NGA NORTHEAST GAS ASSOCIATION
NYSEARCH

Technology Brief

Evaluation of GeoLocation & Pipe Damage Assessment Applications

Description: **Develop and test an above-ground, self-contained measurement system to detect steel anomalies on transmission pipelines.**

Status: **Feasibility proven. Ongoing development of the measurement system and technology.**

BENEFITS

As more stringent regulations are designed and released to address improvements to pipeline safety in an effort to reduce the frequency of pipeline failures, an increased focus has been placed on pipeline inspection, data acquisition, and analysis to increase safety. The benefit of this project is to provide an optimized system to perform ground-based damage assessments of buried steel transmission pipelines with minimal time spent and maximum survey-data analysis to identify potential areas of pipeline deterioration. Identification and remediation of steel transmission pipeline anomalies increase pipeline safety thereby reducing the frequency of pipeline failures.

BACKGROUND

One of the priorities identified by the NYSEARCH consortium has been the location, inspection, and identification of anomalies on buried steel pipe. The natural gas industry inspects buried steel pipelines to detect anomalies such as corrosion, dents, cracks, holidays, etc. Over the years, gas utilities have been developing technology to deal with these issues, and while substantial progress has been made, improvements are still needed to efficiently locate and detect corrosion and damage to pipelines. NYSEARCH identified Skipper NDT as a leading developer of GeoLocation and inspection technology to address this priority.

In 2017, Skipper NDT launched an R&D program to work towards creating an innovative, efficient, and effective way to locate and inspect buried steel pipelines remotely. Skipper NDT has patented a potential solution for transmission pipeline GeoLocation assessment via an Unmanned Ariel Vehicle (UAV a.k.a drone) or a Ground-based Mobile Cart.

The technology is based on remote surface surveys using magnetostatic measurements. The Earth's magnetic field induces a secondary magnetization in the pipeline, which can be detected at the surface. The Ground-based Mobile Cart is equipped with arrays of triaxial flux-gate magnetometers across the pipeline trajectory. These promising results motivated Skipper NDT to pursue further technology development related to detecting anomalies in buried steel transmission pipelines.

Figure 1: Ground-based Mobile Cart

TECHNICAL APPROACH

In 2019, in conjunction with the Ecole et Observatoire des Sciences de la Terre (EOST), Skipper NDT began working on a new complementary survey method using an active magnetostatic source. The resulting development efforts, covering the initial concept through early research, proved that the

The objective of this project is to develop and test an above-ground, self-contained measurement system to detect steel anomalies on transmission pipelines. The starting point of this project was to utilize the proven hardware previously developed by Skipper NDT as features for this project. Additionally, the evolved design was integrated onto the previously built test bench. The measurement system resides on a vertically moving platform in the tower to scan at various heights along a sample pipe.

Figure 2: Test Bench with Movable Tall Tower

The new design was initially conceived as modular to accommodate design changes and upgrades. The rectangular-frame coil is mostly a mechanical design that is embedded into the tower rack and will later be self-contained, easy to manufacture, and installed into a field-worthy system. The source-current power supply is mostly an electronics design that will be upgraded in several steps to a fully automated system. The positioning and data-acquisition system is already proven and will be used for further developments.

The current-supply for the active source coil was developed separately from the actual coil. The sensor array and positioning system did not require any modifications from the previously developed system. The current-supply electronics were designed as a very simple circuit with three submodules; a power supply, current measurement, and mode-control cascade-switching array.

Concurrently during development, NYSEARCH hosted a field test utilizing Skipper NDT's UAV platform near Norwich, NY in NYSEG service territory. This demonstration survey showed the efficiency of the technology to remotely determine the pipeline position in field conditions. This system conducted magnetic measurements over buried pipelines and provided an accurate 3D position of the pipelines.

PROGRAM STATUS

The active source system was developed in two independent modules: an active source with its frame and connector cables and a source-signal generator. The data acquisition protocol and instruments from the passive-survey system with the magnetometers and the positioning system were successfully used, the test bench was realigned, and the positioning system has been optimally integrated with the newly realigned test bench.

A series of measurements were taken on an actual 6" pipe exhibiting corrosion utilizing the newly designed system and the results were encouraging. Overall, the development of the active-source survey system is progressing according to schedule. The current design serves to completely replace the functionality of the measurement system from EOST and improve its shortcomings.

Highlights

- Successfully field tested the GeoLocation technology via UAV.
- Early-stage test results show the technology can detect corrosion.

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