

# Fast Response Open-path Mobile Gas Leak Detector

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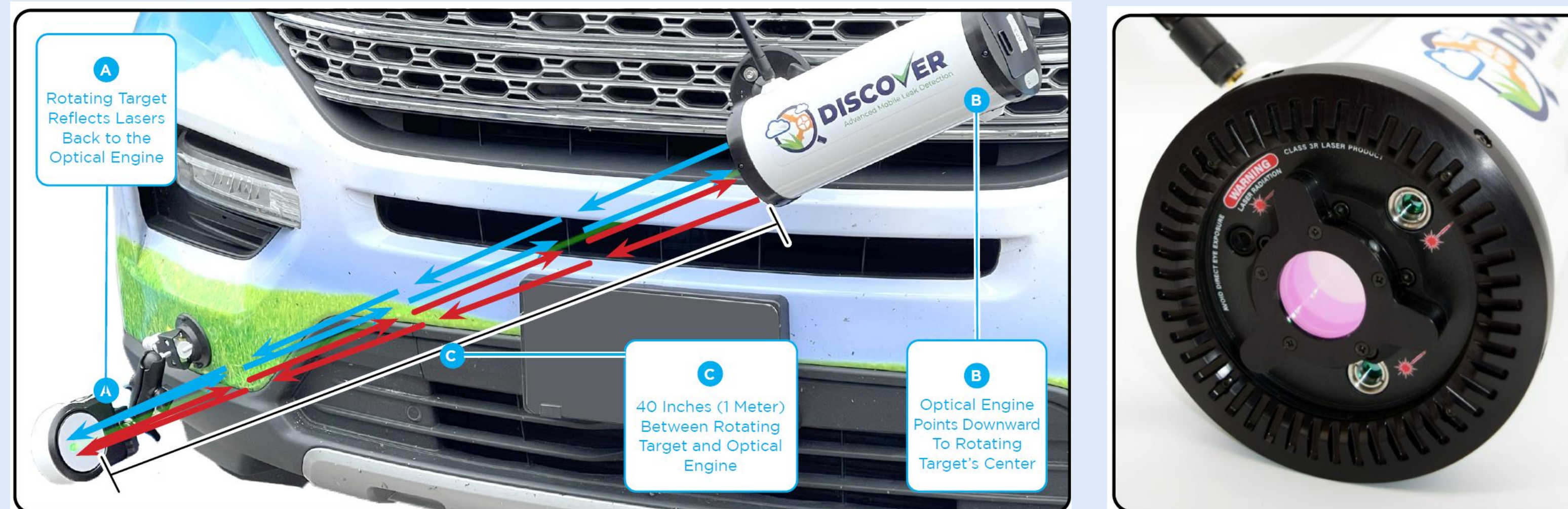
## DISCOVER-AMLD™

A mobile Open-air natural gas leak detection system based on mid-IR backscatter TDLAS (Tunable Diode Laser Absorption Spectroscopy)

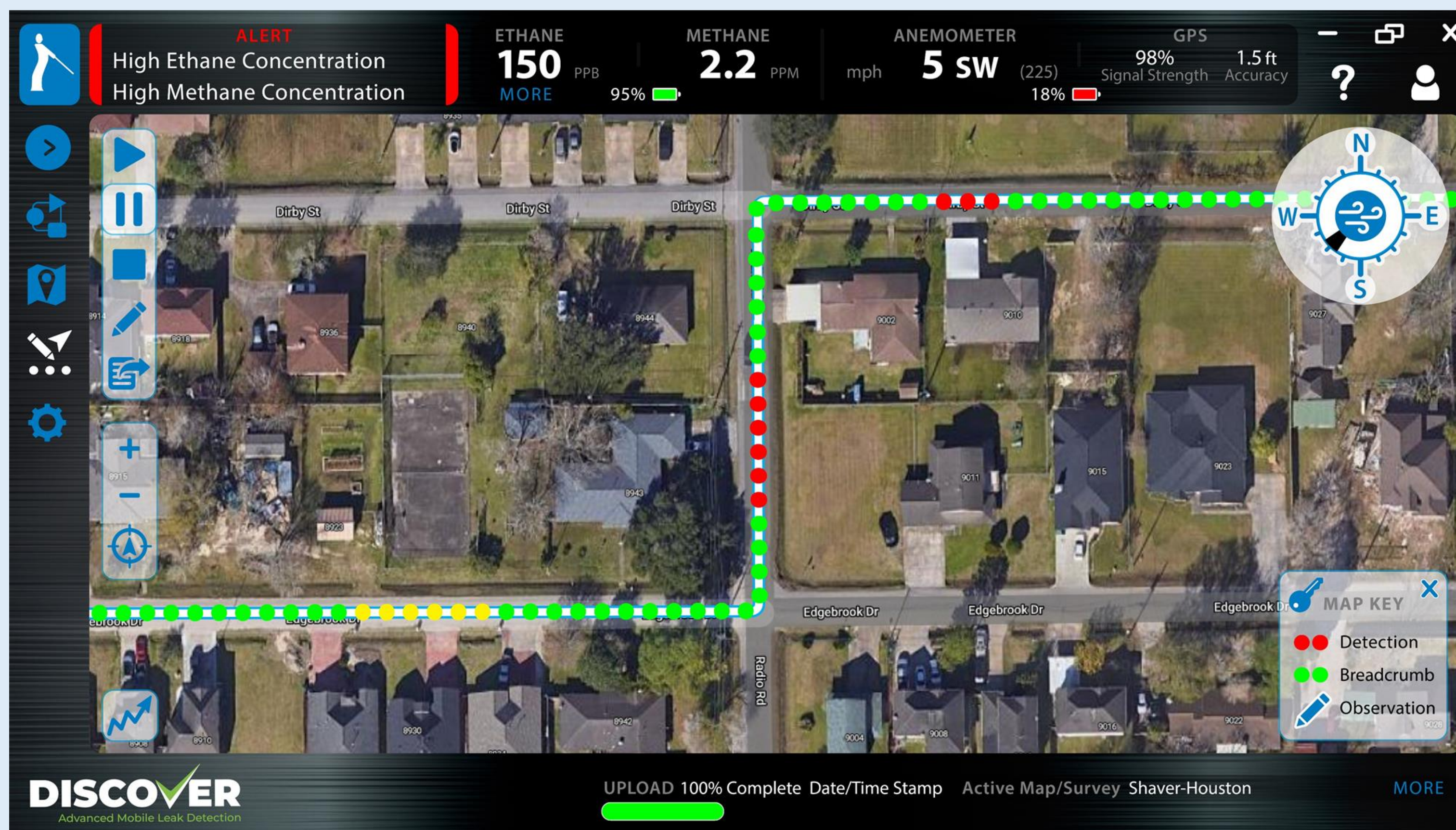
- sensitive to cm-scale leak plumes
- near 100% find rate
- very low false positives and negatives
- easily installed and removed from the vehicle

## MOTIVATION & BACKGROUND

- Natural gas (NG) municipal distribution pipeline infrastructure is surveyed regularly to locate and repair gas leaks quickly.
- Leaking natural gas, composed mainly of methane:
  - Poses a *safety concern*
  - Is a *greenhouse gas*
  - Is a *revenue loss*
- Ethane is a secondary component of natural gas. Concurrent methane and ethane measurement discriminates natural gas from biogas.
- The ability to approximate emission rate and leak location helps to prioritize repairs.
- Open-path, fast (10 Hz), sensitive (<100 PPB) gas detection enables advanced data processing to distinguish between leak plumes and background, locate leak sources, and approximate leak rate.



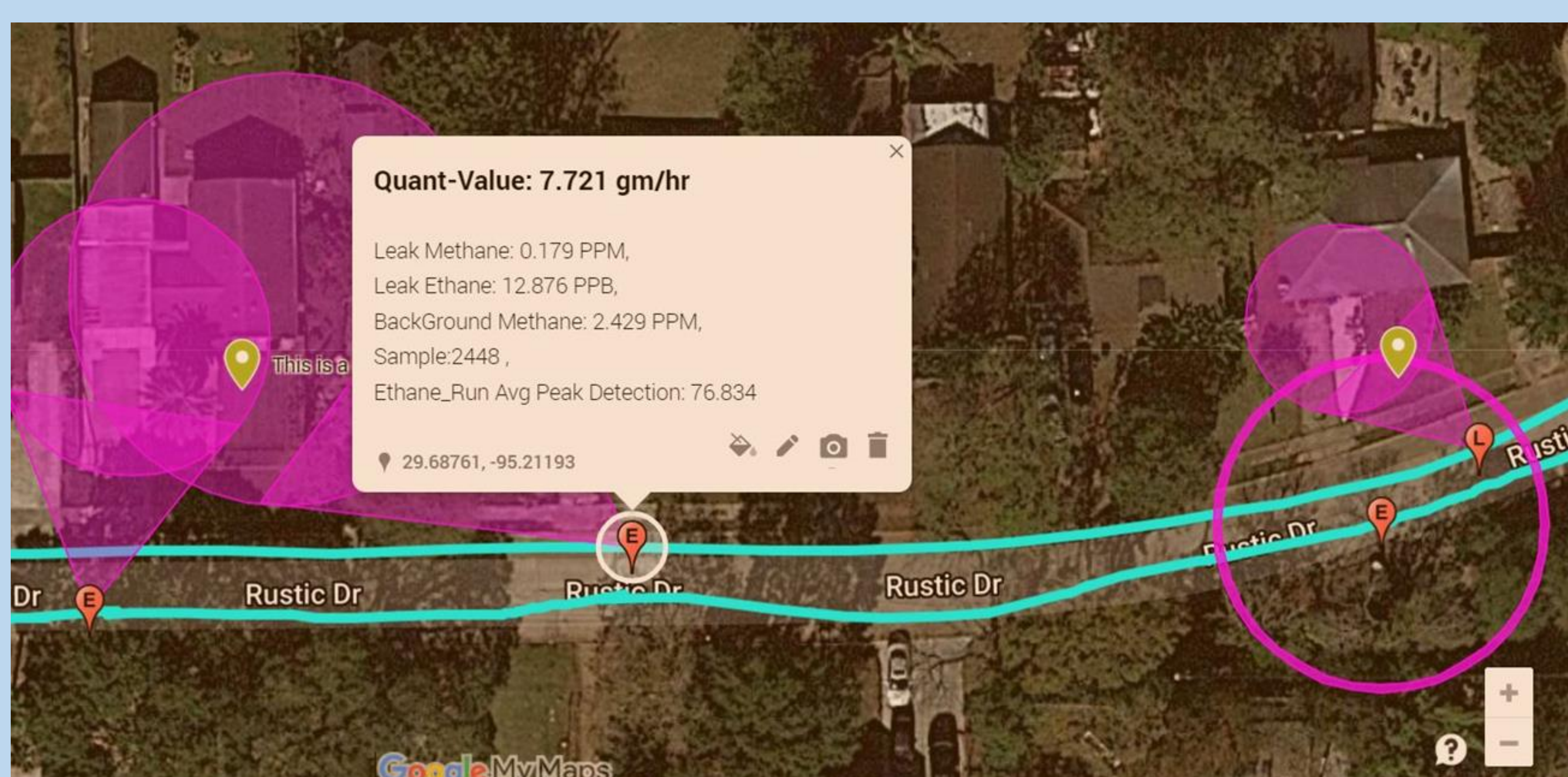
Survey vehicle (top) equipped with open-path gas sensor system with GPS and anemometer sensors on rooftop. Front end of optical engine (bottom right) showing laser beam launch ports and beam receiving port.



(Left) in-vehicle display showing survey route in green and leak indications in red. (Middle) details of one leak indication. (Right) survey coverage in green shade with leak indication in orange and its potential location in red.

## KEY SPECIFICATIONS

Parameter	Description
<b>Gases Detected</b>	Simultaneous detection of methane and ethane.
<b>Sensor Technology</b>	Open-air fixed path mid-IR TDLAS (Tunable Diode Laser Absorption Spectroscopy)
<b>Sensitivity &amp; Resolution</b>	Methane: <100 PPB at 10Hz, <30 PPB at 1 Hz Ethane: <15 PPB at 10 Hz; <5 PPB at 1 Hz.
<b>Selectivity</b>	No cross-sensitivity to humidity, other hydrocarbons or industrial gases.
<b>Response Time</b>	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.
<b>Accuracy</b>	±10% of reading, for methane and ethane in natural gas. ±50% for quantification
<b>Calibration</b>	Field calibration using self-test with natural gas calibration cell. Bump test verification at sub-PPM detection level.
<b>Wind Sensor</b>	Anemometer at 4 Hz.
<b>GPS</b>	GNSS-INS system at 10 Hz, >1 m accuracy, Inertial navigation maintains accuracy when GPS is degraded.
<b>Battery &amp; Display</b>	All sensors powered with re-chargeable batteries (8-10 hr life). Rugged Windows-10 vehicle mounted tablet with HD display.
<b>Certification</b>	EMI/EMC: (EN61000-6-2, EN61000-6-4) (2014/30/EU), FCC 47 CFR part 15 UN 38.3 for Li-Ion battery.
<b>Connectivity &amp; Data Log</b>	Robust Bluetooth 5 (BLE): connection for all data exchange. No wires. Local and cloud based data storage & data analytics. Data Log: date & time, gas readings, true wind vector, GPS data, alarms, calibration/bump test data, etc.
<b>Cloud Access</b>	Full suite cloud based Leak Survey Analytics (LSA) and Leak Survey Management Solution.
<b>User Interface &amp; Reports</b>	Simple intuitive and graphics rich touchscreen operation. Real time leak detection. Post-processed leak detection & leak localization, leak survey coverage area, and emission quantification.
<b>Operation while Driving</b>	Hands-off voice alerts, instructions and commands.
<b>Environmental</b>	Operating temperature: -30 to 50°C Storage temperature: -30 to 55°C Shock & vibration: Per MIL-STD-810-H. IP Rating >65.
<b>Weight &amp; Size</b>	Gas sensor module < 4.5 lbs with battery. Easy to remove and re-install as needed. Rooftop enclosure for ease of mounting of anemometer and GPS modules.



### Early Blind Survey Testing:

- Covered 54 natural gas leaks and 7 sewer leaks.
- > 98 % (53 out of 54) find rate for all true NG leaks. Leak indications were verified with follow up survey (RMLD-CS, DP-IR+).
- 100 % find rate for all sewer gas leaks.
- ~ 6 % false positives (% of NG leak indications that are false).
- < 2 % false negatives (% of NG leak indications that were not discovered).

### Leak Survey Reporting:

- Quantification and localization with data can be downloaded in a PDF report and an interactive KML/KMZ.
- Report available immediately after survey thru LSA platform.
- Green pointers (in left figures) are actual leaks confirmed with walking survey after Discover-AMLD had found them.



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