



UA Summit[®]

May 10 - 12, 2022 | New Orleans, LA

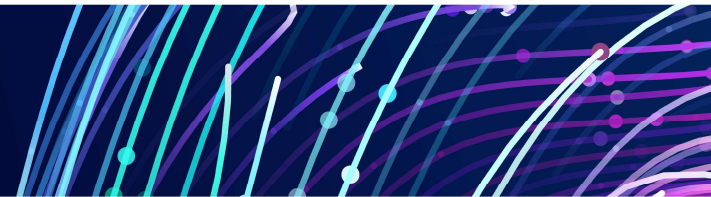
Hosted by **Entergy**

Identification and Flow Rate Estimation of Methane from Satellite Imagery

Adam Silva

Safety

- Take a moment to look around and identify hazards and exits



Introduction

Sr. Artificial Intelligence
Specialist

Natural Gas Dedicated
AI Team Technical Lead

Thought Leader



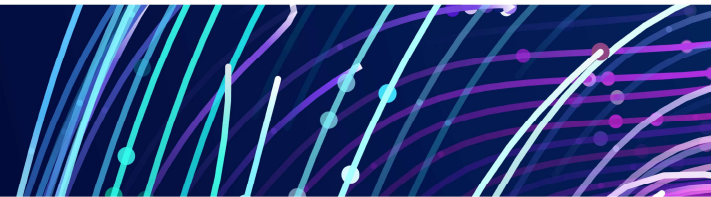
**DUKE
ENERGY®**



**Piedmont
Natural Gas**

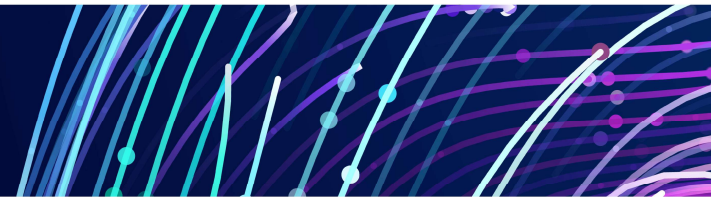
Overview

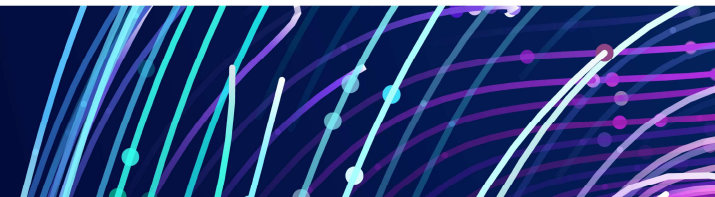
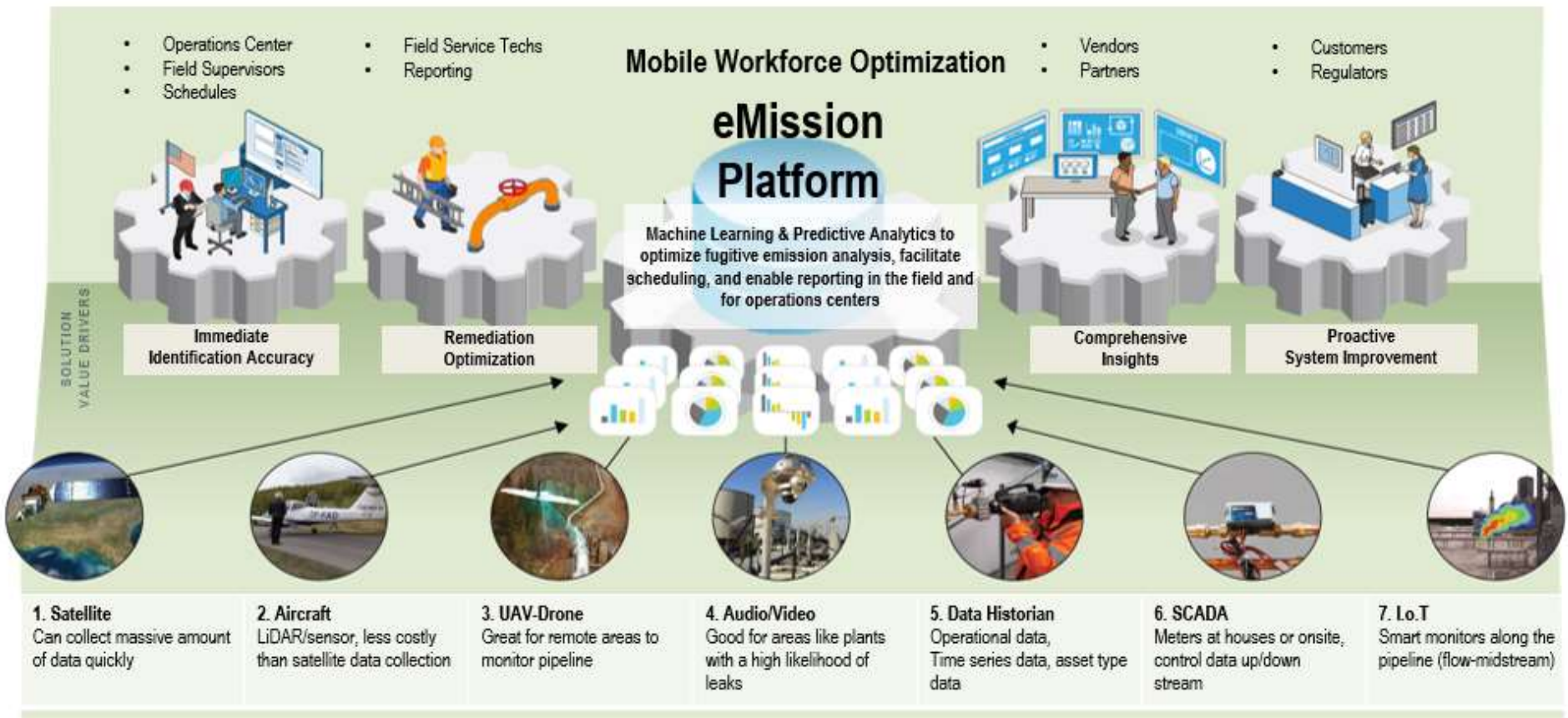
- Safety
- Introduction
- Duke Energy's NGBU Climate Strategy
- eMissions Platform
- Satellite Leak Detection
- Controlled Releases
- 2D Flow Rate Estimations
 - Challenges
- Direct Measurement Using AI



Duke Energy's NGBU Climate Goals

- Net-zero methane emissions by 2030
- Near real-time measurements of methane emissions is required
 - Establish a baseline of emissions
 - Measure emission reductions over time
 - Verify the achievement of net-zero emissions



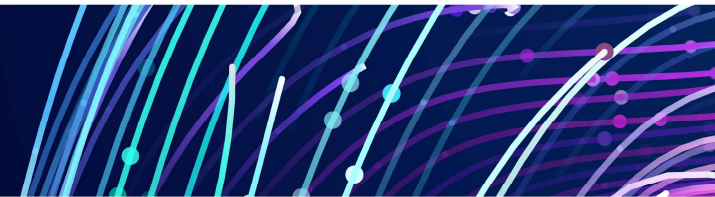


Satellite Leak Detection

- **Satellites can cover a vast area in a short amount of time**
 - This drastically improves detection windows
 - Able to accurately quantify large leaks (>100 scfh)
- **A single satellite capture**
 - Moves in swaths or lanes across the globe
 - A column of air is measured using hyperspectral imaging
 - We are looking for Methane
- **Output**
 - Each column is ~9 sqft
 - Concentration in ppmxm



Controlled Releases



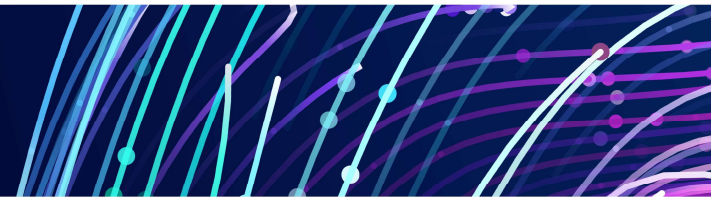
Challenges

- Difficult to identify elevated methane over varying terrain
- Urban obstacles
- Naturally occurring methane
- Artificial inflation due to obstacles
 - Local eddies
- Weather
 - Clouds and rain prevent captures
 - Wind
- Overestimation of flow rate



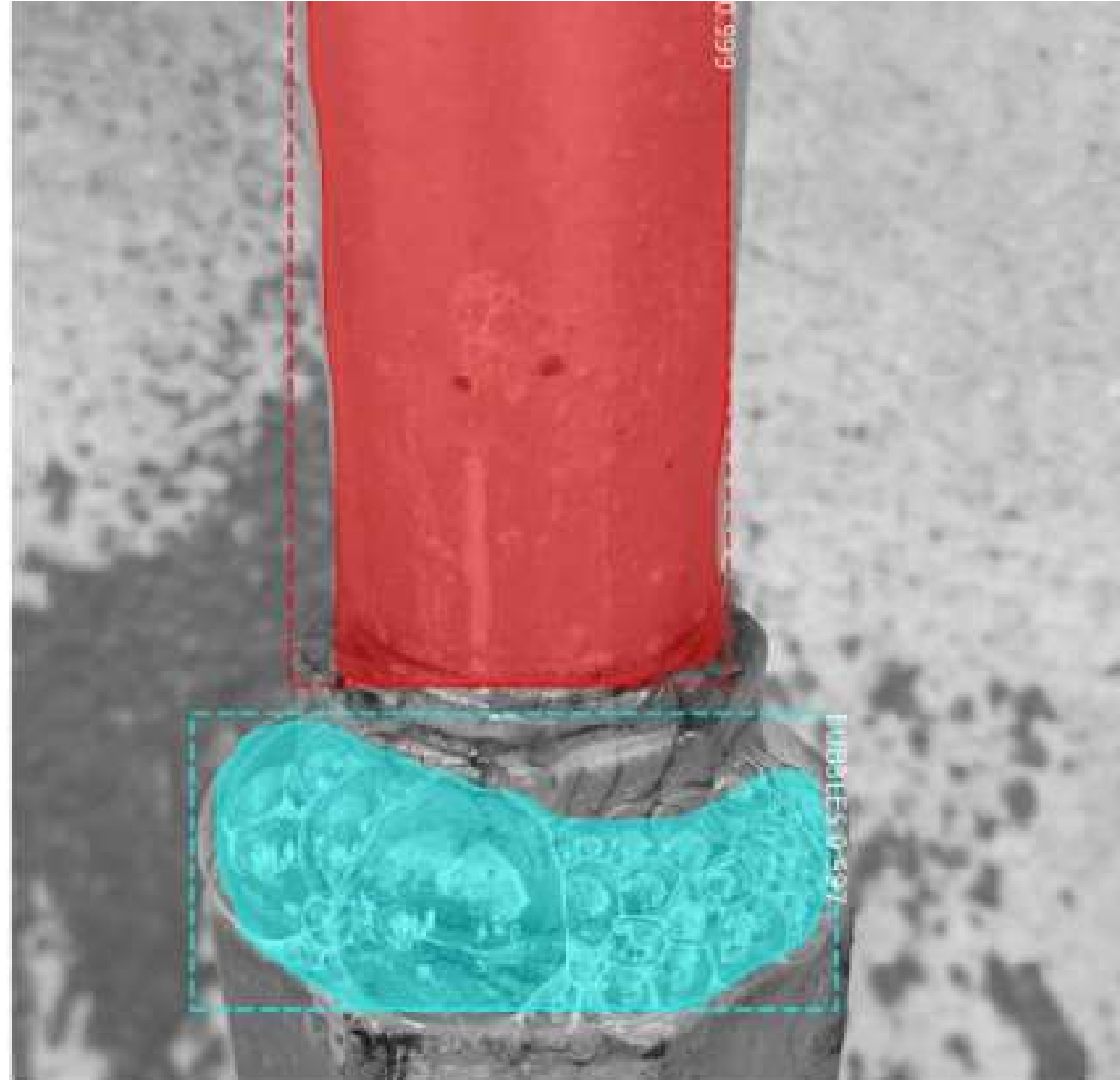
2D Flow Rate Estimations

- Identify the pixels associated to each plume.
- Remove the height component of the pixel value
- Using an adapted version of the Integrated Mass Enhancement method calculate flow rate



Direct Measurement Using AI

- Used to increase validation samples.
- Pipe (red) used to correct for distance from bubbles.
- Correlation of 'bubble area' (blue) to flow rate.
- Other direct measurement
 - Not sensitive enough
 - Not economical
 - Not practical for our workflow

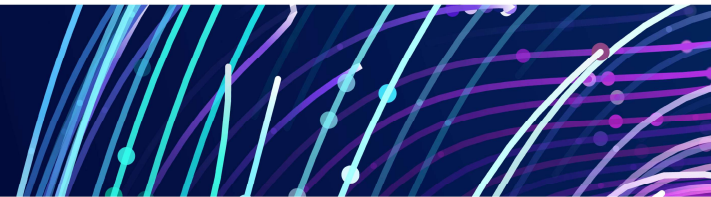


Flow Rate Results

- Satellite
 - ***188 ± 12 %**
- 2D Estimation
 - ***137 ± 39 %**
- Bubble Vision
 - ****73 ± 54 %**

*determined using limited data from controlled releases

**experimentally determined in lab setting



THANKS FOR ATTENDING

Please fill out an evaluation form and drop it in the collection basket located at the back of the room.

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