NGA NORTHEAST GAS ASSOCIATION
NYSEARCH

Technology Brief

sUAS (drone) Inspection of Submerged Pipe

Description: Develop sUAS technology to perform enhanced leak detection surveys and mechanical integrity inspections for submerged gas pipelines.

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

BENEFITS

NYSEARCH has made investigation of technology to improve leak detection surveys and integrity inspections a research priority. NYSEARCH has invested considerable resources developing sUAS technology applications for enhancing traditional inspections and surveys. Expanding development of sUAS technology into assessing submerged gas pipelines would further the practical capability.

BACKGROUND

Continuing testing activity in the sUAS program expands applications and confirms that the gas industry can take advantage of the enhanced capabilities of these small remotely controlled platforms and sensors for routine and emergency surveys and inspections.

Phase I of this project focused on submerged pipe applications and tested multiple sUAS, barge and submersible drone configurations. A variety of sensors were evaluated, tested, and either rejected for not satisfying measurement criteria or accepted for further incorporation into mounted positions on the specific drone platform. Initial operational controlled laboratory and field testing were performed to develop operability movement and patterning.

Initial testing of capabilities for identifying and measuring leaks from submerged pipelines included testing sensors considered capable of differentiation between methane-only biogenic sources with methane/ethane thermogenic gases (pipeline gas mixture) to confirm gas origination. It was suspected and confirmed that both sources of gases coexist near one another and must be distinguishable during a leak survey.

Initial testing for pipeline integrity assessments explored tactics for using drones to perform cathodic pipe inspections on submerged pipe by collecting close-interval-survey (CIS) measurements underwater. An array of half-cells was affixed to an underwater drone platform to collect CIS readings with a data logger.

The results of the Phase I project, with its related and active predecessor project M2019-003 *Expanding sUAS Technology Assessment for Data Analytics and Advanced Sensing,* have demonstrated that multiple remotely operated platforms of airborne sUAS, water surface barges, and underwater submarines incorporating various sensors, effectively perform leak survey and pipeline integrity inspection on submerged pipelines.

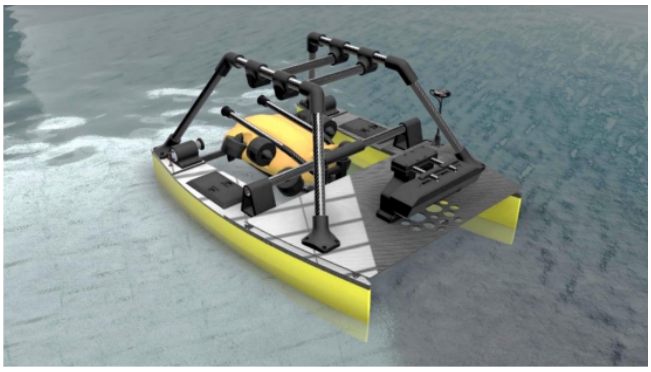

Figure 1. Surface barge transporting and launching submersible diving tool, ROV.

TECHNICAL APPROACH

The objective of this project is to develop technology to perform enhanced leak detection surveys and mechanical integrity inspections for submerged gas pipelines. The previous phase of the project provided full development and conformation of the platforms, sensors, and operating procedures.

The goal of the current phase is to advance and optimize the configuration of these remotely operated platforms, sensors, and field survey and inspection processes, so that they can be adapted within a pipeline operator's integrity management protocol or

adopted by their commercial service provider performing leak surveys and pipeline integrity inspections.

EagleHawk, the selected contractor, is addressing three (3) additional tasks to achieve the goal of advancing the configuration of these remotely operated platforms, sensors, field surveys, and inspection processes. At the outset, the first task was to select the optimized drone platform configuration based on laboratory and field testing conducted during the previous phase. This task included optimization of sUAS, barge, and submersible remote operated platform (ROV) with specific instrumentation.

Figure 2. Submersible pipeline inspection.

After selecting the appropriate technology, three (3) funder field test locations were identified and performed for final modification to the hardware, software and operating instruments. Optimizing the flight pattern during the survey or inspection allows the broadest application of data capture. It also enhances post processing of survey and inspection results, such as color-coded leak detection measurements superimposed on maps and related heat maps of gas plumes.

Each field test was reviewed and evaluated for possible lessons learned for improvements to the platform configuration and operating instruments. Summary documentation detailing the required hardware, software and flight controls for the funder, or their commercial drone service provider, to use to implement the technology within their company protocols is being provided.

Final deliverables include providing a final sensor and platform configuration for the sUAS, barge, and ROV to achieve reliable inspections and survey results leading to readiness for funders and operational procedures.

PROGRAM STATUS

As Phase II is nearing completion, EagleHawk has narrowed down the most effective sensors, sUAS/barge/ROV applications and test procedures. In the last tasks, additional development and testing is providing final field test confirmation of the processes that are ready for commercialization.

Highlights

- Documentation including the required hardware, software, and flight controls for program implemenetation have been prepared and will be available for funders.
- Multiple remotely operated platforms of airborn sUAS, water surface barges, and underwater submarines (ROV), equipped with sensors, effectively perform leak survey and pipeline integrity inspections on submerged pipelines.
- Corrosion assessment on submerged pipe and close interval survey (CIS) technique performed from the barge and ROV platform are under test.

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