



STEPHEN BEYNON – TELEDYNE FLIR

FLIR ADGiLE SOLUTION

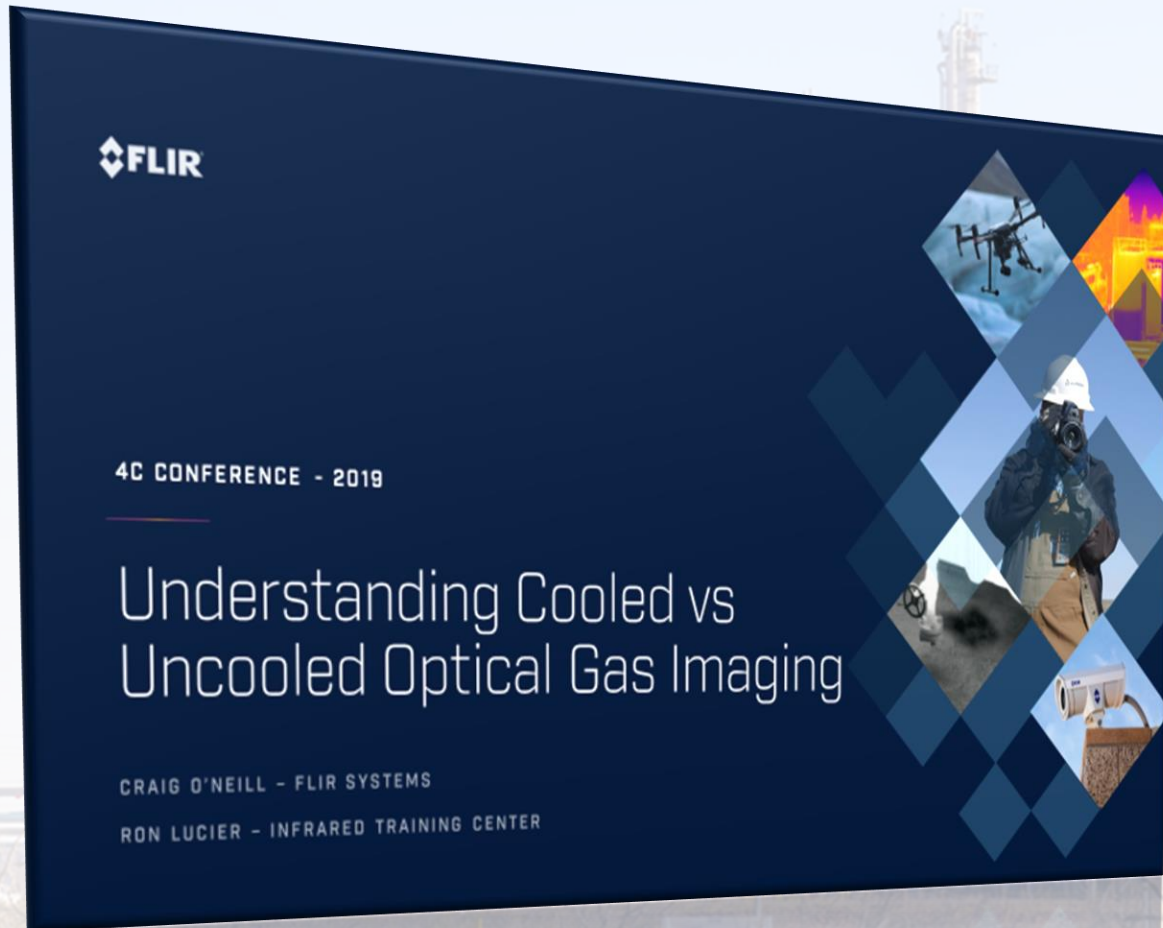
Autonomous Detection of Gas Leaks and Emissions

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A MOVE FROM COOLED TO UNCOOLED



The Advantages of an Uncooled OGI Solution

- Lower in cost
- Requires less maintenance with no cooler
- Developed specifically for methane detection

WHY UNCOOLED TECHNOLOGY?



Market Dynamics

Coalitions focusing on technology and general awareness globally of emissions mitigation tied to methane



Operator Focus

Environmental, Social and corporate Governance focus has operators focusing on emissions mitigations more than in previous years



Regulatory Changes

U.S. EPA has introduced “Alternative Screening using Advanced Measurement Technology” and defined a large-scale emission (10 kg/hr)

OGI: FROM HANDHELD TO FIXED

S-Curve for Technology/Innovation





GF77a & ADGiLE

FLIR COMPLETE SOLUTION

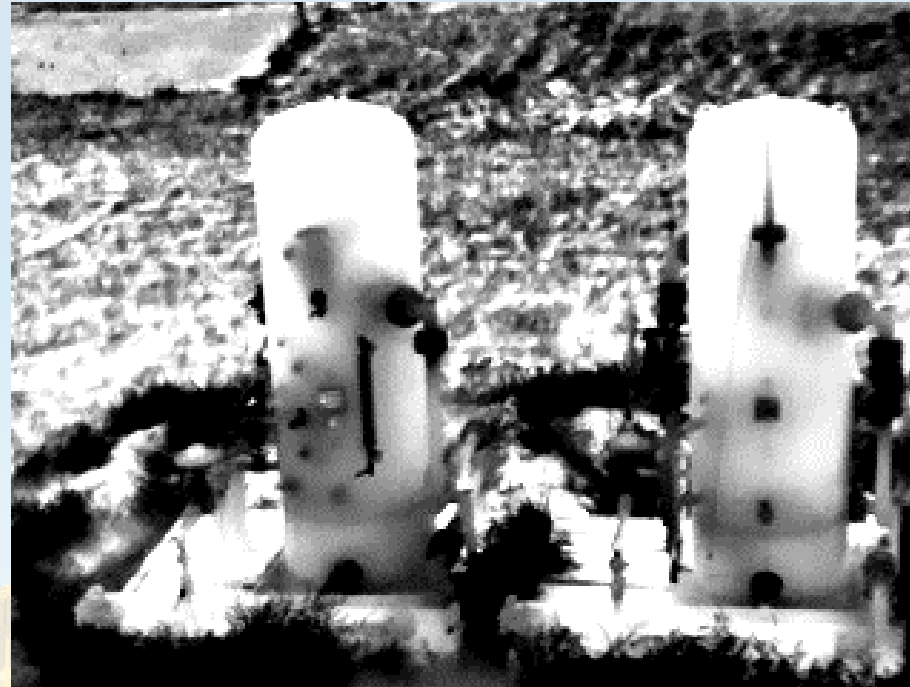
FLIR GF77a Features and Benefits

Features:

- Uncooled autonomous leak detection camera
- Engineered to visualize methane gas
- Small, lightweight and advanced back-end
- High Sensitivity Mode (HSM) enabled
- Multiple lens options

Benefits:

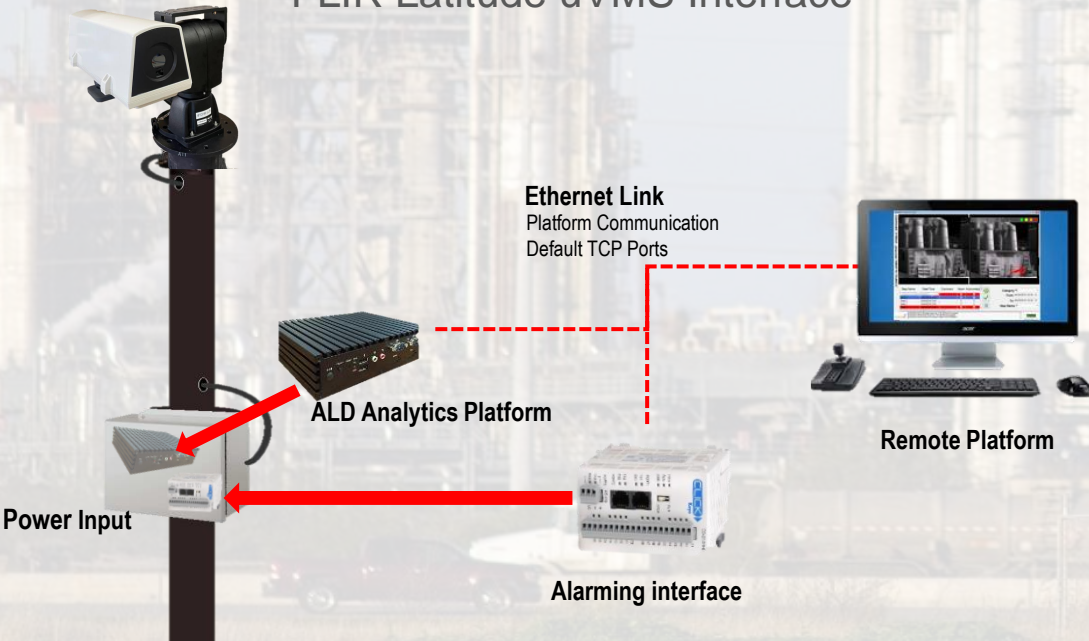
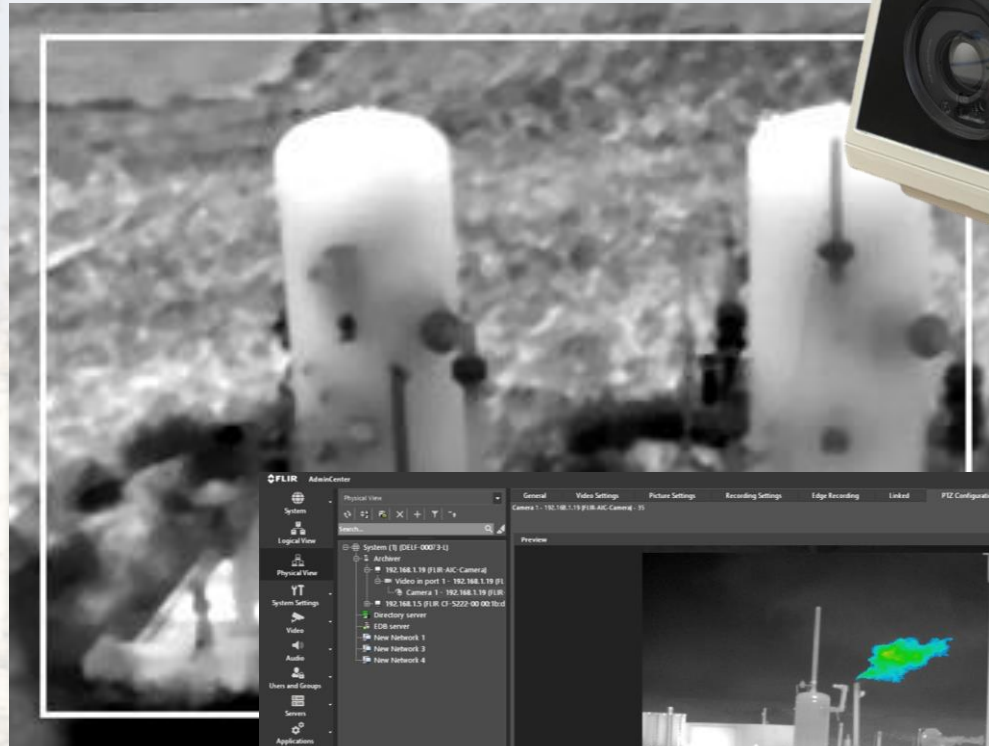
- Maintain valuable capital equipment
- Avoid product loss
- Meet emissions reduction metrics (ESG)
- Ensure safer work environment



FLIR ADGiLE SOLUTION

End to end solution with:

- GF77a Camera in enclosure with pan/tilt
- Analytics powered by Providence
- Environmental panel with edge PC, etc.
- FLIR Latitude uVMS Interface



INSTALLATION EXAMPLE: TANK BATTERY

PTZ OGI Camera Location

Flare



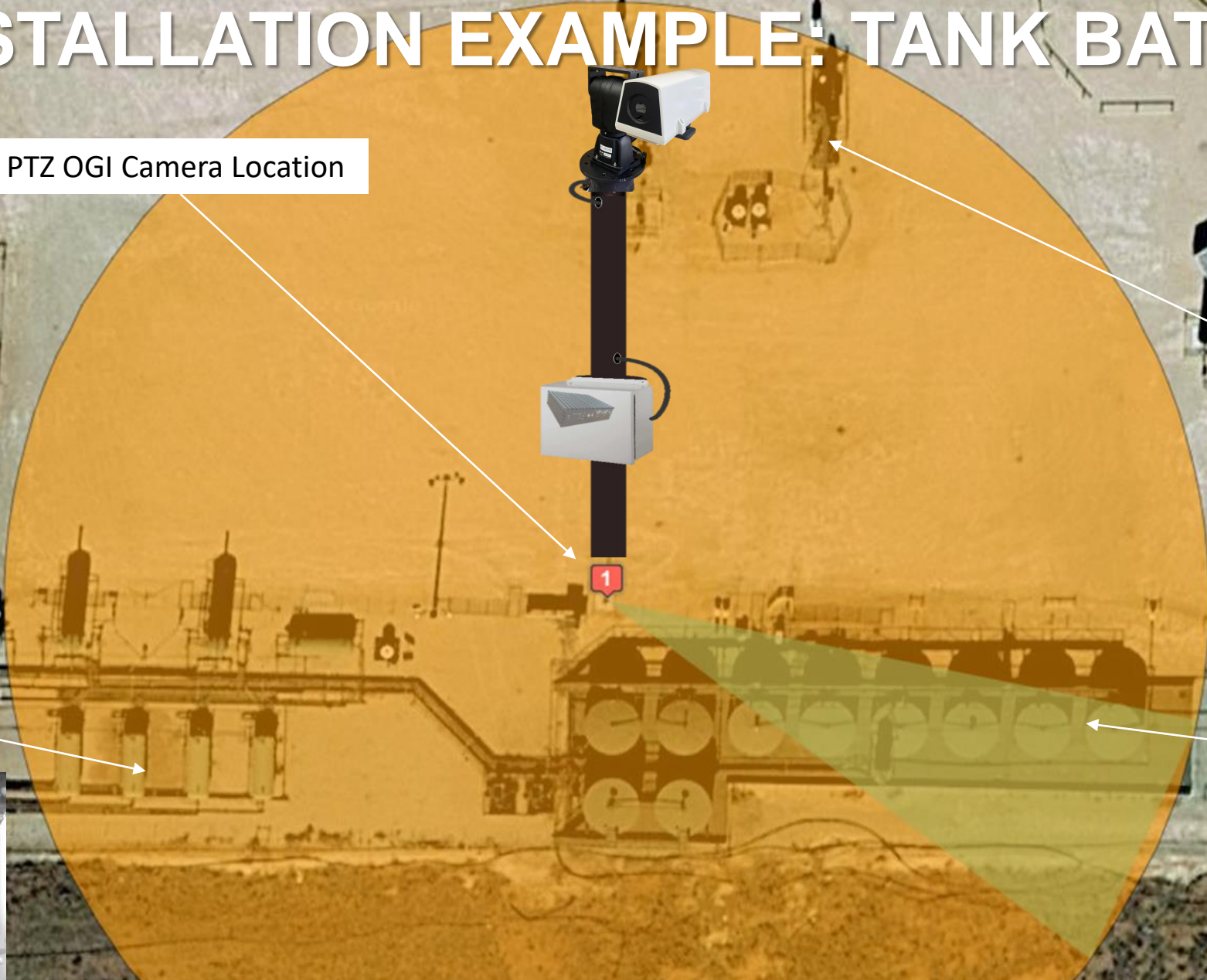
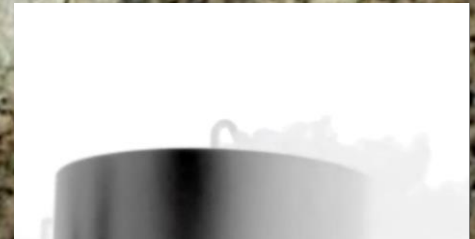
Wellhead



Separators

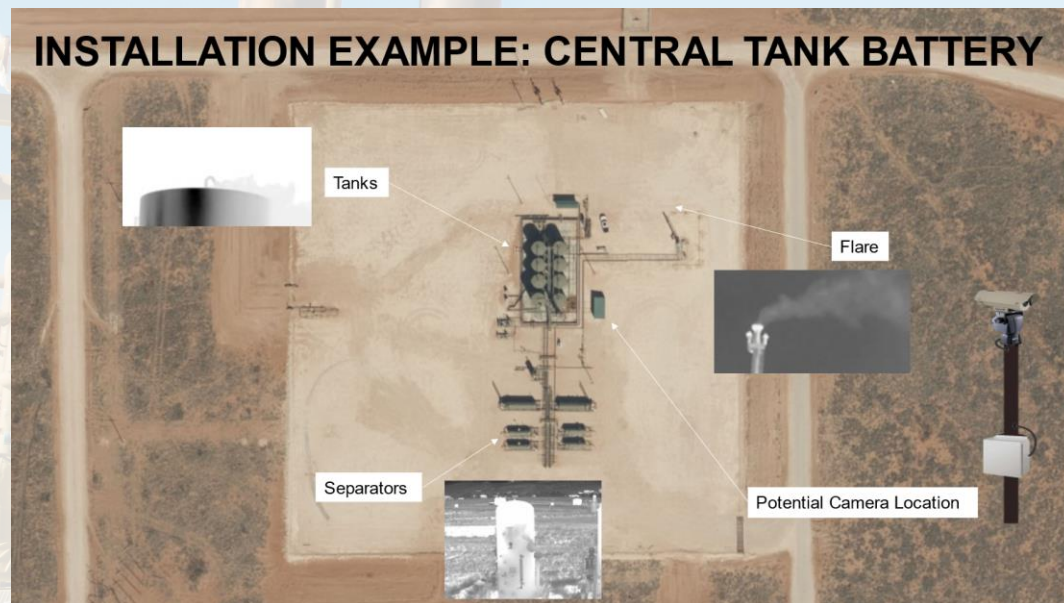


Tanks



FLIR ADGiLE IN ACTION

- Prototype installed H1-2022
- In partnership with large U.S. based Oil and Gas company
- GOAL: Get actionable field results to prove concept, fine-tune analytics
- Expected Launch: Q1-2023 (limited launch with integration requirements)



ADVANTAGES OF FLIR ADGiLE

- Low-cost solution compared to fixed, cooled OGI
- Minimal maintenance after installation
- Continuous monitoring (1-minute, 1-hour, 1-day, etc.) vs intermittent (weekly, bi-monthly, quarterly, etc.)
 - Some leaks are not continuous, they are intermittent and technologies that only monitor intermittently will miss events
 - Many “alternative” technologies are intermittently used (aerial, satellite)
- Situational awareness of the emission event
 - Is the emission event truly a leak (unexpected emission) or an allowed operational emission (vent, unloading, etc.)
 - Most other methane detection technologies (Fixed sensors, aerial/satellite, open-path) are good at “detection” but cannot support “why” there is a leak (i.e., leak vs vent) and require additional investigation, usually with handheld OGI

CHALLENGES WITH OTHER TECH

- **False Readings:** Usually false positive reading requiring an operator to send truck to site to investigate (biggest challenge with fixed sensor technology)
- **Intermittent Leaks:** Leaks that happen intermittently in the process which would be missed by many “aerial” technologies that inspect with a wider temporal frequency (biggest challenge with planes and satellites)
- **Operational Emissions:** Emission events that happen as “day-to-day” operations in the industry like pressure relief valves or controller bleeds (a challenge with all other technologies)
 - These will likely always be challenges until a facility (wellpad, compressor station, etc.) is expected to have ZERO operational emissions
- **Source Level Detection:** OGI allows users to find the “source” of the emission, not just a “site” the is leaking

All of these are the result of non-imaging technologies inability to provide

SITUATIONAL AWARENESS

WHAT IS SITUATIONAL AWARENESS?

Situational Awareness is broken down into three segments:

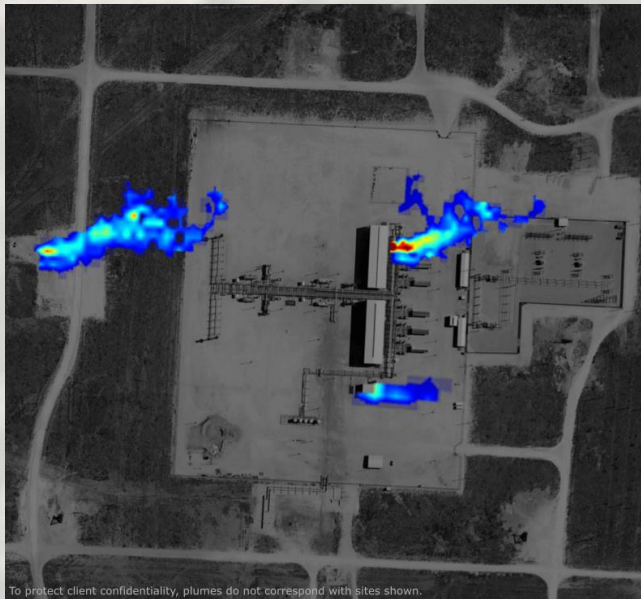
1. **Perception** of the elements in the environment
2. **Comprehension** of the situation
3. **Projection** of future status

Inadequate situational awareness = accidents attributed to human error

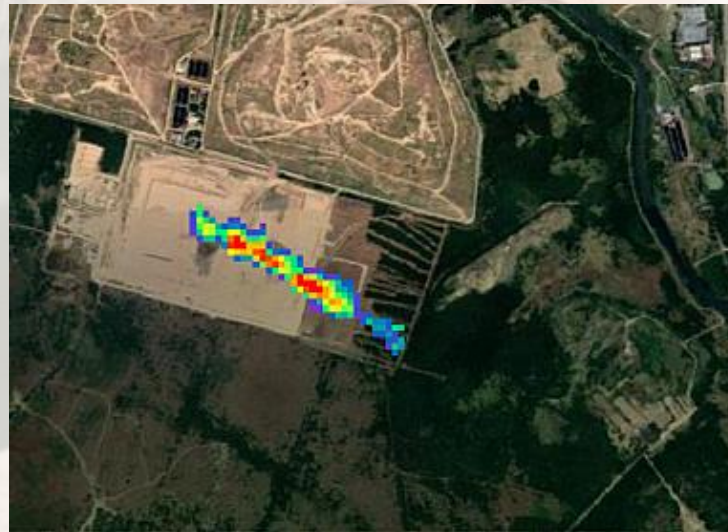
COMPREHENSION OF THE SITUATION

“One picture is worth a thousand words”

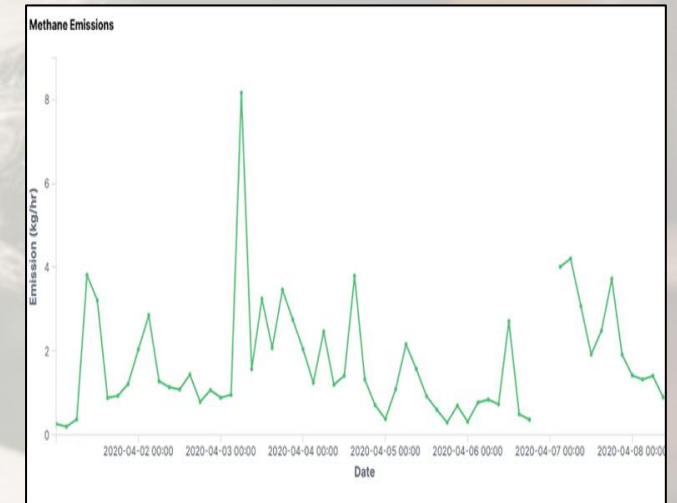
- *Albert Einstein*



Source: Bridger Photonics



Source: GHGSAT



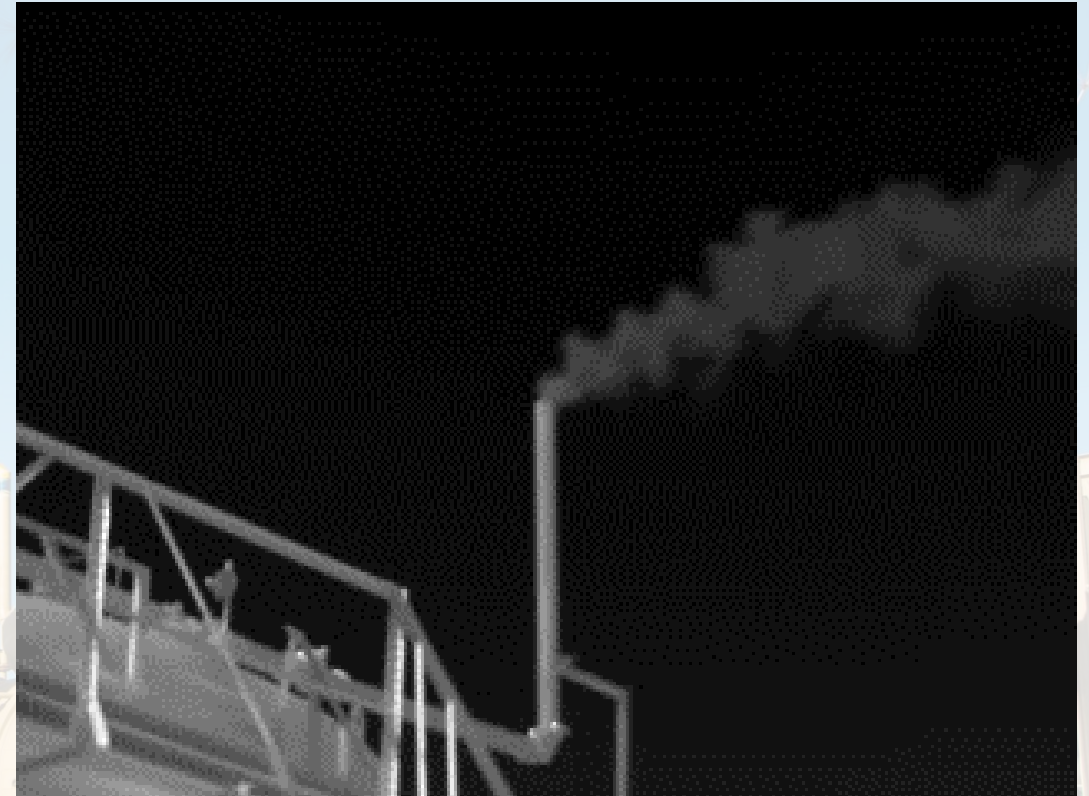
Source: Scientific Aviation

Then what is a VIDEO worth?

OGI: SITUATIONAL AWARENESS



Separator LEAK at Flange



VENT Line Operational Emission

“PICTURE” TECHNOLOGIES



OGI: SITUATIONAL AWARENESS



Image courtesy of OGCI