

## Acoustic Pipe Locator: Technology Transfer



The objective of this project was to transfer the technology for an acoustic-based pipe locator to an appropriate manufacturer/commercializer. In tests in an earlier program, a prototype acoustic-based pipe-locating system was shown to be capable of detecting multiple buried plastic pipes at depths up to five feet.

### Project Description

In a previous OTD project, an operational, hand-held, portable acoustic system for locating underground utilities was designed, built, and successfully demonstrated. The locator was developed to detect small-diameter plastic pipes at depths up to five feet in various ground-surface conditions, including topsoil, concrete, and asphalt.

The concept is to send an acoustic signal into the ground and detect the reflected signal from the pipe at ground level. The device was successfully tested in the laboratory and at several utility locations under a variety of field conditions to detect both metal and polyethylene (PE) pipes. System software provides automated pipe-detection information through an easy-to-operate user interface.

Subsequent activities sponsored by the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (DOT/PHMSA) and OTD resulted in the development and testing of an improved, pre-commercial unit able to detect multiple buried pipes.

In this project, activities were conducted to facilitate the transfer of the technology to a commercial partner. The commercial partner will finalize the integrated acoustic locator based on test results and is expected to manufacture and commercialize the locator.

### Deliverables

Deliverables for this project include the selection of a commercial partner to introduce the product to the market and the transfer of all technical information.

### Benefits

The detection of buried natural gas pipes, especially PE pipe, will assist the gas industry and pipe-locator companies to locate pipes before excavations and construction. This will reduce the risk of third-party damages to the underground utilities, enhance the safety of natural gas distribution systems, and reduce gas industry operating costs.

### Technical Concept & Approach

The project included the following tasks:

- **System Documentation and Preparation**

Preparation and validation processes were required for the integrated system before system presentation, demonstration, and system training. Under this task, electronics, sensor modules, and system software were prepared and tested. The same integrated system was delivered to the commercial partner.

- **System Presentation, Overview, and Training**

In the early stage of technology transfer, the research team conducted a system presentation and demonstration, held a system design overview meeting, and performed system operational training for the commercial partner.



Test result/display during the field trial of the prototype unit.



*At left: 3-D rendering of the acoustic pipe locator system in (a) fully extended and operational mode and (b) folded and storage mode. At right: system operation of the acoustic pipe locator beta unit in the field.*

### • System Verification and Validation

Four major system verification and validation activities were performed during the entire technology transfer process: 1) Definition of system performance per the industry requirements; 2) System design specifications, design requirements, and operational performance; 3) Hardware (electrical/electronic), software, and mechanical design criteria; and 4) System operational guideline, procedure/process, performance, and test protocol.

### • Prototyping and Technical Support

The research team provided technical support throughout the entire prototyping.

## Results

- Two highly integrated, acoustic-based, pipe-inspection systems were demonstrated during the presentation and design reviews. The same systems were also used in several field tests for assisting and supporting the technology transfer project. As a baseline and reference unit, the integrated unit performs well and meets the design and performance specifications. The finalized detection system is compact, portable, and robust in overall system operation and performance.
- Extensive and complete system documentation was established for the project.
- Several design review meetings were held to develop concepts for converting the beta unit into a commercially available prototype product. Design issues, product specifications, and performance criteria were analyzed, categorized, and resolved.

- Preliminary prototype units from the commercial partner were designed, fabricated, and tested. The sample alpha system performs very well and meets the design requirements.
- The overall technology transfer of the acoustic-based pipe locator project was very successful. The commercial partner was able to design, build, and test the pre-production pipe-detection systems and met the product specification and design requirements based on the design architecture and concept of the extensively field tested prototype unit.
- Comments from the field-test participants suggested that the overall system operation was easy and the final detected result was clear and simple to interpret. The availability of results in real time was beneficial for field operation.

## Status

Testing and development activities have been completed. A Final Report detailing project activities was issued in February 2013.

The production of units intended for extensive field trials was initiated by the manufacturer.

The pipe-detection system is now commercially available.

### For more information:

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