SENSIT Technologies

Innovative Detection Solutions

Energy - HVAC - Industrial - Safety

Locating Technology: EM, GPR and APL

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Product Manager

Locate Products

Presentation Outline

- Emergency Safety
- Utility Locating Workflow
- Electro-Magnetic Pipe and Cable Locators
- Ground Penetrating Radar
- Acoustic Pipe Locator
- Conclusion

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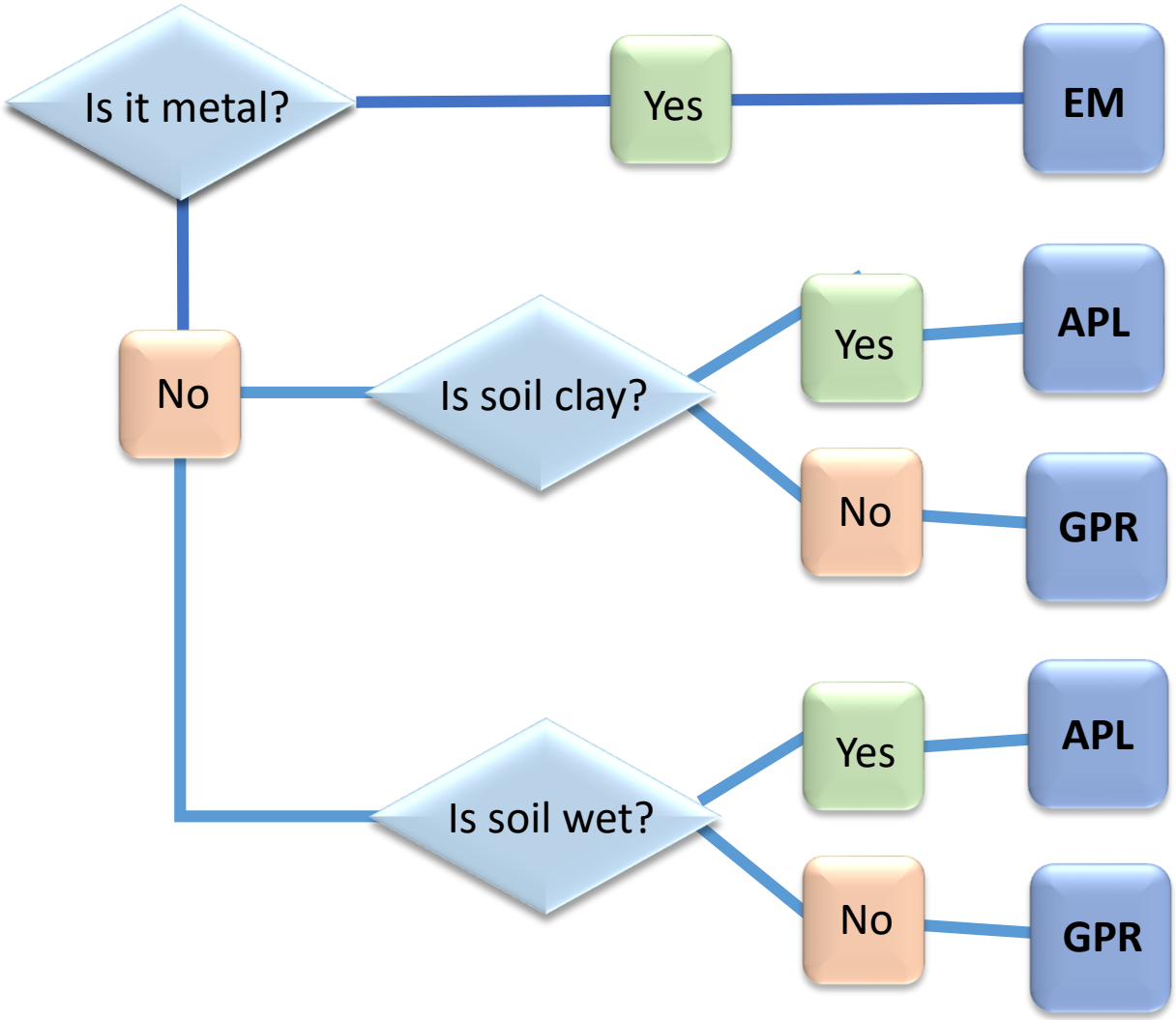
Utility Locating Workflow

Electro-Magnetic (EM)

Ground Penetrating Radar (GPR)

Acoustic Pipe Locator (APL)

Utility Locating Workflow



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I. Electro-Magnetic Locators

History of EM Locators

- 1931 Dr. Gerhard R. Fischer invented first hand held metal detector for commercial use
- 1979 Metrotech created first multi-antenna receiver to give more info
- Today: GPS, Bluetooth, line direction, current mapping, SPAR and more

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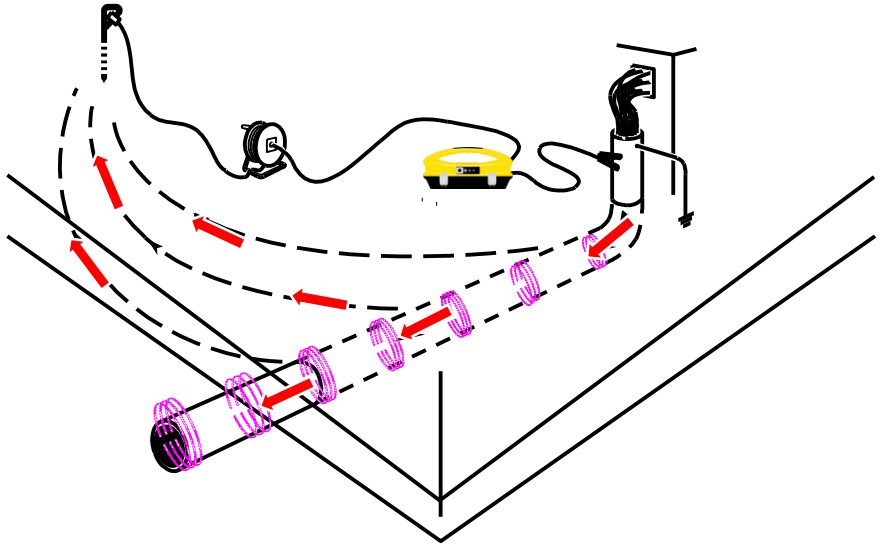
I. Electro-Magnetic Locators

Theory of EM Locators

- Transmitter and Receiver
- Alternating Current
- Magnetic Field
- Path of Least Resistance
- Utility lines must be metallic
- Frequency range: 3Hz-480kHz



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I. Electro-Magnetic Locators

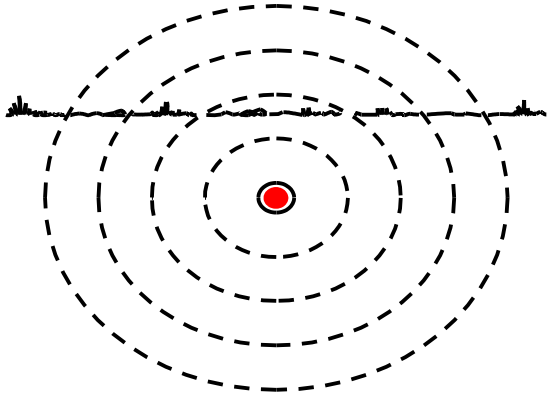
Application of Technology

Transmitter

- Direct Connection
- Induction

Receiver

- Peak
- Null



Point A to Point B - Visual

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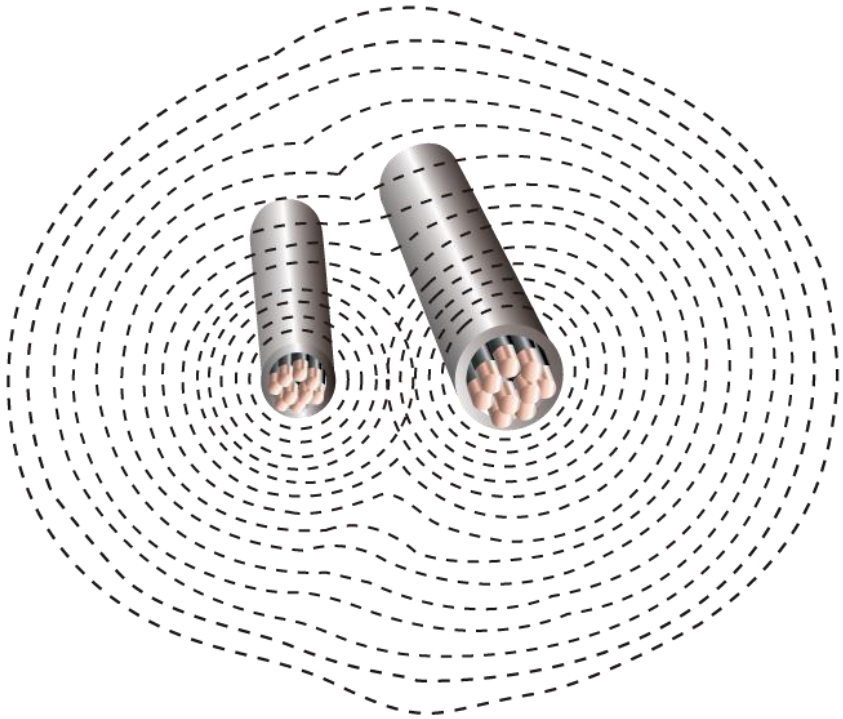
I. Electro-Magnetic Locators

Limitations of Technology

- Lines must be metallic
- Path of least resistance
- Other metal causes distortion



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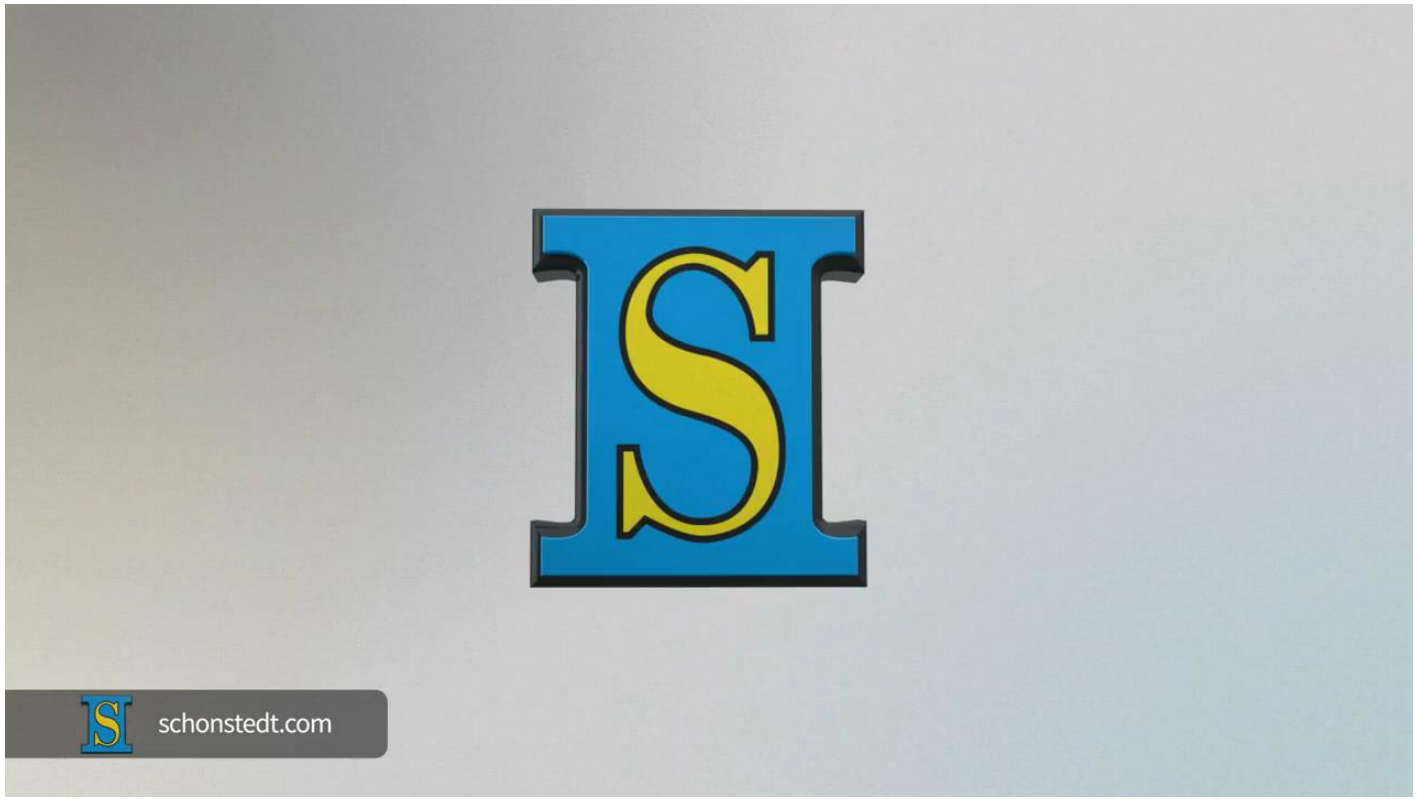
I. Electro-Magnetic Locators

EM Locators - Video



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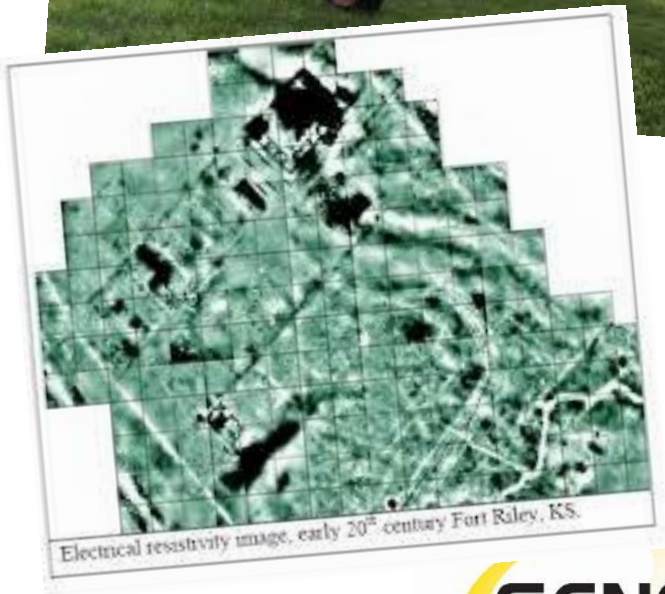
II. Ground-Penetrating Radar

History of GPR

- RADAR first used during WWII to detect aircraft
- GPR was first used to determine glacier depth in Austria in 1929
- NASA put GPR on the moon on Apollo 17
- 1971 GSSI created GPR for commercial use



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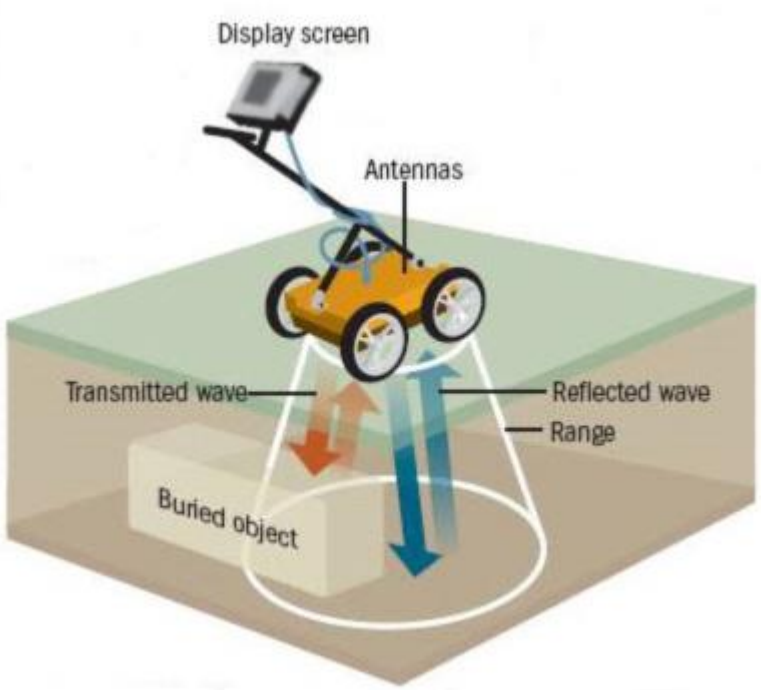
II. Ground-Penetrating Radar

Theory of GPR

- RADAR pulses are sent into the ground and reflect from buried objects, soil layers and voids
- Dielectric constant affects signal
- Median frequency for utility locating: 250MHz



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II. Ground-Penetrating Radar

Application of Technology

- Send and receive GPR antennas are housed in a sensor head on a cart
- Reflections are processed and displayed in real time and used to mark location
- Patterns emerge
- May locate metallic and non-metallic utilities

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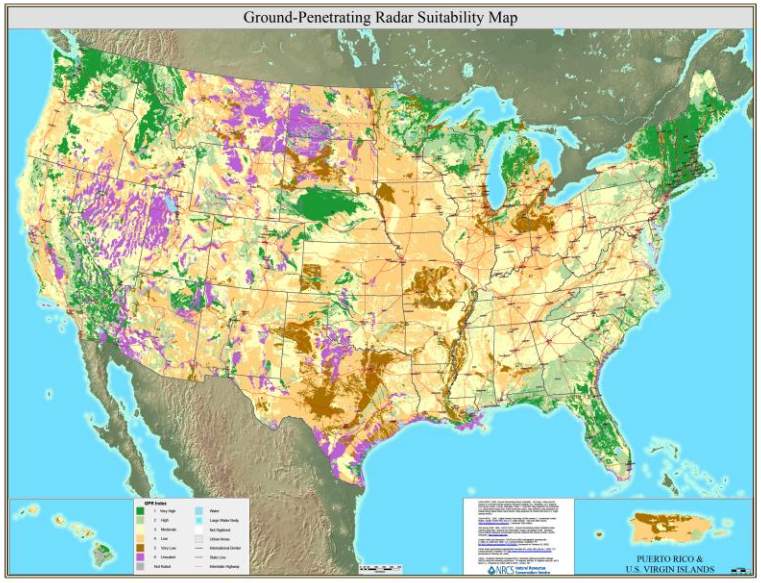
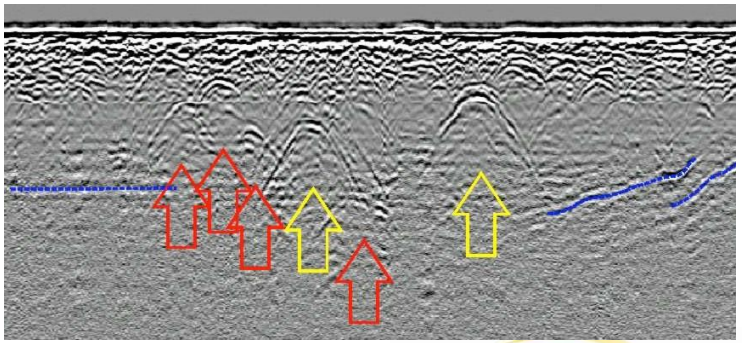
II. Ground-Penetrating Radar

Limitations of GPR

- Dielectric constants dictate depth penetration and data resolution
- Soil type and moisture content are **major factors:** attenuation occurs at shallower depths
- Some materials may not be seen





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II. Ground-Penetrating Radar

GPR - Video

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III. Acoustic Pipe Locator

History of APL

- Project launched in late 90s
- Funded through GTI, GRI, PHMSA, OTD, significant utility support
- Licensed to SENSIT Technologies for commercialization in April, 2011 by GTI
- Market introduction in December, 2012
- 3D Pipe Mapping introduced Q4 2015
- Head-Mounted Tablet Q3 2016

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III. Acoustic Pipe Locator

Theory of APL

- Acoustic impedance mismatch is used to determine if an object is present in soil
- Sound waves are sent into the ground and reflect
- May locate metallic and non-metallic lines
- Frequencies: 500Hz, 900Hz

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III. Acoustic Pipe Locator

Application of APL

- Send and receive components are housed in the APL foot
- Reflections are processed and displayed in real time and used to mark location
- Patterns emerge
- May locate metallic and non-metallic utilities, regardless of soil and material type

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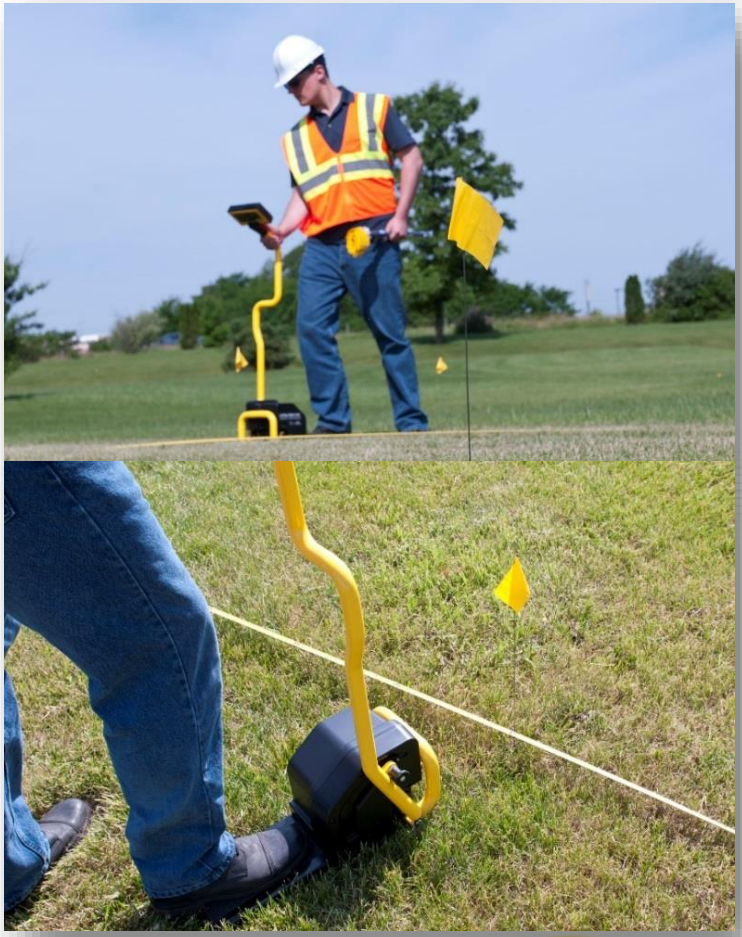
III. Acoustic Pipe Locator

Limitations of APL

- The operator should start on a known reference point and trace to another, whenever possible
- The APL cannot tell what type of utility is being located
- The APL doesn't display depth



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III. Acoustic Pipe Locator

APL - Video

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III. Acoustic Pipe Locator
APL in Action – No Tracer

2” PE gas pipe at 42” below grade

1¼” PVC water pipe at 14” below grade

Confirmed both locations by excavation.

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III. Acoustic Pipe Locator
APL in Action Around the World – No Tracer

Puerto Rico – GeoEnviroTech

India—IGL

III. Acoustic Pipe Locator
APL in Action Around the World – No Tracer

New Mexico

United Kingdom

III. Acoustic Pipe Locator
Beijing Gas

Beijing Gas used the Ultra-Trac APL to locate a leaking pipe in one of its busy downtown neighborhoods. The APL quickly and accurately located the unmarked pipe, allowing them to dramatically decrease the size of the excavation and improve the speed and efficiency of repairs.

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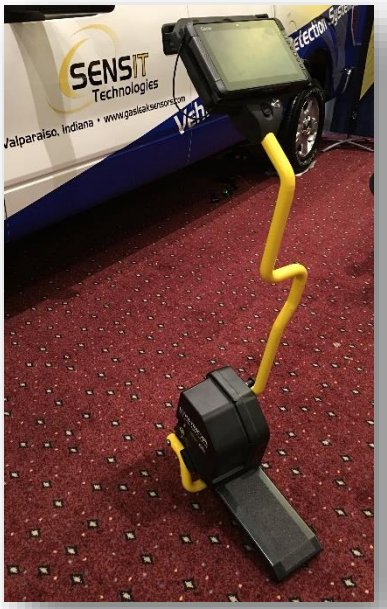
Conclusion

There isn't a single locating technology that can do it all. While they each have inherent limitations EM, GPR and the APL are invaluable tools in the locators toolbox. Utilizing the APL in conjunction with EM and GPR greatly increases the likelihood of locating hard to find pipes, cables and ducts.



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Thank You!

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