

*the Energy to Lead*

# Gas Technology Institute R&D Update – Technologies to Enhance Pipeline Safety

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**North Dakota – South Dakota PSC Pipeline  
Conference  
April 2016**

**Bob Morris – Manager, Business Development**

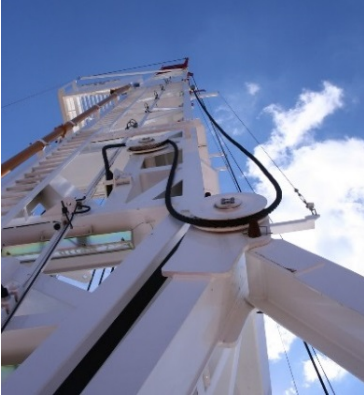
ESTABLISHED 1941

# Company Overview

- > Independent, not-for-profit established by the natural gas industry
- > GTI tackles tough energy challenges turning raw technology into practical solutions
- > Downhole to the burner tip including energy conversion technologies



# Solving Global Energy Challenges



## ACROSS THE VALUE CHAIN

we're enabling a clean,  
sustainable future



# OTD Member Companies

 Alagasco	 Ameren ILLINOIS	 APGA Research Foundation	 ATMOS energy.	 AVISTA®
 CenterPoint Energy	 conEdison	 DUKE ENERGY.®	 ENBRIDGE	 Entergy®
 integrys™	 INTERMOUNTAIN GAS COMPANY <small>A Subsidiary of MNV Resources Group, Inc.</small>	 national Fuel	 nationalgrid	 NiSource®
 NW Natural®	 NYSEG RG&E	 Oklahoma Natural Gas. <small>A Division of ONE Gas</small>	 PG&E Pacific Gas and Electric Company®	 Piedmont Natural Gas
 QUESTAR® Gas	 Southern California Gas Company <small>A Sempra Energy utility™</small>	 SOUTHWEST GAS	 TECO PEOPLES GAS	 Washington Gas

# Working with Customers

- > Partnering at every phase of the technology development cycle, from concept to commercialization

ENERGY  
SOLUTIONS...  
DELIVERED



# GTI Education Programs

## > GTI energy industry training programs

- Training offered since 1941
- Over 40 courses offered annually
- Over 60,000 gas industry professionals trained



## > Broad array of topic areas

- Gas distribution and transmission
- Gas utilization and marketing
- LNG
- E&P



## > Delivery options

- Classroom courses or open enrollment
- Onsite for energy industry customers
- Online and self-guided programs



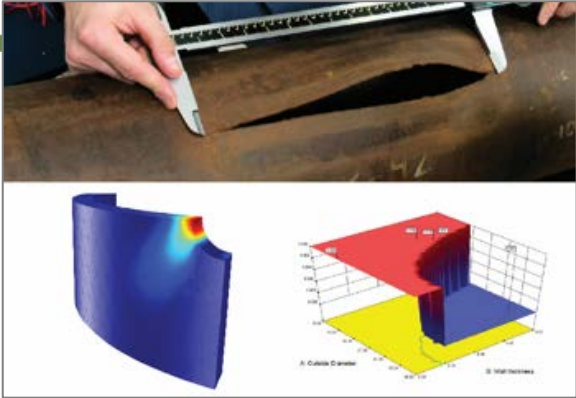
# GTI Energy Delivery Programs



Inspection and Verification



Intelligent Utilities



Risk and Decision Analysis



Construction Techniques



Methane Emissions and Detection



Grid Resilience

# Asset Lifecycle Tracking & Traceability

- > Provides **component level traceability** with high accuracy GPS to locate specific fittings (manufacturer, lot #, etc.)
- > Captures **critical fusion parameters**
- > Captures **pictures, sketches** and other relevant installation data for complex configurations
- > Streamlines operations
  - Improves the **quality and efficiency** of data collection
  - **Eliminates GPS post-processing**
- > **Enables regulatory compliance**
  - DIMP “Know Your System”
  - Plastic Pipe Rule NPRM





# Asset Lifecycle Tracking & Traceability

Information	Mfg. Values
Lot Number	1234567
Production Date	1/4/2010
Material Type	PE2708
Component Type	Electrofusion tapping tee with a stab outlet
Component Size	2" IPS SDR 11 x 1" IPS SDR11



Create GIS Features in the Field

Post to Enterprise GIS

Integrate Data into GIS System of Record

# Natural Gas Distribution Standard

## > Algorithm and ASTM Standard

- Unique identifier for distribution asset tracking and traceability
- ASTM F2897-11a
- Manufacturer implementation through barcoding
- ~50% vendor compliance

Information	Mfg. Values
Lot Number	1234567
Production Date	1/4/2010
Material Type	PE2708
Component Type	Electrofusion tapping tee with a stab outlet
Component Size	2" IPS SDR 11 x 1" IPS SDR11



Character Number	Source	Description of Information	Character	Information
1	<a href="http://www.componentid.org">www.componentid.org</a>	Name of component manufacturer	A	Corresponds to list on <a href="http://www.componentid.org">www.componentid.org</a>
2			C	
3	Component Manufacturer's lot code	Information which can help ascertain relevant traceability information upon request	5	Corresponds to the mfg lot number input of 1234567
4			b	
5			a	
6			n	
7	Component production date code per 5.3	Date of manufacture of given component	0	Corresponds to production date of 1/4/2010
8			6	
9			C	
10	Component material type per Table 3	Material used for component	B	PE 2708
11	Component Type per Table 4	Component type	8	Electrofusion tapping tee with a stab outlet
12			F	
13	Component size per 5.6	Component size	2	Corresponds to size code of 2" IPS SDR11 x 1" IPS SDR11
14			m	
15			X	
16	<a href="http://www.componentid.org">www.componentid.org</a>	Reserved for future use	0	Default value

# Supporting Implementation

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- > GTI spinout, LocusView Solutions, created to provide implementation services for advanced geospatial technologies
- > Provides field tested, customer validated, commercial products
- > Turn-key implementation services including hardware, software, hosting, training, and IT support

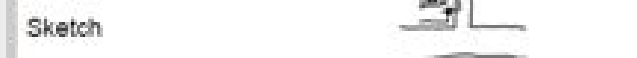
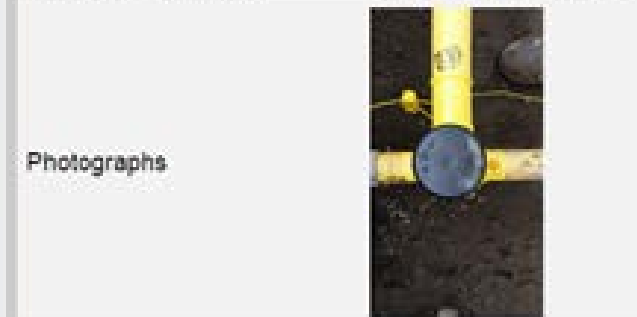


# LocusForm

- > Mobile applications with customized regulatory inspection forms
- > GPS, sketches, pictures, and audio records
- > Codes, standards, and procedures stored on the tab
- > Inspection results compiled into a database for reporting and export



ID	95
Name of Inspector	C. Gumble
Employee or Contractor #	435030
Date	2015-06-25
Depth of Cover	40 inches
Map Grid	24573.28
Type of Joint	Electrofuse
Material	MDPE
Type	Main
Size	2 inch
Status	Accepted
Town or Borough	Union
On Street	E. Main Street
Nearest House Number	3009 e. Main Street
Cross Street	Burt ave.
GPS Location	Latitude:42.10650573, Longitude:78.91010101 10:29:08 EDT
Additional Comments	2 inch x 2 inch h.v. tee a



# RFID Marker Ball Program

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- > Reduce excavation damage by enhancing the ability of locators to properly identify the location of underground facilities
  - Overcomes many of the issues of tracer wire including broken connections and limited access
  - No signal, interference from nearby structures, poor GPS signal
  - Provides a mechanism to locate facilities where traditional locating tools don't work
- > Decrease the cost of collecting and managing marker ball data through advanced mapping technologies

# ROW Monitoring with GPS

## > Value

- Provides situational awareness of potential excavation damage, allowing time for pre-emptive actions

## > Objective

- Develop technology that uses GPS to track excavation activity and provide warnings of encroachment



## > Deliverable

- Commercially available smartphone tracking software and GIS-based monitoring software
- Pilot projects in California, New York, and Texas

# GPS Enabled Leak Surveying

## > Objective

- Develop a system that uses GPS to track the route of leak surveys to verify compliance and reduce paper work associated with leak survey documentation



## > Status

- Integrated with multiple leak detection devices
- Four pilot projects complete
- Full implementations on-going
- Commercially available



# Residential Methane Detectors Program: Safety is Priority #1 (OTD)

- > Customer behavior suggests that odorant alone is not enough for customers to report leaks
- > Recent events have heightened the focus on how unreported leaks can result in tragic outcomes
- > Having an alert system such as a residential methane detector benefits both the customer and the utility





# Remote Gas Sensing and Monitoring

- > Objective: To create a device to **remotely monitor the level of gases during emergency gas leak situations**
- > Need: First Responders need a tool that enables the monitoring of methane, CO, and other gases over a local area
- > Remote monitors can be placed in each home and confined space. The remote monitors would **transmit data to on-site personnel, providing concentration levels in real time**
- > This approach will enhance the safety of first responders and also the general public



# Portable Methane Detector (PMD)

> **Value:** Increase operational efficiency and reduce costs through advanced leak survey technology.

Reduced capital and O&M costs:

- Dual detection levels (ppm and % gas) combines FID and CGI functionality into one device
- No calibration gas/cylinders required

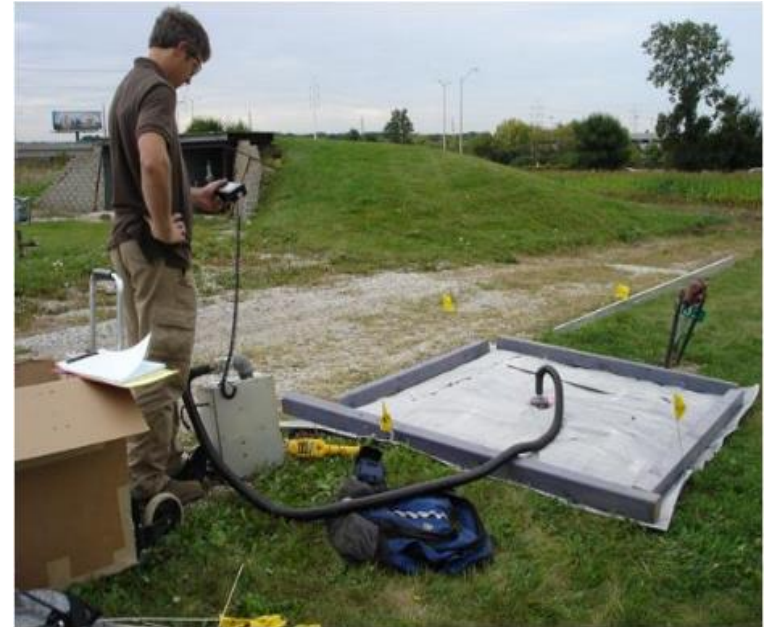
> **Project Summary:** Develop Portable Methane Detector based on proven optical leak detection methods



Available from SENSIT Technologies  
as the Sensit PMD

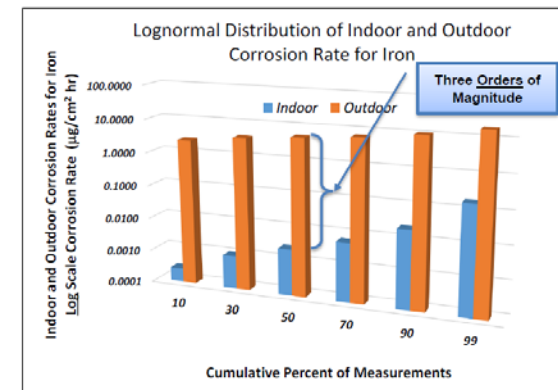
# Emerging Technology for Low-Cost Methane Sensing

- > Better data collection and measurement of methane emissions will enable quicker emission reductions
  - Provides accurate count of emissions
  - Ranks high priority sources
- > Low-cost methane sensing technologies can enable widespread deployment for infrastructure assets
- > GTI and commercial partners are developing a measurement system based on new technology to detect methane and better estimate the location and intensity of methane leaks



# Atmospheric Corrosion & Leak Survey Considerations for Indoor Pipe

- > Independent technical review of risk considerations related to atmospheric corrosion and leaks on indoor piping.
- > Explores a practical risk-based approach to inspections, especially in challenging urban environments, including the **opportunity for extended inspection intervals as part of a Distribution Integrity Management Program.**
- > **GTI White Paper** topics and findings:
  - Atmospheric Corrosion Theory; Outdoor vs. Indoor Piping; Peer-Reviewed Studies
  - Statistical Data – Atmospheric Corrosion & Leak Surveys
  - Risk-based Considerations
  - Indoor atmospheric corrosion rates are up to three orders of magnitude lower than outdoor corrosion rates.



# Mitigating the Risk of Cross Bores

- > **Cross Bore Best Practices Guide** - single source of information for natural gas operators to investigate and remediate existing cross bores as well as prevent future cross bores.
- > **Cross Bore Outreach & Education Program**  
Information to effect positive changes in attitude, practices and operations.
- > **Technology Development**
  - Acoustic Pipe Locator
  - Mechanical Spring
  - Cleanout Safety Device
- > Additional information at [www.otd-co.org](http://www.otd-co.org)



# Cross Bore Program - Technology

## > Acoustic Pipe Locator (APL)

- All pipe materials. Commercialized by Sensit Technologies in 2013

## > Cross Bore Detection – Mechanical Spring

- Detects voids such as intersecting another pipe when directional drilling
- Designed prototype for 4-inch drill head
- Undergoing field testing now, followed by further modifications based on results

## > Obstacle Detection for Directional Drilling

- Acoustic sensor at drill head for detection of obstacles in drill path
- Working closely with HDD equipment OEM



# Intrinsically Locatable Technology for Plastic Piping Systems (U.S. DOT / OTD / 3M)



## > Objective

- Develop and test a viable solution for intrinsically locatable polyethylene (PE) materials with an integral electronic marking system.
- Partner with 3M Company and a large pipe manufacturer to develop the electronic markers and attach the marker to PE pipe.
- GTI will provide third party testing and analysis of the developed system.

## > Focus

- Complete the development, define and test the electronic marker capability, validate the attachment design, and perform laboratory and field testing.

# GTI's Keyhole Program

- > Long-standing GTI Program ~ 10 Years
- > Members include Utilities and Manufactures
- > Addresses technology development needs and market barriers to keyhole adoption
- > Communications
  - Sharing of information to accelerate implementation
  - Meetings and demo's
- > Current efforts include:
  - Jurisdictional Acceptance
  - Keyhole Guidelines and “how to” videos
  - Training
  - Tooling (scrapers, specialty tooling, wire connectors)





# Breakaway Fittings for Meter Safety

- > Breakaway disconnect / shutoff fitting for meter set assemblies (MSA) and other aboveground gas systems.
- > Reduce the risk from vehicle collision or ice/snow falling from a building.
- > Commercially available Q4 2015 – Q1 2016
  - OPW Engineered Systems

**OPW**  
ENGINEERED SYSTEMS  
A DOWER COMPANY

**gti**<sup>®</sup>

**OTD**  
Operations  
Technology  
Development



**gti**<sup>®</sup>

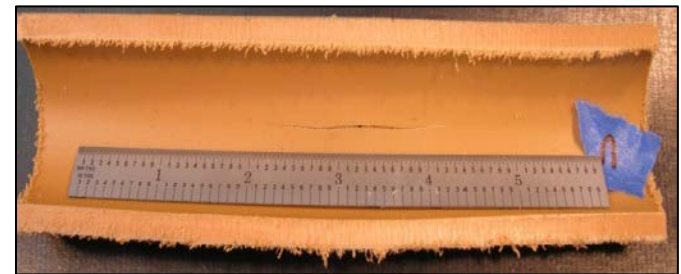
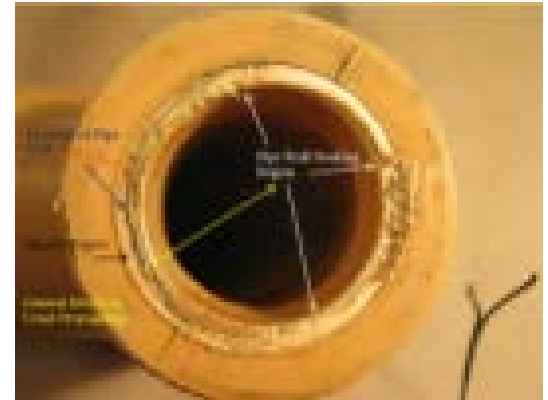
# Kleiss Flow Stopping System

- > **Inflatable Stoppers:** an alternative to currently employed stopping equipment for use on pipes **up to 18” in diameter and pressures up to 60 psig** for the following pipe types:
  - > **Cast iron**
  - > **Steel**
  - > **PE**
  - > **PVC pipes**
- > **No-blow operations**
- > **Small fittings with taps up to 3”**
- > **Lightweight equipment**
- > **Alternative to squeezing PE pipe**
  - > Vintage PE susceptible to cracking
  - > Large diameter thick-walled PE
- > **Commercially available now through Mainline Control Systems (MCS)**



# Risk Analysis of Vintage PE Pipe

- > Failure analysis on piping systems to assist utilities in identifying:
  - Component defects
  - Operator error
  - Material defects / aging
  - Etc.
- > Vintage pipe lifetime prediction to assist utilities in determining risks/remaining life with PE piping systems
  - Vintage pipe prone to brittle like cracking
  - Additional information to put into risk models



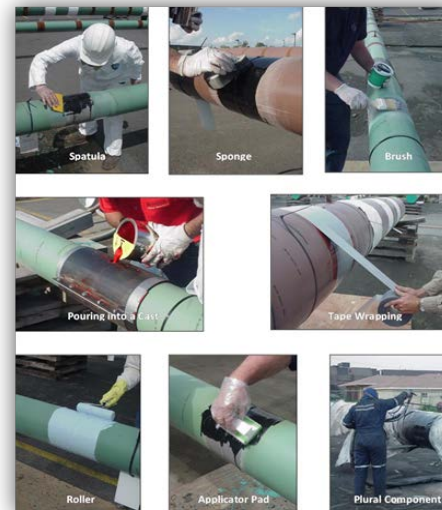
# Qualifying & Enhancing PE Joining Procedures

- > **Value:** Optimizing and standardizing aspects of PE fusion procedures will create a more robust PE piping system and minimize the opportunity for field errors.
  - Surface preparation, cleaning and scraping
- > **Objective:** To bring the industry together to gain knowledge, understanding, and focus to the issues related to robust and qualified joining procedures and develop a consensus on a quality framework with which to address PE joining.
- > **Status:** Initiated in 2015.



# Field Applied Pipeline Coatings

- > **Value:** Minimize risk of pipeline failure, extend useful of assets & minimize remedial measures necessitated by failure of field applied coatings.
- > **Project Summary:** Establish an unbiased, third-party basis for operators to select girth weld coatings which are appropriate for their particular application requirements, and to provide the long coating life demanded by the industry. Project work was in excess of \$6M.
- > **Status:** Project complete. Results available through Project Report or Workshop



# Leak Rupture Boundary Calculator

## > Objective

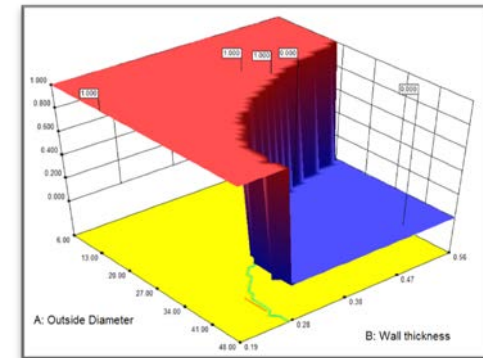
- Develop a **tool to predict whether a pipe will fail by leak or by rupture based on material properties** to assist operators in determining the consequence of failure for individual pipe segments based on pipe characteristics

## > Deliverable

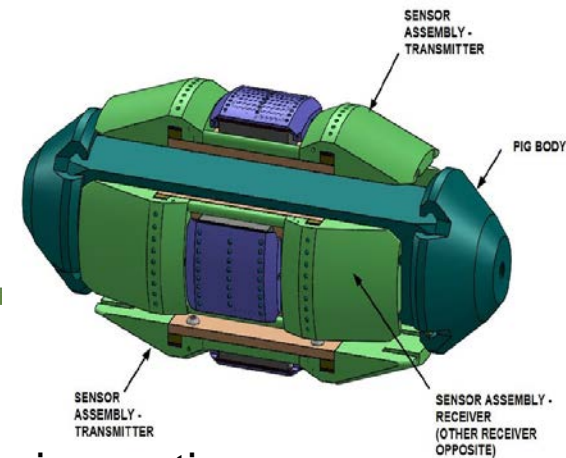
- Software tool that outputs the mode of failure (leak or rupture) based on inputs (yield strength, toughness, diameter, wall thickness) with a stated confidence level

## > Status

- Software tool and training manual available for use, several training webinars provided



# Smaller Diameter EMAT Sensor to Find Cracks & Planar Defects



## > Value

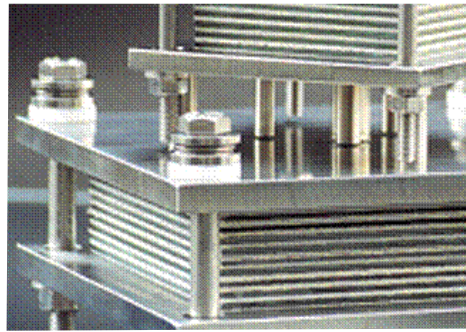
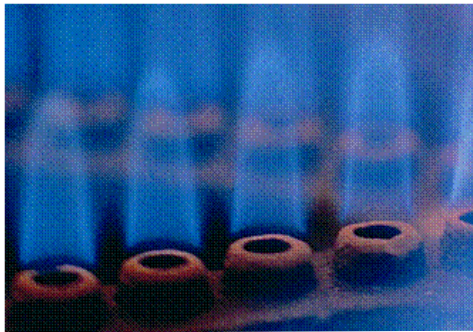
- A low power, electromagnetic acoustic transducer (EMAT) sensor that fits onto existing unpiggable pipe inspection platforms
- Provide crack inspection tools for small diameter pipe; as small as 6-inch, as well as those pipes that cannot use a liquid couplant
- Will work with inspection tools for unpiggable pipe with variable diameter, dead legs, reduced diameter fittings, low flow conditions

## > Objective

- To develop and transfer EMAT sensors for integrity management inspections to the LDC industry with a specific focus on unpiggable pipe of smaller diameters (6 to 18 inches)
- Working with Quest Integrated and Quest Integrity Group (commercializer)

- > **Deliverable** – small diameter EMAT sensor that is capable of being integrated with an unpiggable platform that is bi-directional and collapsible

# Tackling Important Energy Challenges and Creating Value for Customers in the Global Marketplace



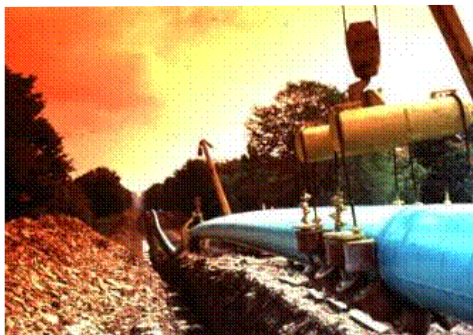
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