

Gas Mapping LiDAR™

A Service for the Oil & Gas Industry



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Service Features

Monitors methane leaks throughout the entire natural gas value chain

Detects leaks 20-100 times more sensitively than airborne IR camera solutions

Locates leaks to equipment level

Quantifies leak rates (flux) with industry-leading accuracy

Maintains performance even with interference from off-site emissions

Provides real-time alerts for dangerous leaks

Provides verifiable, time-stamped, and geo-registered record of monitoring for simple auditing

Provides “answer key” identifying which sites to visit to expedite regulatory monitoring

Minimizes liability of costly accidents

Bridger Photonics' (Bridger's) Gas Mapping LiDAR™ (GML) service makes finding and prioritizing leaks simple. GML uncovers and quantifies natural gas (methane) leaks and physical changes in oil & gas infrastructure including well pad fields, processing facilities, and underground pipeline right-of-ways.

GML uses proprietary laser-based remote sensing technology from an airborne platform to provide 3D LiDAR and sensitive methane concentration maps overlaid on aerial or satellite photography (see example below). GML's proprietary analytics provide leak source locations (GPS coordinates), leak rates (flux), real-time alerts for dangerous leaks, and other information. This information allows oil & gas operators to expedite regulatory compliance monitoring, accurately quantify their methane reductions, and minimize liability of costly accidents.

GML offers industry-leading performance and simplicity. GML's measurement sensitivity is 20 to 100 times more sensitive than airborne IR camera solutions and more than 1,000 times better than the lower explosive limit. GML can distinguish between on-site leaks and interference emissions from other sites. All GML data is time-stamped, geo-registered and can flow seamlessly into customer GIS software (ArcGIS, QGIS, Google Earth, etc.) for simple record-keeping, analysis, and auditing.



Satellite image with gas map overlay

Emitter Information:
Detection Number: 37
Date/Time: 06/21/2018 4:51:58 PM
Location: 40.5956485,
-105.1393781
Max Concentration (ppm-m): 3052

Flux Information:
Detection Number: 37
Date/Time (UTC):
06/21/2018 4:51:58 PM
Mean Flux (scfh): 20.8±5
Background Flux: (scfh) 2.0
Windspeed (mph): 2.5
Plume Height (ft): 7

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Description

Applications

GML has the flexibility and sensitivity to monitor the entire natural gas value chain from “well head to meter”. GML is well suited to large-area projects such as full-field well pad monitoring, long-range linear projects like pipeline right-of-ways, and isolated projects like individual facilities or well pads. Bridger uses an airborne platform (fixed-wing airplane, helicopter, or drone) for data acquisition that is best suited to the customer project, sensitivity, and coverage area requirements.

Customers can simply provide the site location/area, minimum desired leak rate sensitivity, date range, and other project details, and Bridger delivers the specified data. This data provides customers with an “answer key” identifying which sites they need to visit, which reduces customers’ “windshield time” liability.

Because GML locates leaks to the equipment level, each visit is more efficient, and customers save time in repair. Because GML accurately quantifies the leak rates, customers can prioritize repair efforts or simply monitor small leaks over time.

Proven Capabilities

Bridger developed GML with support from the US DOE’s Advanced Research Projects Agency – Energy (ARPA-E) program. As part of ARPA-E, Bridger conducted single-blind testing of GML at the Methane Emissions Test and Evaluation Center (METEC) facility in Fort Collins, Colorado.

For Round 1 testing, GML detected all 17 issued leaks (plus one null) across three well pads and located – in three dimensions – all issued leaks to within a 3-foot (1.28-meter) radius of the source (see Figure 1(left) for example results from Well Pad #1 localization). This makes Gas Mapping LiDAR™ ideal for quickly identifying the equipment that is leaking for efficient repair or regulatory monitoring.

GML also quantified all issued leak rates to within 50% of the METEC uncertainty range (see Figure 1(right) for GML quantification results for all issued leaks). This capability makes GML ideal for prioritizing repairs and quantifying reductions. The lower detection limit shown in Figure 1 of <2 scfh (0.96 lpm) is obtained from <150-foot (<46 m) range and for mild wind conditions.

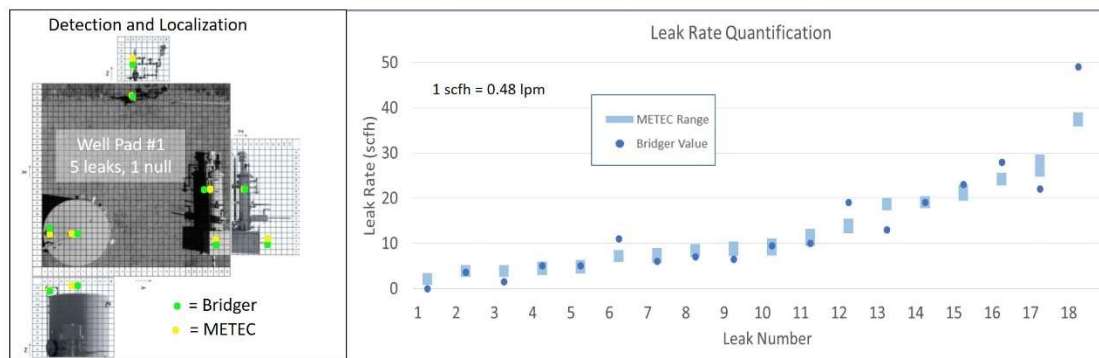


Figure 1. Left: Round 1 localization results for Well Pad #1 showing actual locations (yellow) and Bridger measured locations (green). Right: Round 1 quantification results showing METEC emission uncertainty range (light blue bars) and Bridger emission measurements (dark blue dots) for a null and 17 leaks. This chart shows the leak rates in ascending order, not the order of leak issuance.

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Specifications

Parameter	Typical Performance
Chemical species	Methane (CH ₄) [*]
Lower concentration limit	2-100 ppm-m [†]
Upper concentration limit	50,000 ppm-m
Lower leak rate limit	2-100 scfh (1-50 lpm) [†]
Upper leak rate limit	None unless concentration limit reached
Geo-registration accuracy	2 m x 2 m
Aerial photography resolution	Up to 8 megapixels
Min gas image pixel density	0.25 m ⁻²

Specifications are subject to change without notice

^{*} Contact us for other species.

[†] Bridger adjusts flight platform and parameters to meet customers' lower detection limit requirements.



BOREAL

GasFinder2-AB (AIRBORNE GAS DETECTION)

- No cross interference with other gases
- Instantaneous response
- Autonomous operation

SET

FORGET

DETECT

BOREAL

GasFinder2-AB (AIRBORNE GAS DETECTION)



Airborne Cell with R44 Mount

WHAT IT DOES

- Provides **immediate and unambiguous** detection of the target gas in the ambient atmosphere
- Our technology **counts every target molecule** in the measurement path to give a ppm concentration
- The system combines the ppm concentrations, GPS coordinates, and associated diagnostic data **for intuitive data interpretation**

BENEFITS

- **No Interference** with other gases and **No False Alarms**
- **Fast Response Times and No Memory Effects:** much faster response than other gas detection technologies
- Provides the **best return on investment** compared to any other system
- Can be used in **all weather conditions**
- **Minimal Maintenance:** checks internal reference cell every minute, robust design, and requires no consumables
- **Low cost of ownership**
- **Free and Unlimited** phone and email support

HOW IT WORKS

- The **analyzer is housed inside the aircraft**
- **Fibre optic cable** carries the laser light from the analyzer to the measurement cell
- The **measurement cell is mounted underneath the aircraft**
- The laser makes 3 passes across the measurement cell to form the **active measurement path**
- **The laser does not leave the measurement cell**
- The laser light is then collected and the signal is carried back to the analyzer via **coaxial cable**
- The analyzer then **outputs a serial data string**

DATA STRING & MAP OVERLAY

HHMMSS, Latitude, Longitude, KM/H, PPM, R2, # of Satellites, Status Code



USES AND FUNCTIONS

- PPM concentrations available to the pilot in **real-time**
- The system is **autonomous** so the pilot can focus on flying safely
- Display/Alarm Module will **sound audible alarm** when ppm concentration hits alarm limit so pilot can turn around to investigate
- Boreal can provide analytical reports with **map overlays**

SPECIFICATIONS

- **Max Altitude:** 65m (200ft)
- **Max Speed:** 185 km/h (115 mph)
- **Response Time (Scan Rate):** 3 readings/sample per second
- **Ground Resolution:** 5-10m (16-33ft)
- **Sensitivity:** specification varies depending on gas and application
- **Accuracy:** 2% of reading
- **Uncertainty:** 5% of accuracy
- **Dynamic Range:** 4 orders of magnitude
- **Measurement Path Length:** 6m (20ft) w/ 3 passes
- **Light Source:** Semiconductor Diode Laser
- **Typical Laser Output:** ~10mW
- **Eye Safety:** Class I or Class IIIa (ANSI) & FDA/CDRH approved
- **Analyzer Weight:** 5.0 kg (11.0 lbs)
- **Measurement Cell Weight:** 14.8 kg (32.5 lbs)
- **Analyzer Dimensions:** (LxWxH): 260 x 200 x 160mm (10.2 x 7.9 x 6.3in)
- **Measurement Cell Dim:** 1300 x 300 x 20mm (51.2 x 11.8 x 9.1in)
- **Data Output:** Serial Communication (RS-232)
- **Power Requirement:** 1A @ 12VDC
- **Ambient Temperature:** -30°C to +40°C (-22°F to 104°F)

SYSTEM COMPONENTS



GASFINDER2-AB



AIRBORNE CELL



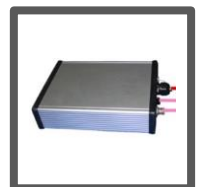
DISPLAY/ALARM



GPS DONGLE



DATA LOGGER



POWER SUPPLY