

## Underground Facility Pinpointing



**Research was conducted on a wide variety of technologies used by utilities to locate underground pipes and facilities. The results are documented in a report that provides an independent, comparative, technical evaluation of tools that are currently available. The information in the report will help focus future technology developments and help utilities to employ the most cost-effective technologies for their specific needs.**

### Project Description

The objective of this project was to conduct evaluations of a wide variety of technologies and products to provide project sponsors with sufficient information about the capabilities of available underground locating equipment so that they are better prepared to make purchase decisions and locating plans.

### Deliverable

The final result of this program was a thorough analysis of the performance of most of the currently available locating devices — as well as a look at emerging technologies — to improve the ability to provide cost-effective locates, minimize or eliminate inaccurate locates, and ultimately reduce damages to underground facilities. The outcome of this project was a detailed report on available underground locating equipment. Recommendations are also included in the report to help participants determine the best tools available based on a company's specific geographic location.

### Benefits

With the major cause of damage to underground facilities being attributed to third parties, the ability to accurately locate buried pipes and facilities is a prime concern among utilities. As a result, numerous manufacturers have developed locating devices based on various technologies.

However, while the industry has several beneficial locating devices it can use, these tools range in capabilities and users have few guidelines to help determine the right tool for their needs. In addition, according to industry surveys, inaccurate locates account for about 14,000 incidents of third-party contact with underground facilities per year — a figure

that could be significantly lower with improved locating tools. (If 10% of these inaccurate locates could be eliminated, the annual cost avoidance to the gas industry is estimated at \$1 million.)

On an individual company level, benefits are also significant. If a locating device is used throughout the year (providing about 200 locates a month) and is performing inaccurate locates 10% of the time, a company is spending about \$22,500 a year (an estimated \$750 per inaccurate locate), which could be avoided with new or improved technology that could pay for itself in a few months.

### Technical Concept & Approach

The technical approach for this project involved:

- Identification of available locating tools (through literature searches, interactions with manufacturers and utilities, trade show participation, etc.)
- An analysis of each locator to determine the engineering principle used
- An assessment of each tool's ability to accurately locate (horizontal and vertical location) various types and sizes of facilities, in various soil types, and at various depths
- An evaluation of each tool's repeatability, reliability, features, options, ease of use, ergonomics, information provided by the locators, and how much the information is subject to interpretation.

Members of the research team attended classes at Staking University in Manteno, IL, on the fundamentals of using electromagnetic and ground-penetrating radar devices to learn more about the intricacies of locating buried facilities and to gain a better understanding about designing and constructing test sites. Through the class, participants were presented with the



*Researchers evaluated the effectiveness of a wide variety of facility-locating devices.*

technical aspects of the design of locators (antenna configurations, frequency, etc.) to help in the evaluation of locating devices.

Investigators performed a detailed study of the parameters affecting a locating device's ability to function in various soil types and conditions. It was determined that soil conductivity and relative dielectric constant, both highly dependent on soil moisture contents, are the two key parameters for most pipe-location techniques.



## Results / Status

This project is complete and a Final Report is available.

A comprehensive technology search was conducted through a review of available literature, industry surveys, conference attendance, and solicitations with manufacturers. As a result, products from more than 15 manufacturers were received for evaluation.

Tools evaluated included devices based on electromagnetic and ground-penetrating-radar technologies. Other technologies researched included acoustic/ultrasonic, magnetic, and capacitive tomography.

All of the technologies were tested on a variety of pipe types and sizes, in various soil conditions, at Gas Technology Institute (GTI) facilities, Staking University, gas distribution company facilities, and other sites. Tests were conducted on locating steel, cast-iron, copper, and plastic piping, as well as tracer wire.

Researchers received locating devices for evaluation from many companies, including:

- 3M Dynatel
- Aqua-tronics
- DitchWitch
- Fisher Research Laboratory
- Heath Consultants
- McLaughlin
- Metrotech
- Pipehorn
- Radiodetection
- Rycom Instruments, Inc.
- Schonstedt Instrument Co.
- Seek Tech
- Tinker & Rasor

In addition, various emerging technologies were evaluated, including a ground-penetrating radar device from Bahktar Earth Radar, the "Hyper Radar" system from Harris Technology, Witten Technologies' Computer-Assisted Radar Tomography Imaging System, GTI's capacitive tomography imaging system, and other promising technologies.

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