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Mobile Based and Aerial Leak Detection Solutions for Gas T&D Infrastructure

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Your Safety Our Commitment

About Heath

Key Facts

- **Founded in 1933**
- **3rd Generation family owned**
- **Certified women's business enterprise**
  - By Women's Business Enterprise Council

Solutions

- **Technology**
  - Advanced Mobile (AMLD)
  - Portable and handheld
- **Services**
  - Leak Survey
  - Locating
  - Meter reading
  - Damage Prevention

Footprint

- **Technology**
  - Rich history of product sales throughout all 50 USA states, Canada and International
- **Services**
  - >2000 employees conducting survey operations across USA

Affiliations

American Gas Association

Canadian Gas Association

International Gas Union

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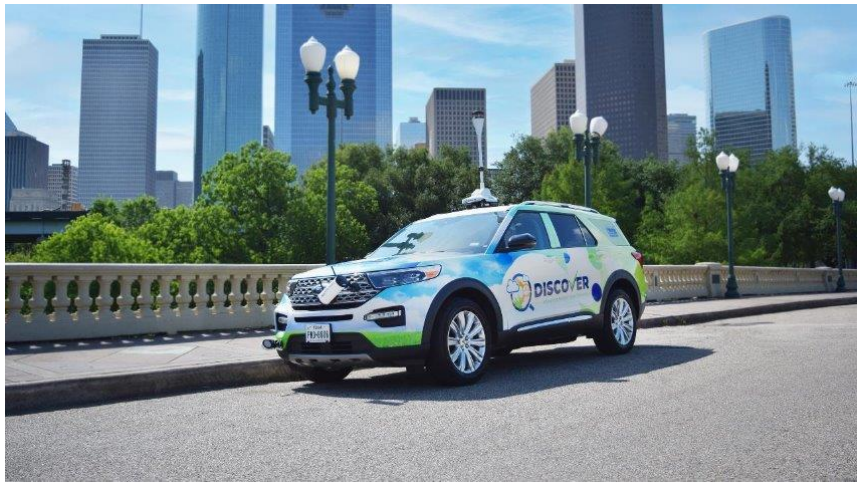
Leak Detection Solutions for T&D Infrastructure

Mobile-Based

- Advanced leak detection technologies with part-per-billion resolution
- Designed for on-road or off-road capabilities
- Improves accuracy, efficiency and safety in leak survey



Aerial-Based

- Laser-based detection technology
- Designed to work with existing aircraft
- Drastically lowers the cost of leak survey

Mobile-Based Leak Detection

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Mobile-Based Leak Dectection

Overview

- Vehicle based leak detection technology
- Open path design for rapid response
- Simultaneous detection of methane and ethane with part-per-billion resolution
- Ability to distinguish between pipeline and naturally occurring biogas
- Minimal occurrence of false positives and negatives when compared to competing technologies

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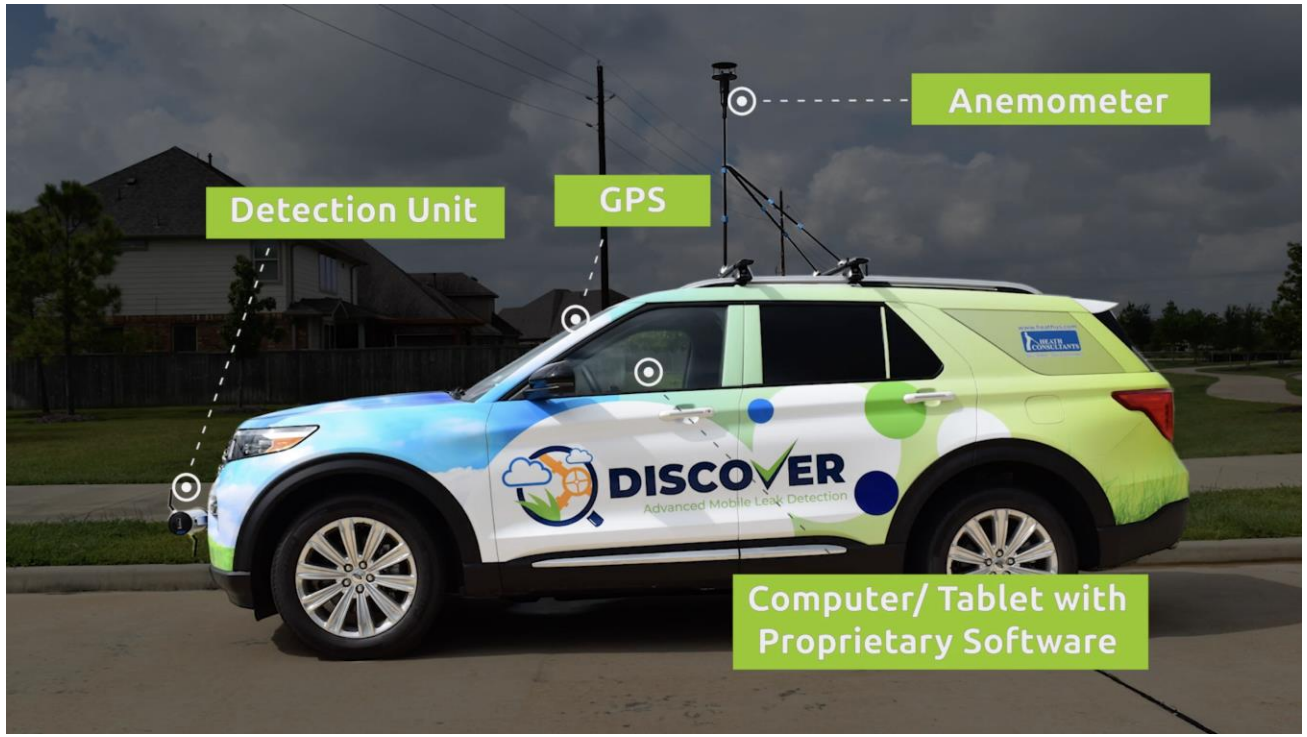
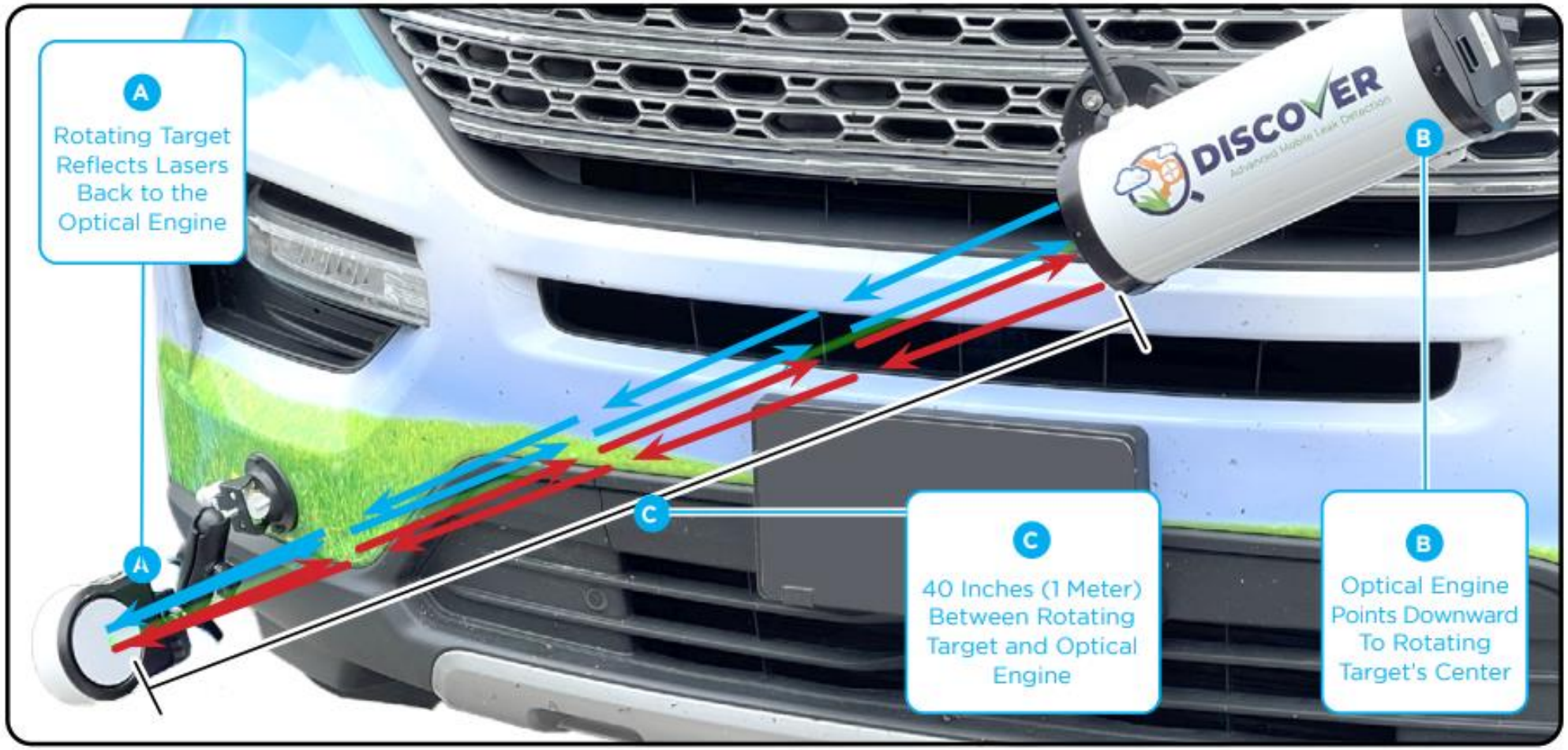
Mobile-Based-Heath's Discover AMLD®

Key Components

- **Detection Unit**
  - Comprising of optical engine and laser target for methane and ethane detection
- **GPS**
  - Supporting vehicle navigation and indication location recording
- **Anemometer**
  - Measuring wind speed during survey
- **In-vehicle User interface**
  - Running Heath's proprietary leak survey software



How Does Discover Detect Methane/Ethane?



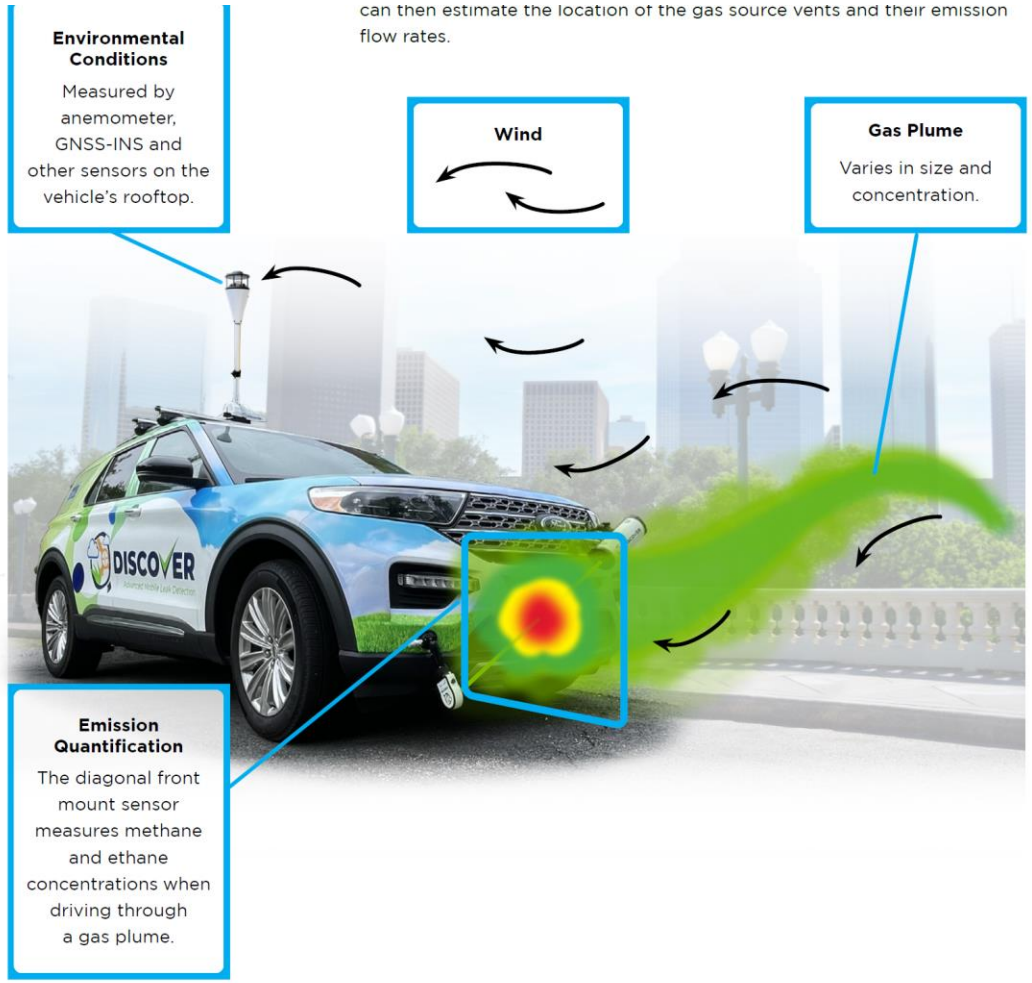
How Does Discover Localize, Source, and Quantify Gas?

1. Gas plume travels through sensor beam path attached to front of vehicle.

2. Open-path design provides rapid analysis of detected methane and ethane concentrations.

3. In parallel, environmental conditions and location are being measured by the rooftop anemometer

4. In-vehicle user interface provides audio and visual alerts of natural gas and biogas indications.



Discover AMLD – Off-Road

Overview

- Same technology as on-road version
- Reduced footprint for survey in areas with access or terrain challenges
- Off-road sensor tube that houses the laser
- Ideal for vehicle-restricted areas
- Applications such as transmission or gas gathering pipelines

Simplicity and Flexibility in Operation

Benefits

- Ability to install on a variety of vehicles for operational flexibility
- System can be mobilized in a matter of minutes
- Wire-free installation
- Open path technology for instant detection
- Significant lower price point than competitive products
- Optional sensor tube for further simplicity in operations

Key Terminology – Discover AMLD Operation

System Operation

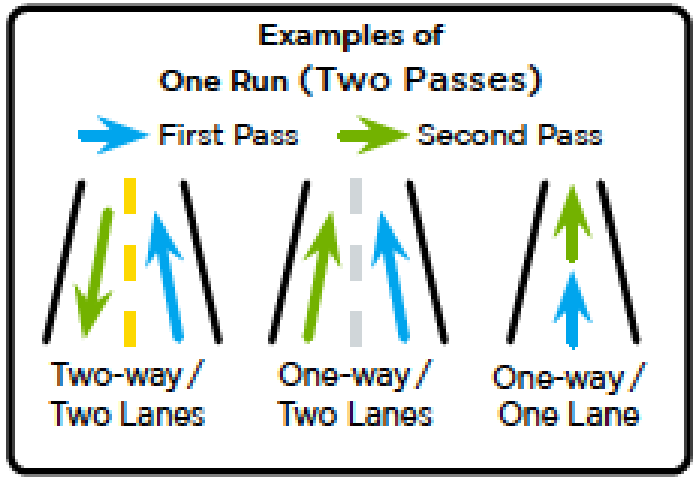
The AMLD Operator will perform a set number of runs and passes based on the program type such as:

- **Super-Emitter**
- **Distribution Compliance**
- **Transmission Compliance**

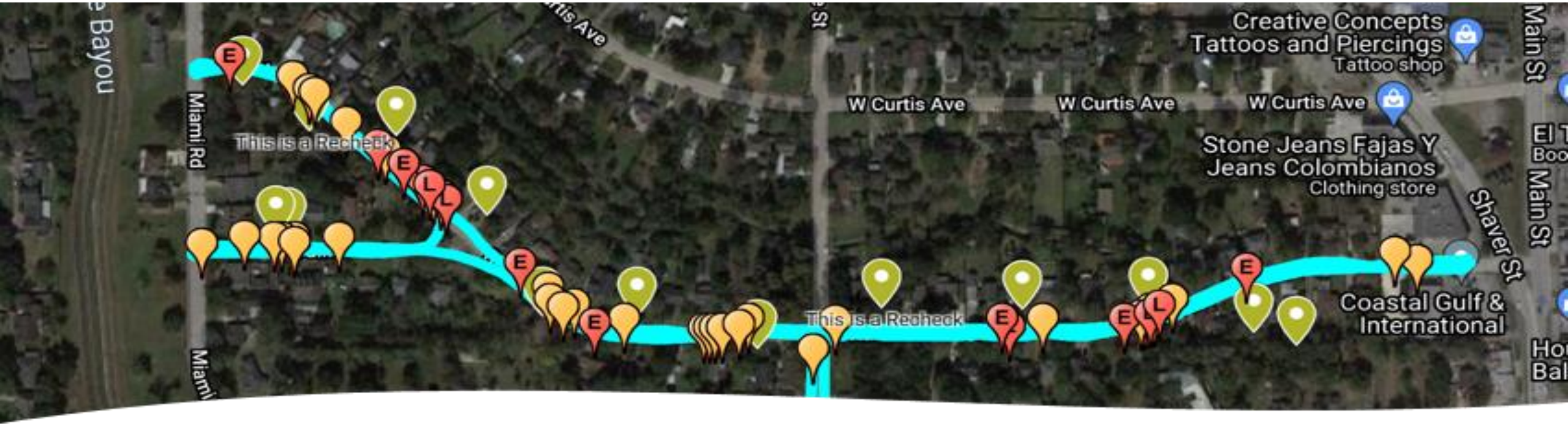
What are runs and passes?

Passes = Trajectories driven by AMLD operator

Runs = Two passes from both sides of designated streets



The Importance of Sample Rate/ Response Time



- 100Hz(100 samples/sec) provides more data aggregation enabling better decisions for true leak detection
- Higher precision localization and emissions rate
- Drives survey route faster up to 25mph

Key Specifications – Discover AMLD

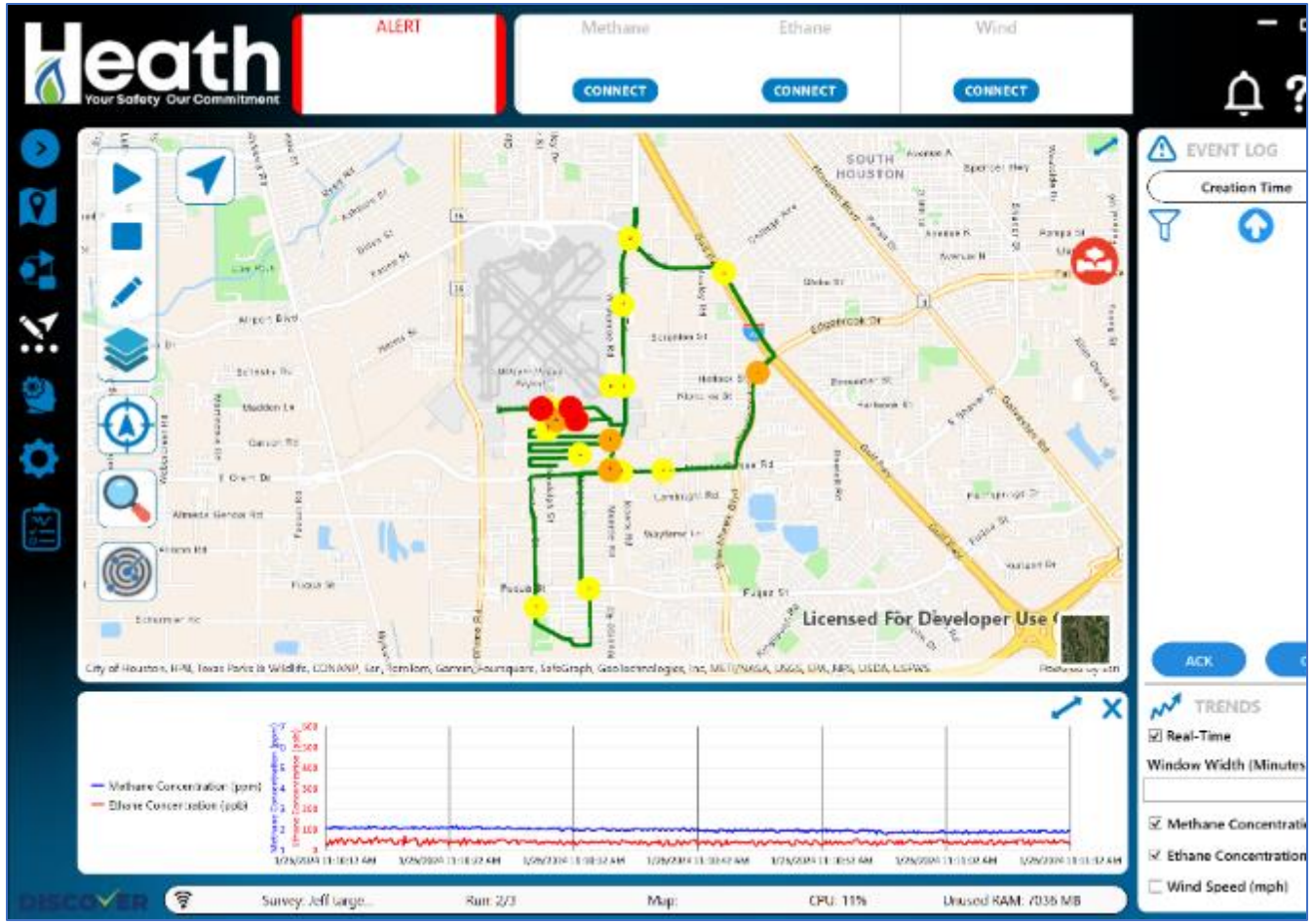
Gases Detected	Simultaneous Detection of Methane and Ethane
Sensor Technology	Open-Air Fixed Path Mid-IR TDLAS (Tunable Diode Laser Absorption Spectroscopy)
Sensitivity & Resolution	Methane: < 100 PPB at 10 Hz, < 30 PPB at 1 Hz
	Ethane: < 15 PPB at 10 Hz, < 5 PPB at 1 Hz
Selectivity	No Cross-sensitivity to humidity, other hydrocarbons or industrial gases
Response Time	Sample frequency of 100 Hz, Data update rate of 10 Hz Ability to detect 10 cm wide plume at 10 m/s (22 MPH) vehicle speed
Accuracy	±10% of reading, for Methane & Ethane in Natural gas, ±50% for quantification
Calibration	Field Calibration using self-test with a Natural Gas Calibration Cell
	Bump Test verification at sub-PPM detection level.
Wind Sensor	Anemometer at 4 Hz
GPS	GNSS-INS system at 10 Hz, < 1 m accuracy, Inertial navigation maintains accuracy when GPS degraded
Battery & Display	All sensors powered with Re-chargeable batteries (8-10 hr life).
	Rugged Windows-10 Vehicle Mounted Tablet with HD display

Key Specifications: Contd

Certification	EMI/EMC: (EN61000-6-2, EN6100-6-4) (2014/30/EU), FCC 47 CFR part 15
	UN 38.3 For Li-Ion Battery
Connectivity, Data Log, Cloud Access	Robust Bluetooth 5 (BLE): connection for all data exchange. **No Wires!!**
	Local and Cloud Based data storage & data analytics
	Data Log: User ID, Date & time, Gas readings, True Wind Vector, GPS Data, Alarms, Calibration/bump test data etc.
	Full Suite Cloud Based Leak Survey Analytics and Leak Survey Management Solution
User Interface & Reports	Simple intuitive and graphics rich touch screen operation Real Time Leak Detection Post-processed Leak Detection & Leak Localization Leak Survey Coverage Area Emission Quantification
Operation while Driving	Hands off voice alerts, instructions and commands
Environmental	Operating Temp: -25°C to 50°C
	Storage Temp: -25°C to 55°C
	Shock & Vibration: Per MIL-STD-810-H
	IP Rating >65
Weight & Size	Gas Sensor Module < 2.4 kgs with battery.
	Easy to remove and re-install as needed.
	Rooftop enclosure for ease of mounting of Anemometer and GPS

In-Vehicle Technology - User Interface

- Simple and easy to use
- Color coded indications
- Route completion highlights
- Real-time ethane and methane data feeds
- Status indicators for all critical components
- Data upload to cloud for post-processing and reporting



Reporting

DISCOVER
Advanced Mobile Leak Detection

Leak Analytics Report

General

Survey Name	CAZ 2024 CYCLE 4 GRID N50-\	Start Time	08/14/2024 12:53 utc
Surveyor/s	Aidan Fraughton	End Time	08/14/2024 01:47 utc
Total Distance Traveled	12.67 miles	Total Methane Emissions	0.5 scfh
Average Indications per Mile	0.16	Methane Emissions per Mile	0.1 scfh
Approx. Distance Covered per Pass	6.34 miles		

Analysis Parameters Settings

Methane Threshold	0.15 ppm	Coverage Flowrate	0.5 scfh
Ethane Threshold	20 ppb	Methane Emissions Filter	0 scfh
Indication Cluster Distance	82 feet	Methane Ethane Ratio	30
Indication Type Filter	All Indications	Methane Emission Units	SCFH
Extended Search Radius	150.0 feet		

Measurement Statistics

Maximum Methane Amplitude	1.1 ppm	Maximum Ethane Amplitude	16 ppb
Average Wind Speed	2.23 miles/hr	Maximum Wind Speed	11.95 miles/hr
Average Vehicle Speed	13.97 miles/hr	Maximum Vehicle Speed	23.27 miles/hr
Maximum Quantification	0.5 scfh		

Result Overview

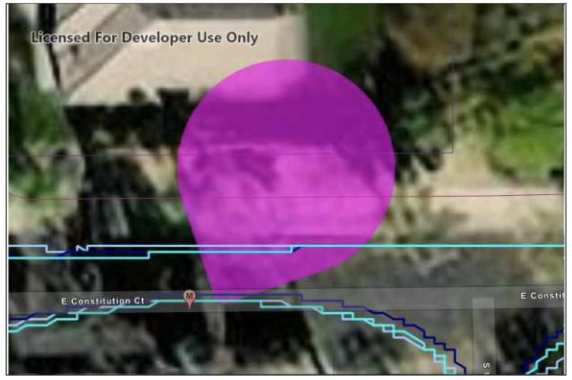
	Natural Gas	Indeterminant	Sewer Gas	Total
Indications Count	0	1	0	1

Complete Survey Route

Indication #1 Details

Indication Type	Medium-Confidence Natural Gas Indication		
Address	4066-4072 E Constitution Ct, Gilbert, AZ, 85296, USA		
Coordinates	Latitude: 33.3226051 , Longitude: -111.7022247		
Emission Quantification	0.8 scfh	Survey Name	S8-71
Methane Amplitude	2.059 ppm	Ethane Amplitude	35 ppb
Background Methane	2.38 ppm	Background Ethane	27 ppb
Wind Speed	1.2 miles/hr	Wind Direction	26.4 degrees
Vehicle Speed	12.3 miles/hr	Vehicle Direction	88.7 degrees

Indication #1 Map



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Aerial-Based Detection

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VANGUARD
PIPELINE INSPECTION


Falcon-XL
AERIAL METHANE DETECTOR
LASER METHANE
DETECTION POD

Vanguard Falcon-XL

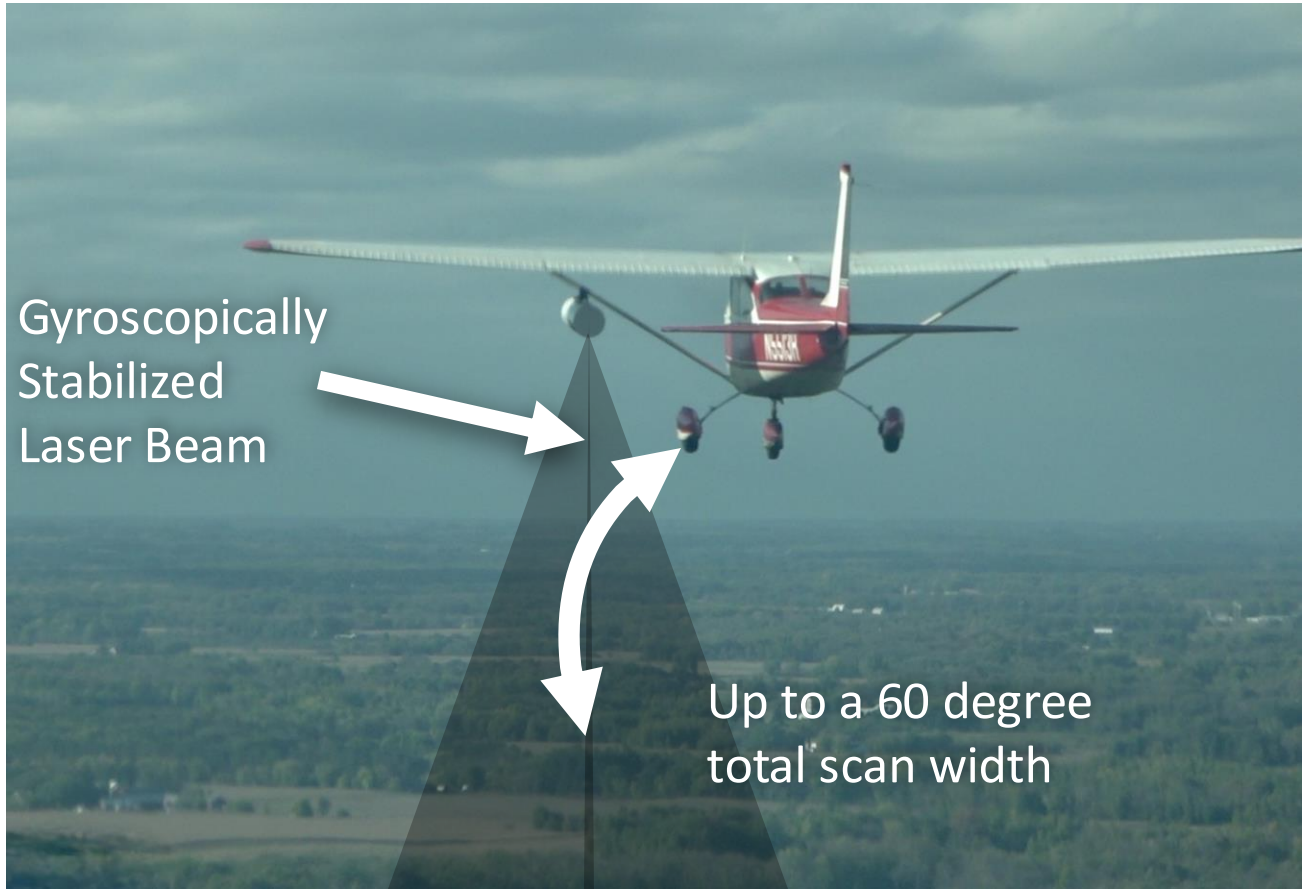
Overview

- Allows existing pipeline patrol to find methane gas leaks while on routine patrol
- Designed and tested for Cessna Aircraft
- Provides user full control over data recorded

How does it work?

System Operation

- The Falcon-XL uses a safe, low-powered infrared laser to sense the amount of methane over the pipeline.
- The laser's wavelength is tuned so that it is attenuated by methane molecules.
- By measuring the amount of laser light that reflects from the ground after passing through a methane plume, the system can locate a gas leak and estimate the leak rate



Falcon-XL

Benefits

The Falcon-XL was designed to:

- Plug & Play on existing aircraft with no modifications
- Drastically lower the cost of gas leak inspections
- Help stakeholders comply future PMSHA and EPA regulations

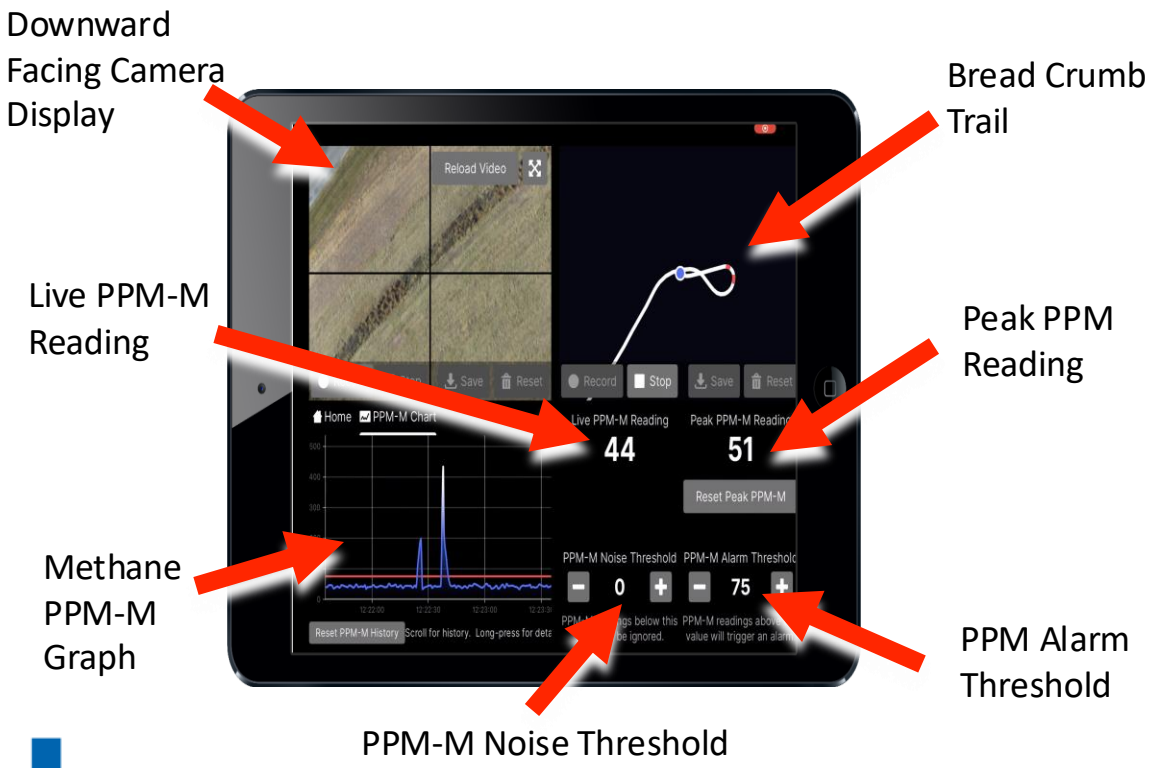
Falcon-XL

Benefits

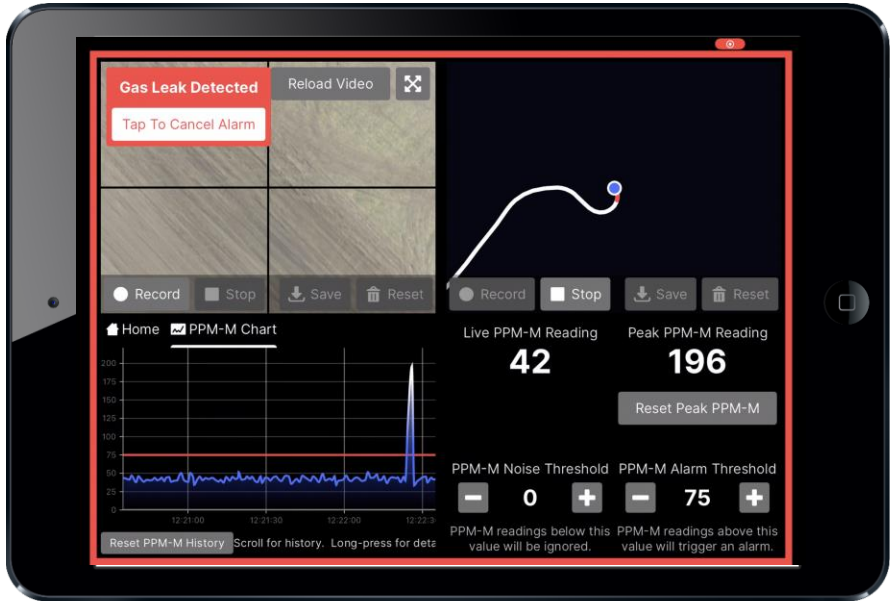
- Unlike other technology requires no complex post-flight analysis
- Pilot is instantly alerted if methane gas leak is found
- Easy to install and remove (under 10 minutes)
- Pilot utilizes an IPad application to control and monitor system in-flight

Falcon-XL- Simple and Easy to Use

Intuitive User Interface

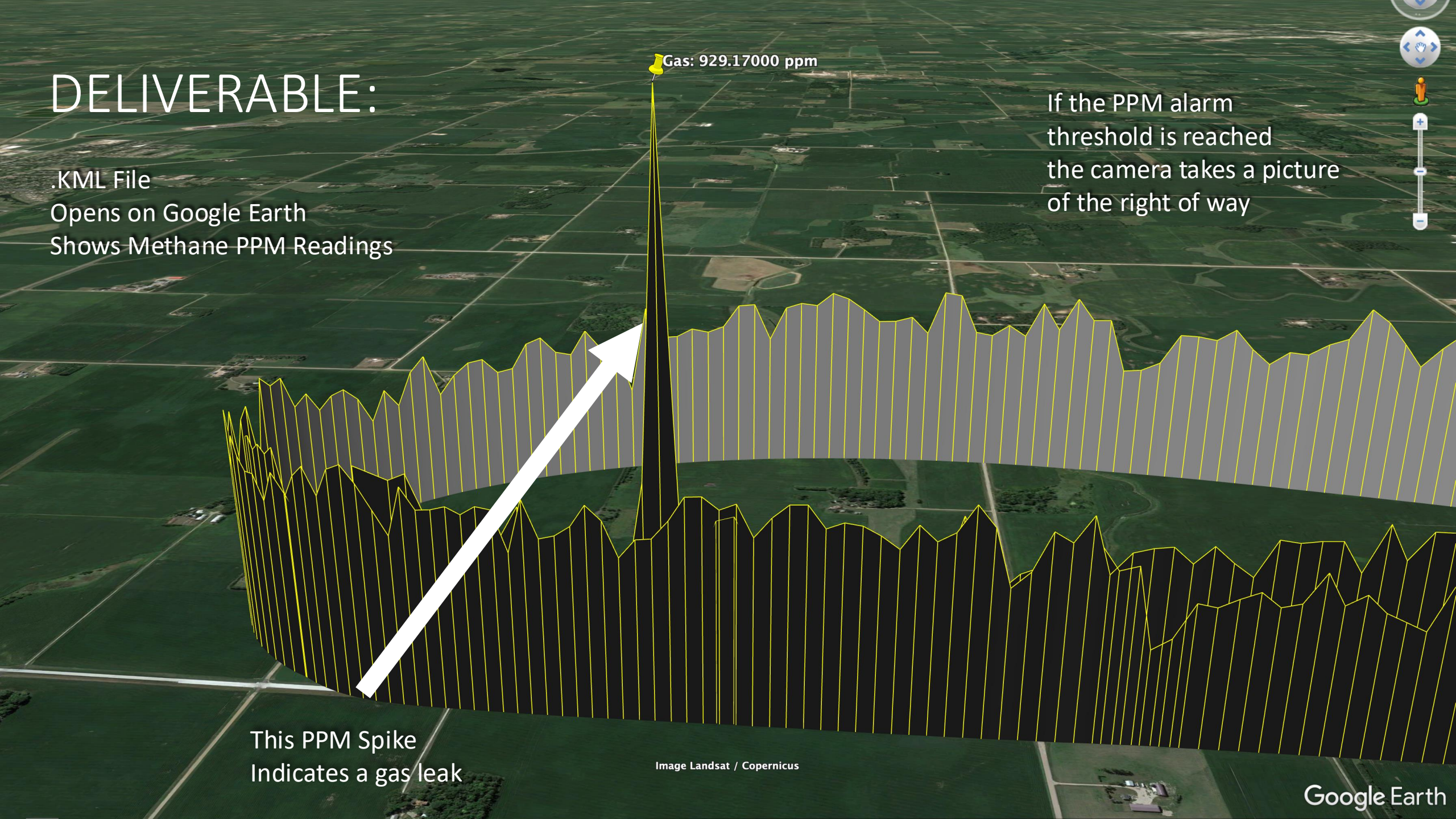


Real-Time Alerts



DELIVERABLE:

.KML File
Opens on Google Earth
Shows Methane PPM Readings



If the PPM alarm threshold is reached the camera takes a picture of the right of way

This PPM Spike
Indicates a gas leak

Leak Investigation

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Leak Investigation Technologies

RMLD-CS

Infrared optical gas detection system, **same TDLAS technology as Discover AMLD**

- Intrinsically safe (IS) with rating of Class I, Division II for indoor and outdoor operation
- Detection up to 30m away (100ft)
- Operates under a variety of environmental conditions

DP-IR+

Infrared optical gas detection system

- High-sensitivity for detecting methane
- Operates under a variety of environmental condition
- Built-in self-test and zero functionality

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Questions?