



PROJECT  
**CANARY**

# **Continuous Monitoring – A Path to Directed LDAR Inspection**

**4/21/22**

PROJECTCANARY.COM

Confidential

# **We Measure What Matters.**

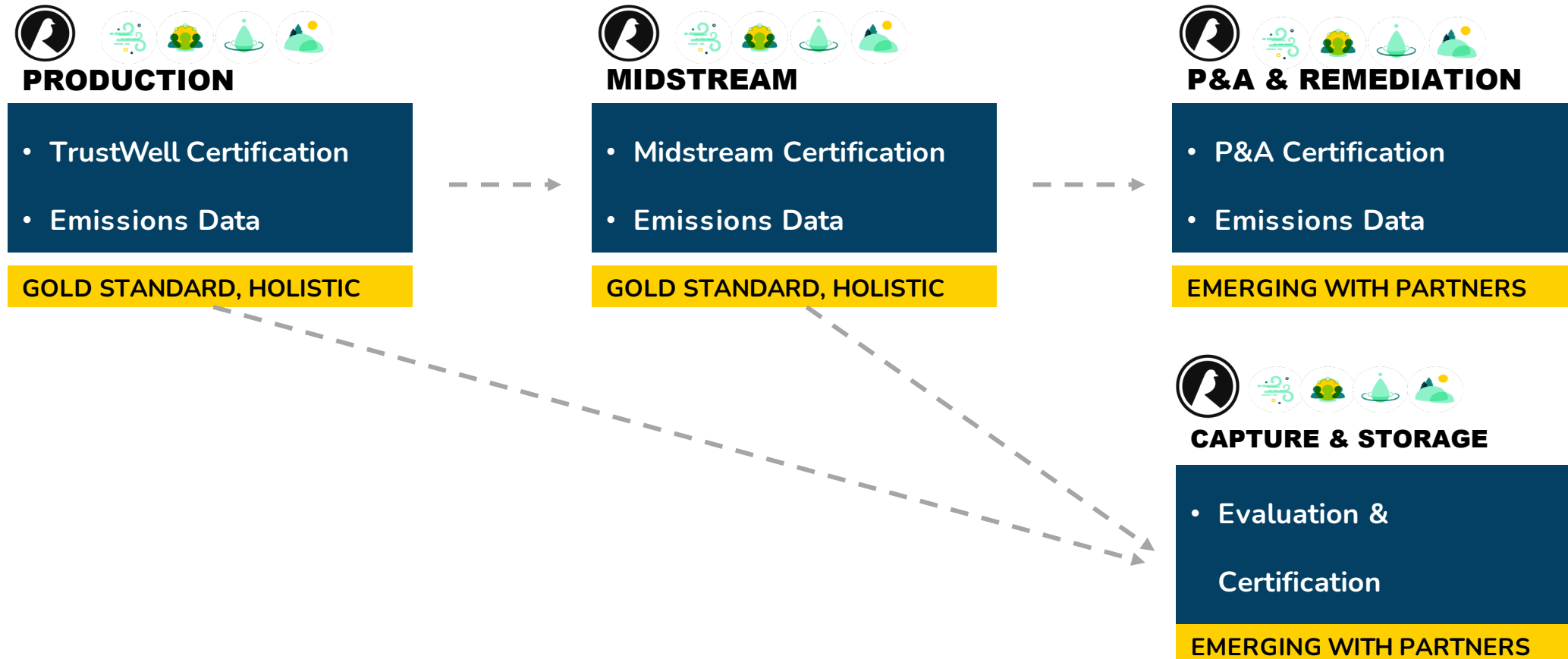
Project Canary (a Public Benefit Corporation) is a SaaS-based data analytics company focused on accurate corporate climate ESG data for emission-intensive companies.

We are the leaders in environmental assessments and continuous monitoring technology.



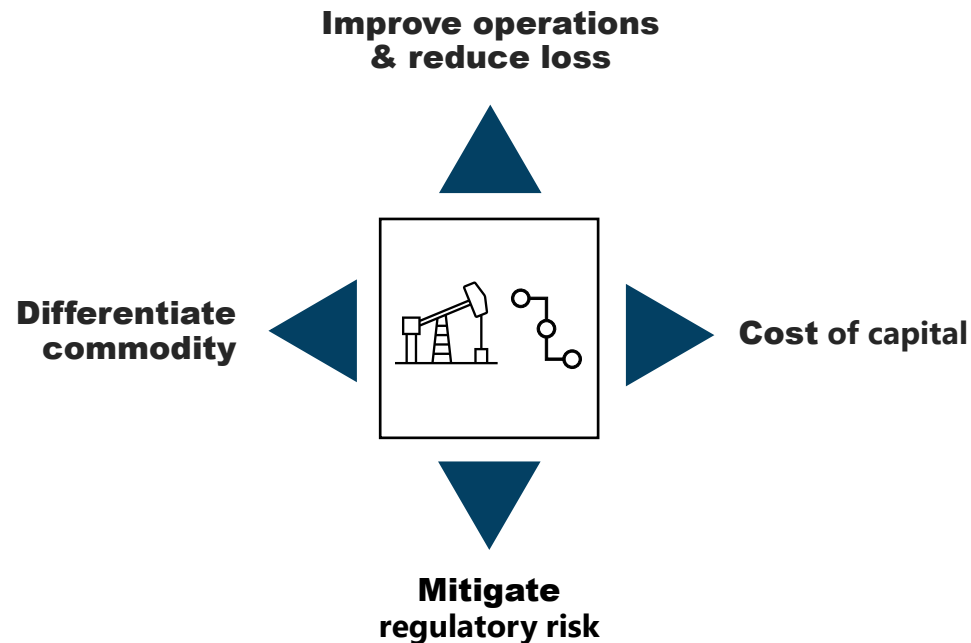
OUR SOLUTIONS COVER THE ENTIRE ENERGY VALUE CHAIN

# Project Canary – Continuous Monitoring and Environmental Assessments



# Our Valuable Data Helps Our Partners Build a More Resilient Core Business

## The Benefit our Data Provides



## Partners in ESG Strategy

### Operations

Catch emissions across all equipment: thief hatch, VRU, underground pipeline leak

### Capital Markets

Reduce cost of debt, improve equity value

### Regulatory

Avoid compliance events by catching leaks earlier than scheduled LDAR inspection

### Differentiated Commodity

Access RSG markets with gas premium and export access to global markets

# Effective Continuous Monitoring Adds Efficiency to LDAR Programs

## Alternative Instrument Monitoring Methods (AIMM)

### Working AIMM Applications in Multiple States

Colorado AIMM process

New Mexico Alarm Process

USEPA Alternative Work Practice

Potential in Wyoming and Pennsylvania

## Partners in Reducing Costs

### Increasing Efficiency

Detect methane emissions faster both from the site and specific leak location

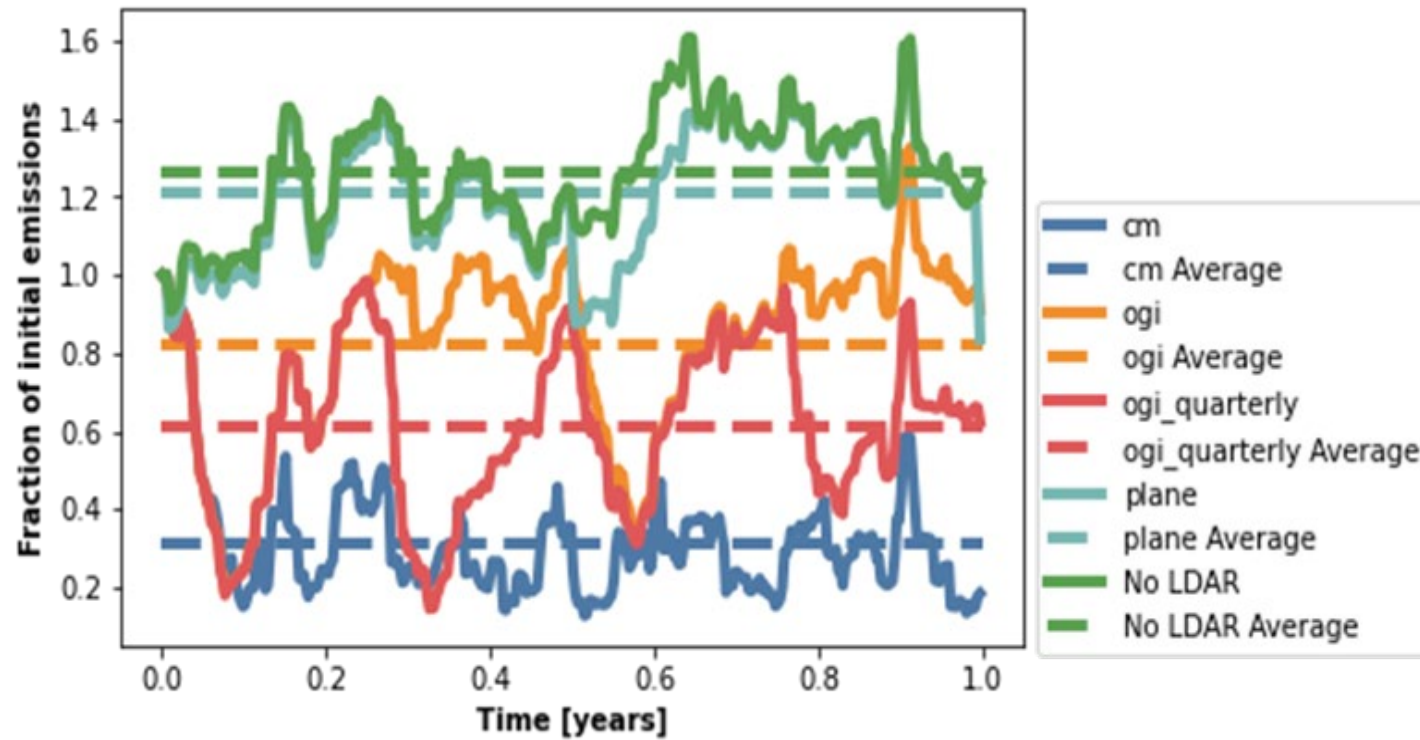
Capture intermittent emissions that periodic surveys may not

Provide rapid verification of repairs

Collect additional temporal information real-time

Collect volumetric flux rates real-time

# FEAST Modeling Demonstrates Effectiveness of Continuous Monitoring



Continuous Monitoring detects initial emissions much faster than OGI or aerial surveys.

FEAST modeling is being repeated in Q2 2022 with enhanced inputs. MEET model will be added to the evaluation

METEC testing in Q1 and Q2 2022 will support new FEAST modeling

Advancing Development of Emissions Detection (ADED) METEC field tests scheduled for May and June 2022

Exploring other venues and approached to demonstrating the effectiveness of continuous monitoring

# Leak Detection and Repair by Exception

## Potential Efficiency Gains Once AIMM is realized

- Decreased required LDAR inspection frequency – this is in the Colorado proposal
- Advanced machine learning in our Dashboard will provide LDAR and Operations teams with data to target non-routine / non-permitted emissions sources
- Reduce the number of inspections with no findings. Eventual decrease in OGI cameras and operators
- Data can be used to demonstrate repair efficacy. Time stamp conclusion to end event with no OGI camera inspection required

## Potential Return on Investment Based Upon Early Leak Detection

- Finding potential leak violations earlier may help to avoid violations with state and/or federal agencies
- Commodity loss may be more limited if source of leak is gas intended for sale
- Continuous monitoring is a path towards gaining Responsibly Sourced Gas (RSG) contracts
- Operators have seen interest rate reductions or other financial incentives in credit lines
- Continuous monitoring can be used to aid approval process for state and federal permits
- Shadow benefits – ESG performance indicator, social cost of carbon calculations, defense against industry skeptics, investors and regulators

# Here's How Our Real-Time Data Has Lowered Emissions

Problem	Event Type	Alert Time Source Attribution/Remediation	Solution
Liquid Knock Out Tank Frozen	Normal Operation	73 hours	Frozen tanks had to have their vapor lines disconnected, leading to emissions.
Inefficient Flaring	Hardware Inefficiency	42 hours	SCADA data confirmed that a combustor didn't light, flow pressure issues fixed - improving combustion.
Vapor Recovery Unit Pressure Issues	Hardware Inefficiency	7 hours	Vapor Recovery Unit pressure levels accounted for, preventing continued emissions.
Thief Hatch Left Open	Leak	4 hours	Operations team made aware of event; hatch closed and leak remediated.
Unplanned Storage Tank Venting	Hardware Inefficiency	40 minutes	A seal was stuck open, leading to pressure buildup in storage tanks leading to venting. Closing the seal fixed the issue.
Water Hauling Emissions	Process Inefficiency	10 minutes	Oil Field Services company didn't connect to vapor line. OFS companies addressed by HSE Dept.



**CURRENT TECHNOLOGY**

# Canary X Continuous Monitoring Unit

## Canary Unit

Modular & affordable, can use 12+ pollutant sensors, cellular connection, 6+ days of backup battery power, 1 year of data storage

## Summa Canister

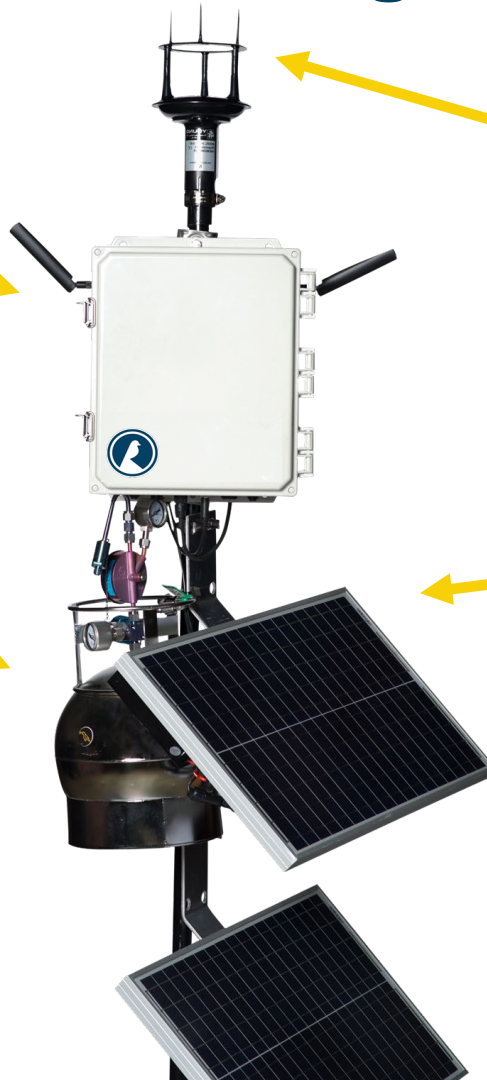
Patented approach to automated “grab” air samples. Allows for parts per trillion clarity about a plume’s composition

## Anemometer

Precise wind speed & direction. Key to mass quantification and source attribution

## Solar Power

20W – 30W solar panels



**CANARY X**  
**Specifications**

	<b>Unit</b>	<b>Value</b>
<b>Measurement principle</b>		Tunable Diode Laser Absorption Spectroscopy (TDLAS)
<b>Target gas</b>		CH4
<b>Concentration range</b>	ppm	0-10,000 ppm
<b>Lower detectable limit*</b>	ppm	≤ 0.4
<b>Precision**</b>	ppm	≤ 0.8 ≤ 0.25 with 10 s averaging
<b>Sampling rate</b>	Hz	2
<b>Resolution</b>	ppm	0.01
<b>Accuracy</b>		1-2 ppm over range
<b>Temperature operating range</b>		-10 to 65oC (14 to 150oF)

Notes: \*2 sigma, \*\* 3 sigma,



**CANARY X**  
**Leaks Detected**

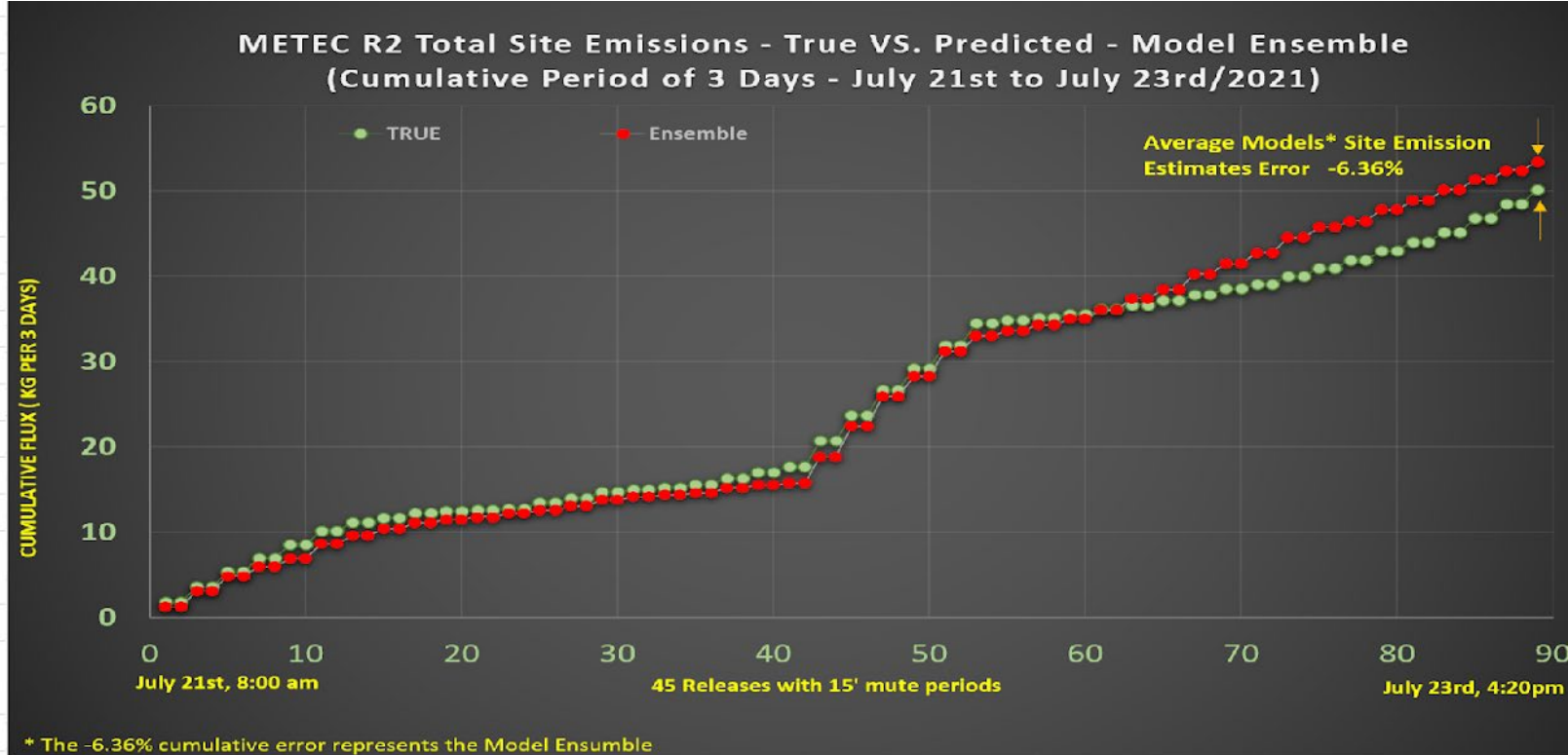
Equipment group	Within 100m (300 feet)	Within 12m (36 feet)
Chemical injection pump	45%	85%
Compressor seals - NS	65%	95%
Comp. BDV	95%	99%
Flanges	95%	99%
Liquid unloading	87%	98%
Open-ended lines	60%	95%
Pneumatic controllers	90%	98%
Regulators	45%	85%
Seals - not spec.	98%	99%
Threaded con	60%	95%
Tanks/hatches	50%	85%
Valves- PR	80%	95%
Valves- other	88%	96%
Vents -General	85%	95%
<b>All sources</b>	<b>65%</b>	<b>90%</b>

Confidential

Notes: % of leak volume of overall estimated leak based on industry averages from field measurements. For example, a Canary X sited within 12 m (36 feet) of a chemical injection pump will detect nearly all leaks, but may miss smaller leaks. Data from: Brandt, A. R., Heath, G. A., & Cooley, D. (2016). Methane Leaks from Natural Gas Systems Follow Extreme Distributions. Environmental Science & Technology, 50(22), 12512–12520. doi:10.1021/acs.est.6b04303



EMISSION RATE  
**Quantification – Accurate & Improving**



METEC testing continues. Next round includes many more trials with blind testing and more challenging event scenarios

# CONTINUOUS MONITORING & REAL- TIME DATA ANALYTICS DASHBOARD



Methane concentrations over time



Alert Event Log

Start	Duration	Calc.
12/09/2021 07:08	8 min	12.8 >> 5 ppm TVOC 12.8 (5m Avg) >> 5 ppm TVOC
12/07/2021 14:20	8 min	12.2 >> 10 ppm TVOC 6.7 (5m Avg) >> 5 ppm TVOC
12/04/2021 18:48	34 min	78.7 >> 10 ppm TVOC 60.8 (5m Avg) >> 5 ppm TVOC
10/14/2021 10:57	1 min	15.7 >> 10 ppm TVOC
08/25/2021 14:50	8 min	14.9 >> 10 ppm TVOC 10.4 (5m Avg) >> 5 ppm TVOC
08/05/2021 09:58	6 min	5.2 (5m Avg) >> 5 ppm TVOC
08/03/2021 07:50	36 min	6.7 (5m Avg) >> 5 ppm TVOC
03/18/2021 19:06	5 min	73.6 >> 10 ppm TVOC 27.8 (5m Avg) >> 5 ppm TVOC
01/31/2021 06:10	7 min	5.5 (5m Avg) >> 5 ppm TVOC

Wind speed & direction for source attribution



Map of site – shows monitor locations

Site wind rose data

# PROJECT CANARY

## Project Canary Dashboard – Data analytics at your fingertips

Dashboard technology continues to grow in sophistication and will soon be launching a new view on source attribution and quantification

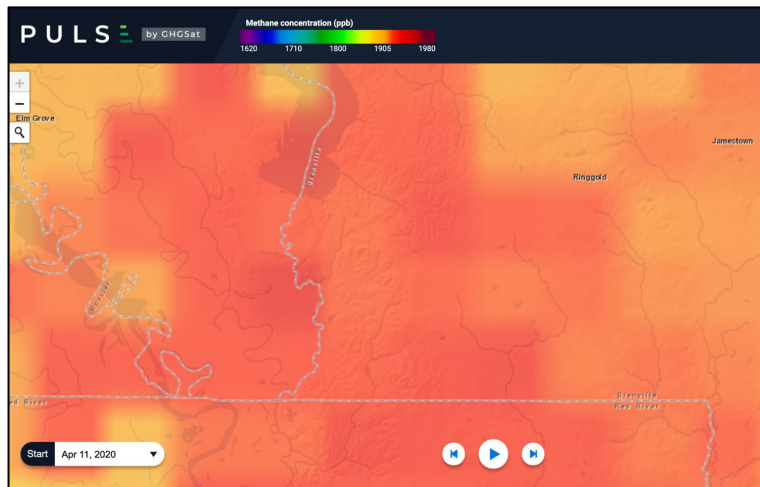


### Satellite Resolution

(2,000m x 2,000m)

Data from Pulse by GHGSat

<https://pulse.ghgsat.com/?lat=32.28&lng=-93.32&zm=12>



## PROJECT CANARY

### MARKET NEED

# Independent, Localized, Measured & Certified Data

- ▶ Key stakeholders demand 3rd party certification, self-estimates won't fly
- ▶ Can't pinpoint and fix the cause without high fidelity data
- ▶ Facility-level assessment & measurement required



### Project Canary Facility-Level Resolution

(.01m x .01m)

## Our New Technology – What Project Canary Is Working on Now

- **Project Canary SmartAlerts** – Machine learning based program that uses continuous monitoring data to determine baseline of emissions fingerprint and uses this to predict future emissions. Comparing actual emissions to those predicted provides SmartAlerts.
- **Project Canary Quantification Version 2 (Beta)** – Enhanced Gaussian Plume modeling uses enhanced statistical algorithms to increase accuracy. Testing underway now. Beta versions rolled out for select customers
- **BIG NEWS**– Project Canary just announced acquisition of **Aeris Technologies**





# Our dashboard with SmartAlerts Learns to Differentiate Emissions

- Set on site level
- Specific to methane
- Alert threshold set on difference from predicted over 4 hour rolling average
- Sensitivity threshold of 1- 5 corresponds to 100%- 500% over predicted
- Predicted values determined by device level models trained on ~30 days of data factoring in several environmental variables

PROJECT CANARY DASHBOARD – SOURCE ATTRIBUTION AND EMISSIONS QUANTIFICATION

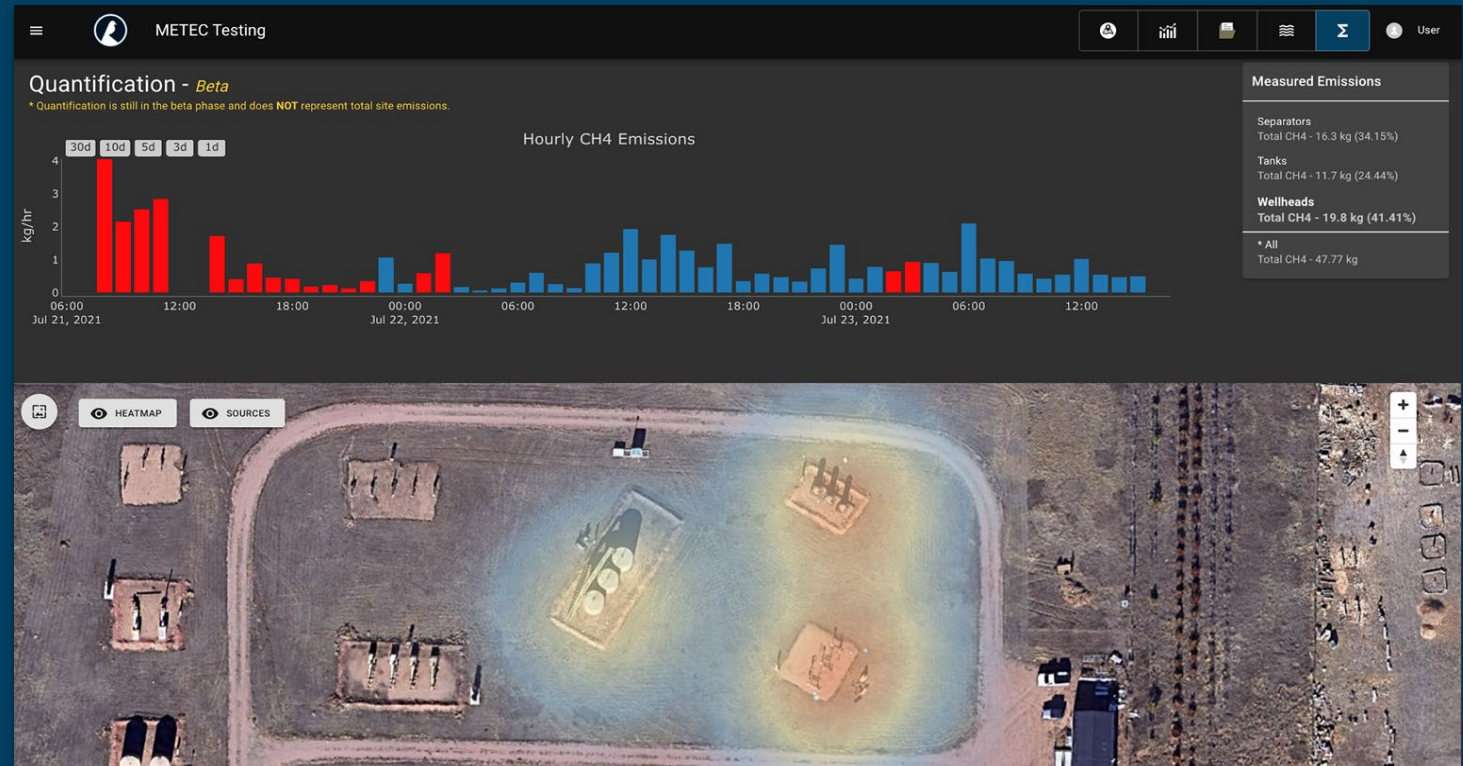
# With Site-Level Quantification Of Emissions, Project Canary Enables a Traceable Value Chain.

- **Accurate Emission Profile**

Project Canary calculates *actual* emissions PRE and POST P&A. attribute emission volumes at the well bore and surrounding area.

- **Actionable Data to ELIMINATE Emissions from Plugged wells**

Project Canary's traceable value chain can allow generation of Methane Performance Credits from verified no-emission plugging jobs.



# The MIRA Platform: *Pico, Ultra, and Strato Series*

- **MIRA PICO Series: “lab in a lunchbox”**

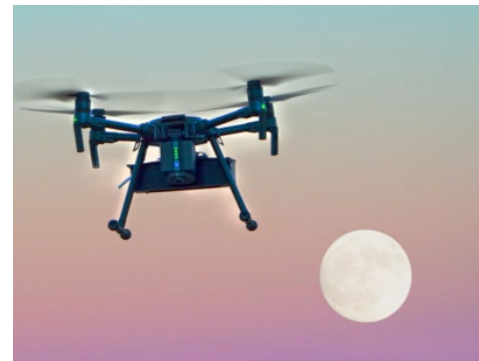
- 1ppb/s sensitivity typical for most species
- Lunchbox sized (5.7 l vol., 2.75kg/6lbs)
- AC/DC, 15W, 6hr battery, *GPS, WiFi, RS-232*

- **MIRA Ultra Series: Low Drift**

- Same core technology as *Pico Series*, except...
- Low drift via ***temperature stabilized optical core***
  - *1-2ppb drift typical*
- *Portable and 3U Rackmount versions available*
- *Battery Option: 2-3 hours continuous operation*

- **MIRA Strato Series: Drone**

- Same as Pico, but smaller and lighter (2.8l vol., 1.9kg)
- 1.5 hour battery



# MIRA Mobile Leak Detection Solutions

***Multiple solutions at several levels and price points, data services***

- **Pico Mobile LDS**

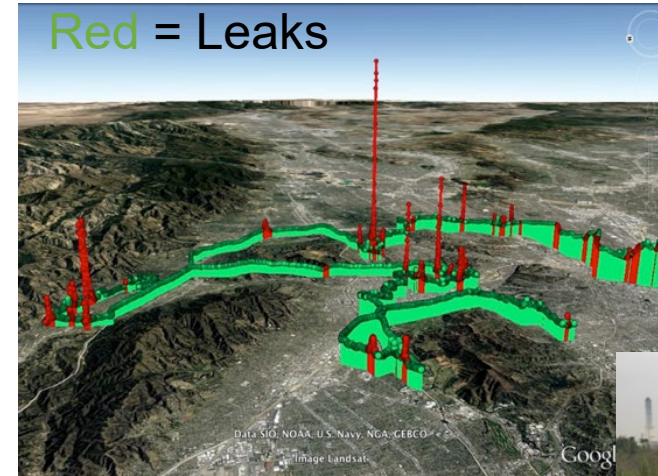
- *Ultraportable, versatile Mobile/handheld tool*
- Methane/ethane + GPS provide accurate “leak maps” over time

- **Advanced Mobile LDS**

- Methane/ethane + GPS + wind + Analytics
  - *EDF Mobile Methane Challenge*

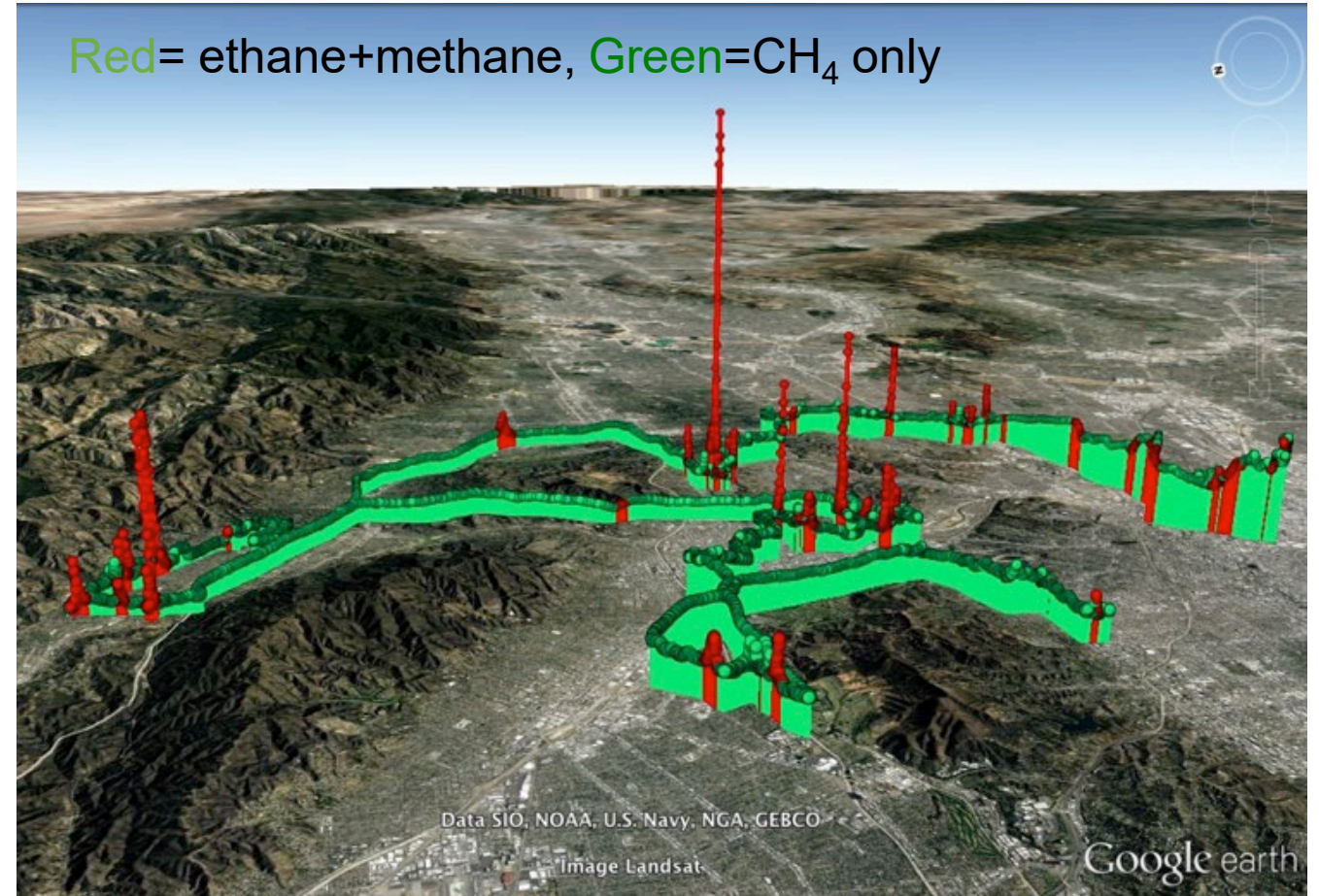
- **Responder Advanced LDS “Kit”**

- Transforms any vehicle into an advanced mobile leak detection system in minutes: Real-Time



# P&A Leak Mapping: MIRA *Pico Mobile LDS*

- Methane/ethane+GPS enables real time leak maps
  - “Trigger” for leak surveys/repairs
  - *Confirms absence of leaks*
- LDS channel partners secured
- MIRA has 30x greater ability to discriminate leaks from biogenic gas than competitors
  - *Car-mounted sensors create hyperlocal leak maps*



# LEARN MORE ABOUT PROJECT CANARY



**David Stewart**

VP of Customer Success & Environmental Solutions



**david.stewart@projectcanary.com**



**+1 (970) 342-5461**



**1200 17<sup>th</sup> St., 26<sup>th</sup> floor Denver, CO 80202**

<https://www.projectcanary.com/>





**Thank You.**



Our culture is rooted in trust and inclusivity — because we believe in both. Our mission is rooted in the crisis of our generation and beyond. We are deeply committed, not because it makes great headlines – because it matters. We are a 2021 Best Company for the World and Top 5% B-Corp.

 ProjectCanary1

 ProjectCanary

200 17th Street, Floor 26  
Denver CO 80202

[info@projectcanary.com](mailto:info@projectcanary.com)  
[www.projectcanary.com](http://www.projectcanary.com)



Get to Know Us