Current Research Related to Remote Sensing & Leak Detection

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Operations
Technology
Development

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Operations Technology Development (OTD) Overview

Stand-alone, 501c(6) not-for-profit, member-controlled company where gas utilities work together to develop technology solutions to common issues

- Membership dues based on number of customers
- New projects identified by members based on needs
- Each member votes own dollars to specific projects
- All members have access to all project information

25 member utilities

$10M annual dues

$150K–$750K member/yr

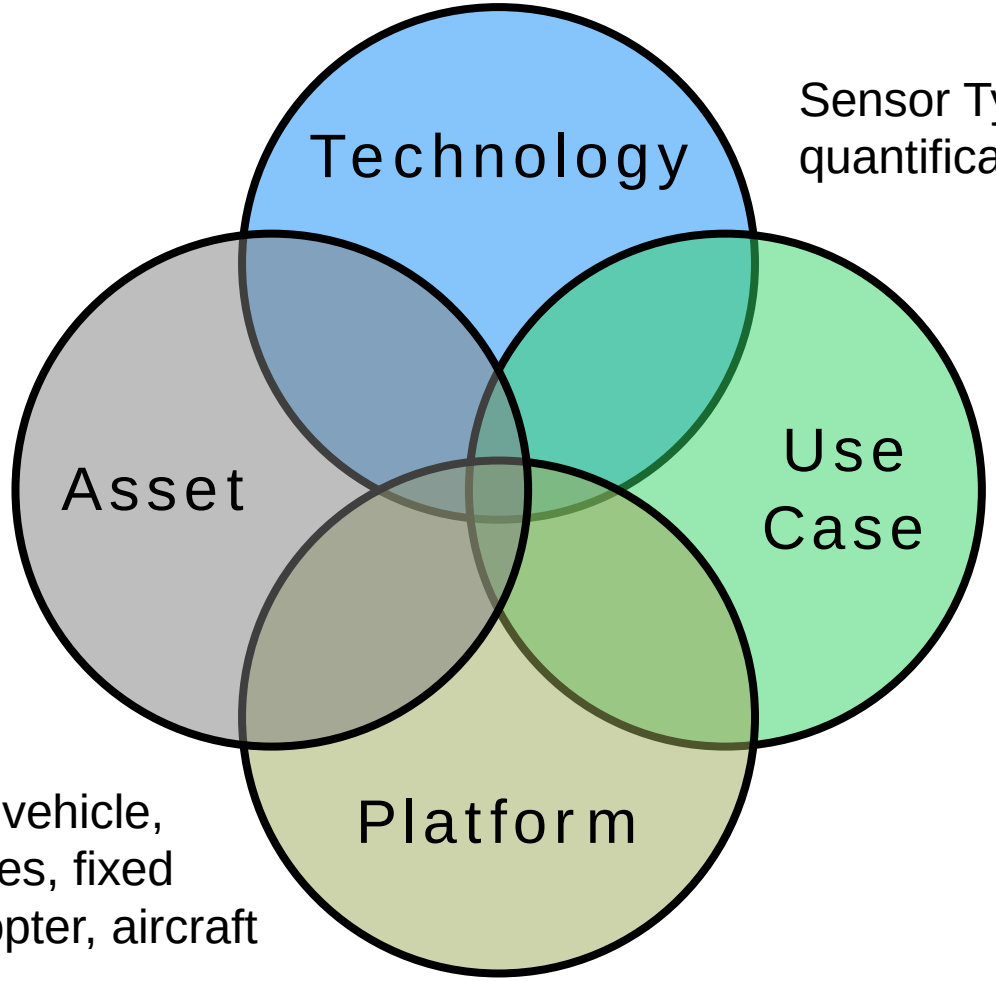
$0.50/ meter/yr

www.otd-co.org

OTD Operations Technology Development

OTD Member Companies

Remote Sensing and Leak Detection



Sensor Type, detection, quantification, measurement

Pipelines (transmission, distribution), above ground facilities, customer meters

Leak survey, monitoring, investigation, first responder, emergency response, GHG reporting

Hand-held, vehicle, UAVs, drones, fixed wing, helicopter, aircraft

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OTD Methane Detection and Measurement Projects

Technology Development

- 7.15.b Methane Sensor for First Responders
- 7.15.b Unattended Methane Monitor
- 1.14.d Leak Flow Rate Tool
- 7.18.c Robots for Methane Detection
- 8.18.e Technology for 24-7 Leak Detection

Technology Evaluation

- 1.14.g Residential Methane Detectors
- 7.16.f Methane Sensor Invest (BioInspira Eval)
- 7.16 b Gas Imaging Technologies
- 7.17.e Methane Tools for Leak Survey and Point Source Monitoring
- 7.18.d Drones for Methane Detection
- 7.18.f Evaluation of “Point and Shoot” Technologies

Modeling Leaks

- 7.17.a Leak Detection and Repair Model
- 7.15.c Leaks from Slow Crack Growth Study

Methodologies

- 7.16.a Leak Prioritization
- 7.17.d Soap Bubble Test for Meters

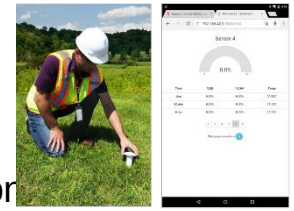
Measurement Studies

- 7.16.h DOE Project Co-funding (measurement of emissions from pipelines and industrial meters)
- CARB Projects: Quantifying Methane Emissions from Natural Gas Distribution Pipelines and Residential Customer Meters in CA

Leak Detection and Monitoring

TECHNOLOGY DEVELOPMENT

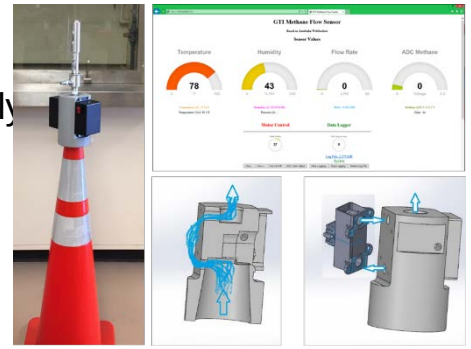
Methane Monitoring Tools For Utilities and First Responders



Network of remote sensors connect wirelessly for full situational awareness via phone or tablet. Provides information about natural gas concentration at multiple points at a leak site. Initial field testing underway on two form factors: (1) First responder use case and (2) Utility measurement use case (semi-permanent longer-range wireless access for utilities to assess and monitor leaks over time).

Field Tool for Improved Leak Measurement and Classification

Methane concentration does not tell the whole story. Utilities need a repeatable method to compare the leak rate and prioritize Class 2 & 3 leaks. Simultaneously measures CH_4 concentration, air flow, temperature, and humidity for improved quantification of leak classification.



TECHNOLOGY EVALUATION

Evaluating Gas Imaging Technologies

Gas imaging cameras are a tool that allows for the safe detection and identification of leaks as well as enable the quantification of leak flow rate, resulting in increased safety for customers as well as utility employees along with the quantification of environmental benefits associated with leak repair and/or pipe replacement programs. The project will investigate using gas imaging cameras for identifying and detecting leaks on buried piping systems as well as other gas facilities.

Advanced Methane Detection Technologies for Utility Operations

The adoption of these new advanced methane detection technologies can improve the ability to identify and locate leaks resulting in a more efficient leak detection and repair process. These technologies also have the potential for remote monitoring of target assets that may require frequent longer-term detection of methane. Broadening the tool box of methane detection devices will allow for more tailored leak detection methods resulting in increased safety for people and the environment.

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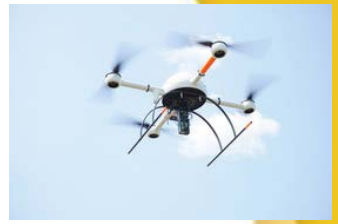
Leak Detection and Monitoring

Robots for Methane Detection

Having a remotely operated robot-based methane detection system can provide a safer method for investigating a leak when the potential for high/explosive methane concentrations exist inside of a structure. Knowing the methane concentrations profile within a building provides better knowledge about the leak event and allows for a more effective and efficient utility response. The project is developing a remotely operated robot based methane detection unit to reduce worker exposure to potentially hazardous scenarios.

Drone Based Methane Detection



With advancements in this space, methane detection systems are moving from hand held devices to mobile platforms such as vehicles and UAVs. 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.

Soap Test for Leak Rate Characterization

Utilities are moving towards characterizing leaks on customer meter sets, similar to pipeline leaks. This proposal seeks to evaluate a methodology to efficiently estimate the leak rate on an above ground distribution asset by using a soap test. This will allow operators to estimate emissions from meters in the field without the need for additional equipment.

Technology for 24-7 Leak Detection

The deployment of an automated system for continual leak monitoring would provide benefit in terms of resource allocation and scheduling. Personnel could be freed from some routine leak patrol activities. Information provided by the monitor can be used to target personnel activities where they are most required. To integrate a suite of existing technologies into a prototype 24/7 leak monitoring system. It will make use of state of the art methane sensing, wireless connectivity, and web hosting technology.

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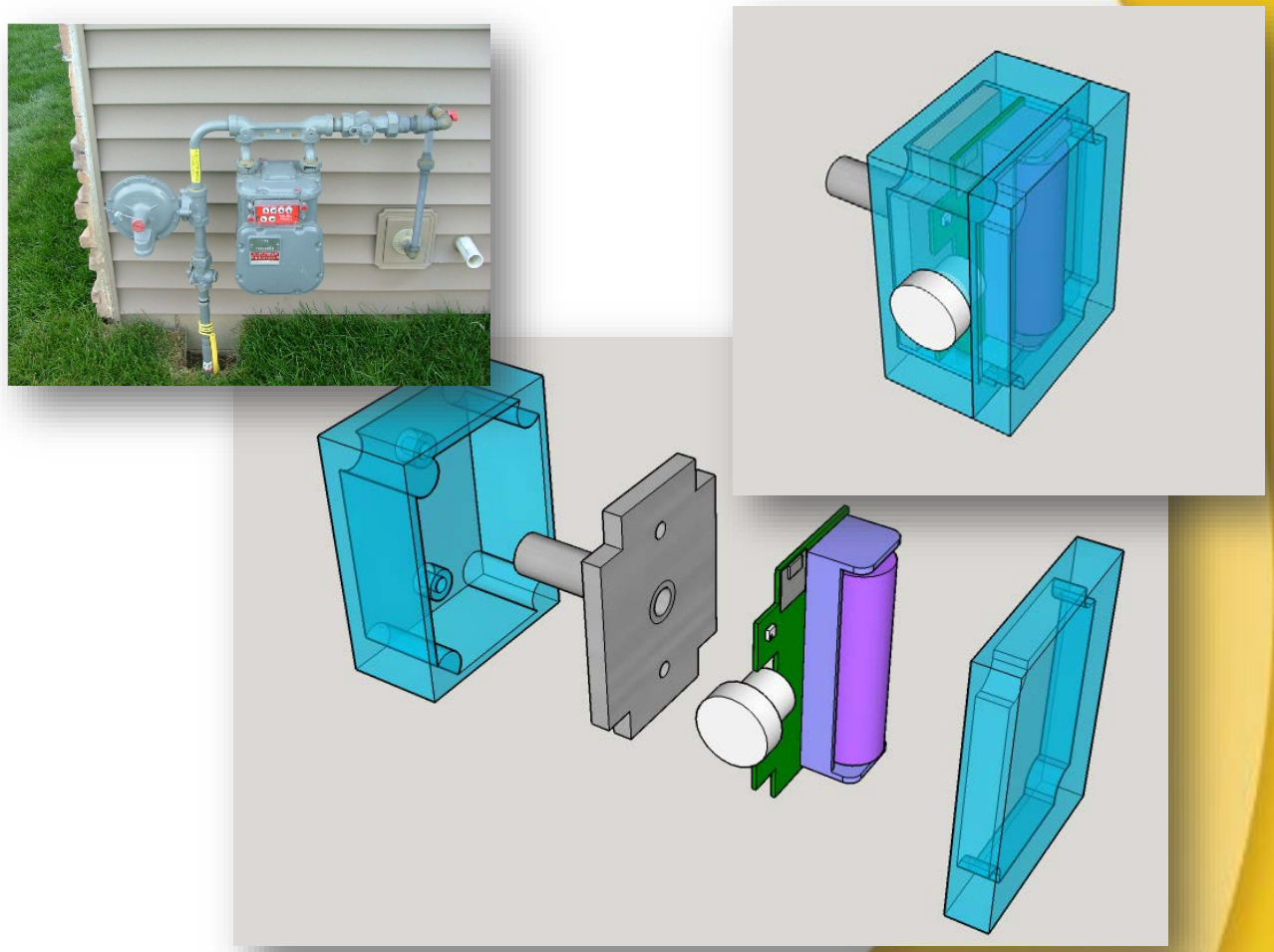
Exploring IoT Application: Remote Pressure Sensing

- Examine current IoT offerings with regard to monitoring applications for gas utilities
- Multi-year remote pressure monitoring
  - Star network topology
  - Single AA size battery
  - 8 year runtime without EH
  - 24 readings / 1 send per day
- Energy harvesting
  - solar / vibration / thermal



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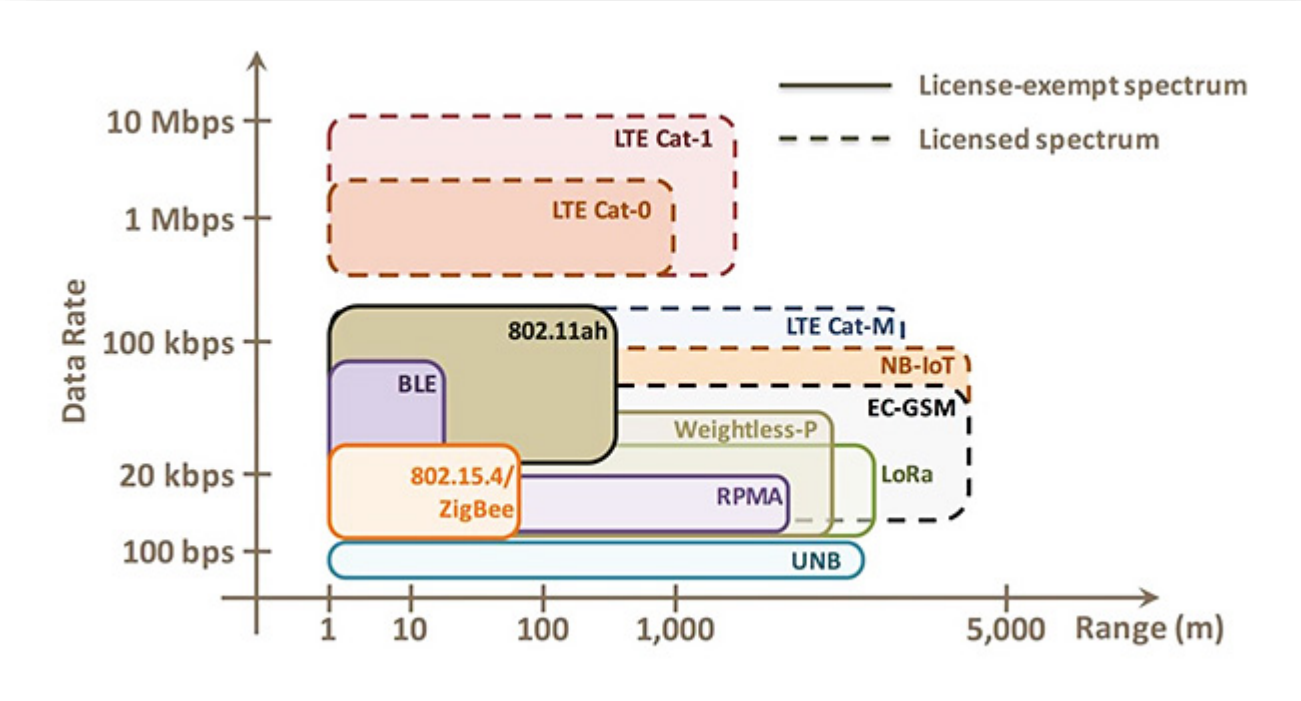
IoT Wireless Technologies

- Increasing LPWAN offerings
  - LTE carriers
    - LTE Cat-1,0,M
    - NB-IoT
  - LoRaWAN / Sigfox
  - Wi-SUN Alliance
    - 802.15.4g WPAN mesh
  - Bluetooth 5 mesh
  - LoRa mesh



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Other Applications of Remote Sensing: On-Line Biomethane Gas Quality Monitoring

- **Objective and Value**
  - Identify a technology that can monitory biomethane gas quality ***on-line*** for constituents that are not routinely monitored by on-line instruments but that are critical to gas quality, such as siloxanes, BTEX
  - Ensure safe incorporation of the new fuel gas into the gas stream
  - Results are instantly available instead of waiting days or weeks for an off-site laboratory analysis
  - Response to an upset condition could be immediate
- **Status/Next Steps**
  - Experimentally validate industry technologies ranked most promising in Phase I in detecting the unconventional contaminants found in biomethane

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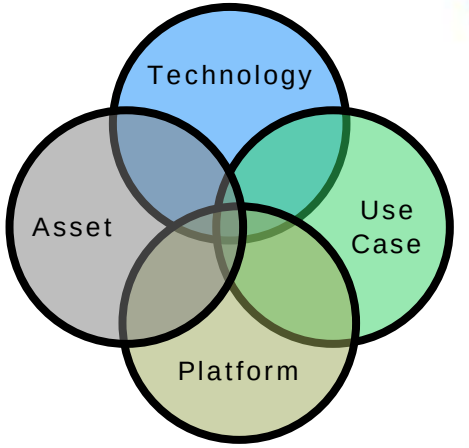
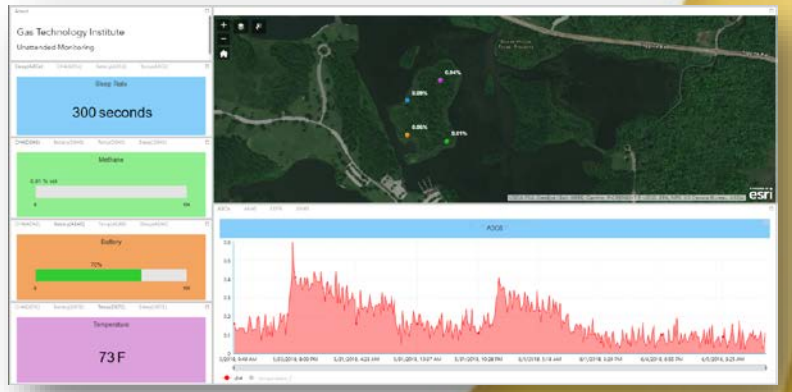
Needs and Challenges

- Real time monitoring, processing and display
- Multi-sensor platforms
- IoT integration into devices
- Networking and communication of sensors back to operators
- Data integration for risk/decision management
- Operational and deployment considerations
- Changing work practices





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Questions

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