



ABB ANALYTICAL MEASUREMENT

Advanced Gas Leak Detection Solutions

Novel platform reduces risk, increases safety, and decreases waste

Doug Baer, Ph.D.
Global Product Line Manager – Laser Analyzers



Motivation

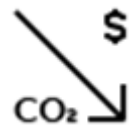
Why do we need *advanced leak detection*?

- Improve the integrity of natural gas infrastructure
- Respond to PIPES Act of 2020



Safety

- Explosion risk
- Aging infrastructure (cast iron, steel)
- Loss of life & property
- PR challenge
- Fines, penalties, criminal prosecution



Efficiency

- 2.2M miles of natural gas pipeline (US)
- 1M known well heads, many unknown (US)
- Faster surveys required
- Cost savings to meet regulations



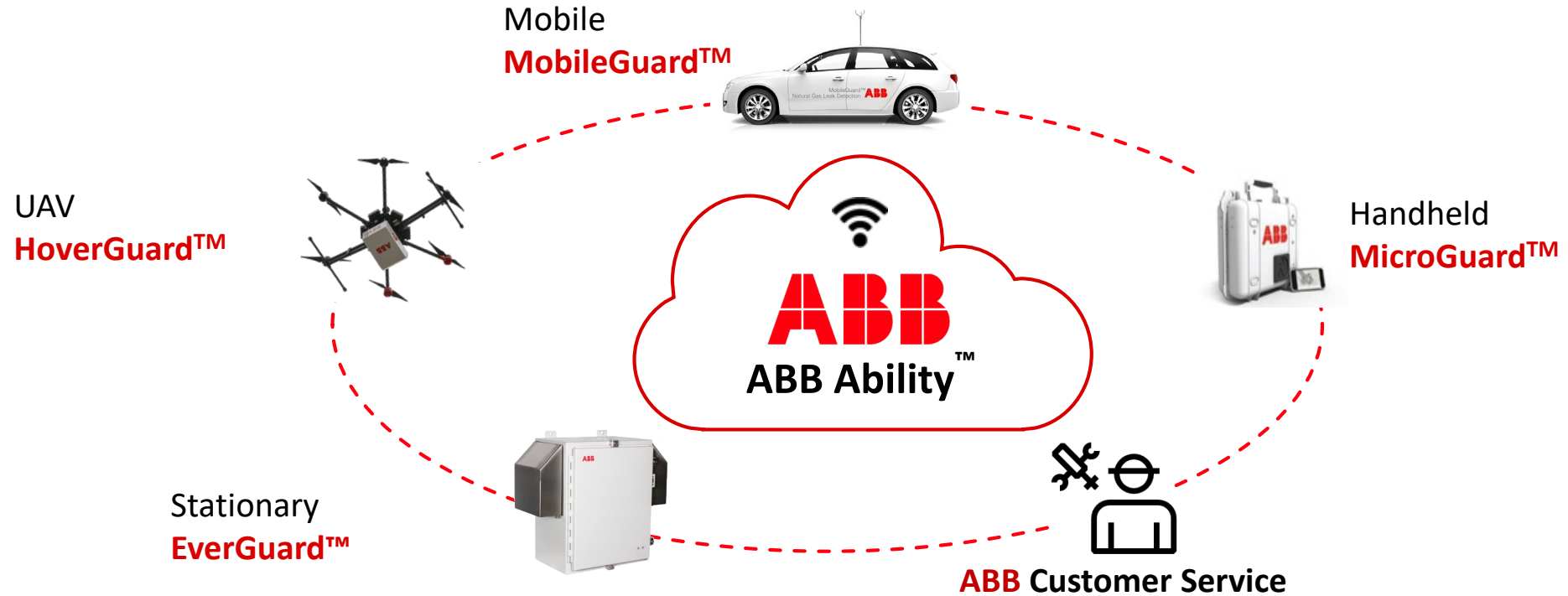
Environmental Conscientiousness

- Reduce greenhouse gas emissions
- Public pressure
- EPA Methane Challenge



ABB Ability™ Natural Gas Leak Detection Platform

Advanced Leak Detection solutions: reduce risk, cost, and waste



Leading-edge technology combined with advanced data analytics yield compelling, cost-effective solutions

Conventional laser system vs. ABB's core technology

ABB's patented technology provides higher sensitivity and accuracy

Tunable diode laser absorption spectroscopy

- First-principles measurement – no calibration required
- Highly selective – only target gases absorb probe wavelength
- Fast – measure full spectra quickly (in 1-2 millisecond)
- Robust – utilizes telecom-grade lasers and detectors
- Insufficient sensitivity – cannot measure low levels in near-IR

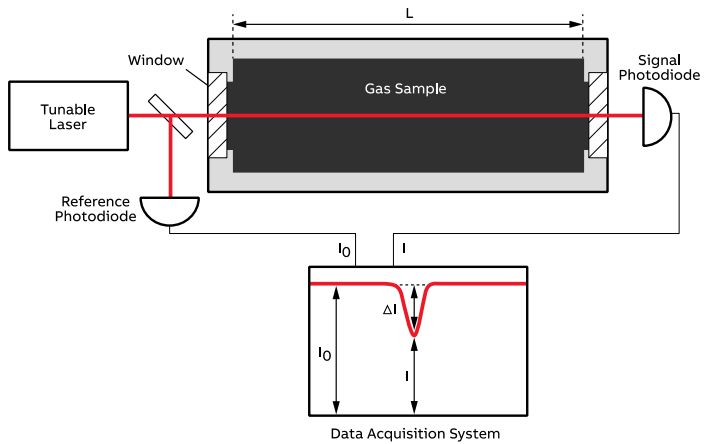
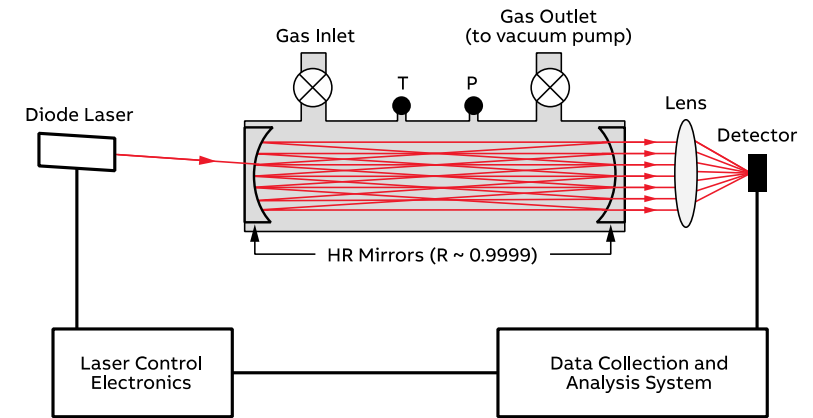


ABB patented Off-Axis ICOS (OA-ICOS)

- Patented 4th-generation cavity-enhanced technique
- Optical cavity provides effective path length of 1 – 100 km
- Enables use of reliable/ rugged telecom diode lasers
- Increased dynamic range of 1,000 – 10,000
- Robust – exact alignment not critical, enabling mobile monitoring
- Improves TDLAS with **increased** sensitivity, ruggedness, range



MobileGuard™

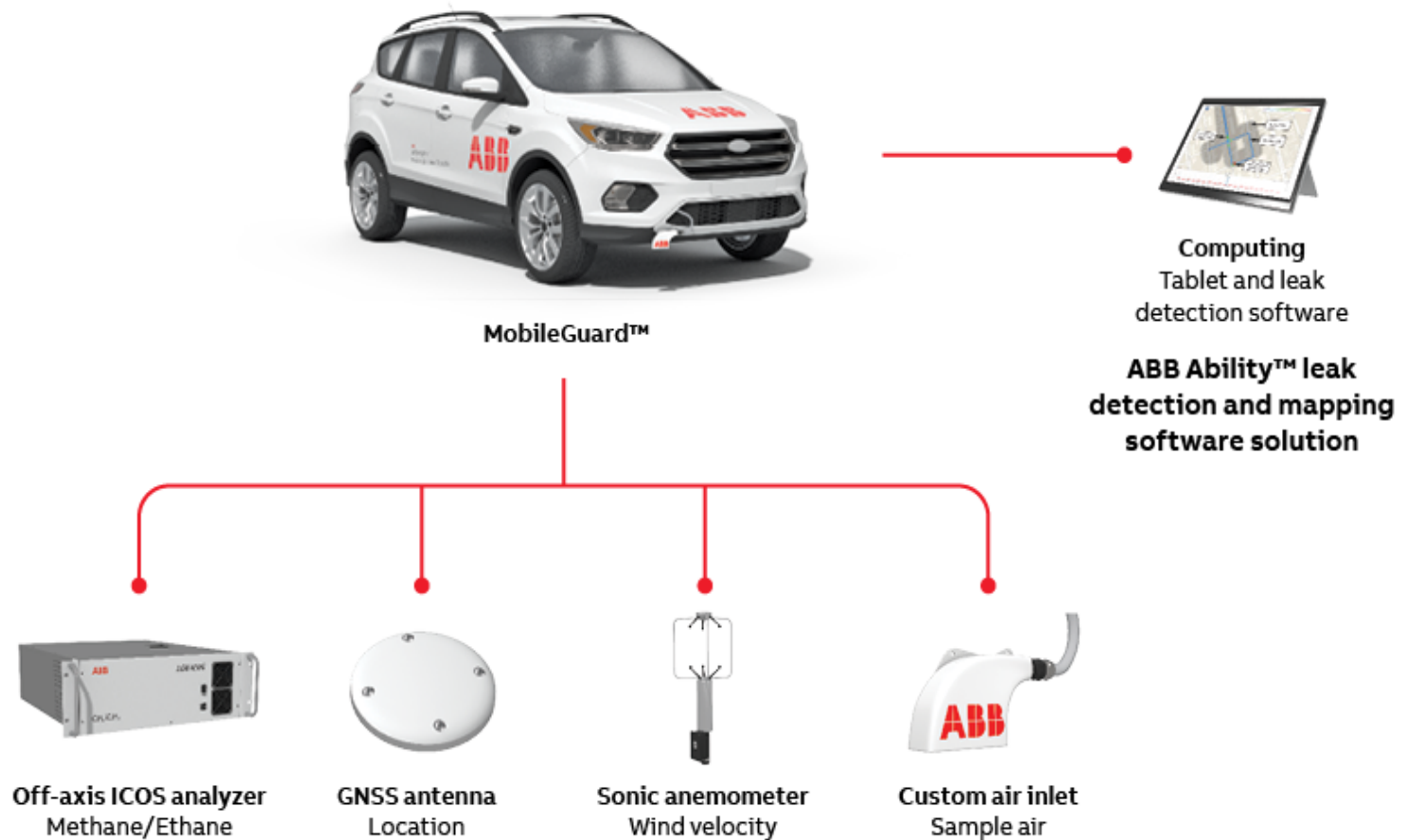
Mobile Gas Leak Detection Technology



MobileGuard™ solution

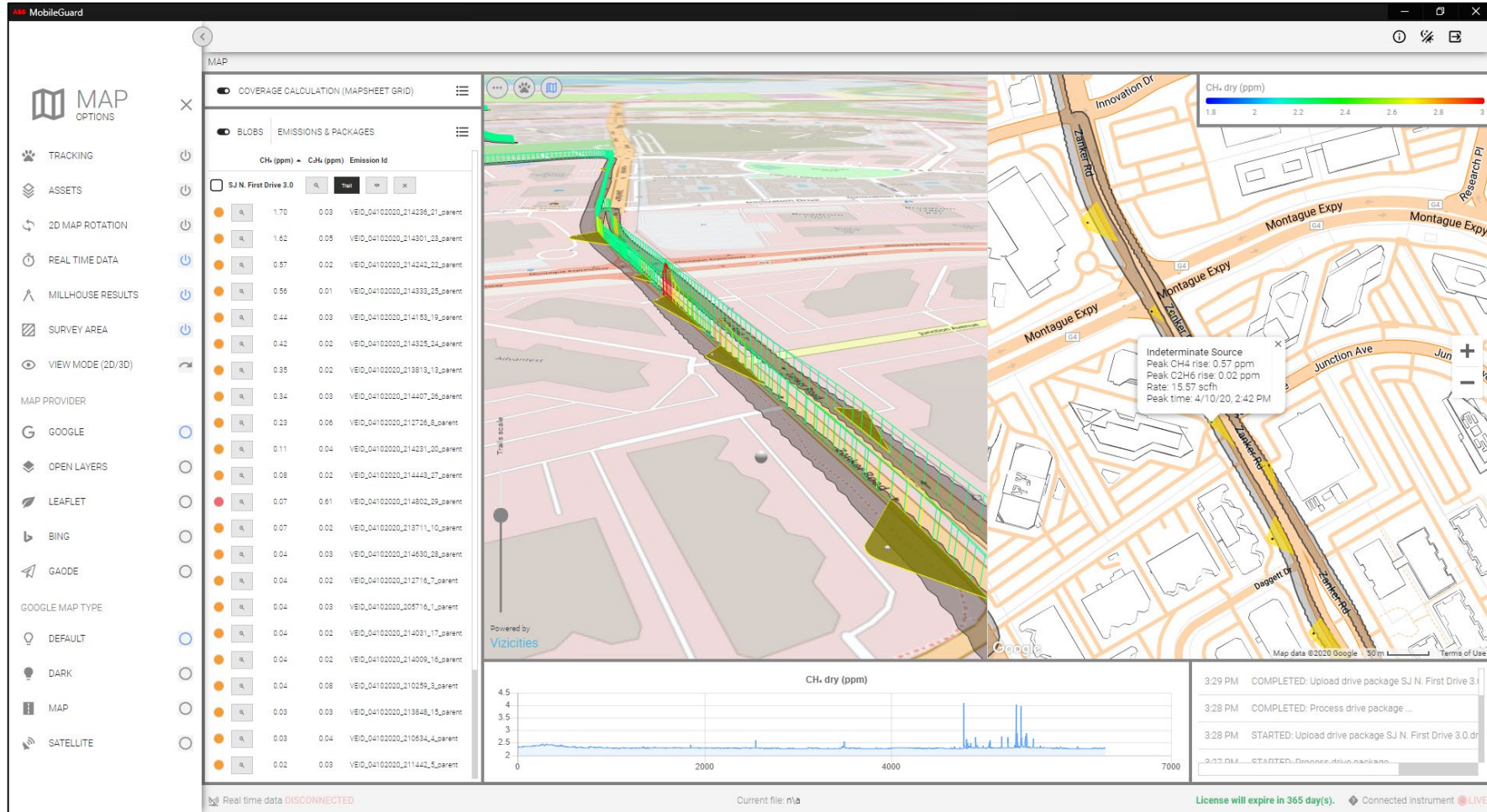
Main Features

- Fast, reliable estimates of leak location & size
- Source attribution (thermogenic vs biogenic)
- Real-time visualization
- Real-time analyses
- Real-time remote monitoring of vehicles
- Cloud storage / sharing
- Digital reports generated automatically
- “Big data” analytics
- Customer owns all data



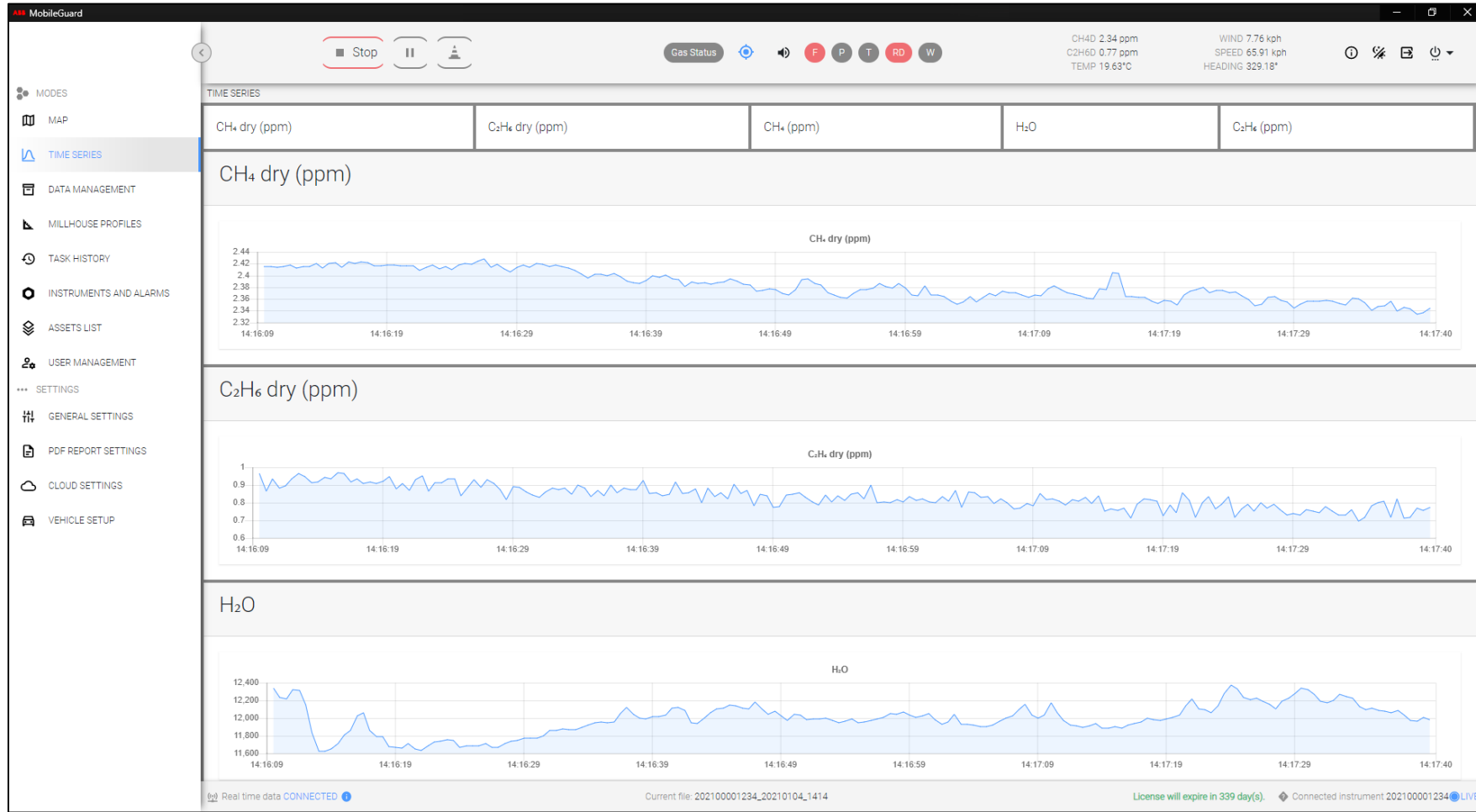
Graphical User Interface

Data rich, comprehensive RT display



Graphical User Interface

Time charts of raw data

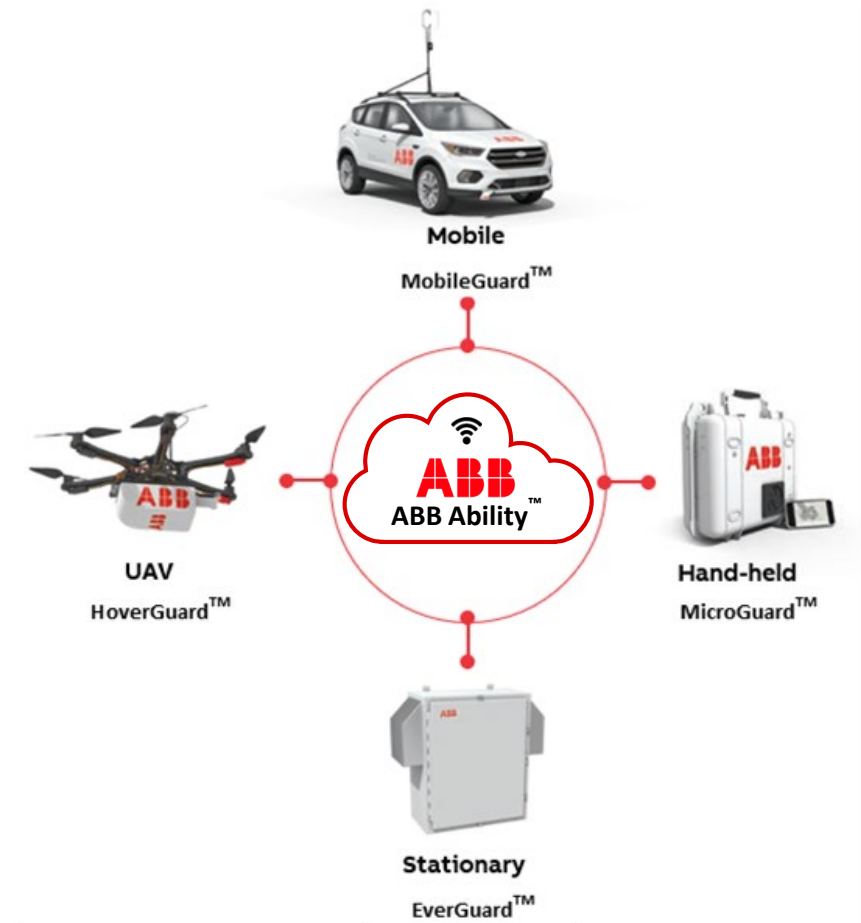


Cloud storage and analytics

Cybersecure data sharing and archival

Microsoft Azure and Google Drive

- Drive, walking packages uploaded automatically
- All data: customer owned and controlled
- Set sharing access per user
- Unlimited reprocess capability: Command Center
- Secure: ISO27001 info security certified



Import Merge selected packages Share Drives Refresh NOTE: only packages with matching instrument and package types can be merged

<input type="checkbox"/>	Name	Survey start	Instrument ID	Instrument type	Package Type	Status	Sync.	Reprocess
<input type="checkbox"/>	1234_20190530_0629	2019-05-30 06:29:18	1234	fmeaRMY	DRIVE	ONLY_LOCAL	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	1234_20190530_0617	2019-05-30 06:17:10	1234	meaRMY	DRIVE	ONLY_LOCAL	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	170600002020_20190520_1259	2019-05-20 12:59:29	170600002020	meaRMY	DRIVE	ONLY_CLOUD	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/>	170600002020_20190520_1150	2019-05-20 11:50:03	170600002020	meaRMY	DRIVE	ONLY_CLOUD	<input type="checkbox"/>	<input type="checkbox"/>

MicroGuard™

Portable Gas Leak Detection Technology

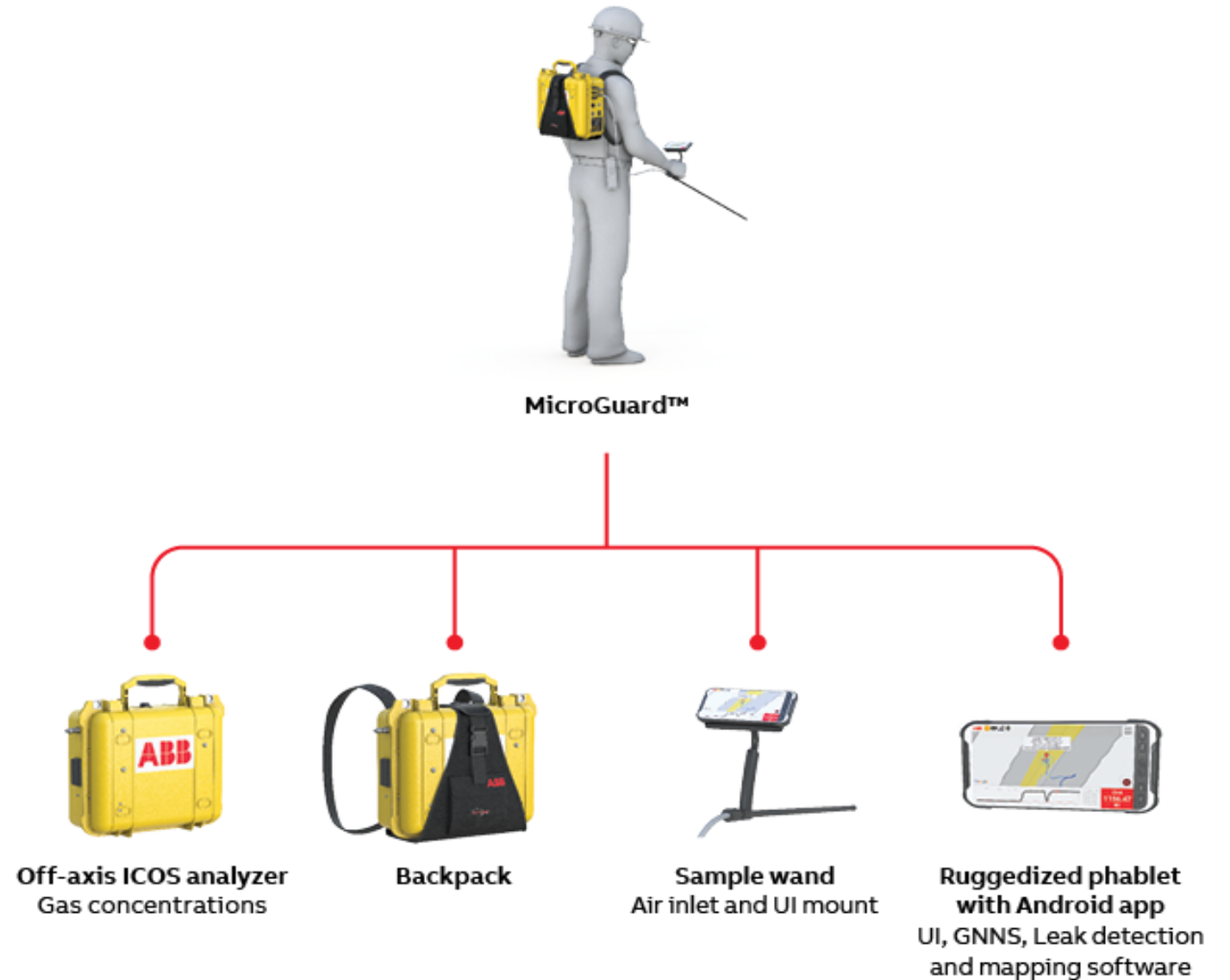


MicroGuard™ Solution

Next-generation leak emission pinpointing

Overview

- Fast, sensitive, precise:
detects even hidden leaks far from source
- Reduces find times from 45 min to < 5 min
- Fastest response (2.5 Hz)
- Fastest data rate (10 Hz)
- Wireless user interface (tablet/smartphone)
- Automatic generation of investigation report
- Supplements MobileGuard™ to yield comprehensive, effective solution
- Cloud storage / sharing / analytics

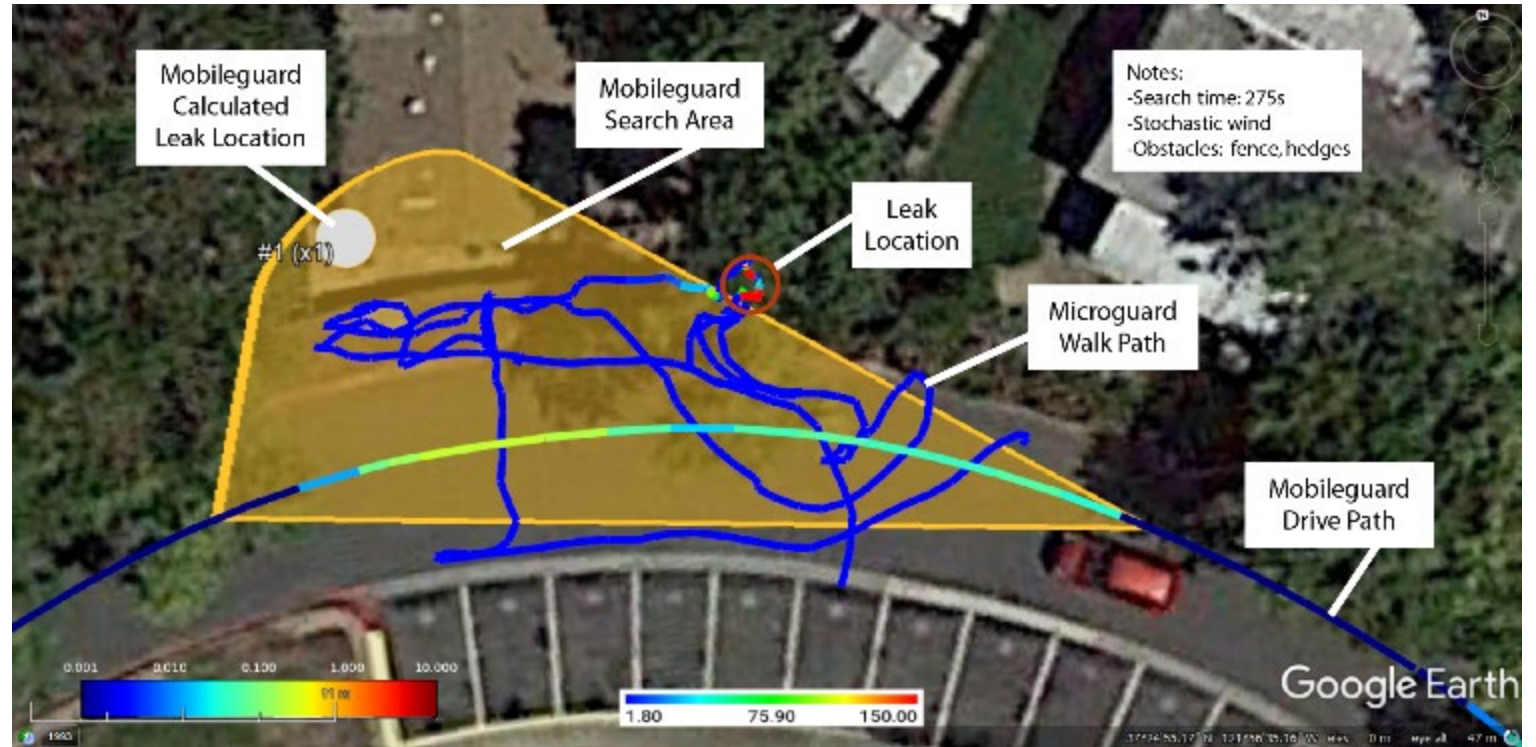


MicroGuard™

Example Field Results (w/ MobileGuard™ map)

Walk Package Results

- 4.5minute search time
- Obstacles added difficulty
- Emission source located 15m from estimated location



HoverGuard™

Portable Gas Leak Detection Technology

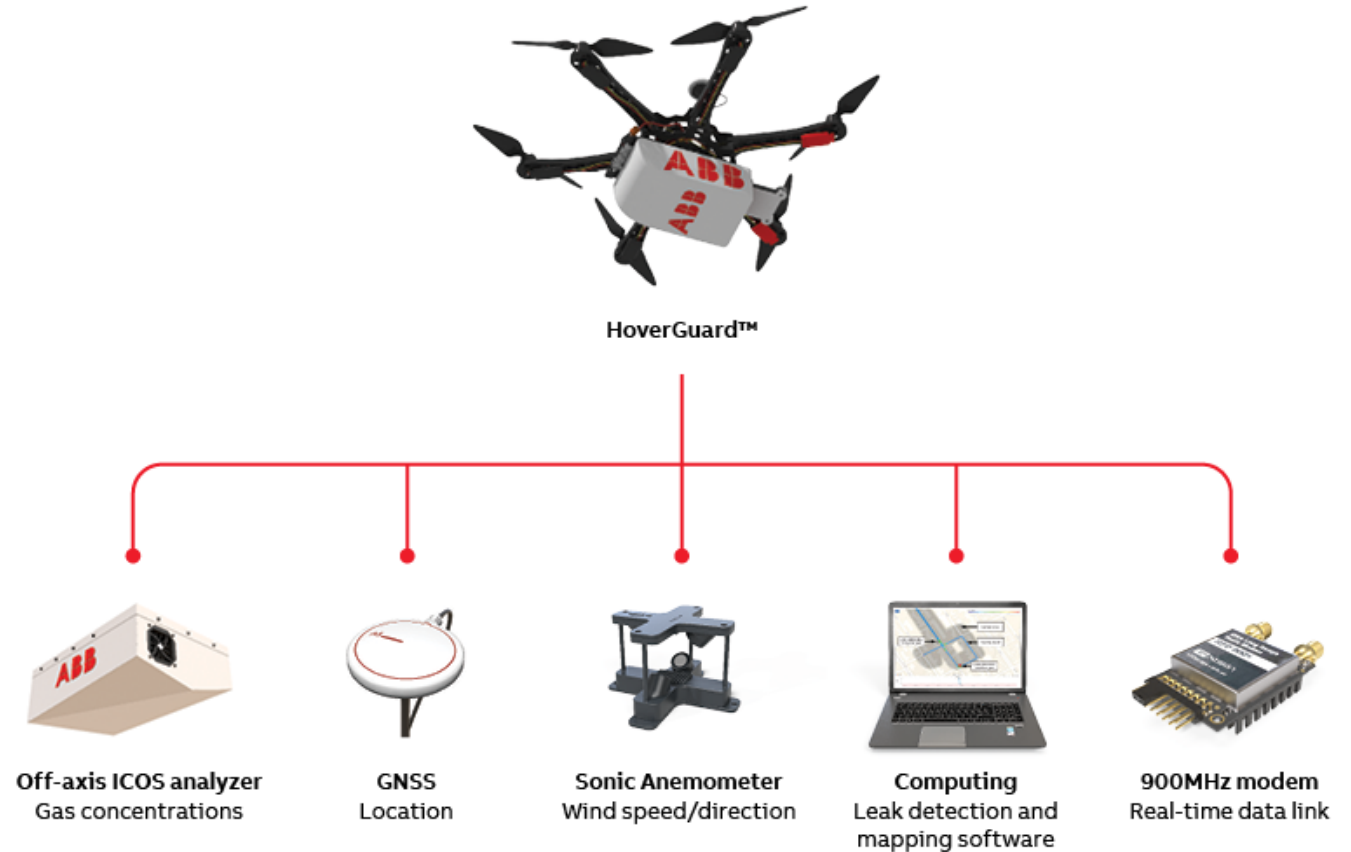


HoverGuard™ Solution

Primary components

Main Features

- High sensitivity detects leaks far from source
- Fast response (2.5 Hz) enables measurements while flying at high speed
- Fast data rate (10 Hz) allows high spatial res
- Proprietary software provides estimates of leak origin and size (emissions rate)
- Patented technology provides high accuracy measurements at the precise UAV location
- Advanced analytics and mapping software provide real-time results
- Software generates advanced digital reports easily shareable via cloud connectivity
- Cybersecurity gives customers confidence their data and systems always remain safe



Controlled Releases (blind studies) at METEC

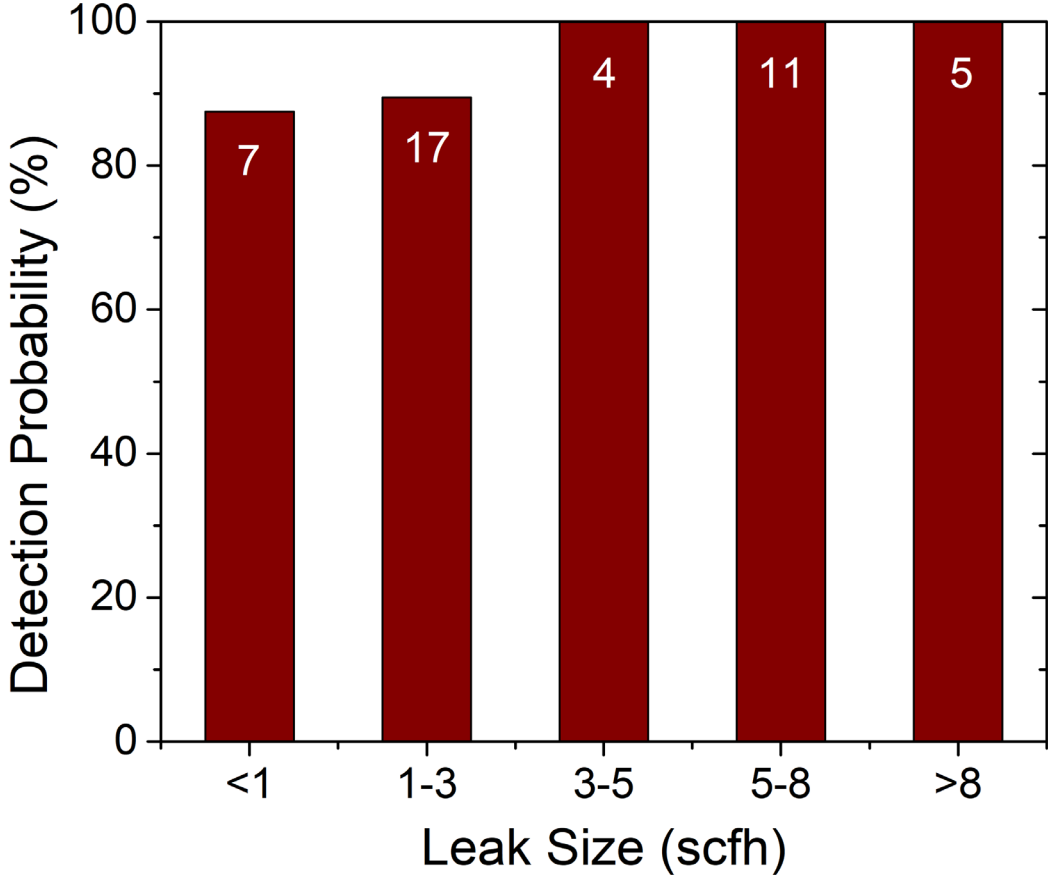
Invited Testing

- METEC is a controlled release facility in Fort Collins, CO designed to simulate natural gas infrastructure in the US
- Used for controlled testing of leak detection technologies
- ABB sensors tested by 2 UAV-based service providers
- **Measurements recorded while flying safely 5-10 m above assets**

ULC Robotics



Advisian (WorleyParsons)

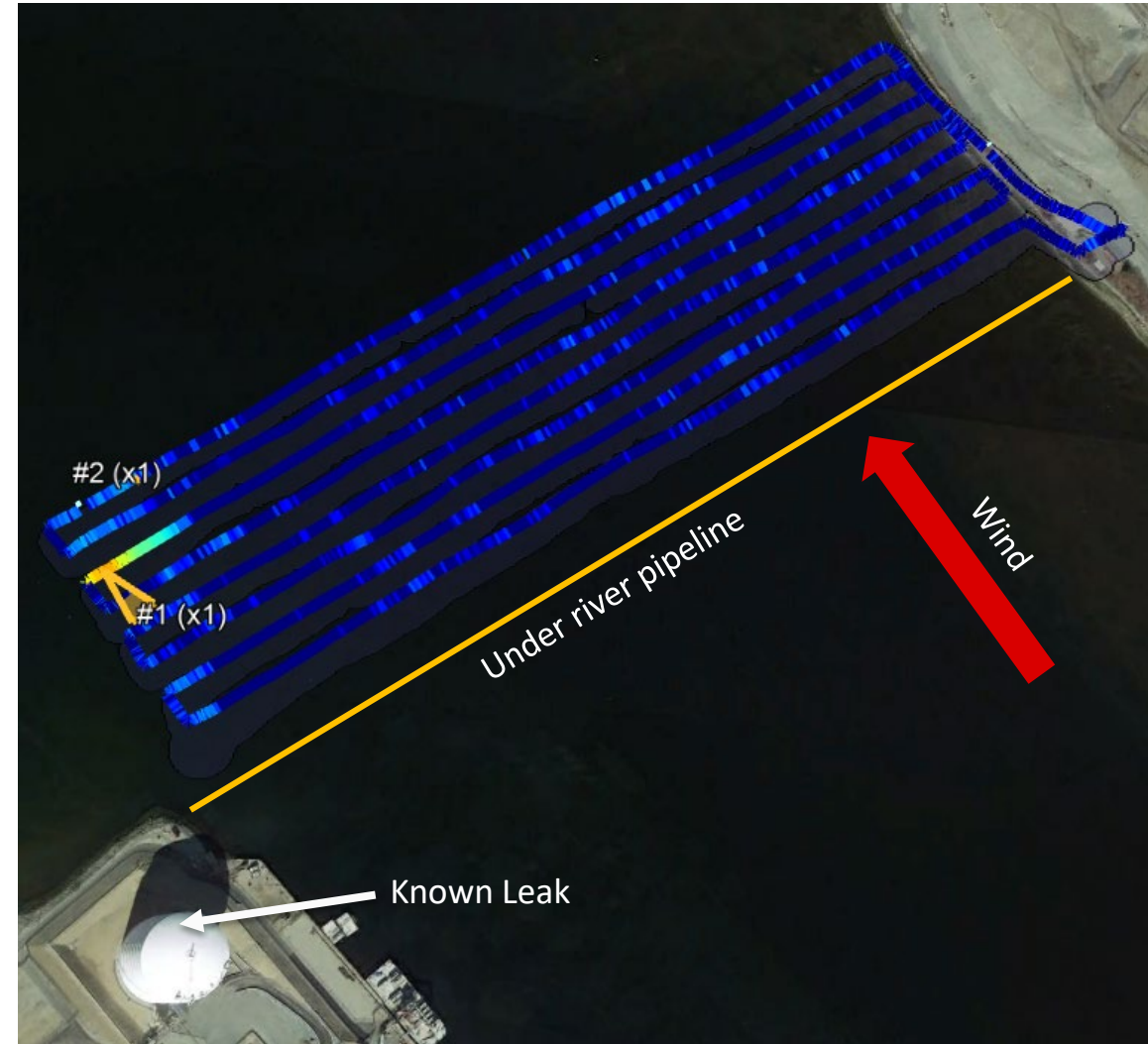


90.2% detection efficiency

US Pipeline Inspection

Live Pipeline Use

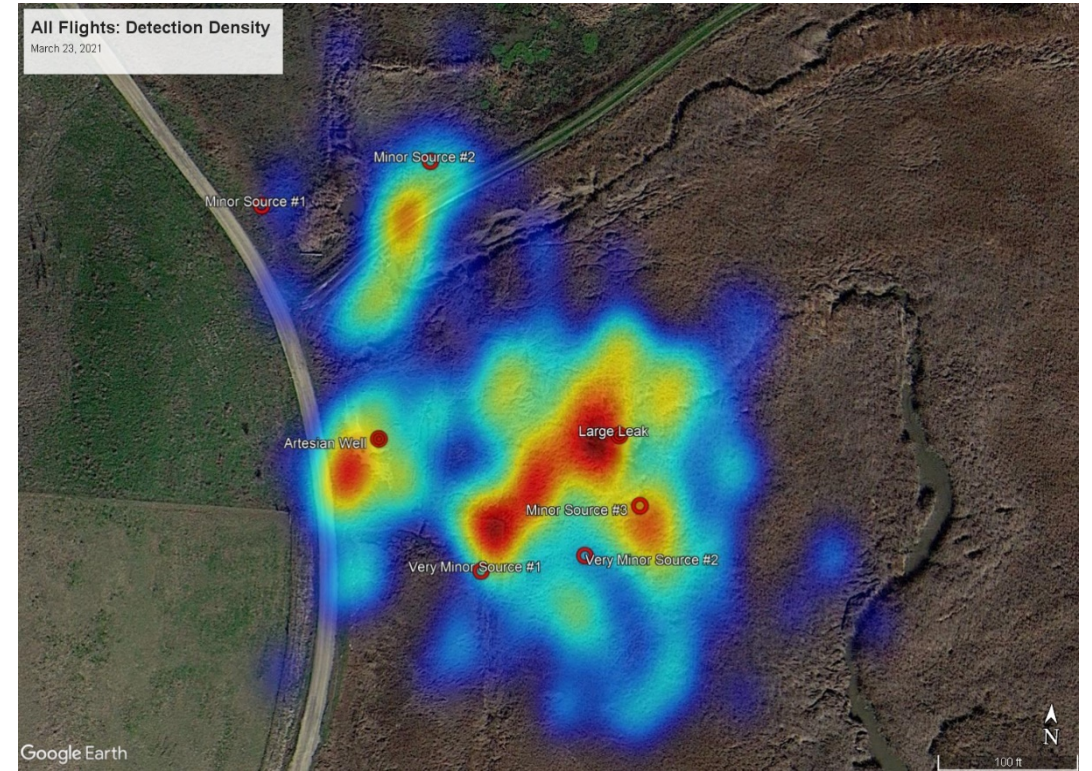
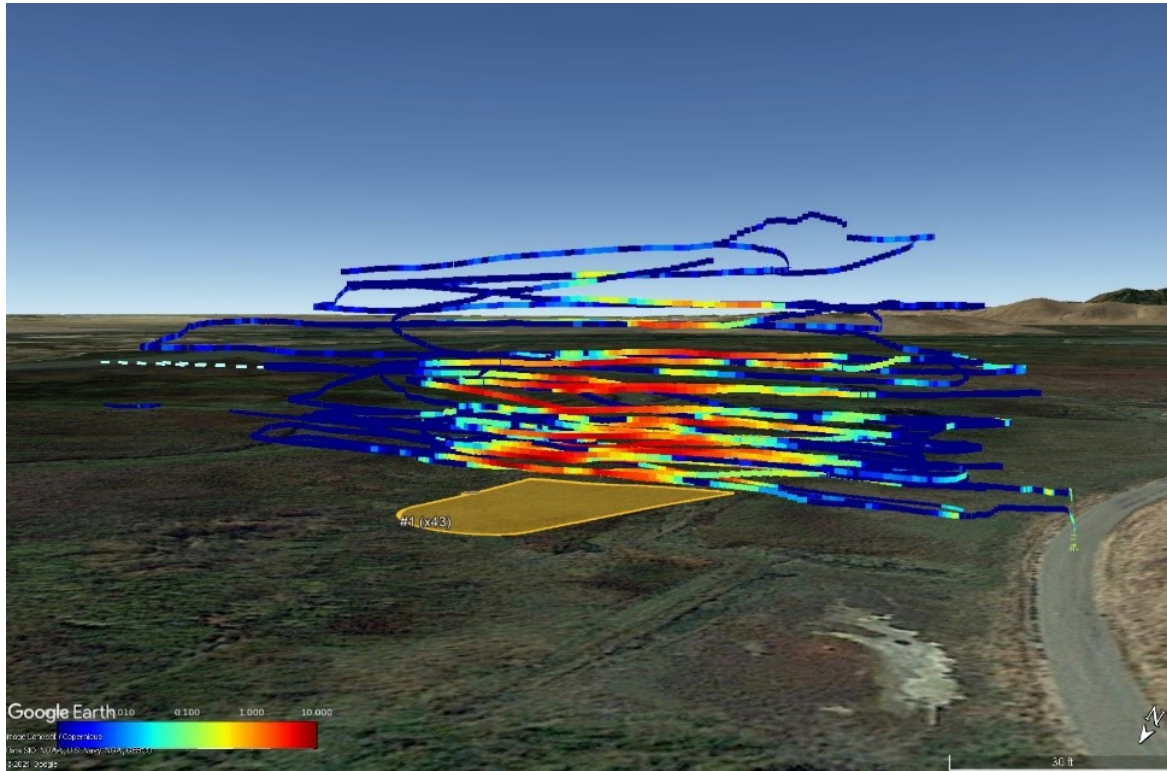
- Under-river pipeline accidentally over pressurized
- Inspection required for possible damage
- Conventional method: looking for bubbles was performed
- ABB sensor results compared to bubble method
- ABB sensor identified a known leak at SW storage facilities



Finding large undocumented emissions sources

Collaboration with Lawrence Berkeley Laboratory (University of California Berkeley)

- Only one known previously (Artesian well)
- Detection of multiple unknown sources



Finding large undocumented emissions sources

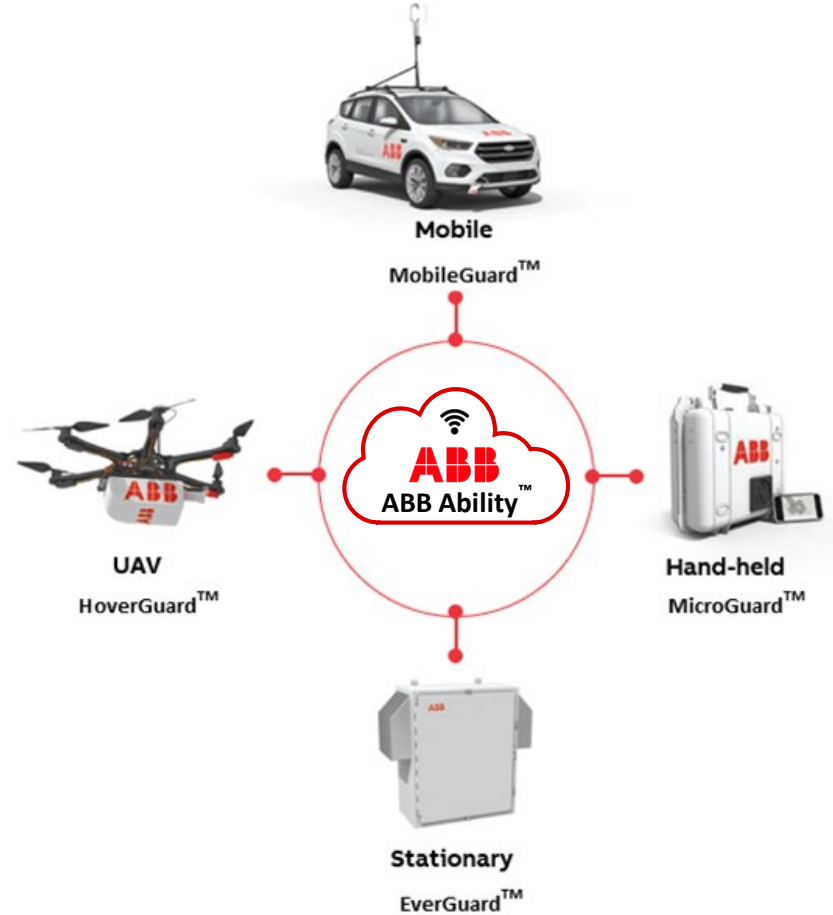
Collaboration with Lawrence Berkeley Laboratory (University of California Berkeley)



Summary: ABB Ability™ Gas Leak Detection Ecosystem

Benefits

- Proven performance
- Cybersecure
- Customer owns all data
- Detects hidden leaks
- Full featured HW and SW
- Service and reliability
- Comprehensive solutions
- Cost-effective
- Product offering
- Survey-as-a-Service offering (select areas)



Advantages

- More efficient surveying
- Finds even hidden leaks
- Source attribution (detects CH₄/C₂H₆)
- Integration of data/maps
- Full data ownership and custody
- No warm-up time
- Service, serviceability, & stability
- Fast ROI

ABB advanced leak detection solutions go beyond detection to find, attribute, and quantify more leaks faster