, effectively and in full compliance with all FAA and FCC regulations
- 2) Evaluate the performance differences between manned & unmanned aircraft
- 3) Establish a test range for continuing research

## Benefits:

- Increased safety (eliminate risk to pilots)
- Far greater endurance
- Higher precision flight profiles
- Smaller signature
- Emergency Response



Parameter	Units	Cessna 172	RS-16 UAS
Endurance	Hours	4	12 to 16
Range	Miles	400	600+
Fuel	Gallons	52	1.5
Pilots	No.	1	0.33

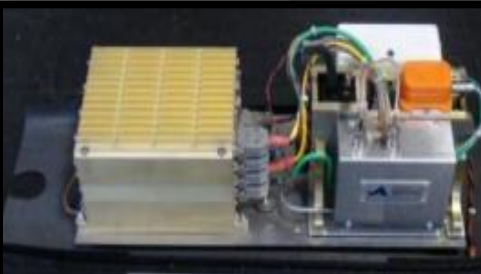
# ROW-3K: Long Range UAS

19

- **Project Timeline:**
- **COA Application submitted with Virginia Center of Excellence**
- **Projected Initial flights to begin October 2014**



**Mobile Operations Centers**



**Runway not required for launch or landing operations**



## Multi-Mission Payload System

- Machinery Threat
- Gas Leak
- Liquid Leak
- Encroachment
- Emergency Mgmt



**Flies for 12+ hours on 1.5 gallons of gasoline**

# Compressor Station Focus

20

- **PRCI has historically focused on engines/drivers**
- **Gas Machinery Research Council has historically focused on gas compressors**
- **Good history of collaboration**
- **PRCI compressor-oriented work is on characterization, not technology development**
- **PRCI engine-oriented work primarily for criteria pollutant reduction (NO<sub>x</sub>, CO, Air Toxics)**
  - Methane reduction a virtuous by-product, as improved combustion reduces misfires, which are a major source engine exhaust methane emissions

# GHG Measurement Methods, Procedures, and Reporting Systems for EPA Reporting

21

- **Objectives: Review eGGRT-GHG reported data for natural gas transmission and storage to:**
  - Identify data outliers and gather additional data on the root cause of fugitive emissions
  - Conduct data analysis to develop additional emission factors to simplify future data reporting. Statistical validity from large data set
    - ***3 years of Subpart W data sets to work with***
  - Free up resources to move from accounting towards remediation and prevention
    - ***Let's be honest – resources are not unlimited***

# Develop/Update GHG Fugitive Emission Factors for Gas Transmission and Storage

22

## ▪ Objectives:

- Improve 15 year-old GHG emission factors, which may enable operators to avoid or reduce the frequency of direct fugitive emissions measurements at affected facilities

## ▪ Some final results are available to members only:

- Acoustic Leak Detection Device Performance Review
- Characterization of Natural Gas Pneumatic Device Types and Review of EPA Default Pneumatic Device Controller Vent Rates

## ▪ Nomenclature for Natural Gas Transmission and Storage Greenhouse Gas Emissions is publicly available

- [http://prci.org/index.php/pm/pubs\\_localdetails/?docid=655](http://prci.org/index.php/pm/pubs_localdetails/?docid=655)

# Methods to Reduce the Carbon Footprint of Pipeline Stations

23

- **Objective**

- Catalogue the opportunities to reduce carbon emissions at compressor stations
- Thermal efficiency (CO<sub>2</sub>)
- Fugitive methane (CH<sub>4</sub>)

- **Final result is publicly available:**

- [www.prci.org](http://www.prci.org)
- “Methods to Reduce the Greenhouse Gas Footprint from Pipeline Compressor and Pump Stations”
- [http://prci.org/index.php/pm/pubs\\_localdetails/?docid=869](http://prci.org/index.php/pm/pubs_localdetails/?docid=869)

# Greenhouse Gas Roadmap Development

24

- **Plan to develop an overall PRCI GHG roadmap**
  - Currently each technical committee is working independently
  - Compressor & Pump Committee farthest along, but the reduction to pipeline integrity impacts (e.g., pipe repairs w/o blowdown) is not well captured
- **Any resultant projects will be coordinated with larger pipeline industry initiatives to EPA/DOE**





# Thank you. Questions?

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