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The Northern California Pipe User's Group
29th Annual Sharing Technologies Seminar

VIRTUAL EVENT
February 18, 2021

LOOK AHEAD HDD RADAR PROVIDES REAL-TIME OBSTACLE DETECTION

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ABSTRACT

'ORFEUS' (Operational Radar For Every drill string Under the Street) is a horizontal directional drilling machine with "look ahead" radar incorporated into the drilling head to detect and warn the operator of obstacles during the drilling operation. Initially developed in Europe, the first phase of development allowed for the realization of experiments, on-site tests, and user input to estimate and validate the technology. The system was found capable of detecting object (pipes, cables, walls, etc.) in the proximity of the drilling head, up to a distance of about 1.5 feet, both ahead and aside. A dedicated real time software was developed and tested; it is capable of displaying the positions of the detected targets in the 3-D space. Further research by the Gas Technology Institute, with funding from PHMSA, is being conducted with the aim of full commercialization of the technology.

OVERVIEW

The ORFEUS system incorporates radar technology directly within the drill head. The rotation of the drill head allows 360º detection of objects (Figure 1). Installation may be done with minimal impact to field operations (Figure 2). Installation of an on-board display allows the rig operator to view the detected objects and, if necessary, take corrective actions to prevent striking subsurface infrastructure (Figure 3). The final commercial product will be adaptable to any boring rig configuration.

Figure 1: A possible operative situation for the bore-head radar

Figure 2: ORFEUS being installed on HDD rig.

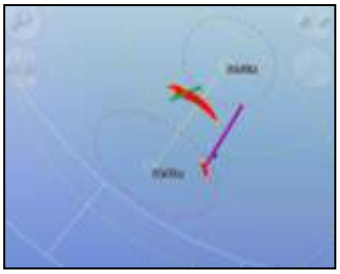

Figure 3: Actual real-time operator display showing 3D representation of detected objects.

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REDUCING EXCAVATION DAMAGE IN THE NATURAL GAS INDUSTRY USING REAL-TIME GIS AND MOTION SENSORS

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ABSTRACT

PG&E and the Gas Technology Institute (GTI) partnered to develop a GPS and Motion Sensing System to support damage prevention efforts. The system utilizes real-time GPS and motion sensors placed on mechanized excavation equipment to monitor the excavator's location and activities. The system uniquely identifies digging, idling and moving of the equipment, three common tasks for equipment at excavation sites. When digging is detected, situational awareness is increased by an automated, preemptive alert system that simultaneously notifies utility personnel and excavation equipment owners and their excavator operators that prompts appropriate actions to prevent dig-ins.

OVERVIEW

GTI has licensed the technology to Hydromax USA, LLC for retail commercialization and it is branded as UtilAlert™ (Figure 1). The system is designed to be plug-and-play, supplied by either a 12v or 24v connection and easily installed on excavation equipment (Figure 2). The system utilizes real-time GPS and motion sensors placed on excavation equipment to monitor the excavator's location and activities. In addition, this information is transmitted real-time using the cellular network to UtilAlert's cloud-base system then analyzes the data to uniquely identify when the excavation equipment is excavating, idling or driving. This information is accessible within a stand-alone, web-based Geographic Information System (GIS) as a dashboard on a desktop or mobile device (Figures 3). In addition, alerts may be sent via email and text messages.

Figure 1: UtilAlert™ device

Figure 2: Device installation locations

Figure 3: Desktop & mobile compatible dashboard

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FIBER OPTIC SENSOR MONITORING OF PIPELINE INTEGRITY

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ABSTRACT

Pipeline monitoring is an economically viable approach in asset integrity management to proactively capture signs of possible significant incidents due to pipeline anomalies, geohazard events or third-party intrusion. PG&E and its partners started pilot deployment of fiber optic sensor systems to monitor pipeline assets focusing on underground storage well casing integrity monitoring as well as pipeline strain monitoring under geohazard conditions. A full-scale strain sensitivity and fiber-to-pipe attachment lab test verified effectiveness and robustness of the specifically designed distributed fiber optic sensor system to be deployed at an upcoming transmission pipeline fault-crossing mitigation project.

OVERVIEW

Fiber optic sensor technology takes advantage of optical fiber's highly sensitive response to the associated temperature, strain, and vibration. When light travels through an optical fiber, majority of it travels through, but a small fraction is backscattered at every location. A special interrogator receives the backscattered signals and converts them to physical quantities along its length for long distances. The system can provide up to thousands of 'strain gauges,' 'thermo-couples' or 'accelerometers' with a single low-cost fiber optic cable. The technology is immune to radiation and electromagnetic interference as a passive sensor not relying on a power supply outside of the interrogator location. The optic fiber material is relatively inert and can be ideal for long-term monitoring.

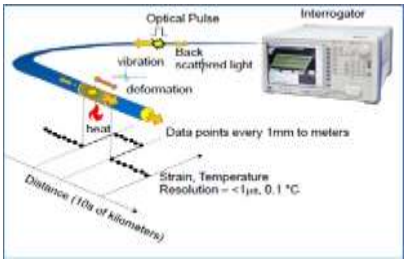

Figure 1: Distributed Fiber Optic Sensor System

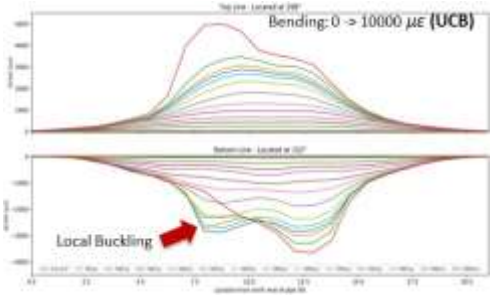

Figure 2: Device installation locations

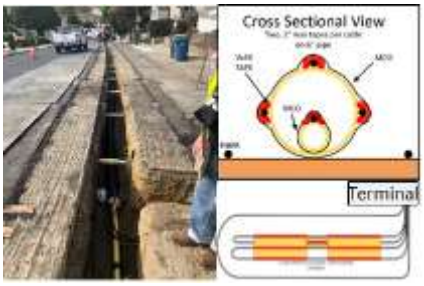

Figure 3: 1st Pilot Deployment on a MDPE cased Distribution Main at a Fault-Crossing Site

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3D MAPPING OF BURIED PIPELINE ASSETS

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ABSTRACT

PG&E and Bakhtar Research & Engineering LLC partnered to develop and field testing of an innovative, low-power Forced Resonance Imaging (FRI) technology that can detect and 3-D mapping of buried metal or non-metal pipeline facilities beyond limitation of the currently known locating technologies. Its architecture based on BakhtarRadar platform that was originally developed for landmine and unexploded ordinance detection, successfully demonstrated feasibility for detecting buried pipelines under different soil coverage conditions in the past. The newly developed prototype for pipeline specific applications - Bakhtar Pipe Detector (BPD) will start field testing at PG&E service territory as well as possibly few sites at SoCal Gas service territory from Q2 2021.

OVERVIEW

This technology utilizes ability of targets' absorption of RF energy in certain frequency bands as a means of determining its presence. RF energy is transmitted at a very low power level and interrogation of the test bed is done through "forced-resonance" with presence of the embedded target displayed through realization of intensity of backscattered energy signature. The approach uses a frequency agile RF non-linear waveform which steps MHz frequency range sequentially, during a transmit sequence or "trace." The proprietary designed transmitting and receiving antennas are impedance matched to near and far fields depending on the applications. The transmitter and receiver are low noise designs enabling energy transmission loss due to the energy absorbed by embedded target to be detected.

Figure 1: BakhtarRadar

Figure 2a: A Job Site with 2 steel Pipelines

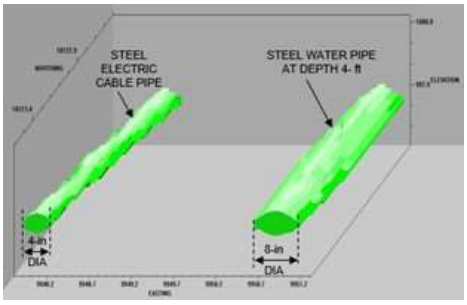

Figure 2b: 3-D Image of the 2 Detected Steel Pipelines (oblique radar cross-section)

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MOBILE AS-BUILT SOLUTION IN THE NATURAL GAS INDUSTRY USING REAL-TIME GIS, GPS AND BARCODE SCANNING

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ABSTRACT

The Mobile As-Built solution is the result of collaborative R&D efforts across the industry and integrates tools adapted to the Gas Pipeline construction process that provides a complete digital as-built package that includes forms, stamps, reports, BOMs, and high-accuracy GPS maps that meets PG&E's as-built standards.

The solution provides improved location accuracy and materials traceability of our assets through high accuracy Global Navigation Satellite System (GNSS) receivers and barcode scanning and supports the end-to-end paperless data management up to the system of record reducing delays, inaccuracies and errors.

The solution was initially deployed with Gas Construction in northern California in 2019 and currently has been utilized throughout PG&E's service territory recording electronically the installation off over 45 miles of gas mains and eliminating the associated paper documents.

OVERVIEW

The Mobile As-Built initiative implements a novel solution that leverages newly developed hardware and software components to capture GPS coordinates and industry standard material traceability barcodes of newly installed plastic distribution assets. The assets are associated to mobile forms generated from the application to eliminate the need of red-lining paper as-designed documentation. The solution utilized in the field comprises of a survey pole, barcode scanner, and GIS application installed on a mobile device (Figure 1).

PG&E has installed various Real-Time Kinematic (RTK) base stations (Figure 2) throughout PG&E's service territory that provide references to adjust GNSS coordinates from higher atmospheric variations that affect the time of flight of the GNSS signals in real-time to meet our high accuracy GPS requirements. The RTK base stations have been created to share the network with various workstreams and workflows utilizing GPS technology (e.g. GNSS locators).

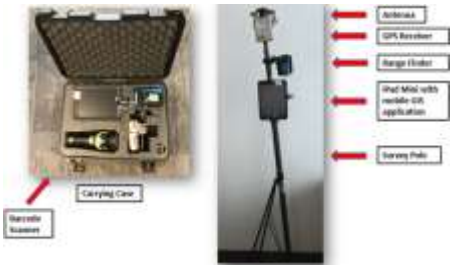

Figure 1: Hardware

Figure 2: Base Station Set-U