

2019 COLUMBIA GAS OTD PROJECTS

Gas Operations R&D Projects

Black Box Reference Device Enhancements, Phase 3

Phase III work will support the continual development of necessary system performance aspects of the Excavation Encroachment System (EEN) and the commercialization activities. In previous phases, the EEN components have been successfully developed into a near-commercial product requiring focus on maintaining system performance, enhancing the software platform and building robust access to the historical data.

EMAT Sensor for Small Diameter and Unpiggable Pipe, Phase 3 – Prototype and Testing

To develop a bi-directional electromagnetic acoustic transducer (EMAT) sensor that can be used to assess small diameter and unpiggable pipelines containing reduced diameter fittings and other restricting features. Phase 3 focuses on prototype and testing based on the success of the bench-scale prototype sensor developed in Phases 1 and 2.

EMAT Sensor - Measure Remaining Wall Thickness Phase 1 and Phase 2

Develop an EMAT wall loss sensor optimized for use on corroded surfaces. First, develop a method to significantly reduce the measurement foot-print size of the EMAT transducer without a significant loss of measurement sensitivity. Second, develop new electronics and implement specific modifications to the EMAT system to minimize what is known as ring-down or dead-time. These two improvements when combined, will broaden the application of EMAT to the industry and bring no-couplant, high-resolution ultrasonic wall measurement capability to existing as well as a wider variety of NDT applications.

Validating Non-Destructive Tools for Surface to Bulk Correlations of Yield Strength, Toughness, and Chemistry, Phase 2

Facilitate the use of non-destructive surface testing: micro-indentation, micro machining, in situ chemistry, and replicate microscopy analysis as accurate, efficient, and cost-effective tools for material property confirmation. This work will provide benefits to pipeline safety, energy continuity, and integrity assessment programs since these techniques do not require a line to be taken out of service and do not destructively cut out samples from the in-service pipeline.

In-Field Compliance Validation

Perform automated validation of field collected data during construction to ensure that all data required for regulatory compliance is captured. This validation will be performed in real-time to identify any gaps while in the field to allow issues to be addressed immediately before the asset is put into service and the project is closed-out. Further, the proposed solution will validate specific material properties and test results to ensure that results support the specified MAOP.

Develop a Long-Term Enhancement of Direct Assessment (DA)

Provide a technically justifiable, augmented method to retain Direct Assessment (DA) as an acceptable integrity assessment process for pipeline segments in light of pending DOT/PHMSA Notice of Proposed Rulemaking (NPRM) regulations. This could include process improvements, complementary inspection additions, and statistical analysis of assessment data – all applied to current DA practices. Focus is on pipeline segments not conducive to a sub-part J pressure test, hydrostatic spike test, and/or in line

inspections (ILI) at this time. This project will likely examine External Corrosion Direct Assessment (ECDA) with other DA processes like Internal Corrosion and Stress Corrosion Cracking being addressed through potential follow on efforts.

JIP Plastics Collaborative - Continuation

The current Plastics JIP program is comprised of representatives from all stakeholders that focus on addressing the plastic systems gaps in R&D and standards development needed to enhance the design, installation and operation of plastic gas distribution systems and the development and publishing of best practice guides. This effort requires broad participation by all stakeholders and subject-matter-experts. It also takes time and adequate funding, and has proven to be truly effective in enhancing the overall quality of plastic piping systems. The JIP participants have established a roadmap and prioritize tasks. The continuation of this important program will allow the continuation of the current efforts and also identify new priorities to be addressed.

Structured Light Scanning Tool for Distribution Pipeline Inspection

Advance the development of a structured light scanning tool for internal inspection of plastic and metallic pipes. Establish a road map with involvement of the technology developer and a potential commercial partner to continue the initial work developed under the PHMSA project for inspection of vintage plastic pipes.

GPS-based GIS Conflation System, Phase 3 - Pilot Project

Develop and demonstrate a real-time GPS-Based GIS Conflation System to increase the accuracy of a GIS using GPS data collected as part of routine operations. A process called conflation is used to shift the geometry stored in the GIS database to match the GPS coordinates of assets collected with high accuracy equipment. This Phase 3 project will focus on increasing awareness of GPS-based conflation as a process that is available to Gas Utility companies.

Tracking and Traceability for Transmission: Steel Pipeline Material Traceability and Pilots

Develop an approach for enhancing and streamlining the traceability of steel assets used in the natural gas pipeline industry. The project will test and evaluate a prototype system that will be deployed in a test environment with a selected group of project participants. The ultimate goal of the initiative is to provide an industry standardized traceability process that can be used by any operator, pipe mill, coating mill, and distributor to transfer and receive asset traceability information.

Pipeline Steel Material Traceability JIP-Demos and Phase 2, Components

This Joint Industry Project (JIP) is proposing to develop an approach for enhancing and streamlining the traceability of steel assets used in the natural gas pipeline industry. The goal of this program is to develop an industry standard protocol that will be incorporated in API 5L to allow operators to reference the protocol through purchasing specifications. The objective of this Phase 2 project is to further develop the EDI protocol that was developed in Phase 1 to also include steel components, valves, and fittings.

Cybersecurity Collaborative - Phase 2

Continue the successful efforts of the Collaborative between OTD and the Department of Homeland Security (DHS) which is a 50% co-funder. The collaborative addresses high priority cybersecurity issues using a multi-year coordinated process focused on the development of an outreach and education process and a technology evaluation and transfer initiative.

Evaluation of Meter Set Placement and Clearances, Phase 2

Provide utilities with knowledge and data to assist in meter set placement options and potentially support changes to applicable guidelines. Phase I provided clearance distances from various house openings and sources of ignition to leaking meter sets and regulators. This phase of the project will perform additional tests with more arrays of sensors to address specific regulator leaks and meter settings that utilities encounter at their service areas.

Remote Emergency Main Shutoff, Phase 2: Stopping Off L.P. Mains with No Excavation

Develop an effective Remote Emergency Main Shutoff (REMS) system that will isolate large diameter, low pressure main lines without the need to excavate. This will greatly reduce LDC response time in emergency situations. Phase 1 of this project successfully tested a process of remotely shutting off 6" and further work has been identified following the tests for 20" mains. This project will refine the concept and make it field ready.

ORFEUS Obstacle Detection Technology for Horizontal Directional Drilling, Phase 2

Produce a field-proven, market-ready, obstacle location technology for use in horizontal directional drilling (HDD) applications. ORFEUS (Optimized Radar to Find Every Utility in the Street) is an effort aimed at developing a safe, cost effective "look-ahead" obstacle detection system for HDD equipment. The ORFEUS effort is conducted by a collaborative organization of multiple companies to develop a prototype that has been field tested, both in Europe and the US. This project seeks to further develop the technology to bring forward a commercially viable product for identifying obstacles in and around the path of a HDD drill rig, therefore, reducing third-party damage to underground utilities.

Material-Supplier Quality Assurance Program

Assist gas utilities in creating best practice guidelines to develop and manage a material-supplier quality assurance program, create a standardized approach to key processes affecting the quality of materials used by the gas utilities, and identify and select comprehensive regulatory and technical requirements specific to products utilized in natural gas transmission and distribution systems.

Spray-On Leak Seal for Meter Set Joints

Identify possible spray-on or brush-on solutions to seal thread leaks on meter set assemblies (MSAs) and conduct a thorough evaluation of the various identified systems. The evaluation effort is to establish ease of use and permanency of the identified sealants.

Advanced Cross-Bore Detection Using Visual and Sensing Technologies

Develop a new to the industry inspection system which combines visual and sensing technologies (e.g. mechanical spring, radar, ultrasound, etc.) to remove the human element and uncertainty from the cross-bore detection process. The proposed solution will be designed to tackle the worst-case scenario; drilling which requires fluid that makes visual inspection impossible. The finished product will be a solution comprised of both hardware and software that can be used to detect potential cross-bores regardless of the bore slot conditions.

Insertable Excess Flow Valves (EFV) for Existing PE Service Lines

Conduct a review of insertable EFVs currently on the market suitable for existing PE natural gas service lines. A reference will be developed including operational parameters, insertion techniques, and other considerations.

Minimum Recovery Time from PE Pipe Pullback

Develop guidelines to understand and predict the recovery time of PE pipe after pullback during trenchless installations such as horizontal directional drilling (HDD) or split & pull.

In-Service Welding Qualification Test Rig Guidelines

Develop a construction guide for the in-service welding test rig to assist gas utilities in the qualification of welders according to the American Petroleum Institute (API) Standard 1104 Appendix B. This appendix refers to in-service welding procedures and qualification testing. As the standard refers to branch and saddle welds, the test rig will also incorporate qualification testing of weld deposition repairs.

Advanced Metering Infrastructure (AMI) Communications Protocols

Investigate recent developments in Advanced Metering Infrastructure (AMI) communication platforms. Several major AMR/AMI vendors have recently endorsed open communication protocols. An industry group, Wi-SUN (Wireless Smart Ubiquitous Network) Alliance, was formed to curate these standards. The output of this project will be a whitepaper that describes the current state of the art of various AMI platforms and field-based network technology standards such as those developed within the Wi-SUN Alliance. GTI and utility operators may use the study's findings to identify vendor solutions that truly are interoperable and offer standard interfaces between disparate utility systems, thereby maximizing return on investment from their AMI system.

Low Cost Non-Corrosive Anodeless Risers

Perform a gap analysis between anodeless risers that are currently on the market and the project sponsors' needs for an enhanced anodeless riser. Following an analysis of the gaps, GTI will discuss with the sponsors how to work with anodeless riser commercializers towards producing an improved low cost and non-corrosive anodeless riser.

Improved Tools to Locate Buried Pipelines in a Congested Underground

Mitigate third-party pipeline damage and cross bores at the earliest stages through the development and commercialization of a geospatial probe to map existing buried utilities by being inserted inside of a live gas pipeline. This probe will be capable of mapping live underground pipes 3-dimensionally and give accurate locations of utilities. Additionally, a cloud-based data collection system will be created to effortlessly collect and store data, so it is easily accessible to the utilities.

Uniform Frequency Code

Create an industry standard, guideline, or best practice uniform frequency code for passive frequency tags/markers used to locate buried utilities. This code would establish a consistent frequency setting for markers based on their respective utility designation such as gas, electric, water, etc. Include establishing a set of frequencies based on the most popularly used settings in the industry today. Seek to publish a uniform code in the appropriate standards or other organization.

Performance, Durability, and Service Life of Residential Gas Regulators

Determine the durability and expected service life of common residential natural gas service regulators. The estimated life will be based on a range of accelerated mechanical and environmental tests on new and field-extracted regulators. Utilities can include service life predictions as a basis for their residential regulators' replacement plans.

Abandoned Line Detector

Create a nondestructive tool that when placed on the exterior of an exposed pipe will determine if the pipe is abandoned or in-use. With the help of multiple on-board sensors, the tool will identify if natural gas or live electrical lines are present within the pipe. The tool will work on both metal and plastic pipes.

Noncamera-Based Technology to Detect Cross Bores

Develop a tool to detect legacy cross bores. Focus on identifying viable non-camera technologies and evaluating prototypes which can lead to the development of reliable and cost effective cross bore detection tool for legacy transections.

Clothing Performance Guidelines to Reduce Heat Stress for Natural Gas Workers

Establish guidelines for selecting workwear ensembles that will provide reduced heat strain and worker comfort in operations conducted in hot conditions. Thermal comfort and heat stress are significant concerns for outdoor workers in the natural gas industry. This project will use modern laboratory tests, including advanced sweating manikins and controlled climate human physiological wear studies. Also, the project will provide a technical foundation for developing work/rest cycles for operations that require workers to wear flash fire suits and other protective equipment in thermal stressing conditions.

Thermally Activated Gas Shut-Off Devices

Conduct a requirements review and performance tests of commercially available thermally activated gas shut-off devices for the industry. These devices will prevent or reduce the escape of gas in the event of a fire at a customer's premise. This review will identify manufacturers and installers of this type of shut-off device. Also, develop a reference document of the operational parameters and other considerations.

Virtual Reality (VR) Training: Emergency Response Situations and VR Library

Introduce virtual reality (VR) as a training tool and demonstrate the value that this type of training brings to the natural gas industry. VR training, or "learning-by-doing", has one of the highest retention rates of all teaching styles and is an adult learning technique. As part of this project, a VR emergency response training module will be developed that can be used and if needed, customized by all project sponsors. The VR emergency response training scenarios may include: Communication between first responders, Eliminating sources of ignition, Performing leak investigation, Evacuating and ventilating premises, Responding to injuries, deaths, fires, explosions, and third-party hits on gas facilities, Making the scene safe, Working with tools and equipment, and Other scenarios identified by the project sponsors.

Pipe Thread Sealant Performance

Evaluate the performance of pipe thread sealants used to lock and prevent gas leakage on metal piping and fittings. This evaluation will include conducting performance tests on the effects of vibration, pipe movement, changing pressures, and changing temperatures. Also, identify thread sealants that resist non-hazardous leakage when exposed to varying combinations of pipe size, pressure, and temperature changes; movement; and general environmental conditions.

Single Path Meter Testing (Sensus and Itron)

Conduct the necessary evaluations of recently introduced Sensus and Itron (and potentially others) "Single Path" Ultrasonic residential meters for utility and State Commission acceptance. This effort will prove the measurement performance and accessory meter technology to allow the use of this style of meters by LDCs.

Evaluation and Demonstrations of the Utonomy Smart Regulator

Conduct a technical evaluation and North American field demonstrations of the Utonomy Smart Regulator for medium and low-pressure gas distribution systems.

Vintage Polyethylene Pipe Squeeze-off – Best Practices

Provide gas utilities with specific guidelines and best practices for performing squeeze-offs on vintage polyethylene pipes and also provide methods to maintain the life of the squeezed pipes.

Over Pressure Protection Options for Low Pressure Gas Distribution

This project will identify and evaluate overpressure protection options available within the industry for low-pressure gas distribution customers. Also, this project will engage gas pressure regulator manufacturers on possible R&D efforts to enhance current designs to meet industry needs. For example, increasing flow capacity, having the ability to regulate minor over-pressure fluctuations, and minimizing the pressure differential through the device. In addition, a reference guide will be created for LDCs to use when considering which type of over-pressure protection option to install on the end of low-pressure service lines to improve overall system integrity.

PRCI Membership

Provide labor and travel support in 2018 for the PRCI membership by OTD. This work is associated with keeping the OTD funders of the project informed about the projects they are funding. OTD will be represented at the PRCI Technical Committees and Board-level Executive Assembly meetings. There are many PRCI projects that complement OTD projects and this project will enable coordination and participation.

Quality Audit Program

Provide natural gas utility operators with a mechanism to collaboratively audit supplier's quality management systems. Conduct an independent and unbiased assessment of industry suppliers in order to improve the overall quality and integrity of the natural gas system. The program was created to streamline and enhance the Gas Utilities' audit processes and make it more efficient.

Remote Gas Sensing and Monitoring Phase 4

Perform field demonstrations of the prototype system that was developed during Phase 1. This will allow the sponsors to work with the prototype and to provide feedback. This feedback will be shared with a prospective manufacturer. The goal of these activities is to provide definition to the form the commercial system will take. The objective of the overall project is to develop systems to allow a leak investigator to remotely monitor methane levels at multiple points within a site under investigation. The investigator uses a tablet, phone, or other connected device to see the gas values in real time.

Leak Detection and Repair Modeling for Distribution Systems, Phase 2

Develop the open source Fugitive Emissions Abatement Simulation Toolkit (FEAST) model to evaluate distribution leak survey practices and technologies. Phase 2 will focus on further optimizing the FEAST model for walking surveys, expanding the use case scenarios, and exploring web-based deployment of the model.

Best Practice for Venting a Building

Investigate natural gas leak and hazardous situation venting best practices and examine procedures that are currently in use by both utilities and emergency responders as well as identify additional means of evacuating gas from buildings. In the event of a residential gas leak, the gas that is present inside of the building should vent in the safest way possible.

Robot for Remote Methane Detection, Phase 1

Develop a remotely operated robot based methane detection unit to reduce worker exposure to potentially hazardous scenarios. This proposal (Phase 1) describes the development of a lab prototype to lay the foundation for remote methane detection inside structures via a remotely operated robot platform.

Drone Based Methane Detection – Phase 1 Preliminary Assessment

Identify unmanned aerial vehicle (UAV, drone) platforms that can be used by utilities to detect methane/leaks. GTI will evaluate the feasibility of using unmanned aerial vehicles (UAVs, drones) to detect distribution specific methane leaks. Several off-the-shelf UAV based methane systems are currently on the market, however, their applicability to distribution use cases is uncertain. In particular, most systems have focused on identifying large point leaks and may not have the sensitivity for use on distribution leaks. This project will be a Phase 1 feasibility study and technology evaluation with the goals of identifying existing UAV methane sensing technology that can be used by sponsors or of identifying a UAV methane sensing system that can be further developed for distribution applicability.

Evaluation of “Point and Shoot” Methane Detection Technologies

Test the effectiveness of laser-based “point and shoot” methane detection tools to identify leaks. Evaluate how well these instruments perform compared to standard handheld CGI type sensors for initial leak identification and how well they perform relative to each other.

Impact of RNG on End Use Applications

Determine the effects of trace constituents in Renewable Natural Gas (RNG) on end use applications. Information from prior projects and the technical literature will be leveraged in this project to evaluate the impact potential trace constituents may pose.

Trace Constituent Database

Create an on-line searchable database that will compile natural gas and renewable gas major, minor, and trace constituent concentrations along with sampling and measurement techniques. A potential home for the database is the Gas Quality Resource Center (GQRC) website and this will be investigated during the project.

RMD’s Sensor Drift and False Negatives

Determine if a Residential Methane Detector (RMD) that experiences a long-term exposure to low concentrations of methane will exhibit sensor drift resulting in a false negative alarm.

Remote QA/QC: Fusions, Phase 1.5: AI

Implement the capability to scan, decode, track, and store ASTM F2897 information within inventory management/warehousing software at the Gas Utility warehouse. Phase 1.5 builds on the potential functionality that was explored in phase 1.

Tracking and Traceability Marking Standard for Natural Gas Transmission Components - Phase 2

Enable the capture of key information required for physically documenting and geospatially modeling new or repaired gas transmission systems to support the latest PHMSA regulatory requirements. In order to achieve this, three major developments must take place: 1) Develop a machine-readable marking standard for all steel natural gas transmission system components. The marking standard would hold key information and allow the linkage of information required to support the latest PHMSA transmission tracking and traceability requirements. 2) Construct an automated field data collection processes linking the required manufacturers' inspection and test documentation, and support automated definition of each field-installed component in the GIS. 3) Gain the required industry acceptance for publication of the standard under one or more standards organizations.

GNSS Smart Automations for Field Data Collection

Increase the quality and consistency of location data collected using Global Navigation Satellite System (GNSS) receivers by automating certain steps of the collection process and reducing the burden on field data collection personnel. Produce a middleware software and hardware technology that operates between the user's existing GNSS receiver and existing field data collection smart device. The new technology will help ensure consistency and verify that quality thresholds are satisfied. Additionally, the technology will reorganize the collection process so that the field data collector is required to operate and handle fewer components during any given step.

Component Marking and Laser Etching Development – Phase 2

Improve the durability and readability of data carriers (intelligent marks) suitable for use on construction materials. While many data carriers (such as barcodes) are suitable for processing materials at point of sale terminals, the use of data carriers in the construction industry for field data collection is just starting. This project will research improvements in data carriers, including barcodes, RFID, intelligent coating systems, and embedded intelligent particles in the bodies of a construction component. The research will focus on data carriers that may be read by a machine during transportation, storage, and eventual incorporation into a network service delivery system or structure. Laser etching is one data carrier that will be tested in this project.

Microsoft HoloLens Platform Enhancement

Build off the ongoing SMP Project Holographic Computing in the Natural Gas Industry, define new capabilities to be built into the Microsoft HoloLens Platform that are specific for the Gas Industry, and tailor specific needs as identified by the Sponsors. This project will identify and potentially develop hardware to improve the usefulness of the Microsoft HoloLens in field situations.

Technology for 24/7 Leak Detection

Integrate a suite of existing technologies into a prototype 24/7 leak monitoring system. Make use of state of the art methane sensing, wireless connectivity, and web hosting technologies. Several use cases and the data requirements for continual monitoring will be investigated.

Structured Approach Incorporating Pipeline Safety Management Concepts into Existing Programs

Improve overall organizational safety by broadly implementing Pipeline Safety Management (PSM) concepts across existing programs and technology platforms used to support the activities of those

programs. Such an undertaking represents a significant change for any organization and could pose several challenges. Demonstrate how tools and techniques from the Business Analysis discipline can be applied to manage the transformation of existing programs for the improvement of pipeline safety management.

Utilizing Feature Class Representations in ArcGIS

Demonstrate tools within ArcGIS that will help utilities manage and maintain both spatially accurate GIS data, as well as cartographically appealing maps. Remove implementation barriers associated with incorporating high accuracy Global Navigation Satellite System (GNSS) coordinates into a GIS system that contains legacy geometries. For example, when GNSS data is collected and added to a legacy GIS, there is often a spatial offset between new and old data. Therefore, even though the new GNSS data is more accurate, data managers hesitate to add the new data because the positional offset creates confusion for anyone viewing the map cartographically.

Smart Phone Tools

Evaluate and rigorously test freely or inexpensively available smart phone apps which may serve as tools for increased safety or productivity for gas utility personnel. The focus will be on apps which the user can download and deploy themselves, rather than on expensive enterprise applications which require expert deployments and on-going maintenance. These include the types of apps employees may already be using without official recognition or accessibility from the company.

Augmented Reality (AR) O&M Procedures and Checklists

To identify and evaluate augmented reality (AR) software applications and hardware equipment (i.e., wearables and handheld) that can be used by field personnel within the natural gas industry to assist with performing operations and maintenance (O&M) tasks. The goal of this project is to demonstrate the value of this technology and identify intuitive software applications and hardware equipment preferred by the natural gas industry.

High-Accuracy Mapping of Leak Surveys

GTI will develop a framework to couple high sensitivity methane/ethane sensors with high accuracy GNSS systems for on-foot leak investigations and walking surveys. GTI will focus on real-time data visualization and compatibility with multiple methane/ethane detectors and GNSS devices.

Determining Data Quality Implications, Phase 2

Develop a methodology, implementation protocols, and case studies that will allow operators to: Construct a pedigree (i.e., data source and quality) analysis of their pipeline system database that quantifies gaps, consistencies, default value rationale, etc.; Calculate a "Health Index" parameter on their database entries at the individual data point and roll up to pipeline segment level; and Facilitate Risk Management activities by demonstrating how the Health Index can be used to prioritize Preventative & Mitigative measures, data collection, risk ranking, and unknown threat determination. Phase 1 developed a process for quantifying the impact that poor quality data has on the results produced by a utility's integrity management risk models. Phase 2 (this proposal) will enhance the current tool and automate key functions to reduce barriers to implementation.

Knowledge Management System, Phase 1

Develop a software system to manage the gas industry knowledge base of subject matter expertise, regulations, business processes, and best practices. The system will automatically read, infer, and connect related concepts from a variety of informational sources such as interviews, regulations, standards, project reports, surveys, etc. This system provides a single platform to improve transfer of institutional knowledge from retiring employees and subject matter experts to new employees. It also assists in improving the understanding of risk management and compliance initiatives for pipeline integrity, operational efficiency, and safety.

Modernize Tools to Assess Third-Party Damage Risk

Develop detailed procedures to modernize third-party risk assessment models by incorporating state-of-the-art physics models, detection techniques, data analytics, regulations, and data sources. The enhanced risk model(s) will bring the outdated variables, hypothesis, and formulas up to date and be flexible to include additional components if missing from the current models.