

Quarterly Report – Public Page

Date of Report: November 30, 2013

Contract Number: DTPH56-13-T-000002

Prepared for: DOT

Project Title: Real-Time Multiple Utility Detection During Pipe Installation Using Horizontal Directional Drilling (HDD) System

Prepared by: Gas Technology Institute/Operations Technology Development

Contact Information: Kiran Kothari

kiran.kothari@gastechnology.org

847-768-0893

For quarterly period ending: November 30, 2013

Technical Status

Two innovative technologies, acoustic and radar, that can automatically and rapidly detect buried pipes/obstacles in front of and adjacent to the drill-head of HDD machines have already been under development by GTI, SoniVerse Inc. (SVI), and Vermeer Corporation (VC) with the assistance of Operations Technology Development (OTD).

The acoustic technology is based on a unique method – listening to noise made by the drill-head and reflected by the approaching pipes/objects. The highly sensitive accelerometers on the ground ‘listen’ to the reflected signals from objects/pipes and analyze the data to provide information on the underground infrastructure in real-time. The prototype system has been tested successfully in a semi-field condition to detect pipes about 20 ft. in the front of drill-head in real-time. The accuracy of detecting pipes is about 2-3 ft. and appears to be somewhat coarse.

The second technology is based on stepped frequency continuous wave (SFCW) modulation, and the prototype drill-head radar has been designed and built. The drill-head has been installed on a commercial HDD machine and has been tested in both laboratory and in semi-field settings. A unique technique to inject and receive reflected signals from pipes/objects near the drill-head has improved the radar operation in the detection of pipes in many more types of soils than commercially available GPRs operated at the ground level. This radar technology detects pipes with high accuracy, but the detection distance of pipes has been limited to about 3-5 ft. around the drill-head.

The project objective is to integrate acoustic and radar technologies to detect buried pipes/objects in front of or adjacent to the drill-head during pipe installation using the

HDD machine in real-time. Under the proposed development, the acoustic technology will provide an alert for pipes/objects at longer distances ahead of the drill-head and back to the HDD machine operator. The machine operator activates the radar system to accurately locate the obstacle pipes, while continuing the drilling operations to avoid hitting pipes.

A system specification and design requirements for fusing the acoustic system with the radar technology was drafted. The final sensor module design for the acoustic system was completed. A first article of the revised sensor module was fabricated and tested. Several transducer array and system carriage designs have been proposed, reviewed and evaluated. The fabrication of sensor modules was completed. The build of array structure and system carriage were underway. The system electronics configuration and design was completed. The initial system electronics bench test was conducted and the electrical/electronic performance met the design requirements. Procurement processes of system components continued.

Results and Conclusions:

The research team has continued to upgrade the acoustic system and components evaluation. The upgraded system is planned to be tested in the local area in the next quarter.

Plans for Future Activity:

- Continue to assemble, upgrade and test the acoustic system.
- Arrange a meeting to discuss the project progress with the research team.
- Arrange the test sites at the Vermeer Corporation location in Pella, Iowa.
- Write the next milestone reports.