Comprehensive damage prevention programs that include effective enforcement have a significantly lower risk of excavation damage and the potential for incidents.

Elements of a comprehensive damage prevention program include:

- Enhanced communication between operators and excavators
- Fostering support and partnership of all stakeholders in all phases (enforcement, public education, etc.) of the program
- Operator’s use of performance measures regarding persons performing location and pipeline construction
- Partnership in employee training
(continued) Elements of a comprehensive damage prevention program:

- Partnership in public education
- Enforcement agency’s role as a partner and facilitator to help resolve issues
- Fair and consistent enforcement of the law to all stakeholders
- Use of technology to improve all parts of the process
- Analysis of data to continually evaluate/improve program effectiveness
GPS Early Adoption in Virginia

- City of Richmond initiated a project to incorporate GPS locations of all critical valves and included photographs of the site locations in their mapping systems. They were among the first operators in Virginia to adopt such technologies on a large scale...
Virginia One Call Technology Pilot Project

• Phase I: Electronic white lining
  – Excavator using hand-held device gathered GPS coordinate data at proposed excavation site and transmitted electronic locate request ticket to VUPS
  – Excavation areas were: Single point (bulls eye); line; or polygon area
  – Automated map selection by VUPS upon locate request ticket entry based on GPS coordinates
Results from Phase I

Pilot Projects tickets were 89% smaller in size
Virginia One Call Technology Pilot
Project Phase II

- Locate Facilities and collect GPS data to create electronic manifest
- Provide manifest to excavators with Positive Response System data
- Provide data to operators for verification of maps and plans
Phase II was Largely Supported by the efforts of the City of Charlottesville
Add Ortho Photography for Improved Location Identification
An example of how the Locate Industry has adopted similar technology as explored in the Virginia Pilot Project for One Call Technology is currently being used in northern Virginia...
Electronic Marking Wand
Wand Generated Documentation

FieldCheck™

Ticket Details
- Ticket: A127301342
- Arrival Date: 10/4/2011, 1:46 PM
- Lat / Lon: 38.66 / -77.39
- Closed By: Baron William
- Work Type: ros
- Work Done For: Verizon FiOS Inc
- Contractor: S & N Communications
- Work Status: MARKED

Clients
- Washington
- M
- MARKED ON SITE

Score Result: Not on Snow/Ice
No. of Manifests: 1
Esketch Mark Mismatch: No

Work Desc
- From Above Address: Follow The White Lines, Marking On Either Side 15 Ft To Feeding HH Located At Front Of 13830 Redstone Dr.
Virginia One Call Technology Pilot
Project Phase III

• Phase III: Electronic Excavation – Utilize GPS with excavation equipment to prevent facility hits
  – Operator’s view
Broadband Electromagnetic Technology

• BEM identifies evidence of ferrous (i.e., steel, CI and ductile-iron) pipe wall loss or other structural defects.

• This technology is in the final development stages at GTI and the Rock Solid Group with OTD funding.

• The BEM tool can be inserted down a keyhole for externally performed pipeline assessments around the complete circumference of the pipe.
BEM

- BEM tools can be assembled for most any size pipe
- Antennas are as small as 1-inch
- BEM smart pig attachments start at 6 inches
  - Pigs are not intrinsically safe, so pipe segment would have to be out of service
- Data can be linked to a company's existing GIS using Esri or other GIS systems, such as GE Smallworld.
- Main and service evaluation these can be plotted on company maps.
Electro-Fusion and Bar Coding
Data May be Stored, Retrieved, and Incorporated into Records

- Serial number of the electro-fusion unit
- Job number
- Operator Identity
- Date/Time of welding cycle
- Fusion cycle number
- Error number
- Fitting manufacturer
- Fitting type
- Fitting size
- Fitting resistance
- Ambient temperature
- Starting primary voltage
- Data input
- Fusion voltage applied
- Fusion time
- Fusion current
- Cooling time
- Pipes prepared
- GPS Coordinates
Training and Inspection

• Use the data to guide efforts for greatest impact
• Focus inspection, outreach and education efforts on large threats first
• Mitigate threats though a better understanding of what causes damages
• Share with others what works/ doesn’t
• Coordinate inspection, outreach and education efforts with other stakeholders
Risk Based Excavation Inspection Tool
Field Inspection Documentation Using iPads
Field Inspection Documentation Using iPads
Location Enhanced Ticket Search ("LETS")
### Location Enhanced Ticket Search ("LETS")

#### Ticket Search Table

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<th>Ticket #</th>
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<th>Type</th>
<th>Name</th>
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<th>Address</th>
<th>Work Type</th>
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**GPS Search**
- Long: 77.432270
- Lat: 37.536249
- Buffer: 1000
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</table>
Location Enhanced Ticket Search ("LETS")
Locating Advancements in Acoustics
Acoustic Locating

What if you perform acoustic locating inductively? Stay tuned...
Broken Tracer Wires
Utility Congestion
Utility Congestion
Rte. 29/Gallows Rd.
RFID: pop-up informational tags active in PDF files.
Data Collection
The Value of Location

- Regularly spaced RFID markers ensure that you are keeping track of what’s in the ground.
- Tied in with GPS, RFID markers allow automatic as-built creation and easier locating
  – Provide unique ID for each piece of inventory
Every Accident can be Catastrophic
Multiple Signals
Problem Becomes Clearer
Abandoned 2” Main Parallels Active 4”
Issue is Identified
New Construction and Renewal Projects

- Open Trench – Marker Tape will be installed
- Trenchless and existing will have disk and ball type markers installed
Leveraging New Technologies

- One Large LDC will be installing about 5 miles of Tracer Tape in 2012
- Another will be installing Tracer Tape on all new open trench installations
- A number of utility operators, including municipal systems, plan to use both programmable and non-programmable EMS devices
  - Gas
  - Power
  - Telecommunications
  - Water
  - Sewer
- Installations are done parallel to conventional tracer systems
  - (18 gauge or thicker, braided or Neptco Tracer wire systems)
- A study will be conducted and a white paper will be published in 2013
In Summary...

• Technology can greatly assist in dealing with known issues and forecasting future problems
• Technology solutions can be low cost and still be effective
• Technology can assist in analyzing data from multiple legacy systems
• Focus efforts on large threats first
• Share with others what works/doesn’t

• We must not become complacent. The minimum requirement may not prevent the next catastrophic incident.
Advancements in Plastic Pipe Locating

Corey Willson
3M Locating and Marking Solutions
Austin, Tx
The challenges for utilities globally are three fold:

Where are my assets?

How do I know they are mine?

How do I protect them?
EM Locating
The Benchmark
Locating & Marking

Provides solutions for locating, fault finding, and accurate marking of buried utilities for companies committed to ensuring safety, quickly restoring outages, minimizing operating costs and efficiently managing assets.
The cable must radiate or transmit an electrical signal so it can be located and traced by a Signal Receiver.
Current flow created by capacitive coupling to ground
Issues with Congestion of Utilities using EM Locating

Cable Locate
Freq Mode Depth Alert
577 Dir Pk Off
85.2 dB
60%

Cable Locate
Freq Mode Depth Alert
97.3 dB
60%
Locator Products

• Selectable frequencies to create optimum current flow
• Selectable power output levels to create optimum current flow
• Antenna configurations to improve accuracy
• Filtering algorithms to reject harmonics
What is the best locator in the world?

The person who is using the locator.
Electronic Marking Products
RFID Marker Technology

Coil Antenna

Disk Housing

Color Code by Utility

Disk inside Ball Housing

A.S.I.C

- Enhanced Marker
- AC/DC
- User Data
- ID Data
- Protection
- Modulator
- Central Control Unit
- Demodulator

ID MARKER
Electronic Marking

User Input Data
- Facility information
- Owner information
- Location information
- Unique Serial No. pre-programmed
Locatable Pipe and Caution Tape
• **Tracer wire was not required for non-metallic facilities**
  – No maintenance to maintain a wireline network that doesn’t carry revenue
  – Reduced material cost
• **No installation costs**
  – No more issues with breakage, corrosion, access points getting lost
• **No issues with metallic wires that could attract lightning or cause other safety issues**
• **No need for locator transmitters and reduced labor for location**
• **No issues associated with electromagnetic locating and congestion of utilities and bleed over**
• **No issues with congestion in public right of ways**
• **No interference from**
  – Nearby utilities
  – Chain link fences, guardrails, cars/vehicles, above ground objects
How does it work?

**Detection method:**
- Electronic resonant markers are placed 1 - 2m spacing
- Detector based on integrated unit that locates existing marker frequencies and RFID markers, cable/pipe locator option
- Different frequencies will be created for each utility, allowing for differentiation in detection
Plastic Pipe Locating Solutions will come in two formats:

- **On-Tape:** electronic markers will be imbedded in a tape, similar to warning tape, that will be rolled out, either over the pipe (similar to tracer wire) or above the pipe (like caution tape)

- **On-Pipe:** Electronic markers will be attached to the actual pipe, during the manufacturing process, allowing for pipe to be “locatable” once it is in the ground
Training on locator is reduced to 10 minutes and location is always exact even in harsh field conditions.
  - Reduced complexity of locator and training requirements
  - Easier to learn for field technicians, more accurate in difficult field conditions

**Tracer wire not required**
  - No maintenance to maintain a wireline network that doesn’t carry revenue
  - Reduced cost
  - No installation costs

**Eliminates problems with**
  - Tracer wire breakage
  - Access points getting lost or damaged
  - Lightning, does not provide a conductive path
  - Corrosion

**Locator transmitter not required**
  - Reduced labor to perform a locate since there is no hook up

**No interference from nearby utilities or issues with congestion**

**Major breakthrough in improving underground safety**
Thank You !