

# **Threat/Damage Prevention**

Improve System Integrity, Reduce Risk,  
and Identify Research Needs

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**Gas Technology Institute**

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**Cleveland, OH**



ESTABLISHED 1941

# GTI 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



# Operations Technology Development (OTD)

- Stand alone, 501c(6) not-for-profit, member-controlled company where gas utilities work together to develop technology solutions to common issues

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

OTD

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# Technologies to Reduce Excavation Damage

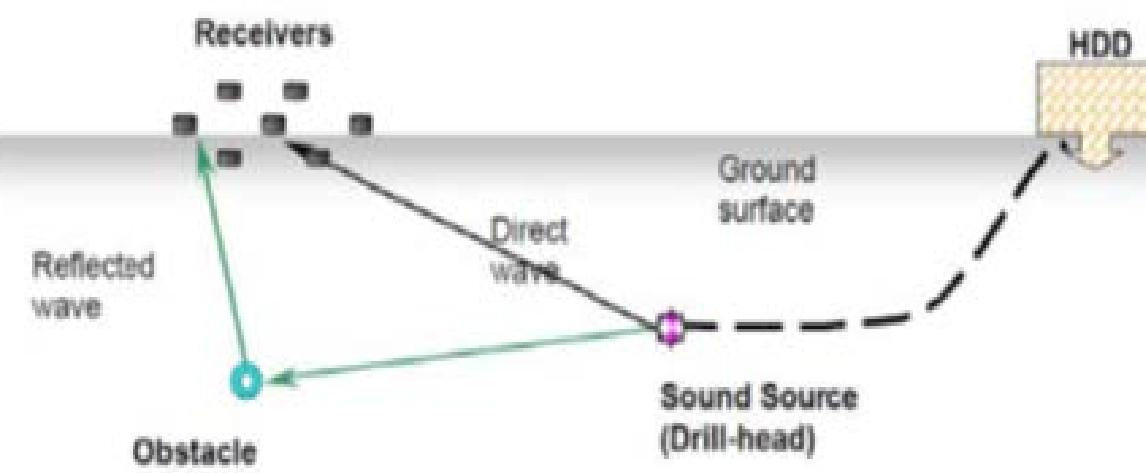
# Mitigating the Risk of Cross-Bores

- **Cross-Bore Best Practices Guide** provides a single source of information that can be used by natural gas operators to investigate and remediate existing cross-bores as well as prevent future cross-bores
- **Outreach and Education** efforts provide information to effect positive changes in attitude, practices and operations (informational videos)
- **Technology** development for prevention and detection methods
  - Acoustic Pipe Locator
  - Cleanout safety device
  - HDD “Look Ahead” development, Acoustic and GPR



# “Look Ahead” Acoustic Technology for HDD Operations

- Integrate innovative acoustic technology to detect buried pipes/obstacles in front of or adjacent to the drill-head during pipe installation using horizontal directional drilling (HDD) machine in real-time
- Technology tested successfully in field condition and detected buried pipes/objects about 20 ft. in the front of drill-head in real-time.



# ORFEUS HDD Field Evaluations

- Conduct field evaluations of the ORFEUS HDD bore-head radar technology (GPR obstacle detection) at various OTD sponsor sites.
- ORFEUS is a European Union financed project aiming at progressing real-time obstacle detection for HDD equipment.



# Excavation Damage Prevention Using Real-Time GIS

## ● Overview

To identify risk of excavation damage to buried gas facilities by:

- Characterizing excavators' behavior by analyzing and transferring data from excavators to cloud-based GIS,
- Increasing awareness of construction equipment activity

## ● Deliverables

- Deliver a low cost 'black box' installed in excavation equipment,
- A high-accuracy GPS location, which overlays with the utility's GIS pipeline maps,
- Situational awareness: A real-time characterization of the "state" of the excavator and excavation activity



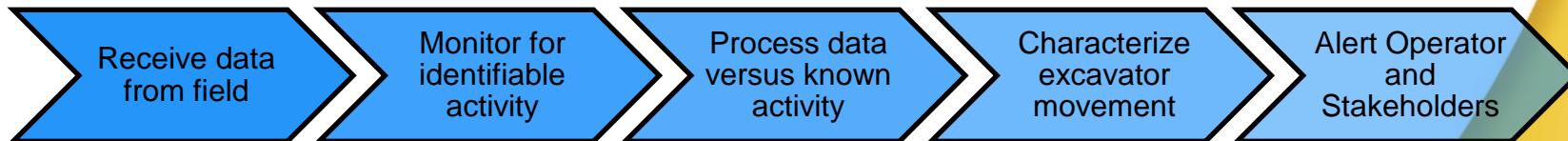
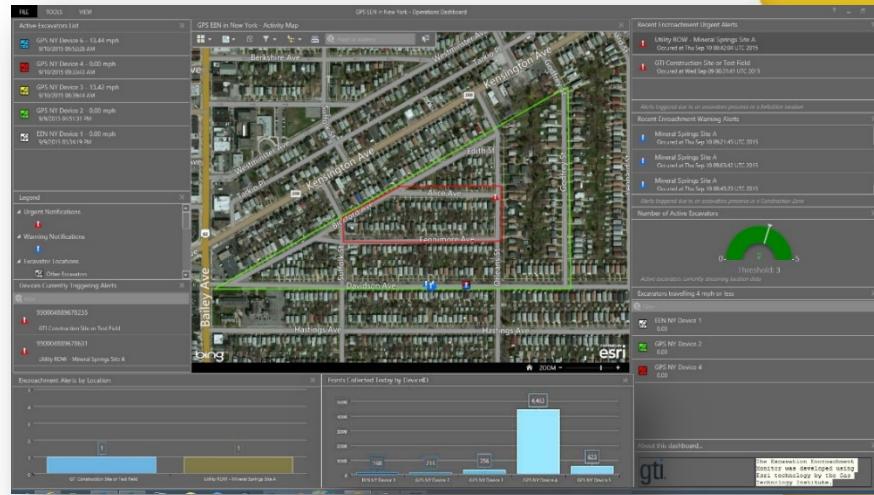
# Excavation Damage Prevention Using Real-Time GIS

## Technology

- Esri ArcGIS for Server
  - Esri Operations Dashboard
- ArcGIS GeoEvent Processor
  - Communication/messaging platform for real-time data streams
- Amazon Web Services

## Characterization Algorithms

- Built on Apache Spark and Apache Kafka
- Processes data stream from excavators and characterizes activity



**OTD**

Operations  
Technology  
Development

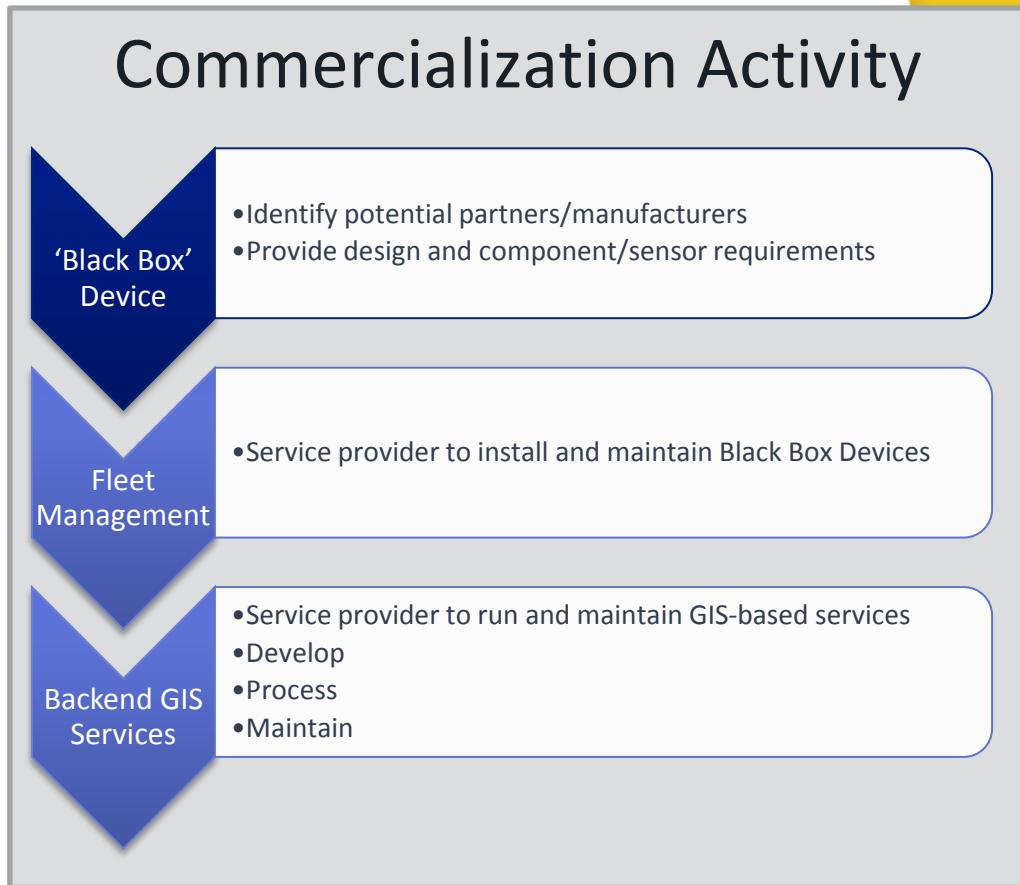
# Excavation Damage Prevention Using Real-Time GIS

## ● Next Steps

- Development of the next prototype device
- Refine and further develop characterization algorithms
- Identify commercialization partners

## ● Pilot Project

- California Energy Commission Project
- 150 device deployment
- Provide backend GIS infrastructure and support for duration of project



# Unlocatable Pipe

- Unlocatable plastic pipe is a great risk for the natural gas companies. Tracer wire that is broken or missing, never installed, inaccessible, and distorted signals from nearby utility lines are all causes for un-locatable PE pipe.

# Acoustic Pipe Locator

- Value
  - Minimizes risk associated with third party damage as well as risk with the utility's inability to locate PE pipe without tracer wire.
  - Minimizes risk associated with "cross-bores".
- Project Summary
  - Pulse-Echo acoustic system capable of locating both metallic and non-metallic gas pipe as well as third party utilities, most notably sewer laterals.
- Status

Available from SENSIT Technologies  
as the Ultra-Trac® APL



Display



Ultra-Trac APL

# Jameson Fish Tape

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- OTD/GTI worked with Jameson to develop a live gas locatable tracer system.
- Traceable Rodder Locates Live Plastic Gas Service and Main Lines From Meter To Main



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

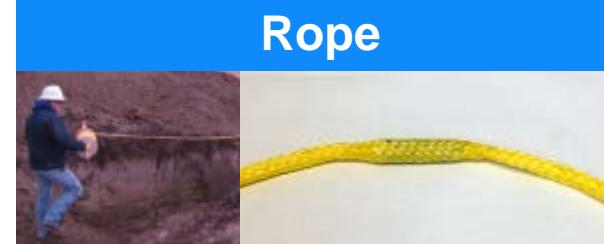
*This project builds on the technology currently used for Path Marking, which consists of Material Resonators and leverages the existing EMS ball marker locator technology.*

The primary goal is to apply directly to the plastic pipe for better accuracy, ease of use and system integrity.

**EMS Caution Tape**



**Rope**



**Marker Balls**



Telephone



Gas



CATV



Power



Water



Wastewater



GP/Rec Wtr

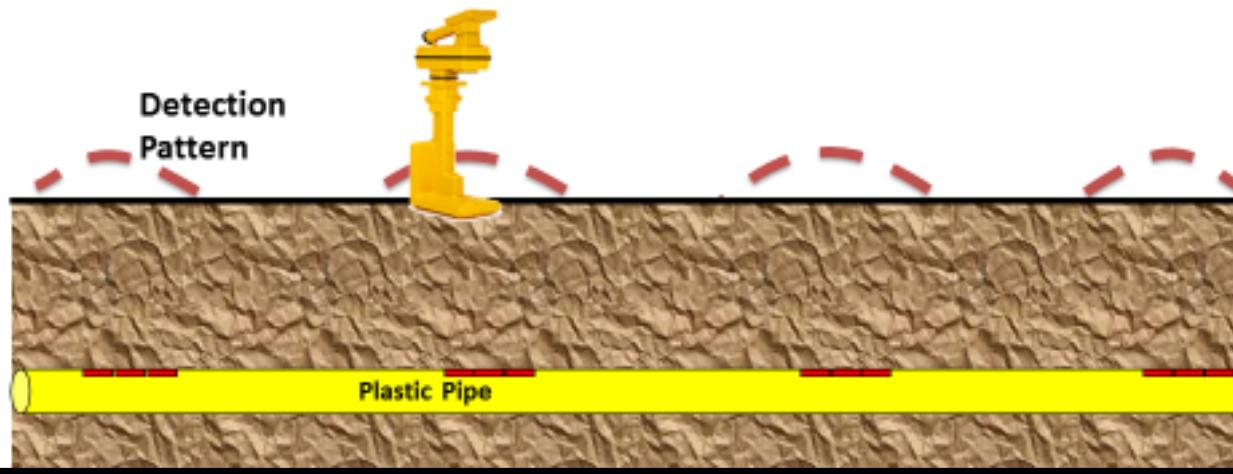
**OTD**

Operations  
Technology  
Development

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

## An Intrinsically Locatable Plastic Pipe – System Concept

- A 53.9kHz passive, flexible, rugged & stable resonant magneto-mechanical electronic marking system for Gas plastic pipe.
- Markers attached to outside of plastic pipe at 8ft spacing, give unique detection pattern and positive identification of utility.
- Independent Marker-Locator system provides high accuracy and long life.
- Eliminates Tracer Wire (eliminates related installation, splicing and access)



The program will be compatible with existing Plastic-Pipe Path locating products such as the EMS Locatable Tape and EMS Rope.

Makes locating faster because there's no transmitter connection, and more accurate because it's an "echo" based transponder rather than a current loop which uses the earth (or other conductors) for return.

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

## Locatable Caution Tape, Rope & Plastic Pipe

### Addresses a critical pain point for gas industry

- Significant improvement to worker & area safety
- Higher life expectancy
- Higher productivity in installation

### Robust

- Continuity not required, if a cluster of tags is removed, the other sections continue to function uninterrupted.
- Does not provide a path for lightning
- Corrosion resistant, maintenance free

### Simple

- Replaces tracer wire, access points and connections
- Reduced complexity of locate – No transmitter connection needed
- Utility identification by frequency

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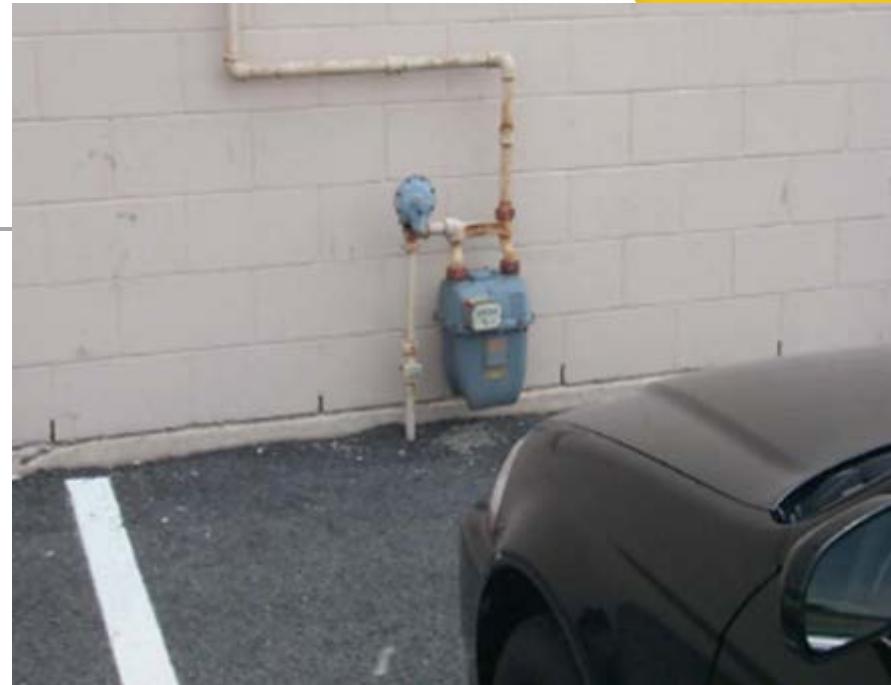
# Technologies to Reduce Risk and Consequences of Excavation Damage and Impact to Aboveground Piping

# 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
- Beta prototypes available 2017
  - OPW Engineered Systems



# “At Risk” Meters?



# What Could Happen to “At Risk” Meters



# What Could Happen to “At Risk” Meters

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# Solution

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- EFV's can mitigate risk when installed on new and replaced services but cannot be easily installed on existing services to mitigate risk.
- Other industries utilize breakaway disconnects. For example, gas stations utilize them on their fueling pumps.



# Designs and Prototypes

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- Several conceptual designs were created.
- The design selected was due to:
  - Simple design
  - Minimal moving parts



# Testing to Validate Prototypes

- Impact testing
- Static load testing
- Flow testing
- **Simulated Field Crash testing**



# Breakaway Fitting Installed at Utility Site



Meter set “as found”



Meter set after breakaway installed

# Integrated Intelligent Safety System (IISS)

- Developing an Integrated Intelligent Safety System (IISS) (Lorax Valve) to mitigate the risk of gas leaks due to third party damage on commercial, multi-family, and small industrial service lines by shutting off the flow of gas.
- Intelligent safety shutoff device that will shut off the flow of gas in the event of line or meter set damage or failure.
- Working towards field pilot evaluations with utilities.

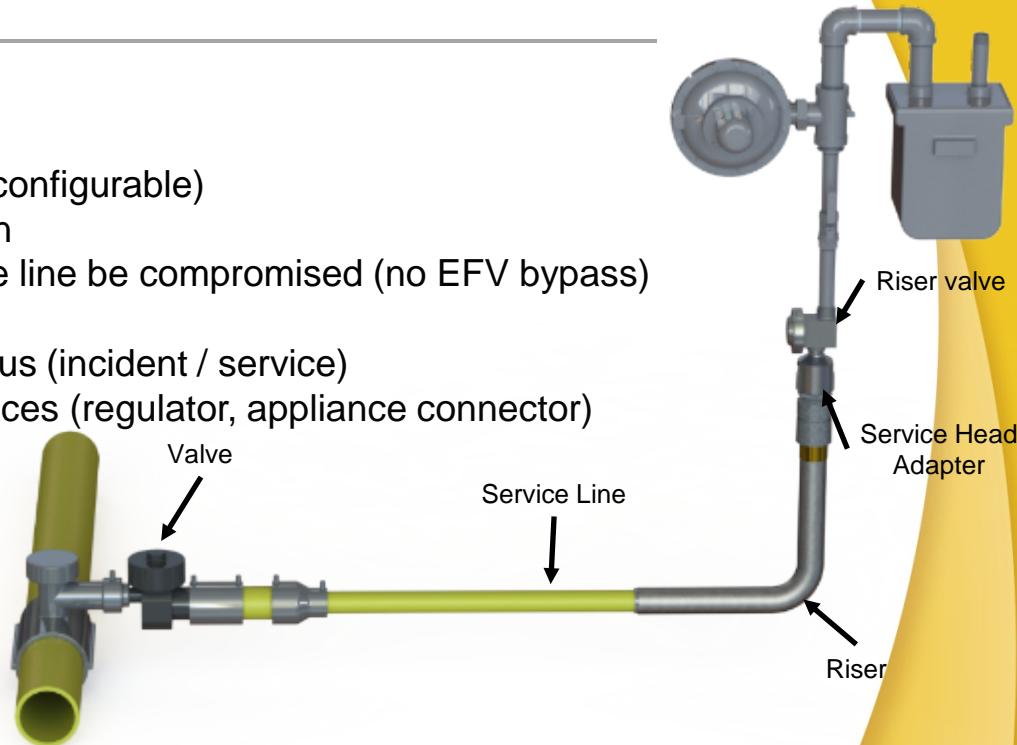
**LineGuardian**<sup>+NG</sup>  
™



# Integrated Intelligent Safety System (IISS)

## Features and Benefits

- 100% Mechanical operation (no power req'd)
- Detects very small to catastrophic line leaks (configurable)
- Full service line / riser detection and protection
- Will halt the flow of ALL gas should the service line be compromised (no EFV bypass)
- Monitored and controlled above ground
- Fully IoT capable and will notify utilities of status (incident / service)
- Technology is ported to other Natural gas devices (regulator, appliance connector)
- Scalable
- Cost effective
- Reduces emissions
- Saves Lives
- Previously commercialized for liquid fuels



Components



Very small leak



Riser Valve

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# Safer Excavation Methods

# Vacuum Excavation

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- Vacuum excavation is an efficient, safe and effective alternative to traditional excavation means within the tolerance zone when used appropriately.
- Need – to improve safe vacuum excavation productivity



# Improved Safe Vacuum Excavation

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## Objective:

- Improve the effectiveness of vacuum excavation with compressed air (or air/water mix) to equal the productivity of hydro excavation.
- The aim is the development of a new tool or system of tools with increased volumetric excavation rates over existing air digging tools.

## Need:

- Digging with air may be slower than digging with water in some soils
- Wet spoils from hydro excavation are not immediately available for backfilling and can lead to:
  - Increased costs in disposal fees
  - Fuel costs, water usage
  - Downtime
- Developing a new tool or system of tools with increased volumetric excavation rates over existing digging tools



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# Best Practices, Dissemination and Industry Adoption

# Recent HDD Incidents

- Recent incidents have highlighted the need for better trenchless practices and better damage prevention rules
  - JJ's Restaurant in Kansas City, MO – Feb 19, 2013
  - Royal Oaks, MI – Feb 27, 2013
  - Louisville, KY – Feb 19, 2013
  - Grand Junction, CO – March 2013
  - Ashville, NC – Jan. 2014
  - St Louis, MO – Feb. 2014
  - Ewing, New Jersey – March, 2014
  - Omaha, Nebraska – January, 2016



# Current Trenchless Procedures/Practices

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- One call laws for potholing of crossing and/or parallel utilities vary by state, city, facility owner, etc. (or non-existent)
- **CGA Trenchless Best Practice**
  - **Practice Description:** Locate in the area of the entrance pit, the trenchless excavation path and the exit pit when trenchless excavation is being used.
  - The trenchless equipment operator performs a site inspection walking the trenchless excavation path prior to commencing work and has a good understanding of the job.
  - The trenchless excavation operator confirms and maintains the path and minimum clearances established by the project owner and design engineer by tracking and recording the path of the trenchless excavation until complete. **Means of tracking trenchless excavations include: electronic locating / guidance devices, pipe lasers, water levels, visual inspection, etc.**
  - When existing facilities are known to be present but cannot be potholed due to local conditions the facility owner and the excavator meet to discuss how to safely proceed with the excavation.
- Is this a sufficient Best Practice?

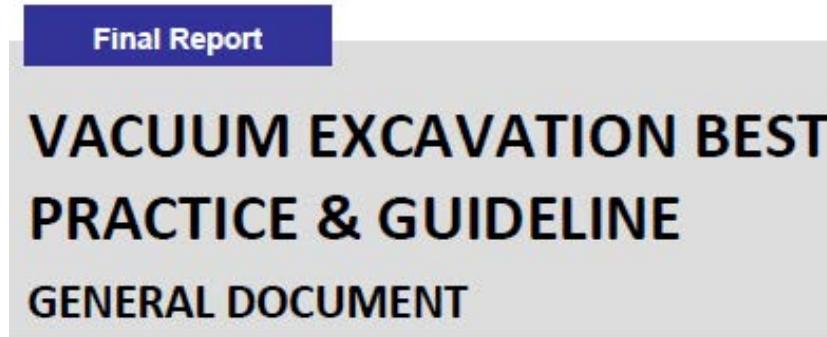
# Creation of Trenchless Best Practices

- Recent trenchless best practices developed
  - Keyhole group (OTD utilities and trenchless manufacturers)
  - AGA (Distribution Construction & Maintenance committee)



# Creation of Vacuum Excavation Best Practices

- Developed Vacuum Excavation Best Practices to support the proper use of vacuum excavation to eliminate damage
  - Keyhole group (OTD utilities and vacuum equipment manufacturers)



# Research Gaps and Needs

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- Require all newly installed underground facilities to be locatable
- Identify/develop technology to create accurate geospatial maps of in-service pipes and other underground facilities (map the underworld).
- Continue to make non-metallic piping intrinsically locatable.
- Research to link the movements of the excavators and other construction equipment to utility GIS systems.
- Implementation support for new damage prevention technologies and alternative methods of excavation (vacuum).
- Technology implementation pilot programs to assist the industry to better understand and adopt new technologies.
- Platforms and outreach programs to disseminate knowledge.
  - Industry best practices that are effective

# Questions

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