

MEASUREMENT & ANALYTICS, JUNE 2024

# Advanced Gas Leak Detection Solutions

Natural Gas Society – O&M Conference

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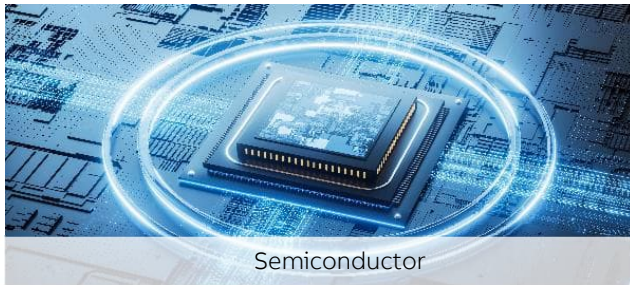


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# Enabling the world to improve productivity and sustainability

Focused on where industry and society need reliable accurate measurements

Improving production  
safety & efficiency



Environmental monitoring  
& regulatory compliance



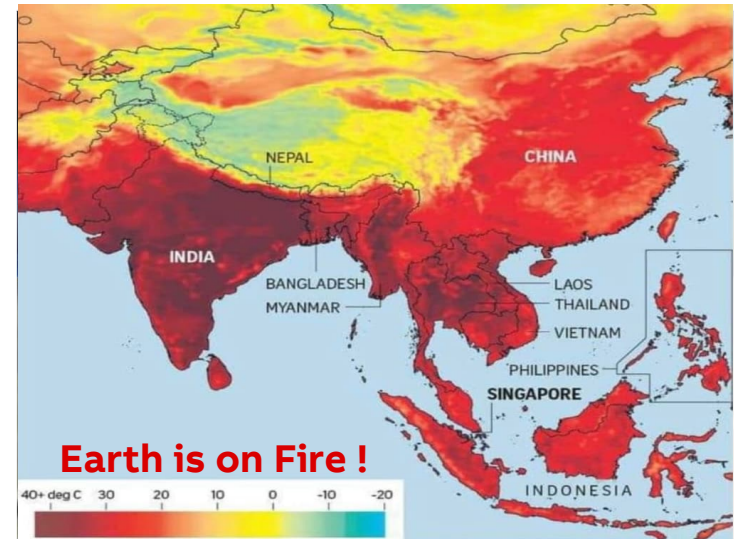
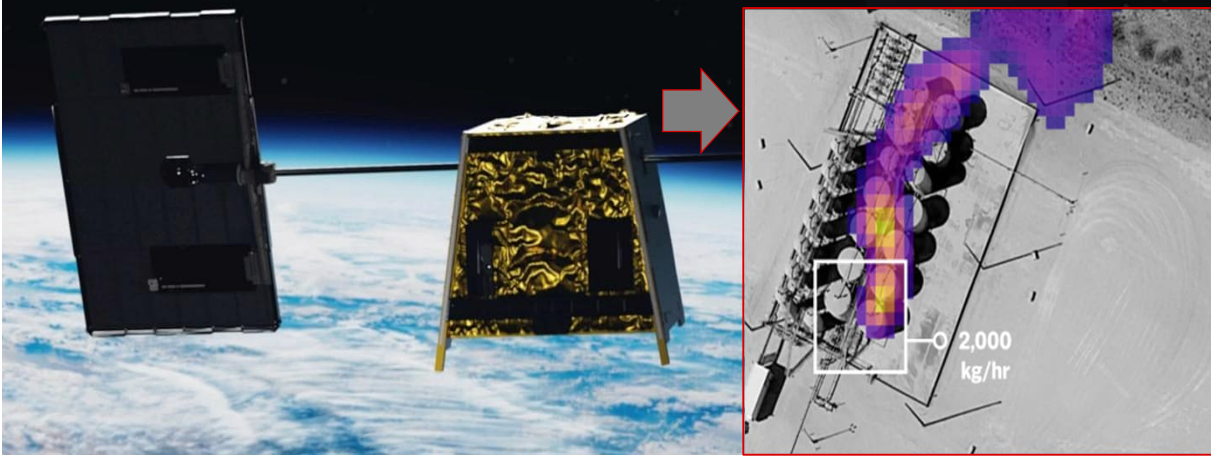
Greenhouse gas reduction  
& climate change impact



# Most comprehensive Optical Sensors for Satellites & Industry Solutions ...

Static, handheld, drone-based, vehicle-based & satellite-based measurement

ABB leverages our industrial heritage in space and vice versa



- ABB is established leader in space optics for Earth observation & atmospheric applications
- Executed for NASA, SpaceX, JAXA – Japan Space, CSA- Canadian Space, ESA - European Space, GHG Sat, etc etc.
- Satellites can now detect methane emissions, calculate total emissions from where & how they change over time. No place to Hide !!



**Solutions:** Greenhouse Gas (GHG) monitoring (Satellite-based optical sensing systems)

Gas leak detection suite (MicroGuard, HoverGuard, MobileGuard)



## Drivers : Improving system integrity

The ABB solution – ultra-sensitive mobile monitoring

### Safety & risk avoidance

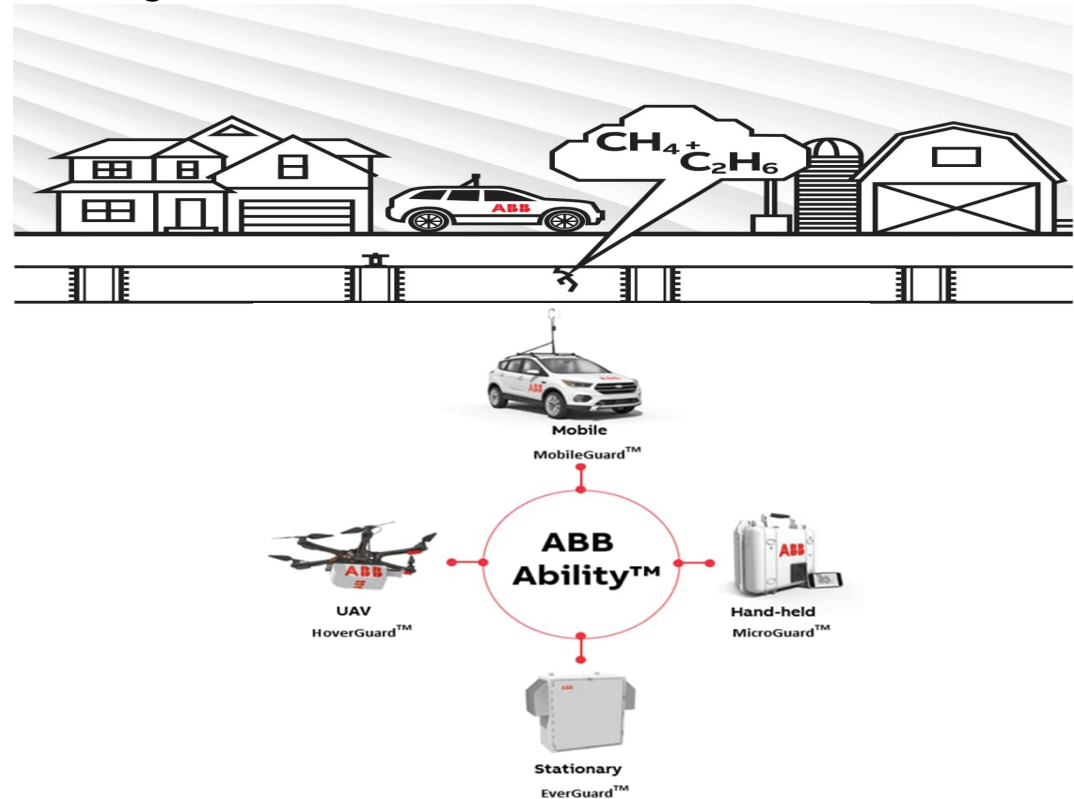
- Aging infrastructure
- Explosion
- Loss of life & property
- PR nightmare
- Fines & penalties
- Criminal prosecution

### Efficiency

- Faster survey
- Cost savings to meet regulations

### Environmental conscientiousness

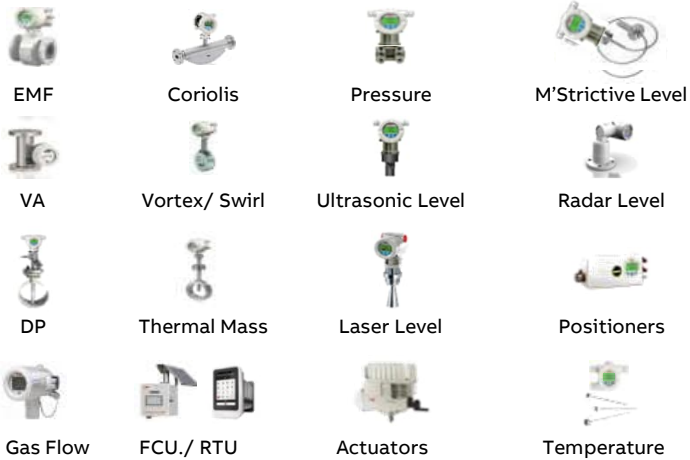
- Reducing greenhouse gas emissions
- Global Methane Pledge COP26 by 100 countries
- 0.3% reduction global temp



# ABB Measurement & Analytics

Measurement made easy: A large variety of products

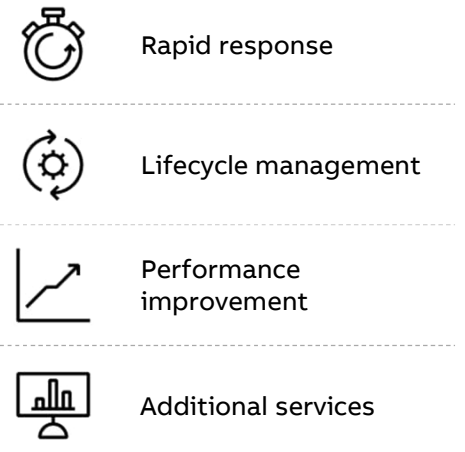
## Instrumentation



## Analytical & force measurement

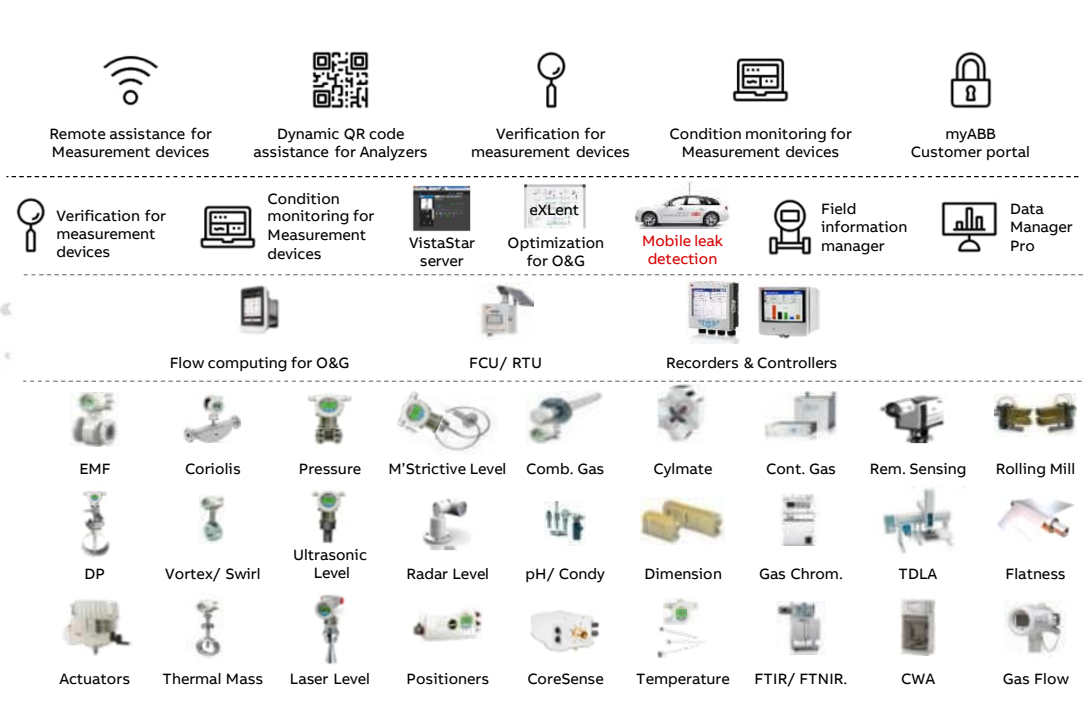
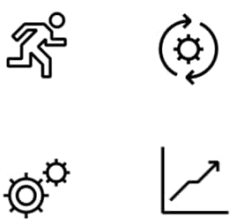
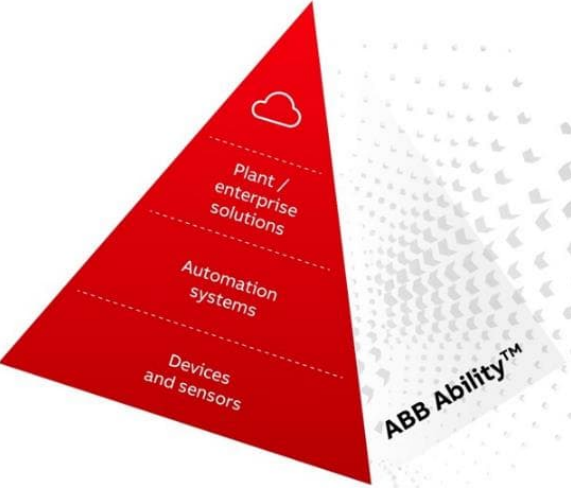


## Service



# ABB Measurement & Analytics Landscape

ABB Ability™ Digital Solutions for measurement devices



**Digital solutions**

**Recorders, controllers and flow computers**

**Data rich sensors**

- Process Control Efficiency
- Quality
- Safety
- Environment Regulations

Rapid response

Lifecycle management

Performance improvement

Additional services



# OA-ICOS: Off-Axis Integrated Cavity Output Spectroscopy

The latest evolution in TDLAS

1<sup>st</sup>: **TDLAS (tunable diode laser absorption spectroscopy)**

[First papers mentioning tunable diode laser for spectroscopy date from the 60's]



+Sensitivity

2<sup>nd</sup>: **CRDS (cavity ringdown spectroscopy)**

[First paper mentioning CRDS using TDL date from the 1988 (Anthony O'keefe, LGR founder)]



+ Accuracy and ruggedness/serviceability

3<sup>rd</sup>: **OA-ICOS (off-axis integrated cavity output spectroscopy)**

[1<sup>st</sup> generation OA-ICOS patent filed 2001, published 2004 (Los Gatos Research)]

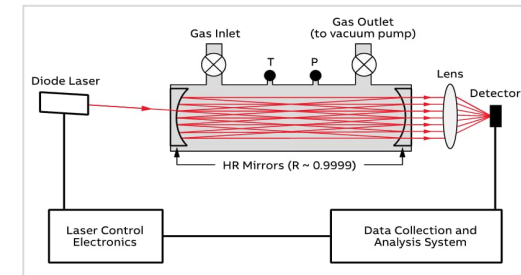
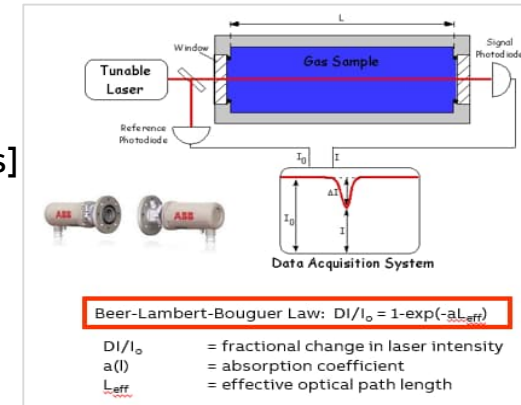
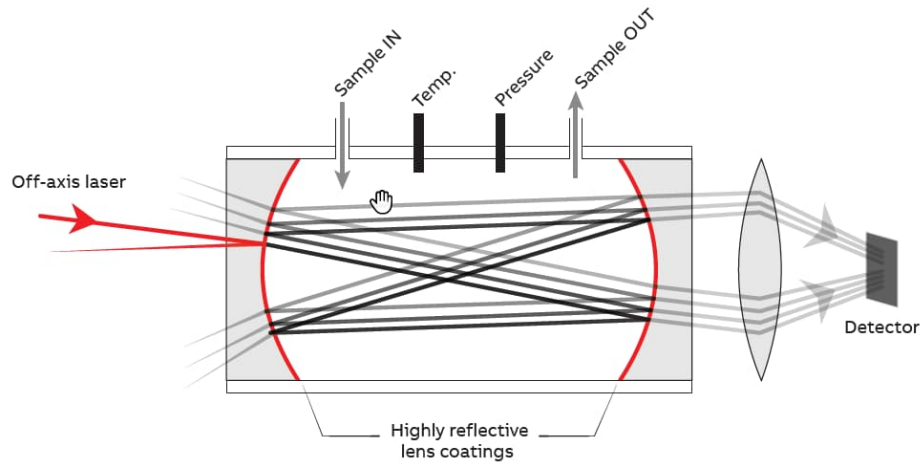


ABB now uses 4<sup>th</sup> generation TDLAS technology in the ABB LGR-ICOS™ analyzers: **latest advancement in laser spectroscopy**

# ABB OA-ICOS Technology

Off-axis Integrated cavity offset spectroscopy – technically advanced compared to other TDLS

## OA-ICOS basic methodology



Effective optical pathlength up to 25 km = sufficient absorption even at trace ppb / ppt levels

## Design features

Laser temporarily trapped inside cavity (Measurement Cell)

– Effective pathlength >km

Off-Axis alignment, parabolic mirrors and lens

– Rugged optical system (control of parameters and alignment is not critical)

Very precise measurement of signals (temperature, pressure, laser intensity, laser frequency, detector baseline, ringdown time)

– Efficient and accurate concentration calculation

Couple multiple lasers into a single cavity for multi-species detection

– Flexibility in measurement





# Advanced Leak Detection Solutions

Packaged on Platforms

Family suite of products  
dedicated to methane  
detection

MobileGuard™



MicroGuard™



HoverGuard™



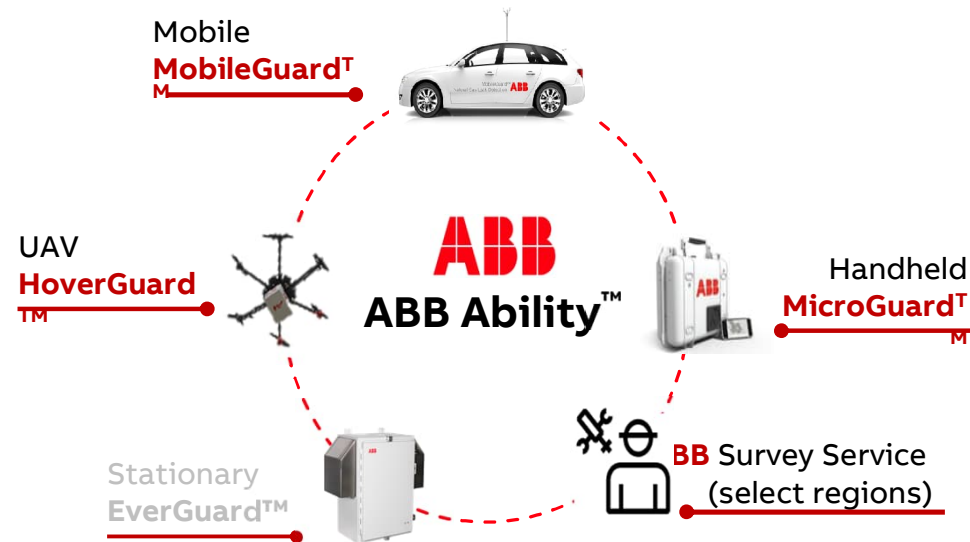
EverGuard™



# Find Gas Leaks Fast

Leading edge, comprehensive solutions reduce risk and cost

- 1 Storage and transport of flammable or dangerous gases pose risks to safety and the environment
- 2 Current methods of finding leaks slow, costly, unreliable
- 3 ABB solutions quickly detect, find, quantify leaks
- 4 Advanced analytics allows historical trend analyses
- 5 Survey-as-a-service eliminates CapEx, training, maintenance



All solutions offer software to map, locate and quantify the size of leaks and generate digital reports automatically that summarize results recorded during a survey.

These reports are shared via the Cloud & secure Cloud server.

Leading-edge products, advanced data analytics, and survey service yield compelling, cost-effective solutions

# MobileGuard™ solution

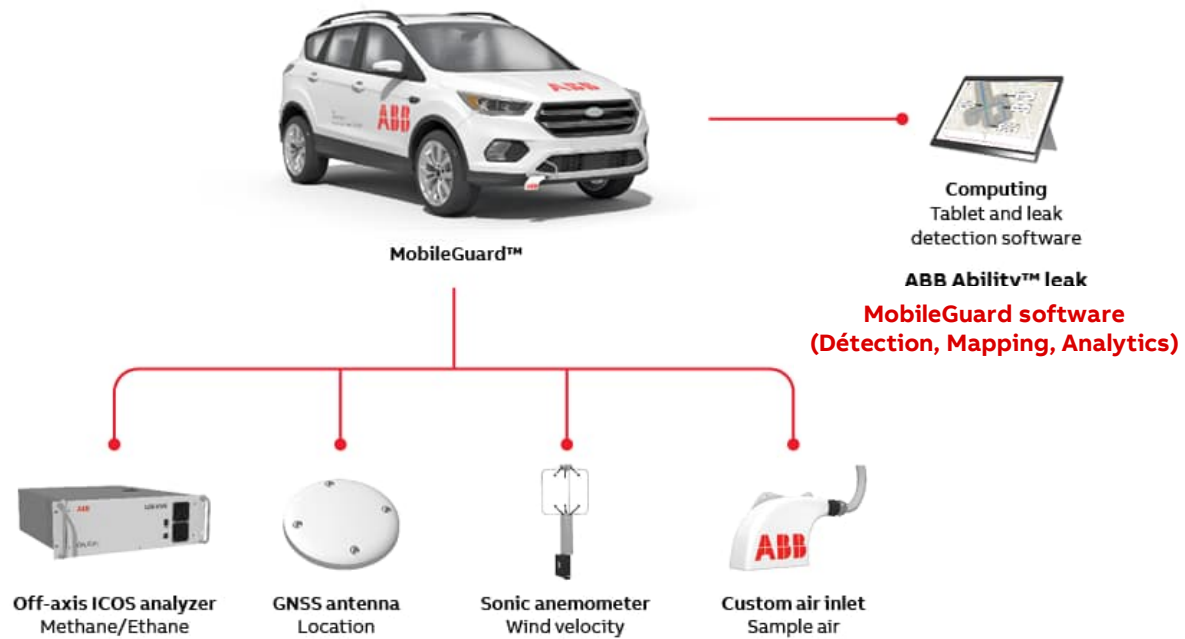
## Primary components

### Main Features

- Fast, reliable estimates of emission location and size (emission rate) while driving
- Source attribution (thermogenic vs biogenic)
- No warm-up time

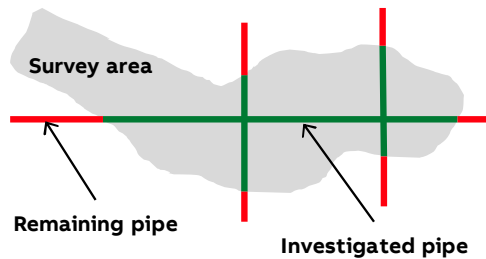
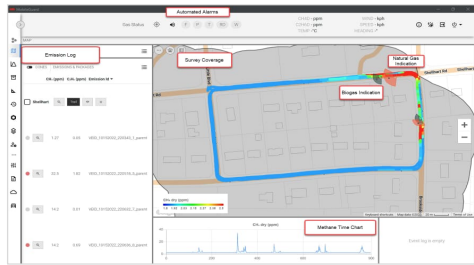
### Digital Features

- Real-time visualization
- Real-time analyses
- Cloud storage / sharing
- Multi-drive analyses
- Digital reports generated automatically
- Customer owns all data



# MobileGuard Software Graphical Interface

Leak Detection, Map display of Survey Route



Start/Stop Drives

Real-time status

Review archival data

Data Stream Status

View Control

Natural Gas Leak Indication

Survey Route

Leak indications list

Methane time chart

Processing Event Log

Methane Color Code

Automatic Status Monitor

Settings, User Management and About

Analyzer Connection

# HoverGuard™: UAV-based detection, mapping, quantification solution

Low payload and low power - Find leaks quickly while flying

## Main Features



HoverGuard™

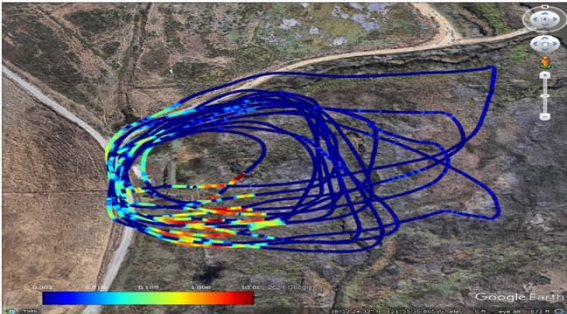


Specification	Value	Notes
<b>Methane sensitivity/precision</b>	<b>2 ppb or 0.1% of reading</b>	<b>1<math>\sigma</math> RMS in 1 sec</b>
Response rate (1/e)	2.5 Hz	flow response, data rate = 5 Hz
<b>Range</b>	<b>0-1000 ppm</b>	<b>CH<sub>4</sub></b>
<b>Power</b>	<b>32 watts</b>	<b>10 - 28 VDC</b>
<b>Weight</b>	<b>3 kg</b>	<b>configuration specific</b>
Classification	-	general purpose
Operating Temperature	5 to 45 °C	ambient

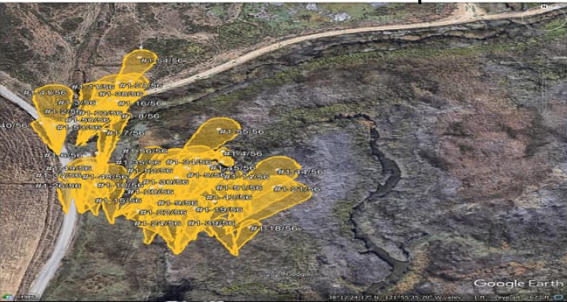


# HoverGuard Processed Data: Flight Path and Estimated Source Locations

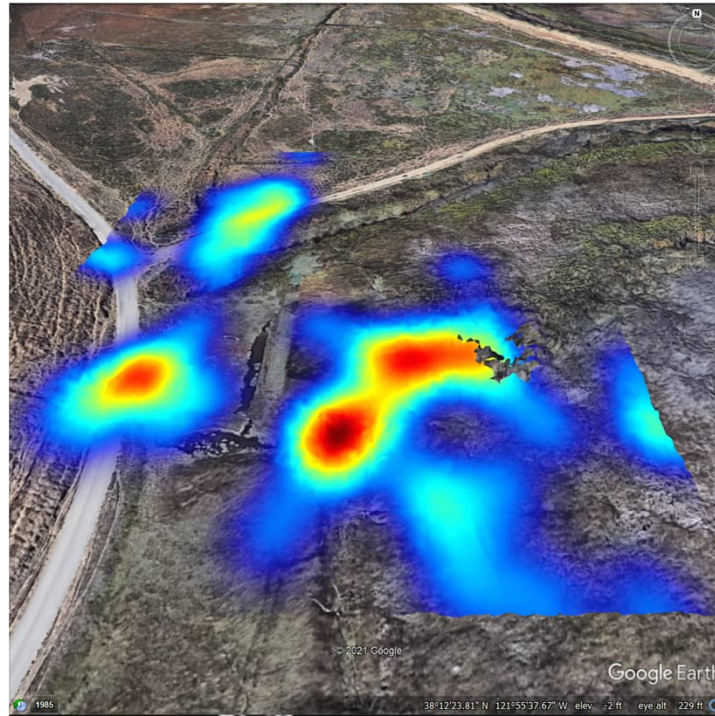
Color coded flight path showing methane concentration



Detection and estimated source locations for each methane peak



Kernel Density Estimation / Heat Map



- In this case, 56 separate emission peaks detected during survey
- For each detection peak, an estimated source location is predicted
- Place marker shaped blobs show detection and estimated source locations, as well as uncertainty

# MicroGuard System

## Constituent Components



MicroGuard™



### System Components

- World's most sensitive handheld methane sensor(2ppb)
- Comfortable backpack carry
- Integrated sampling wand and UI
- Ruggedized Phablet
  - Full sun readable screen
  - 8-hr battery life
  - IP67 rated
  - High accuracy GPS

### Software Components and Features

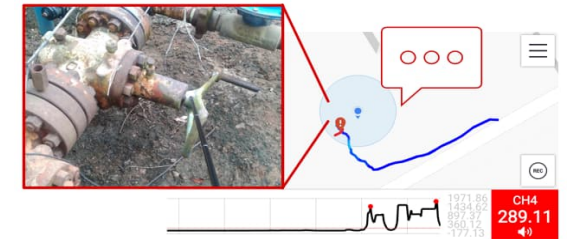
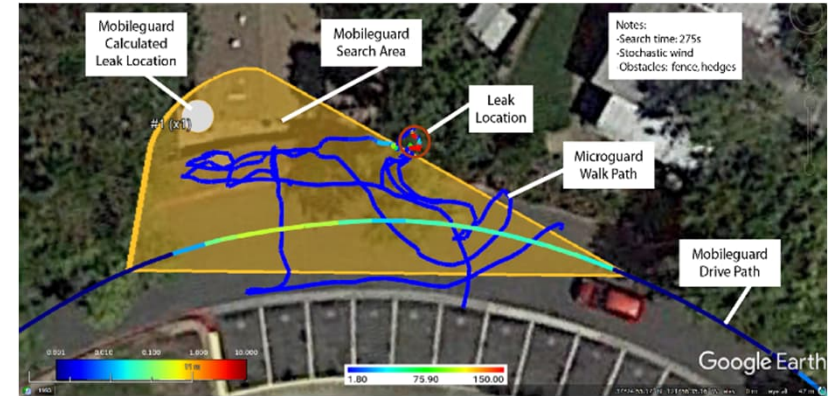
- Bluetooth connection to analyzer
- In-field geospatial data visualization
- Real-time, automatic leak detection
- Add user notes (text, photos, video, etc.)
- View vehicle results via Cloud
- Automatic digital report generation
- Cloud storage/sharing/analytics

# MicroGuard™

Example Field Results (w/ MobileGuard™ map)

## Walk Package Results

- Record CH<sub>4</sub> concentration vs GPS
- Audio feedback for CH<sub>4</sub> concentration
- Analyzer health alarms
- View emission indications from MobileGuard
- Automatically detects and aggregates leaks
- Make and view comments
- Embed photos/video/audio
- Draw on map/satellite images
- Automatic generation of digital reports



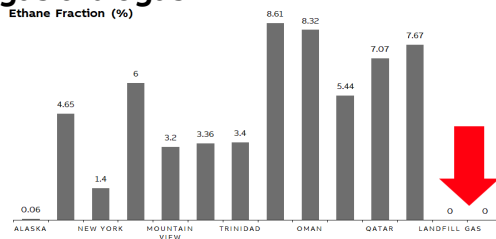
Capability to detect and pinpoint emissions sources in minutes, ABB's innovative Walking Procedure to find the origins of the leaks directly and reliably.



# ABB Leak Detection Suite - Summary

Find the leak fast, no matter where it is

## Differentiates between natural gas & biogas



## Major operational cost savings

- Less labor, more coverage, 2x to 10x less expensive than other mobile options



Fly

Walk

Drive

## Ownership system & reporting transparency

- Customer owns system & data
- Deliver real-time reporting to select stakeholders via Google Drive (or other user-controlled servers)



## Deploys across all types of terrain

- Mounts to cars, ATVs, aircraft or drones

### High sensitivity sensor

- Parts-per-billion (ppb) sensitivity
- Detect up to 100 meters away



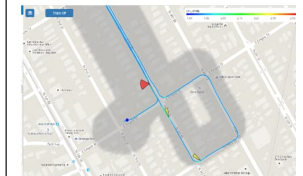
### Mobile platform

- Geo-located measurements
- Survey quickly and efficiently



### Leak detection software

- Easy-to-use interface
- Automatically find leaks
- Geographic Information System (GIS) compatible



Locates leaks up to 500 feet (~150 meters) away because it's 3000x more precise than legacy methods

**ABB**