GTI ENERGY

solutions that transform

2023 Pipeline Safety Research and Development Forum

2023 PHMSA Forum- October 31- November 1, 2023

Abigail Corbett, PhD

acorbett@gti.energy

We develop, scale and deploy solutions in the transition to low-carbon, low-cost energy systems

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SOURCE MAKE MOVE STORE USE

We work collaboratively to address critical energy challenges impacting gases, liquids, efficiency, and infrastructure

OTD Operations Technology Development

UTD Utilization Technology Development

GTI ENERGY ETP Emerging Technology Program

LCRI LOW-CARBON RESOURCES INITIATIVE

METHANE EMISSIONS MITIGATION STRATEGY

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AIM: To demonstrate **scalable** solutions that **accelerate** and increase the effectiveness of **operational** efforts to reduce methane emissions from natural gas systems this decade

- Develop and validate new technologies and operational practices
- Build and scale approaches in broad collaborations
- Hub for centralized data storage and analysis to provide suite of data solutions to operators and regulators
- Leverage digitalization and data capabilities to aggregate and anonymize data for use by academics, government research and industry efforts to accelerate mitigation efforts

VERITAS

PROJECT ASTRA

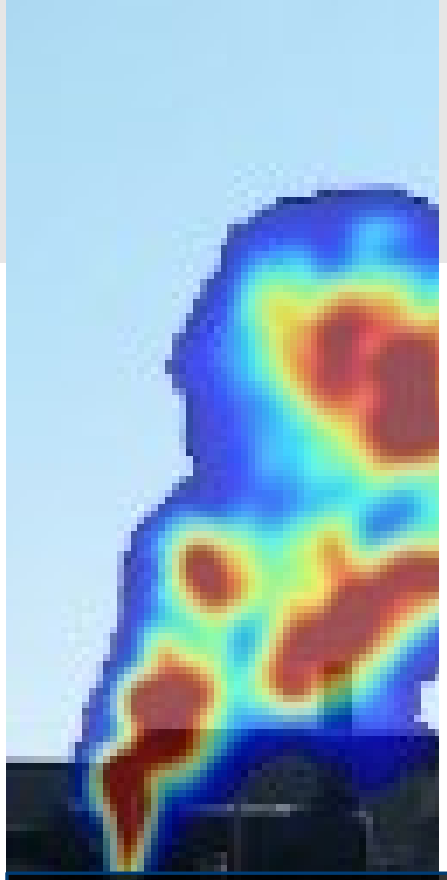
CH_4 COLLABORATORY TO ADVANCE METHANE SCIENCE

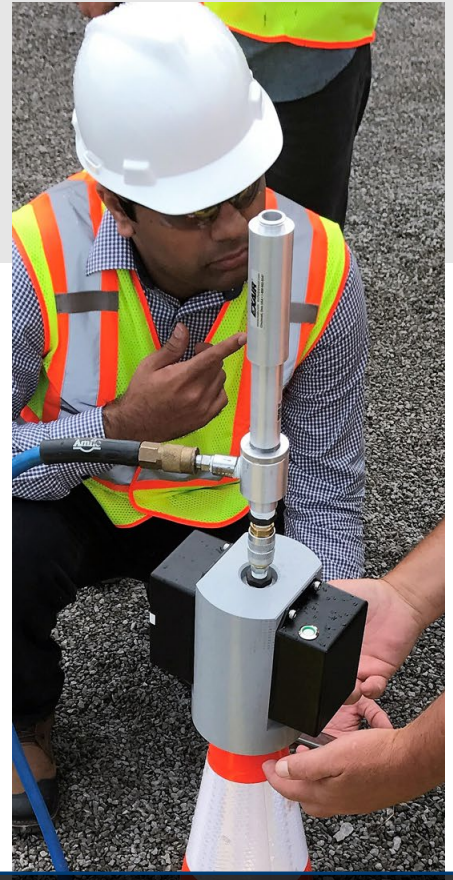
center for METHANE RESEARCH

Methane Detection and Remote Sensing

Flexibility to deploy multiple technology SOLUTIONS

- Technology Development
- Technology Evaluation
- Modeling
- Methodologies
- Measurement Studies





Technology
- Sensor Type
- Detection
- Quantification
- Measurement

Platform
- Hand-held
- Vehicle
- UAVs
- Drones
- Aircraft

Asset
- Pipelines
- M&R Stations
- Compressor Stations
- Meters

Use Case
- Leak survey
- Leak Investigation
- Stationary Monitoring
- First Responder

Methane Emission On-Going Projects

- Evaluation of current **advanced mobile leak detection** systems
- Use of optical gas imagers and handheld laser methane detectors for **large distribution leaks**
- Development of a **quantitative gas imager**
- **Pipeline Thermographic Internal** Inspection
- **Basin wide emissions inventory** in Haynesville Basin
- Develop **integrated methane monitoring platform**
- **Storage tank** emission assessment and quantification
- Survey of **natural gas pipelines**

Satellite Methane Detection for Distribution Applications (OTD Funded)

- Investigate the **state of satellite technology** and **advanced analytics**, with a specific **focus on applicability to distribution** and transmission use cases.
- Increases knowledge of **limitations** and the potential future use of satellites as another method to identify larger leaks.
- LDCs are continually asked to increase their capabilities for leak detection but must do so without adding onerous cost to rate payers. Very little information exists on the performance of satellites for LDC leak detection, and there is need to understand the capabilities and limitations to use satellite data for leak detection, and the cost to implement this leak detection strategy.

Advanced Mobile Leak Detection (Funded through OTD)

- Used by several natural gas utilities to cover **larger areas of the network more frequently**
- Identifies leaks but utilities have not developed guidance for operationalizing the information
- Quantification is still being developed
- GTI Energy is currently running baseline detailed **technology evaluations**

Mid-IR Open Path

Near-IR Open Path

Mid-IR & Near-IR Pumped

Walking Survey (Funded through OTD)

- Traditional method for **leak detection**
- Leak detection for safety meets leak detection for emissions quantification
- How does this get updated for **quantification**?
- How do we **optimize** walking surveys?
- Can walking survey be used to **inform methane emission quantification** efforts such as Veritas?

AOI-3- Detailed Measurement Informed Methane Emission Inventory of the Haynesville Shale Basin (DOE funded)

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Project Objectives:

- Implement and **evaluate Veritas protocols** at one operator facilities in the Haynesville to create a **measurement informed emissions inventory** using **aerial measurements and continuous monitors**
- Perform basin-wide aerial measurements to develop **basin-wide measurement informed methane emission inventory**
- **Compare** Haynesville methane inventory estimate **to other oil and gas producing basins**

Partnership with Operator to gain emissions data from aerial surveys, continuous monitors, and operational data to gain understanding of emissions profile of one operator over the basin, that will then be used to extrapolate emissions inventory across the whole basin.

Natural Gas/H_2 Blend Detection Schemes

Advancing Hydrogen Leak Detection and Quantification Technologies Compatible with Hydrogen Blends

Advance leak detection as **hydrogen** is introduced into natural gas infrastructure which will be realized through five different areas of effort

1. **Evaluate leak detection equipment** currently used by natural gas pipeline operators
2. Provide **guidance** on new/altered **usage protocols**
3. Map out any **threshold of hydrogen blending** above which these devices become ineffective
4. Identify any **impacts of varying amounts of hydrogen on the calibration and analytics** of currently used leak detection equipment
5. **Develop** a proof-of-concept **hydrogen detection scheme** to fill any gaps identified by the project team

Future Projects using AI

Identifying Functional Issues with High Frequency AMI Reads

Objective: analyze high frequency AMI data to develop methods for identifying anomalies.

Business Value Add

- **Smart meters** and high frequency meter readings produce **large volumes of data** that **can improve gas operations** by enabling the detection of tampering, theft, failure states, or other anomalies.
- **Identifying these features** can save utilities and customers money and improve the safety of local distribution systems.

Industry Need

- The large volumes of data produced by high frequency AMI data present an opportunity **to improve operational processes**.
- Analyzing these data **requires advanced analytical and machine learning techniques for pattern recognition and classification**.
- Mining and analyzing these data can enhance operations by **improving safety and billing, assessing equipment health, and reducing theft**.

AI for Field Operations

Objective: developing models to segment and isolate meter-set components, eliminate background noise, and synthesize images using Generative AI for use during model training.

Business Value Add

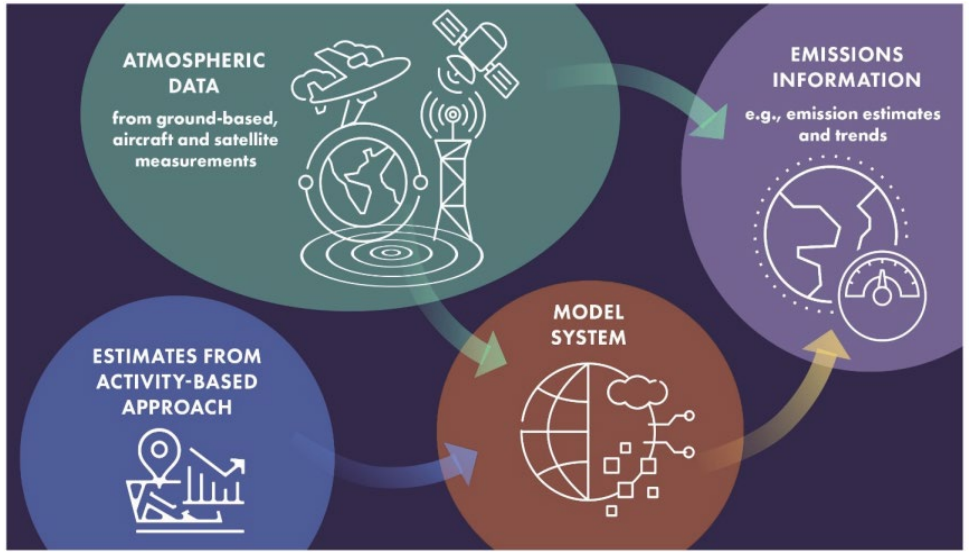
- The benefits of **computer vision models** to **identify rust** include improvement of field data collection; informed asset maintenance prioritization and asset lifespan increases; cost savings on part replacements; and improved workflow, accuracy, and efficiency for fieldwork.

Industry Need

- **Corrosion control** and field maintenance for utility assets are essential activities with **significant regulatory, safety and cost** implications, especially for meter sets.
- It's estimated that roughly **15-35% of the cost of corrosion could be avoided** using available corrosion control practices.
- **Identifying and classifying rust** on meter sets will help utilities ensure rust identification and proper remediation; increase asset lifespans; ensure data control and capture practices; and improve safety outcomes around meter sets.

Needs and Challenges

- **Frameworks** for companies to evaluate and prove performance of **Advanced Leak Detection Programs** to address requirements in Notice of Proposed Rulemaking
- **Detection of pure hydrogen** from a safety and leak limitation perspective
- Guidance on **tiered approaches** to gas leak detection and emissions quantification
- **Satellite verification for probability of detection** for gathering lines, transmission lines, storage fields, and distribution network
- NETL is assessing emissions across 500 miles of **gathering pipelines**, considering diversity in regions, materials, and ages. GTI is supporting NETL in outreaching to **operators interested in participating in this project** and are open to different levels of engagement



Quantifying Greenhouse Gas Emissions (Source: National Academies of Science 2022)

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solutions that transform

GTI Energy develops innovative solutions that transform lives, economies, and the environment

www.gti.energy

acorbett@gti.energy