Northeast GAS ASSOCIATION

NYSEARCH

Technology Brief

Harris Cast Iron Joint/PE Pipe Locator

Description: An innovative, ultra-low frequency radar imaging tool that can be used in a wide range of soils for locating both plastic pipe and joints on Cast Iron or Ductile Iron pipe.

Status: Proof-of-Concept Achieved. Two rounds of prototype development completed. Controlled and field tests completed. Independent commercial evaluation completed.

BENEFITS

Potential benefits of a successful plastic pipe and cast iron joint locator system would include: 1) reduced number of hits to pipe, 2) reduced system downtime and customer disruption, 3) ability for excavation crews to use keyhole over full excavation when operating on pipes, 4) reduced repeat locates, 5) reduced test pits for new construction (stakeouts for new construction), and, 6) increased safety.

Early Prototype System under Test

BACKGROUND

Based on years of development and operational experience, members of NYSEARCH/NGA are clear on the needs and benefits of a pipe location tool and a combination tool for pipe location and cast iron joint location. Problems with state-of-the-art technology include: lack of accuracy particularly for quantifying vertical location, lack of performance in certain soils (such as clays), complex operation, high expense and confusion in distinguishing between pipes, joints and other underground objects. NYSEARCH embarked on this development because of the prospect of having a combination tool. Also, the Harris offering had some unique innovations that change and possibly expand the limits of conventional Ground Penetrating Radar (GPR).

TECHNICAL APPROACH

NYSEARCH, the research, development, and demonstration organization within the Northeast Gas Association retained Harris Technologies to develop a light-weight, reliable locator for PE pipe and cast iron joints.

While functionally similar, there are important differences between the technical principles employed by the Harris concept and those employed by conventional radar. Commercial GPR devices typically operate in the general RF spectrum regime between 250 megahertz and 900 megahertz (the highest RF spectrum allowed by FCC specifications). RF energy above 100 megahertz is attenuated by conductive soils (such as clay) and this is explained as one reason why commercial GPR devices have difficulty in soils with high clay content. Also, the Harris technology operates well below 100 megahertz and this allows penetration under all soil conditions while offering the equivalent spatial resolution of a gigahertz-class radar. Thus the technical principles of the Harris approach are claimed to result in two fundamentally different improvements: a) better soil penetration (ability to penetrate conductive soils), and, b) better spatial resolution.

During the Phase I project, the goals were to design, develop and produce an advanced antenna that has the functional capabilities of a commercial product. In Phase I, Harris completed the design, development and laboratory testing of a narrow band ferrite rod antenna which has several additional commercial advantages that include: 1) size of a few inches and weight of less than one lb, 2) operation in many of the traditional narrow unlicensed ISM bands as already confirmed by FCC provisions, and, 3) narrow radiation beam pattern that is

suited for cluttered underground environments. Also during the Phase I project, a method was developed to directly measure the soil dielectric constant in real time and therefore get high accuracy on vertical location predictions.

In Phase II, two objectives were pursued. The first was for Harris to advance the design and to produce and test a unit that has the functional capabilities of a commercial unit. The second was for the technical team and sponsorship (NYSEARCH funders with added Phase II cofunding from DOT/PHMSA) to advance the technology to a point where it is ready for commercial transfer. In addition to tasks that optimized the antenna hardware and software and further reduced the size of the prototype, Harris and the sponsorship worked together in four sets of testing. There were two live field tests at different times during the project and two sets of controlled field tests. In all cases, the field test data was checked against real truth validation data.

Miniaturized Harris Antenna Locator System Under Initial Evaluation

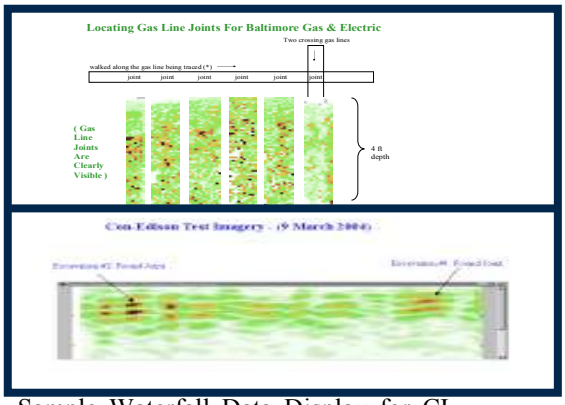
PROJECT STATUS

In the first phase, the Harris technology met its technical targets. These targets were based on performance requirements and deficiencies found in testing before the Phase I project started. Then prior to the initiation of Phase II, while the Phase I testing showed significant advancement, additional improvements and commercial advancements were identified. Test results in Phase II showed that the technology had made some progress in user display, real time output and portability but system engineering issues emerged as did some limits in the design and results associated with the smaller antenna.

NYSEARCH funders conducted four sets of tests; two controlled at a well-defined site at Staking University in Manteno, Illinois and two in members' territories; Con Edison and PECO Energy.

The Sponsorship also completed an independent commercial review of the tool and important recommendations have been made to the Harris team. Recommendations address the needs of customers and prospective commercializers and the options available to Harris if they choose to manufacture and service their own units or if they choose to license the technology to outside service providers.

Harris is completing the test reporting and Final Report for the Phase II project. NYSEARCH will be issuing its overall report that includes the Harris tasks and results, the users' input and information on field test validation, and the Technology Transfer assessment by the Independent Consultant to its sponsors and DOT/PHMSA. Recommendations and next steps as to further development and/or formal evaluation will be decided after those reports are issued.



Sample Waterfall Data Display for CI Joints

Harris System in Live PECO field tests

FOR ADDITIONAL INFORMATION

Daphne D'Zurko
Executive Director, NYSEARCH
Vice President, RD & D
Northeast Gas Association
1515 Broadway, 43rd Floor New York, NY 10036
212-354-4790
ddzurko@northeastgas.org

Tom Davis
Business Development Manager
Harris Technologies Inc.
4265B Brookfield Dr.
Chantilly, Va. 20151
281-364-0002
tjdavis111@aol.com