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**WBENC**  
WOMEN'S BUSINESS ENTERPRISE


## Advanced Leak Technologies

Pipeline Safety Seminar  
Public Service Commission of West Virginia  
Gas Pipeline Safety Division and GOWV

- Roy Montemarano – Heath – Technical Services Manager

## LEAK DETECTION HISTORY

- Vegetation Surveys – 1930's – 90's
- Bar-hole Surveys – 1940's – present. Probe bar & CGI
  - Used today for centering / pin-pointing underground leaks
- Mobile and Portable FID – 1950's to present day
- Portable multi-gas CGI's
  - Late 70's – 80's
- Mobile OMD's – open path: late 90's to present
- RMLDs – 2005
- Portable & Mobile Optical / IR technology – mid-2000's
- Aerial Detection: early 2000's with optical / laser instruments
- OGI – Imaging Camera – mid 2000's to present
- Fixed Monitors: Mid 20<sup>th</sup> Century



## Disadvantages of Flame Ionization

- Heavy
- Not Intrinsically Safe
- Requires a fuel source
- No Auto-scaling
- Analog Display
- No datalogging
- Manual Calibration
- Not Methane Specific
- Been around for  
~ 70 years plus



## The Gas Industry Challenge:

*Must be as Good or Better Than Flame Ionization*

- Maintaining PPM sensitivity
- The elimination of fuel source
  - (hydrogen or hydrogen/nitrogen) necessary for instrument operation.
- Self-Calibration
  - eliminating the need for external calibration gases.
- Methane Specific
  - eliminate "false positive" indications from automobile exhaust and other hydrocarbons.



## Portable Infrared Detectors - PPM

Starting in 2007 began the replacement for Flame Ionization (FID) instruments.



- Detection capabilities from 1 PPM – 100% gas (auto-ranging).
- Can be used to both detect a leak (PPM), and confirm a leak indication, via a sub-surface test (% gas).
- Intrinsically Safe
- No fuel gas required for operation.
- Self calibration or need calibration gas
- Methane specific/selective – eliminates “false positive” indications.

## PORTABLE – PPB LEAK DETECTION



- Methane in the PPM – PPB range
- Ethane in the PPB range
- GPS
- Data Collection and transfer



## The Evolution of Mobile Leak Detection



Using FI / IR  
portable instruments



Optical Methane  
Detection

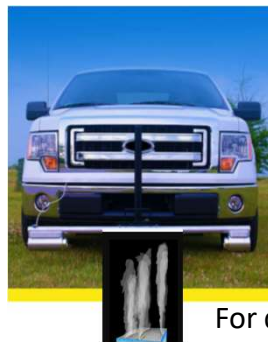
Advanced Mobile



## OPEN PATH – OPTICAL METHANE DETECTOR

- 1997 – introduction of the Optical Methane Detector - still in use.
  - Increased speeds allow for huge productivity gains
  - Virtually eliminating false positives
  - Increased survey frequency of high consequence areas
  - Access to pipelines in rural and off-road areas
  - Survey of Distribution mains only
  - Survey of Transmission lines
  - Detection coverage limited to length of bar
  - Can see down to 1 ppm /1 ppm-m
  - Average recommended survey speed 10 – 15 mph.

- ***The need for a portable methane detector is still needed to determine where the leak is.***



For detection, the Plume of gas must be between the light bar

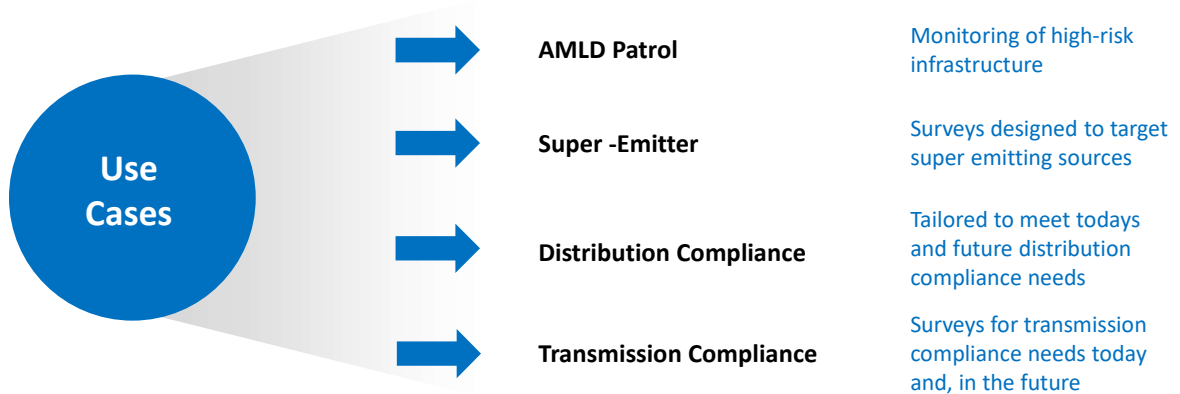


## The Parts Per Billion Revolution – AMLD

- Advanced Mobile Leak Detection (AMLD) is the future of leak survey
- 2011 Introduction into the market
- Cavity Ring down / Open Path technology
- Can detect both methane and ethane
- Can see longer distance than the previous mobile applications



## SYSTEM OPERATIONS



## AMLD PROCESS

- AMLD + Investigation – faster than conventional walking survey
- Improved safety – Reduce employee exposure to potential accidents – walking survey
- Targeted Survey operations – utilize survey crew for targeted indication investigation
- Enhances gas detection capabilities



## AMLD (cont'd)

- Can survey both the main and gas services verses traditional mobile survey that can only survey the main
- Can differentiate between natural gas and biogas (sewer, landfill, etc.) Specific to methane and Ethane.
- Reduction in walking survey and problem areas with poor access.
- Overall – can't have one without the other. You still need "boots" on the ground to determine the severity of the leak detected.



## REMOTE LASER DETECTION

- 2005 – Remote Methane Leak Detector (RMLD)
  - Detects leaks in the PPM - M range up to 100 feet +
  - Operator does not have to walk entire length of service line to detect leaks.
  - Increase in production
  - Ability to survey "Hard to Access" or "Can't Get In" areas



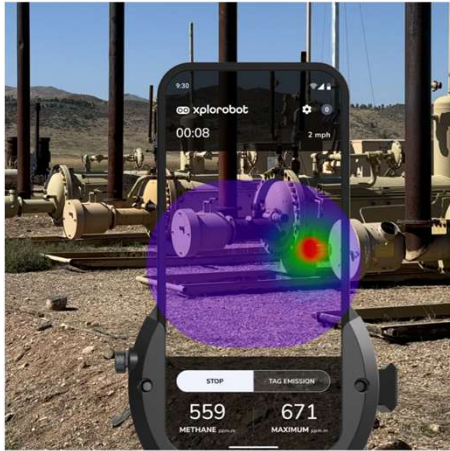
## Next Generation Remote Laser Instruments



- Advance Leak Detection (ALD)
- Minimum sensitivity 5 ppm-m
- Methane specific (TDLAS)
- Intrinsic Safe



## PORTABLE LASER GAS IMAGER



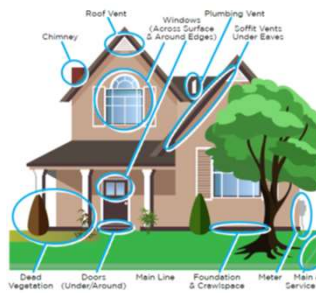
- Detects methane leaks as small as 1 gram per hour (< 1 CFH) using advanced TDLAS (methane specific) and high-res imaging for pinpoint accuracy—even at the component level.

- EPA Certified



## AGA - Gas Filled Structure (GFO) Emergency Policy and Wet Weather Report

- Use of a Remote Laser Detector & portable IR detector for leak Investigation
- Activate CGI, **utilize Remote methane laser detector**, if available, to scan and determine the presence of methane within the structure from a distance.



## The Introduction of Optical Gas Imaging Camera

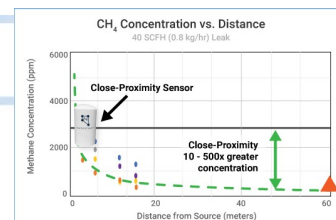


- Prior to OGI, each leak was found using traditional LDAR technology
- Quantification was then determined by:
  - Bagging Test
  - EPA Method 21
- OGI allows for the visualization and "plume sizing" of natural gas leaks
  - Allows for rapid screening of components
  - Provides a qualitative result only
    - gas concentrations must still be measured
  - U.S. EPA (meets Quad b) allows for the use of both OGI and Method 21
  - Appendix "K" -sensitivity 0.15 G/H Regulations requires 19 g/h
  - Sensitivity 9 ppm - m



## Fixed Systems – Remote Monitor Systems

- Allows for 24/7 monitoring
- If a leak is detected it triggers an automatic notification to the appropriate personal
- Solar or AC powered
- Minimize potential incidents, reduce greenhouse gasses and increase dispatch speeds for responders
- Fixed gas monitors are independent monitors capable of displaying PPM – LEL methane concentrations.
- Wind data from the anemometer, to quantify the leak size and pinpoint the leak location. Dependent on system.



Well pads

Tank batteries

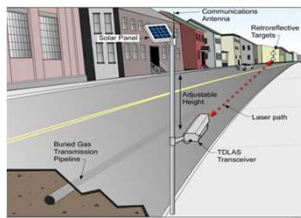
Compressor stations

Processing facilities

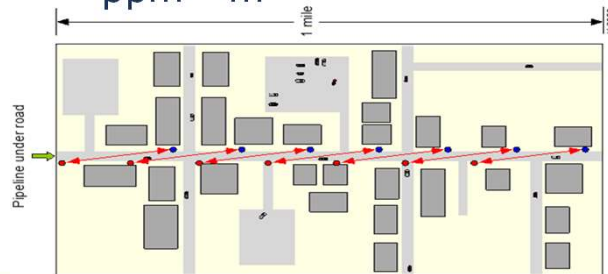
Pipeline infrastructure



## FIXED OPEN PATH



- Open path continuous monitoring system that uses field back scatter TDLAS technology. Detection sensitivity 5 ppm - m



## DRONE / UAV



**Drone technology** has become an increasingly important tool in detecting methane leaks, particularly in industries such as oil and gas, agriculture, and waste management. The integration of advanced sensors with drones allows for efficient, safe, and cost-effective monitoring of methane emissions over large areas or difficult-to-access locations.

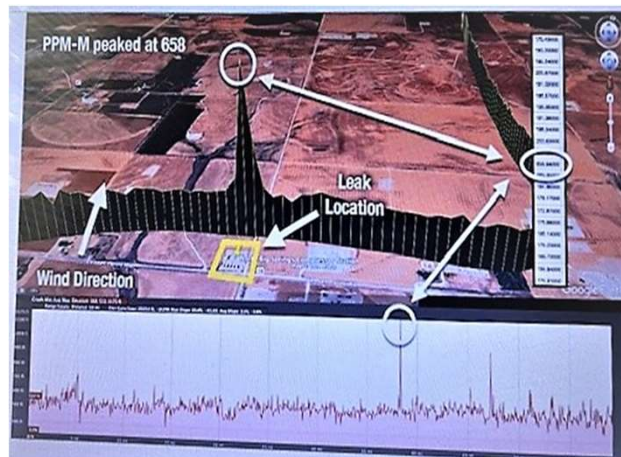
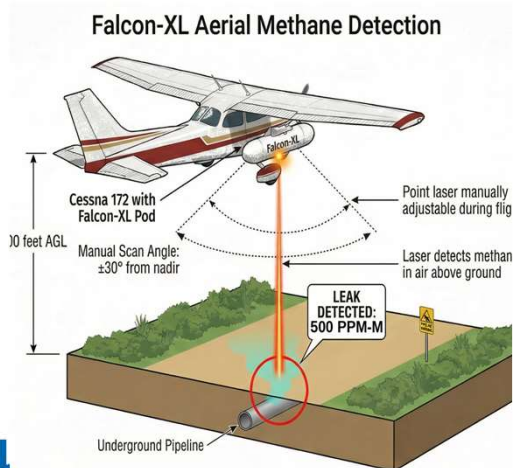


## FIXED WING / HELICOPTERS

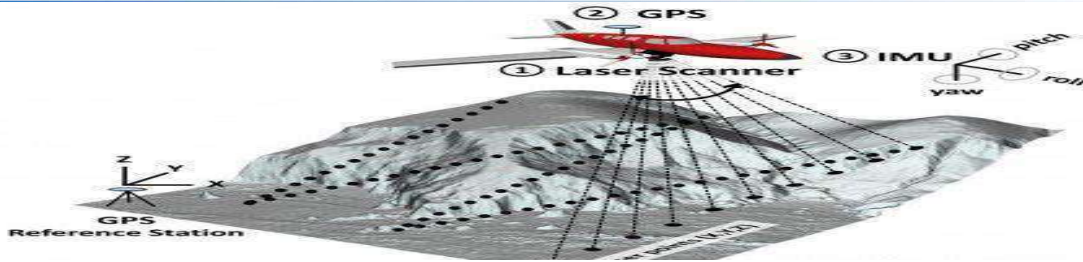
- Pipeline companies have used fixed wing / helicopters (LIDAR) for Right Of Way (ROW) inspection of their lines for encroachment, unauthorized digging, damage due to flooding / earthquakes, etc. Some are equipped with specialized leakage detection instrument – such as cameras (OGI) , and TDLAS technology plus GPS.
- They meet Federal Regulations / Compliance .
- Can average up to 300 miles of inspection per day
- GPS of leak location will need to be surveyed by walking survey using either, a Hand – Held leak detector such as an FI /IR / RMLD type instruments.
- Distributions companies have also used with success detecting leakage - especially in industrial areas where customer lines are on top of the roof and areas that are not usually inspected by a gas company



## FIXED WING (cont'd)



## Plane (LiDAR: Light Detection and Ranging)

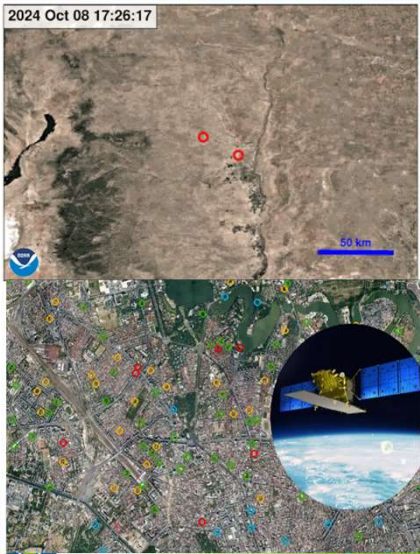


**LiDAR (Light Detection and Ranging)** technology is primarily used for mapping and surveying applications by measuring distances using laser pulses. While LiDAR itself is not typically used for directly detecting methane leaks, there is an emerging technology that combines LiDAR with spectroscopy for methane detection, sometimes referred to as **Differential Absorption LiDAR (DIAL)** or similar approaches. This technology allows for the remote detection and quantification of methane concentrations over large areas.

**Principle:** DIAL uses two laser wavelengths—one that is absorbed by methane and one that is not. By measuring the difference in the reflected laser light between these two wavelengths, the system can detect the presence and concentration of methane in the atmosphere.

## GAS LEAKS FROM SPACE -SATELLITE

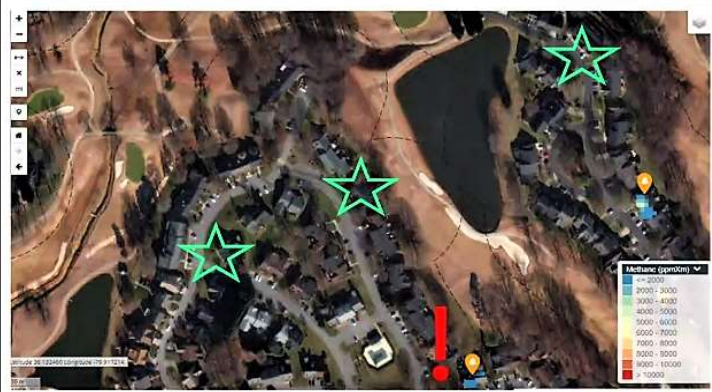
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- **Satellite technology** for detecting methane leaks is an advanced and increasingly important tool in global efforts to monitor and reduce greenhouse gas emissions. Satellites equipped with specialized sensors can detect methane emissions over vast areas, including remote and inaccessible regions, providing critical data for environmental monitoring, regulatory compliance, and climate change mitigation.
- **Remote Sensing:**
- **Spectroscopy:** Satellites use spectroscopic techniques to detect methane. These sensors measure the absorption of sunlight reflected from the Earth's surface in specific wavelengths corresponding to methane's unique spectral signature. By analyzing the intensity of light absorbed by methane in the atmosphere, satellites can detect and quantify methane concentrations.
- **Infrared and Near-Infrared Imaging:** Some satellites are equipped with infrared and near-infrared sensors that can detect the thermal emissions of methane or its absorption features in the atmosphere. This allows for the identification of methane plumes and the mapping of methane sources.

## Satellite Leak Detection – Find It/Fix It

January 8, 2024 Capture



July 7, 2023 Capture



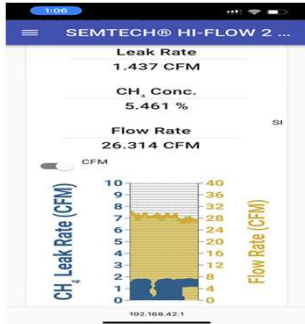
## The Focus on Fugitive Emissions

- Natural gas utilities have been historically focused on “hazardous leaks”
  - Low grade leaks were allowed to stay on the books
  - Many utilities carried leak backlogs in the 10,000+
- Global and National Climate Initiatives have shed light on the environmental impacts caused by the emission of unburned methane.
  - Carbon Trading and Carbon Taxes have turned the focus on the quantification of natural gas emissions

***The need for a natural gas leak “quantification” tool arises***



## High Volume Emissions Sampling – Above Ground



- High Sampling originally developed in the 1990's
- A High Flow Sampler (HFS) entrains the emissions in a stream of air and routes the combined flow through an instrument where flow and concentration measurements are used to compute the emission rate.
- The High Flow Method remains one of the few methods suitable for isolating individual emission points for direct measurement
- Meets EPA requirements – 0000b



## Underground leaks -Find It. Pin-Point /Quantify / Purge It.

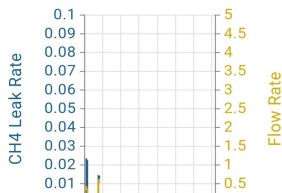
**STOP PURGING**

CH4 Leak Rate (SCFM)  
0.015

CH4 Concentration (%)  
2.461

Flow Rate (SCFM)  
0.591

SI  CFM



- **Highly Accurate Methane Detection (0.03% to 100%)**  
Delivers reliable readings across an exceptionally wide concentration range, enabling confident decision-making in both routine monitoring and critical leak-response situations.
- **Rapid Leak Pinpointing**  
The integrated micro-pump quickly draws in samples to precisely locate methane sources, reducing troubleshooting time and operational downtime.
- **True Quantification for Compliance & Reporting**  
Measures both gas concentration and flow rate (CFM), providing the data needed for emissions reporting, compliance documentation, and performance verification.
- **Efficient Purging Options**  
Choose between the 0.75 CFM internal pump or a 3 CFM external compressed-air purge to optimize speed and accuracy in demanding environments.
- **Portable & Field-Ready (<10 lbs.)**  
Easy to carry, and ideal for extended field use without fatigue.



## ADDENDUM TO PUBLIC SAFETY

- **AGA / NTSB encourages the use of natural gas detectors in homes and businesses,** which can provide early warnings of leaks, allowing for prompt evacuation and reporting.
- Besides smoke detectors and CO monitors, which are the most common in homes and business, very few homes have natural gas detectors / Residential Methane Detectors.



## Residential Methane Detector (RMD)

DeNova Detect®  
By New Cosmos USA, Inc.



- Early detection and warning
- Protection against natural gas hazards
- Can be installed in apartments, homes, business/manufacturing
- Voice alerts in English or Spanish
- No wiring needed
- NFPA 715 – Standard for Installation of Fuel Gases Detection and Warning Equipment
- The UL Standard will be lowered from 25% to 10% LEL



## Conclusions

### *The Future is Bright!*

- More advancements in the past 20 years than the previous century
- New regulations are driving technological break-throughs
- More product competition than ever before
- Natural gas growing exponentially around the world

