Gas Technology Institute (GTI) R&D Update – Technologies to Enhance Pipeline Safety

National Association of Pipeline Safety Representatives
September 2, 2015

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Company Overview

ESTABLISHED 1941

> Independent, not-for-profit established by the natural gas industry

> Providing natural gas research, development and technology deployment services to industry and government clients

> Performing contract research, program management, consulting, and training

> Wellhead to the burner tip including energy conversion technologies
Addressing Key Issues Across the Energy Value Chain

Expanding the supply of clean, abundant, and affordable natural gas
Transforming natural resources into clean fuels, power, and chemicals
Ensuring a safe and reliable energy delivery infrastructure
Promoting the clean and efficient use of energy resources
Working with Customers

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

ENERGY SOLUTIONS... DELIVERED
Our Sponsors

[Logos of various sponsors]

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

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<td>Component Size</td>
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Create GIS Features in the Field

Post to Enterprise GIS

Integrate Data into GIS System of Record
> Algorithm and ASTM Standard

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

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Character Number 16 is reserved for future use, with a default value of 0.
GTI’s Asset Traceability Technology

> GIS-based solutions for mapping new construction with traceability for pipes, fittings, and fusions

> Technology
  - Mobile GIS software
  - Tablets and smartphones
  - Barcode scanning
  - High accuracy GPS
  - Real time spatial data correction
  - Disconnected editing capability
  - Cloud hosting

> Fusion
  - Captures critical fusion parameters, seamlessly archives data in GIS, creates bar code label with 50 year life
Supporting Implementation

> 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 tablet

> Inspection results compiled into a database for reporting and export
RFID Marker Ball Program

> 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 - Overview

- ISSUES
  - Economics
  - Safety
  - Codes
  - Market Channels
  - Consumer Behavior
  - Product Performance

- NEEDS
  - Improved Lifecycle Costs
  - Improved Accuracy and Reliability
  - Adoption of Codes and Standards
  - Expansion of Channel Partners
  - Enhanced Awareness and Education
  - Product Development

- PATHWAYS
  - Market Analysis
  - National Campaign
  - State/Regional/National Approach
  - Technology Development

- Full Adoption
  - Cost-effective, reliable, accurate product that is readily available
Residential Methane Detectors – Program and Timeline

2014
- Phase 1 testing of commercially available residential methane detectors*
- Phase 2 testing of commercially available residential methane detectors (includes international products)

2015
- Consumer behavior study
- Address existing product’s detection levels
- Begin effort to create a fit-for-purpose UL standard
- Establish plan for pilot program

2016 - 2017
- Execute pilot program
- Education/public awareness campaign
- Work with manufacturers to get products into market with lower detection levels

*testing was done in 2010
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
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
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
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)
Emergency Main Stop-Off Station

> **Value:** Create the capability to achieve a rapid shutdown of gas flow in large diameter, low-pressure mains in the event of an emergency at a fraction of the cost of installing large diameter valves.

> **Project Summary:** Develop a double-block and bleed bag stop system with permanent, quick-entry tap for 16” – 36” piping systems.

> **Status:** Prototype systems complete and being tested
Portable Flash Fire Suppression System

Objective:

> To develop a portable system that can detect a flash fire just after ignition and begin immediate suppression to allow workers the time needed to egress a worksite.

Focus:

> The development of the PFFSS is focusing on four key areas of design: Portable device, detection camera, suppression system, and autonomous unit.
PE Pipe Splitting

> **Value:** Pipe splitting can offer significant cost savings while performing the operation more efficiently with less disruption to traffic and the general public.

> **Objective:** To evaluate and **refine existing** PE pipe splitting equipment, for the replacement of aging infrastructure, such that **standardized tooling packages** become commercially available along with operating procedures.

> **Splitting systems currently available from TT Technologies and Hammerhead**
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.
Evaluation of CIP Liners, Structural Liners & Composite Pipe for Pipe Rehabilitation

Evaluation of composite pipes and cured-in-place (CIP) liners for the rehabilitation of gas distribution and high-pressure lines. The report investigates these trenchless rehabilitation options.
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
Material Verification Techniques for SMYS

> Value

- Industry needs a technique that can be used for SMYS establishment for records backfilling or MAOP verification that does not require line shutdown

> Objective

- Develop and validate a sampling method that provides a full wall, longitudinal specimen without line shutdown
- Use existing ASTM and API codes with minimal changes or additions
- Results should be equal or superior to currently required sampling and testing methods

> Deliverable

- Approved testing technique that allows sub-sized samples removed from a hot tap to be used to determine a pipe’s yield strength. A Special Permit for the technique has been granted.
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
Composite Pipeline Repair Systems

> **Value:** Will substantially reduce the cost of repairing using the cutout method and will allow a comparison of repair techniques used on similar types of pipeline damage.

> **Objective:** To research, test and assess various repair techniques and provide justification for their use as is allowed by 49 CFR Part 192.

> **Deliverables:** Test data and reliable engineering analysis to validate that commercial repair methods can be used to permanently restore the serviceability of the pipe.

> **Status:** Complete
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
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
Tackling Important Energy Challenges and Creating Value for Customers in the Global Marketplace

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