Second Quarterly Report

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Contract Number: DTRS56-04-T-0007

Prepared for: U.S. Department of Transportation, Office of Pipeline Safety Research and Development and NYSEARCH/Northeast Gas Association

Project Title: Infrasonic Frequency Seismic Sensor System for Preventing Third Party Damage to Gas Pipelines

Prepared by: NYSEARCH/Northeast Gas Association

For quarterly period ending: March 31, 2004

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The team has been working on the following tasks:

- Independent Assessment by Geophysical Consultant.
- Industry Design Review.
- Completion of the PIGPEN EP-1 sensor design.
- Establishment of an Integrated Algorithm for Threat Detection and Identification.
- Fabrication of six PIGPEN EP-1 sensors and data acquisition system.
- Identification of Potential Field Test Sites and Initial Preparation for Field testing.
- Testing and calibration of the EP-1 sensors.
- Preparation and execution of field checkouts and field tests.

PIGPEN EP-1 Sensor Design and Industry Design Review

PSI completed the design of the 1st PIGPEN Experimental Prototype (EP-1), including the mechanical design and front-end electronics design. A Design Review Meeting was held by NYSEARCH for sponsors on 16 February 2005 in Saratoga Springs, NY. The design review information is found in PSI document VG05-031, ”Infrasonic-Frequency Seismic Sensor System for Preventing Third Party Damage to Gas Lines”.

Establishment of an Integrated Algorithm for Threat Detection and Identification

Using the architecture that was defined in the first quarter, the algorithm was tested and refined. It was further tested and the results were presented at the Design Review Meeting.

Independent Assessment by Geophysical Consultant

Based on a recommendation from its sponsors in the earlier NYSEARCH PIGPEN program, an independent geophysical consultant was hired to focus on the soil mechanics

and geophysics associated with the application of these point sensors in the underground utility environment. The consultant's work was initiated during this quarter.

Identification of Potential Field Test Sites and Initial Preparation for Field Tests

NYSEARCH Staff worked with its industry sponsors to define criteria for the field test sites and then to identify potential sites. After considering several different sites, a site was selected in upstate New York in the New York State Electric and Gas (NYSEG) service territory.

Fabrication of six PIGPEN EP-1 sensors and data acquisition system

Based on the approved design, PSI fabricated six EP-1 sensors. Those sensors included the sensor, weatherproof mechanical housing, and front-end electronics. We fabricated a data acquisition system that included wireless communication to enable data acquisition in the field at long ranges.

Testing and Calibration of EP-1 sensors

Though bench testing and calibration, PSI validated the EP-1 design. The EP-1 sensor met the design goals of increased sensitivity and reduced noise. The front-end electronics also met the desired frequency bandwidth requirements. The resonance frequency was out-of-band as designed. PSI conducted calibration testing at Sypris Test and Measurement in Burlington, MA. The facility achieved excitations of 3 Hz and 1/10 G. At Sypris, we measured the sensor response and identified the natural resonances of the EP-1.

Preparation and Execution of field checkout and field tests

As part of the system checkout, PSI conducted three half-day field exercises at a location near PSI. At these field exercises, PSI acquired data using a sledgehammer as the source. PSI also conducted a full-day field checkout with a private contractor at a building site in the Boston area. At this field checkout, PSI acquired data of two types of excavators. These field exercises and checkouts were in preparation for the field test hosted by NYSEARCH/NGA and NYSEG in Johnson City NY.