

Methane Airborne Detection Solution

DECEMBER
TECHNOLOGY
INFORMATION
SESSION
EMISSIONS MANAGEMENT

DATE
December 2, 2024

TIME
8:00am - 10:00am (MST)

REGISTER TODAY
Virtual Event

DOMINIC PITUCH
PRODUCT MANAGER
QNERGY

EDAN PRABHU
CEO & FOUNDER
PRABHU ENERGY LABS

JEAN-PHILIPPE GAGNON
FIELD APPLICATION ENGINEER
TELOPS

PTAC
PETROLEUM
TECHNOLOGY
ALLIANCE
CANADA



Introduction

Operators have testified to EPA that fugitive emissions can be reduced at a given site by 80-90% using advanced screening methods

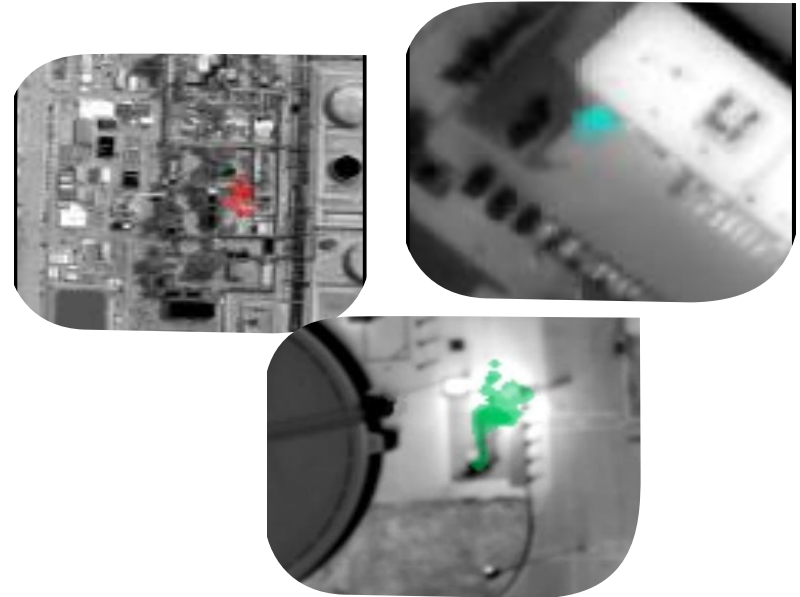
<https://business.edf.org/wp-content/blogs.dir/90/files/Investor-Guide-to-Commenting-on-EPA-Methane-Rule-Proposal.pdf>

Telops

Exosens Group

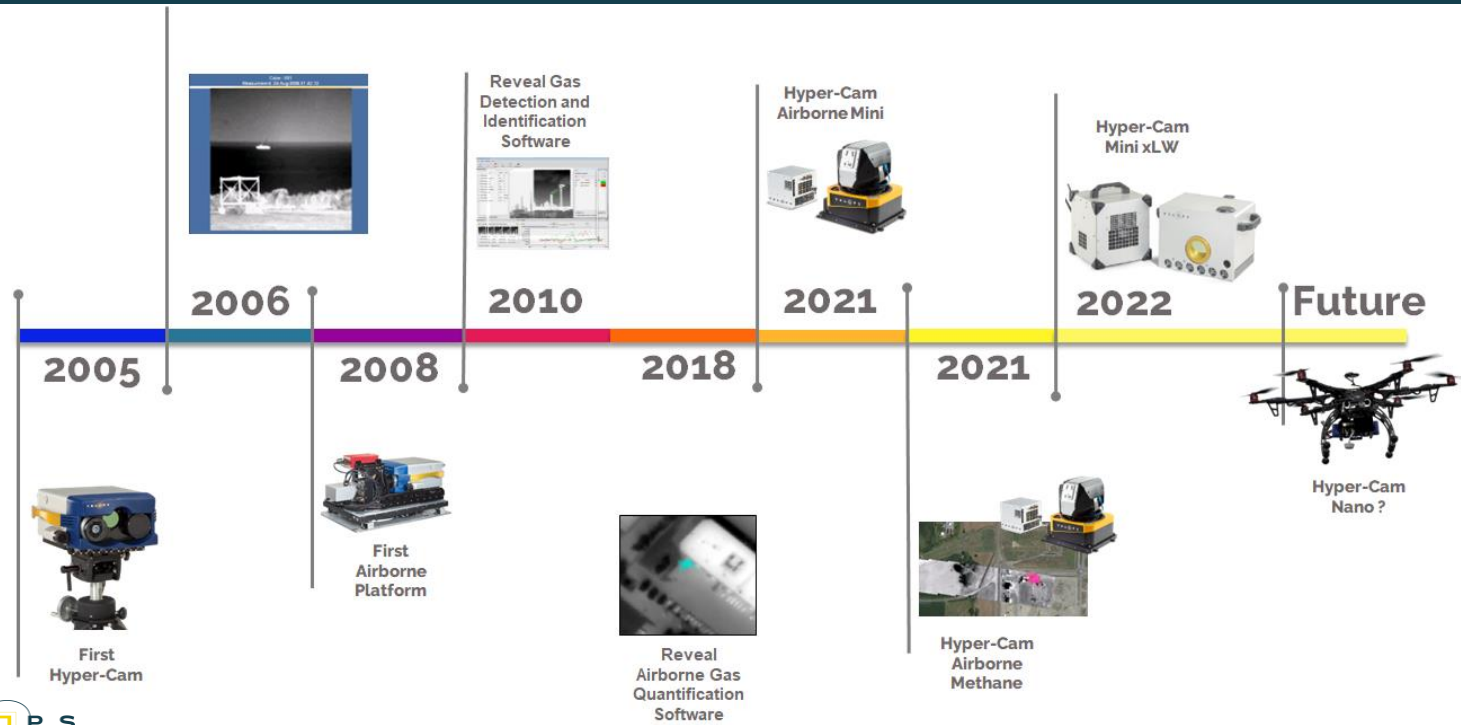
- ◆ Telops was started in 2000 in Quebec City (Canada), and now employs over 90 people (Ph.D., M.Sc., Eng.).
 - ◆ It has established itself as a world leader in thermal infrared imaging solutions.
- ▣ 2005: Development of the first hyperspectral infrared camera
 - ▣ 2008: Launch of the airborne version
 - ▣ 2010: Development of the gas detection and identification software
 - ▣ 2021: Launch of the Hyper-Cam Airborne Mini

It now offers innovative solutions for aerial methane leak detection and quantification.



Telops

Exosens Group

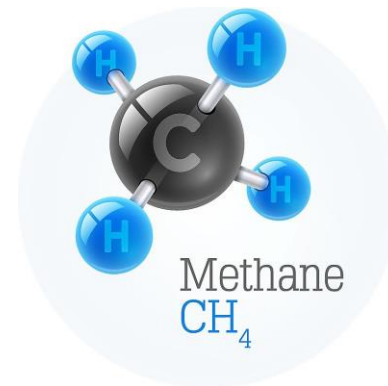


Methane

Natural Gas



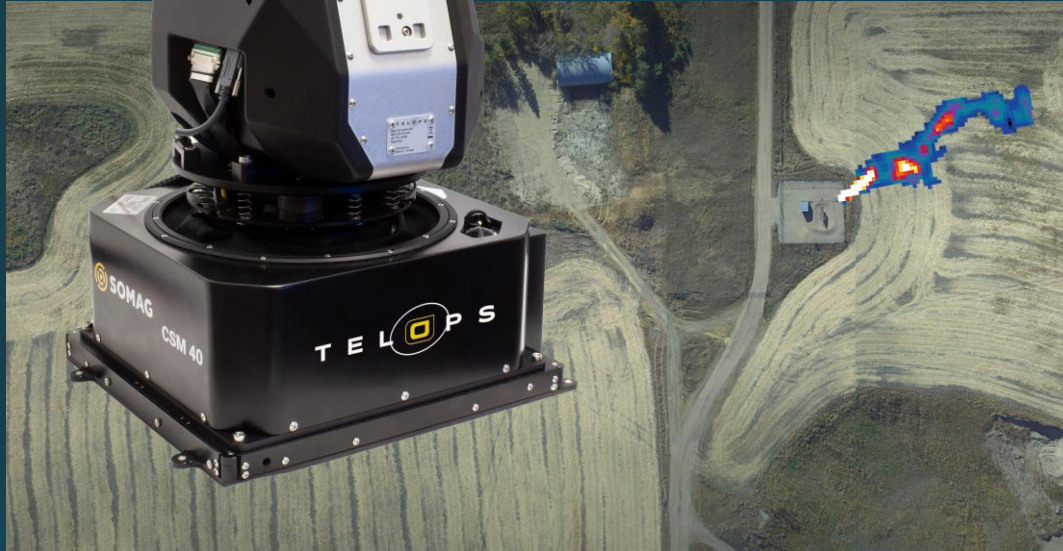
- Powerful greenhouse gas with a warming impact 86 times stronger than CO₂ per unit of mass over a 20-year period
- Atmospheric lifespan of around 12 years.
- Reducing methane emissions can slow the rate of warming and have positive impacts in our lifetime.



Measurement Techniques

- Optical gas imagers (OGIs)
 - Strong gas detection capabilities.
 - Limited in their ability to accurately identify type of gas.
 - Not suited to survey multiple assets rapidly and cost effectively.
 - Approved method for detecting fugitive methane emissions from equipment.
- Aerial surveys
 - Detection of more important leaks.
 - Monitor difficult to access areas.
 - Well adapted to survey multiple assets in a cost-effective manner.





The Hyper-Cam Airborne Mini

A Passive Hyperspectral Camera for
the **D**etection, **I**dentification and
Quantification of Methane Fugitive
Emissions

Hyper-Cam Airborne Mini

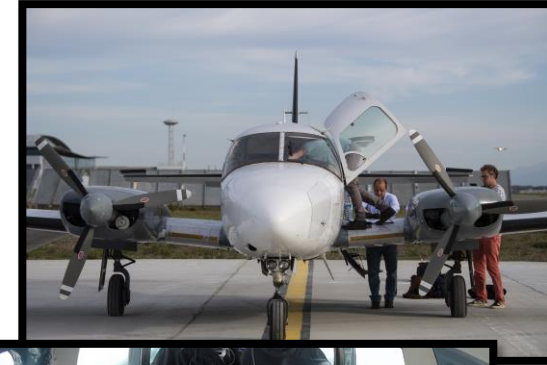
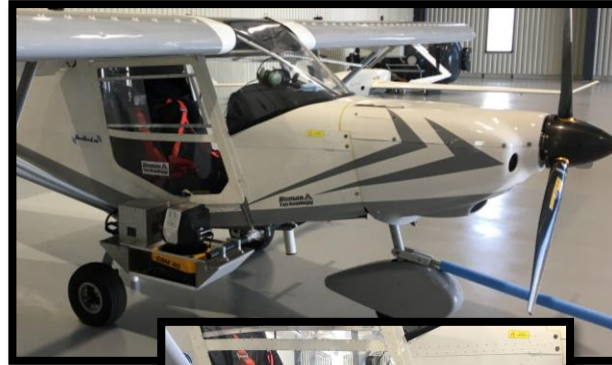
Passive Hyperspectral Camera



- ◆ Robust, flexible, high performance Passive Hyperspectral Camera based on proven design.
- ◆ Automatically adapts operational parameters to flight conditions to ensure 100% area coverage
 - [°] Streamlined Automation: The system's streamlined automation ensures smooth operation without constant manual input.
- ◆ Real-time gas detection & identification
 - Quantification to leak rate in post-processing.
- ◆ Excellent detection performance over snow, water, day and night.
- ◆ Integrated 4096 × 3000 pixels visible camera
- ◆ Detects many other gaseous hydrocarbons and VOCs.

Hyper-Cam Airborne Mini

Multi-Platform

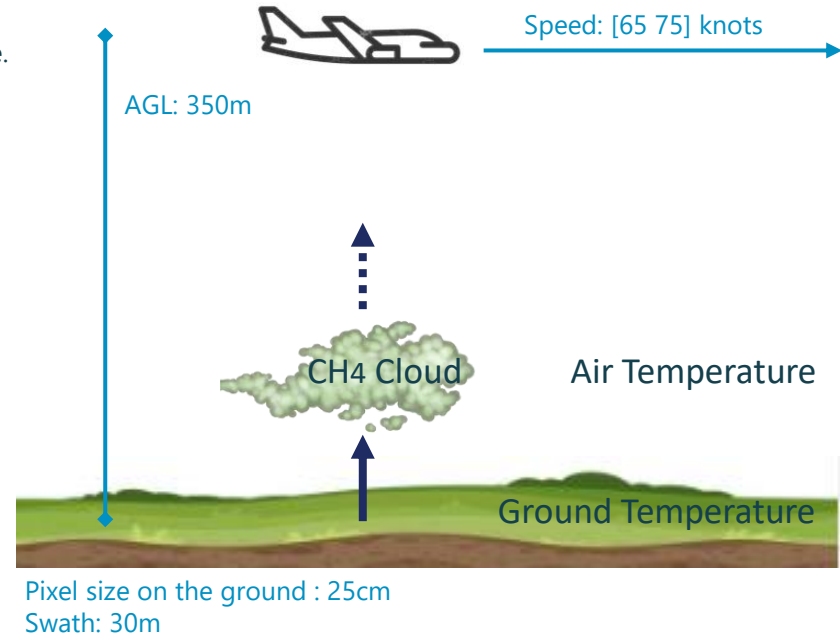


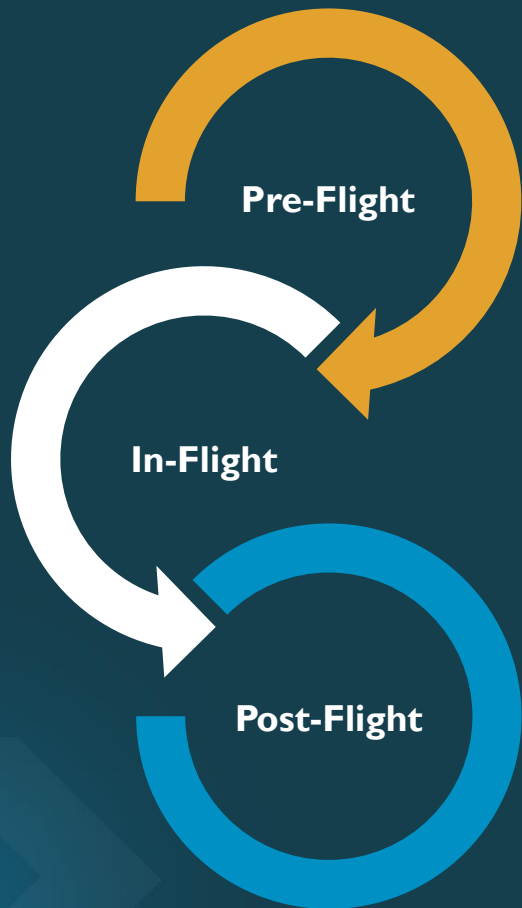
Hyper-Cam Airborne Mini

Passive Thermal Infrared Camera

- ◆ Passive infrared hyperspectral camera:
 - [▫] Collects infrared light emitted/reflected by objects in the scene.
 - [▫] Decomposes the light into a multitude of contiguous spectral bands. A spectrum per pixel.
 - [▫] No laser light emitted.
- ◆ Signal is produced by thermal contrast between temperature of the background and the one of the gas plume.
- ◆ Signal is proportional to
 - [▫] $(\text{Gas Quantity [ppm}\cdot\text{m]}) * (\text{Gas Plume Temperature} - \text{Ground Temperature})$
- ◆ Excellent detection performance over a wide range of conditions including over snow, water during both day and night.

Typical flight conditions





Methane Airborne Detection Solution

A Complete, Field-Proven and Cost Effective Solution to Manage Methane Emissions, Simplify Decision Making, and Confirm Regulatory Compliance

Methane Airborne Detection Solution

A strong partnership with experienced geospatial survey companies

Team effort!



LiDAR Services International (LSI).

Calgary, Alberta , CA



SkyCam Aviation, Inc.

California, USA



BARR GeoSpatial

Texas, United States

Calgary, Alberta, CA



General Overview

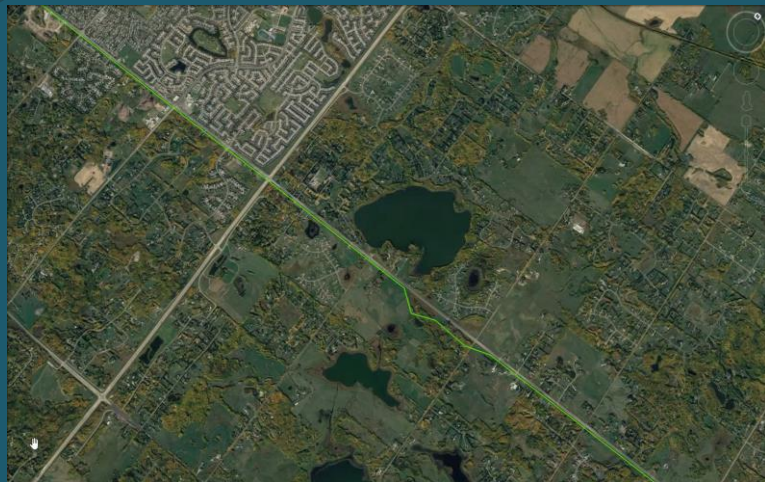
Methane Airborne Detection Solution

◆ Preflight

- Provide geographic information (GIS) to our team.
- Our team will create the optimal flight plan.
- Discuss flight plan, schedule and goals.
- Our team handles all aspects of flight and survey logistics.

◆ Flight

- Our team will execute the mission.
- Real-time notifications for important leaks are provided to the operator in the aircraft.



Pipeline track

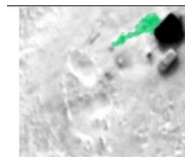
Inspection corridor

Aircraft track

Measurement

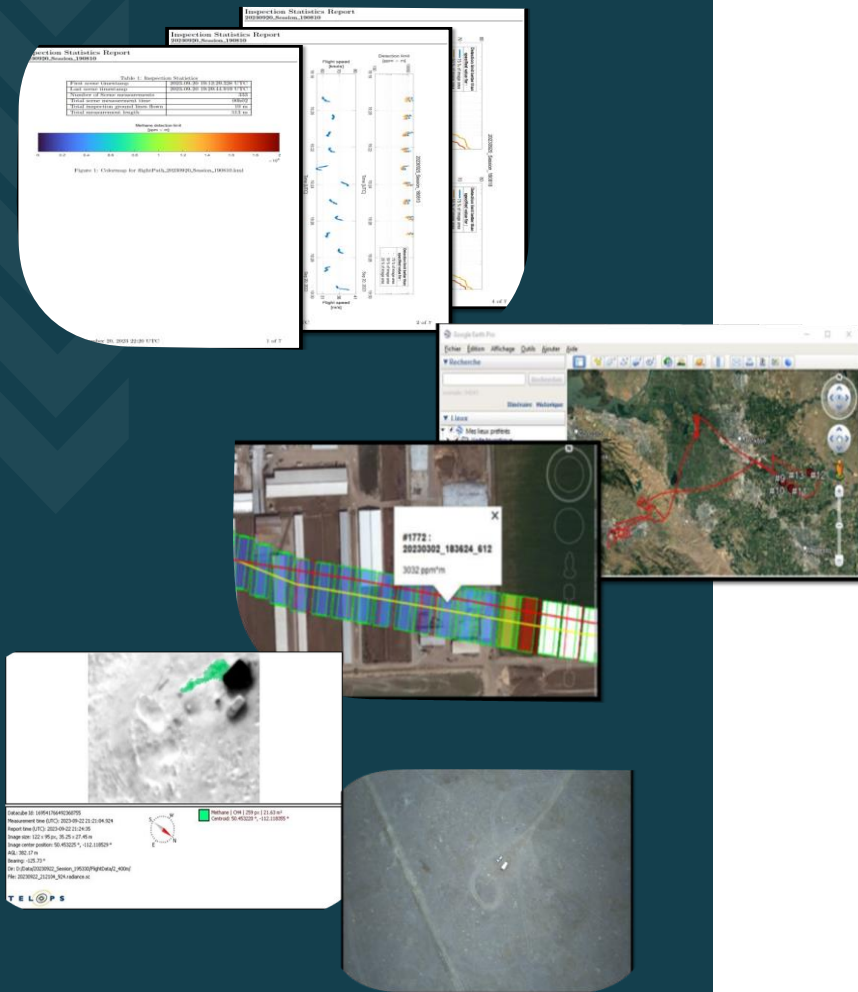
Clear actionable Deliverables

Real-Time

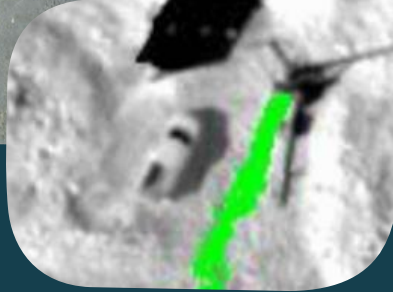
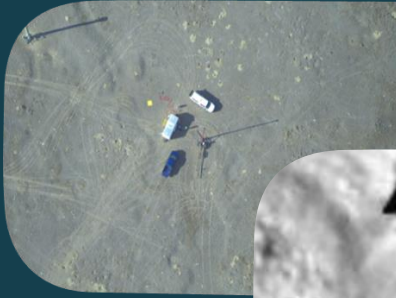


Post-Flight

- P1 - Immediately following a flight: detailed flight inspection report
 - P2 - 24h after the flight: complete set of geoTiff images
 - P3 - 10-14 days after flight: Final list of the positive detections
-
- Interesting fact
 - Detection limit provided for complete area surveyed.



Summer



Winter

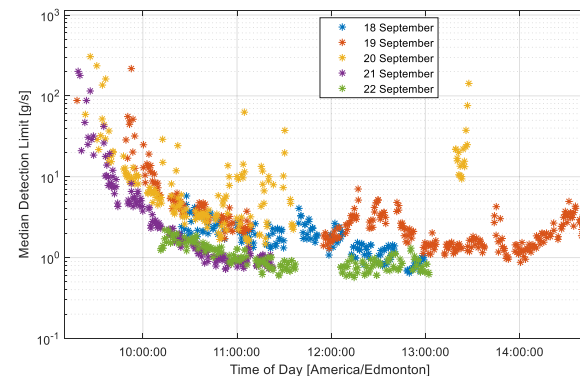
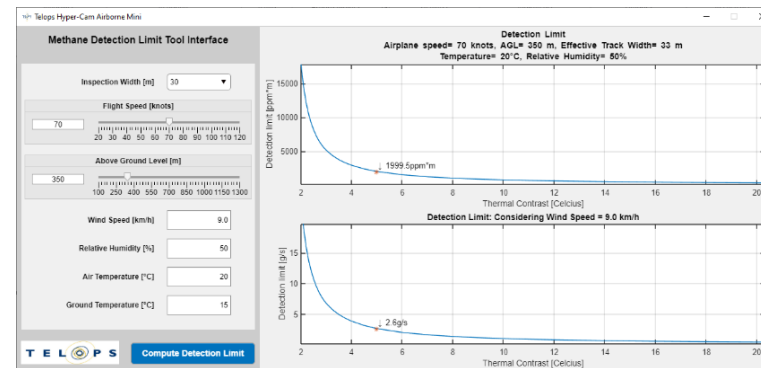


Technical Considerations and Recent Results

Detection Limit

Predicted and Calculated

- ◆ The system sensitivity (expressed as the methane detection limit) depends on various variables:
 - Flight parameters (speed & AGL)
 - Instrument settings (image width)
 - Environmental conditions (Thermal contrast, Wind speed and RH)
- ◆ Pre-flight: Telops developed a tool to estimate the detection limit in leak rate units [g/s].
 - Facilitates decision making
 - ◆ Select flight parameters
 - ◆ Select camera settings
 - ◆ Select most appropriate time to fly
- ◆ Detection limit is also calculated after a flight to provide the actual inspection performance.

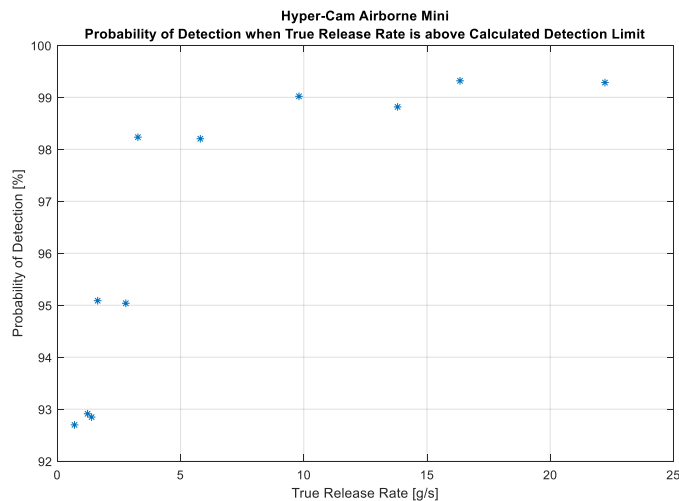


Detection Performance

Probability of Detection (PoD)

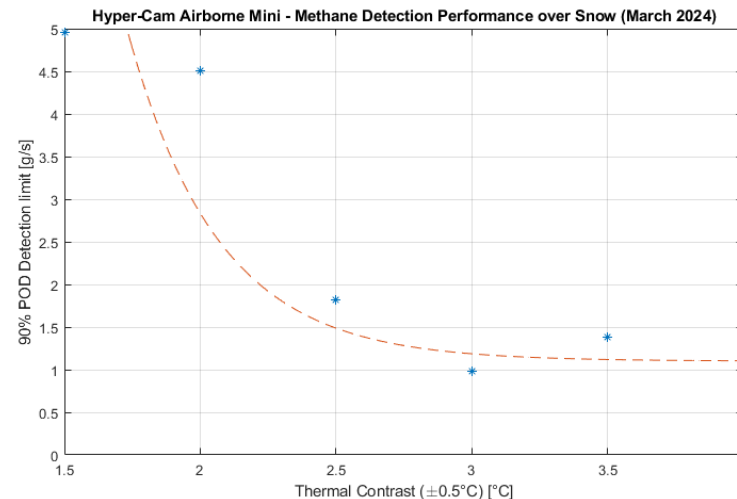
◆ Summer

- [◻] 93% of Probability of Detection when a release is at a rate equal or higher than the calculated detection limit (~1 g/s)
- [◻] The PoD becomes > 98% when a release is larger than 5 g/s and higher than the calculated detection limit



◆ Winter – Snow Covered

- [◻] A 90% PoD for methane leak rates of 1.2 g/s or higher for thermal contrasts of 3°C and higher.
- [◻] Good thermal contrasts are obtained in the winter despite snow covered ground.



Key Takeaways



- ◆ Cost effective solution: manage emission related decision making, reduce risks and confirm compliance.
- ◆ Reporting: Real-time, clear and actionable reports.
- ◆ Our unique system:
 - [◻] Adapts autonomously
 - [◻] Automatic and real-time reporting
 - [◻] Multi-platform
 - [◻] Multi-mission
- ◆ Detects many other gaseous hydrocarbons and VOCs.
- ◆ Multiple blind test release missions over various release sites under various conditions in the last two years.
 - [◻] Good confidence in the inspection results using the Telops' Hyper-Cam Airborne Mini since the system calculates its detection limits on every measured scene
 - [◻] **The Telops' solution can be used all year long** for methane release inspection, since the performance is not impacted by the presence of snow.
 - [◻] Good thermal contrasts are obtained for both summer and winter conditions with the ground covered by snow