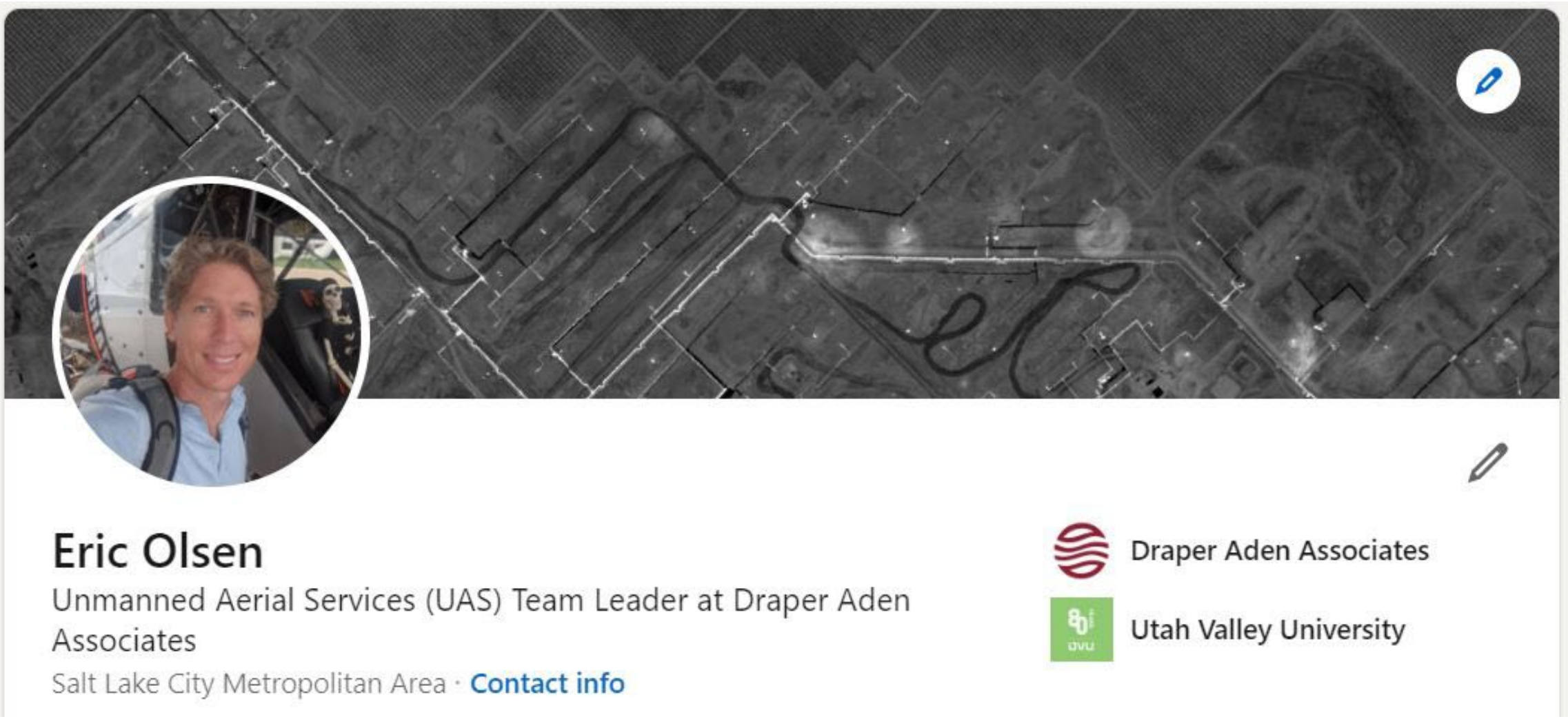
Drone Emission Detectors For Monitoring Landfill Gases

Innovative technology using drones to detect, map, and quantify methane, hydrogen sulfide, VOCs and other emissions from landfills.

Eric Olsen

- Draper Aden Associates & Drones
- Drones 101
- Drones in Oil and Gas
- Optical Gas Imaging
- Borrowing tech from Oil and Gas
- Utah Department of Clean Air
- Drones are in landfills now



Education: Computer Science and Aviation
Career: Software developer, Business owner (Aerial Thermal Imaging), UAV architect (Viper Drones)
Interests: Family, Homebuilt aircraft

Draper Aden UAS Team

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Drone? UAV? UAS?

- Drone is a catch-all definition and commonly used in media
- UAV is an acronym that stands for Unmanned Aerial Vehicle
- UAV is unmanned and doesn’t have a pilot controlling it
- UAS is an acronym that stands for Unmanned Aerial System
- Complete unmanned system including accessories and equipment that you need to allow a UAV to function such as GPS, camera, software

Drone Basics

- IMU - Inertial Measurement Unit: detecting the current rate of acceleration with an accelerometers. The IMU detects changes in rotational attributes like pitch, roll and yaw
- Propulsion System - motors, motor controls, and propellers
- Battery - Lithium ion, Lithium polymer
- Radio Link – Flight commands, aircraft health, telemetry, sensor feedback
- Payload – Cameras, sniffers, LiDAR

Drone History

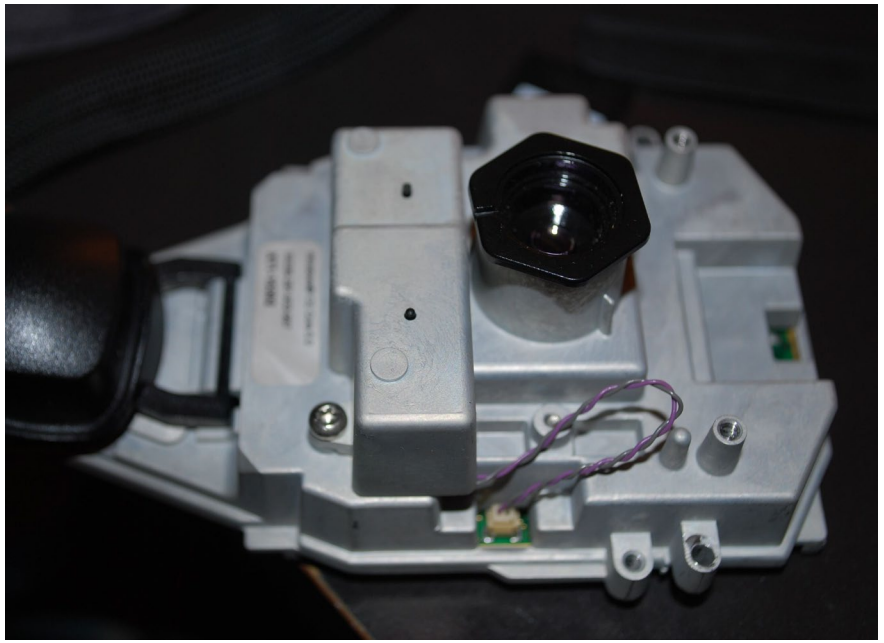
- Original used as weapons
- Documented in 1849, when Austria attacked Venice using unmanned balloons
- RC planes popular in 1960s. Breakthroughs in transistors allowed RC components miniaturized enough to be sold to civilian customers at a reasonable cost
- The rapid growth in the usage of smartphones reduced the prices of microcontrollers, accelerometers, and camera sensors

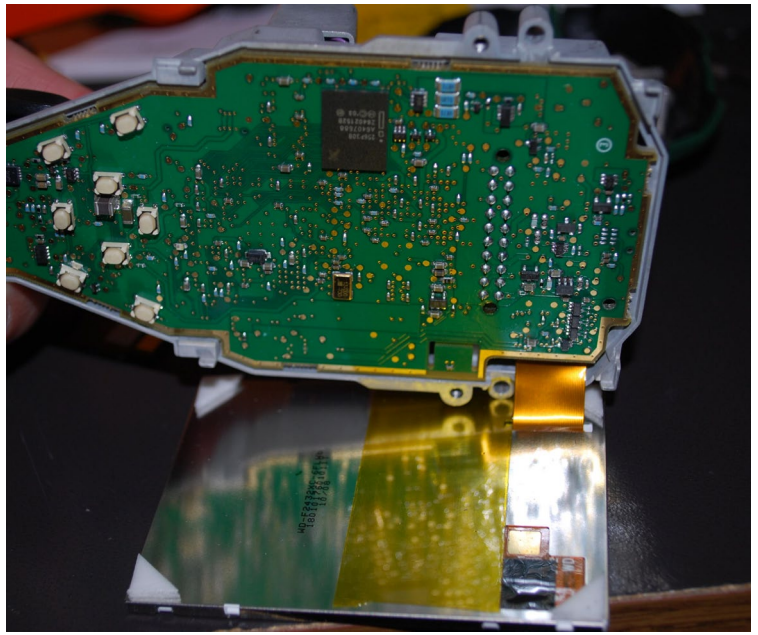
Integrating a sensor, computer, dataloggers

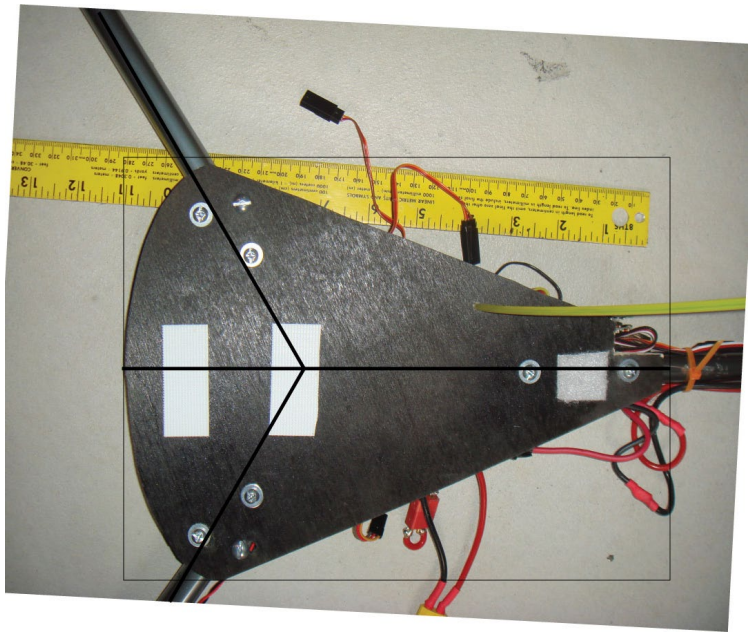
- Telephone to Smart phone
- RC aircraft became smart similar to phones, then smartphones
- Collect data in new places
- Combine that data with GPS, air temp, humidity, altitude

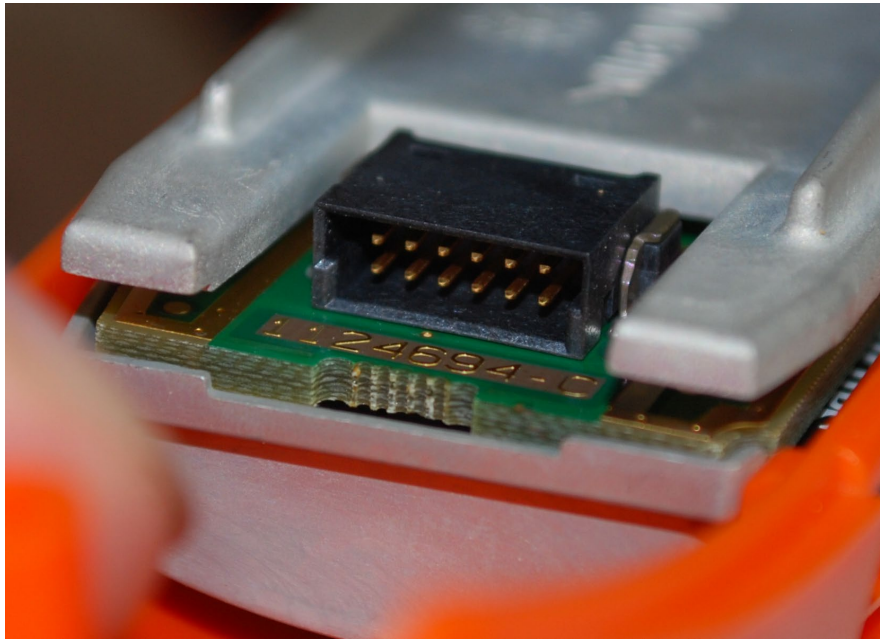
How I got started in UAS

- Radio Control
- Rotorcraft School
- Knife Edge Software
- DIY Drones
- I built solutions because there were no options, and the industry was asking for help
- Reverse engineered a thermal camera









How I got started in UAS

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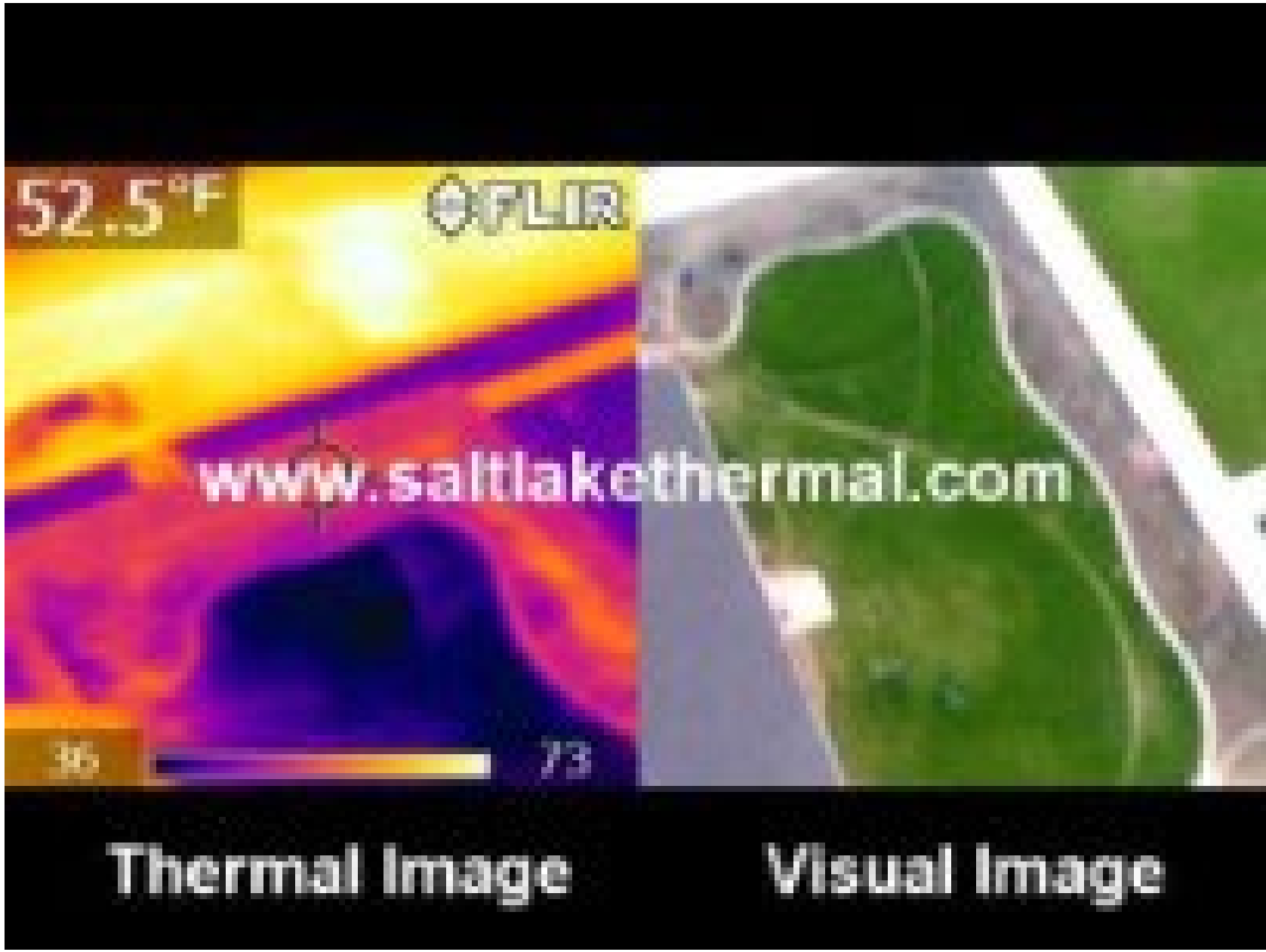
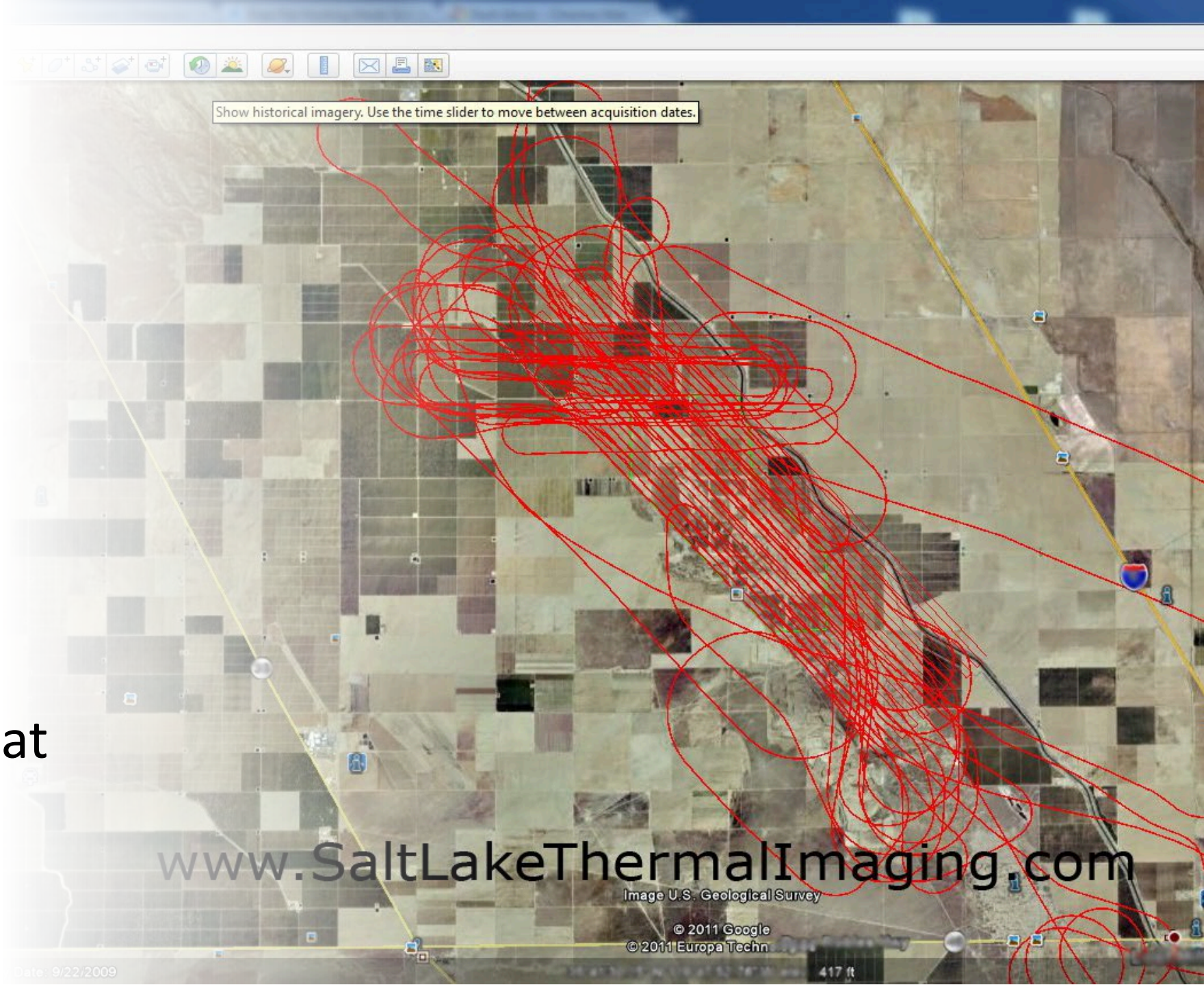


Oil and Gas

- 6/2011 Rescuers retrieve oil worker's body from sinkhole
- Salt Lake Thermal Imaging became Aerial Thermal Imaging
- Added manned aircraft, and perfected unmanned
- Secured contracts with large energy companies
- Learned about Hydrogen Sulfide detectors to be used in the oil and gas industry

Oil and Gas

- Measuring surface thermal expressions
- Landfills also have heat build up that can be mapped



Success in Oil and Gas

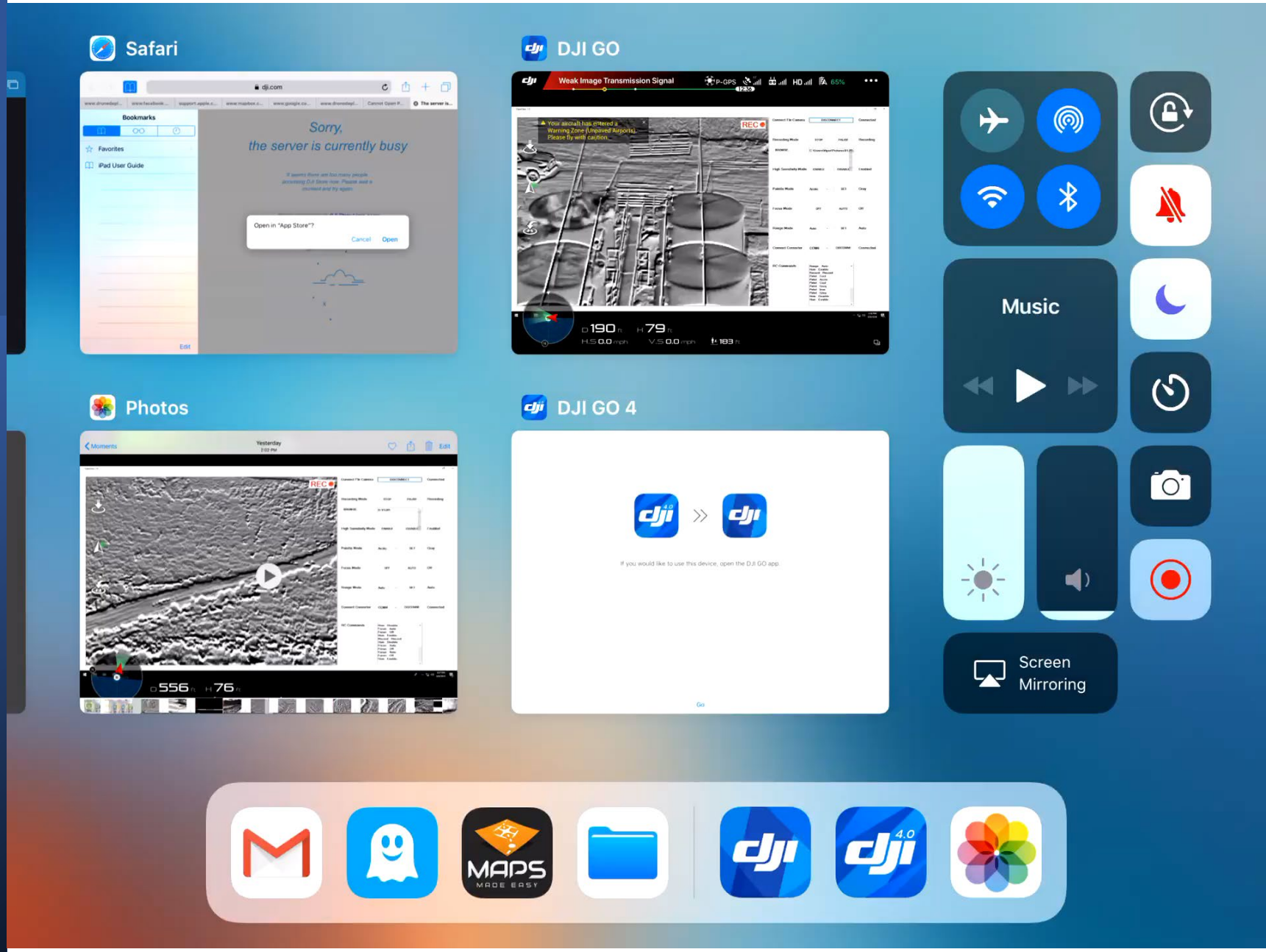
Optical
Gas
Imaging

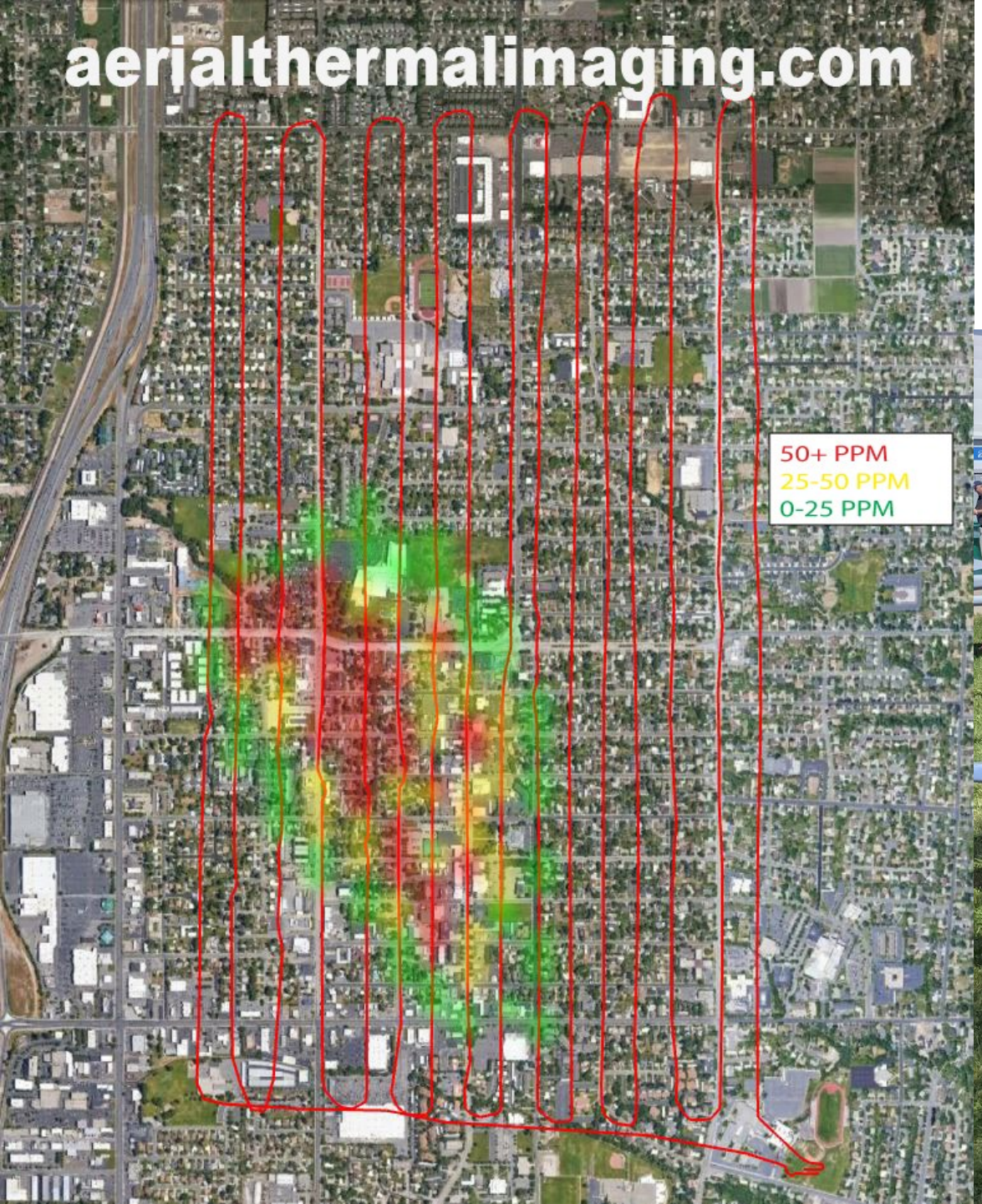
How does OGI work?

- OGI is usually infrared camera form
- Visible light we see with our eyes cannot see hydrocarbon gasses
- These gasses are invisible, but have a narrow infrared spectral response
- The OGI camera is tuned that narrow infrared spectral response
- Cameras are cooled to reduce noise

Success in Oil and Gas

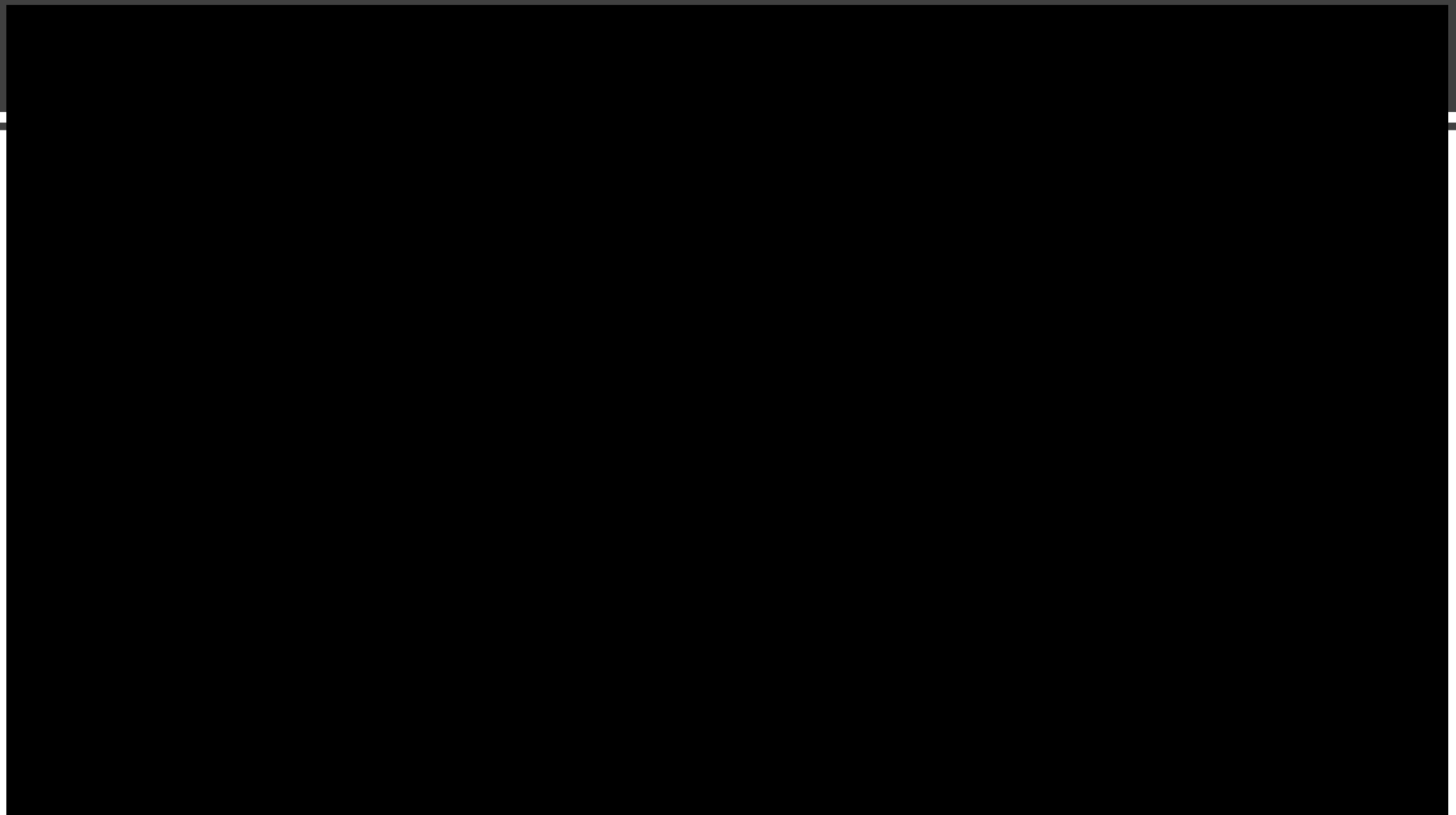
Success in Oil and Gas





Utah Department of Clean Air Sniffers at work

OGI and Sniffers



ing tech
and methods from
the oil and gas
industry

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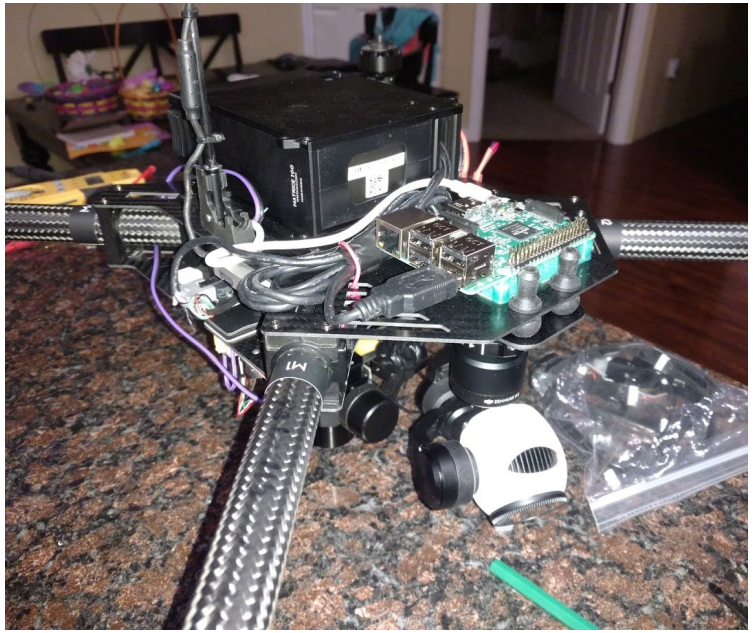
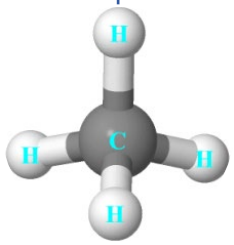
OGI & Landfills

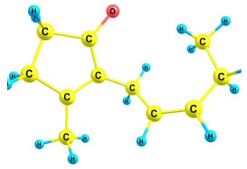


Airborne Sniffers

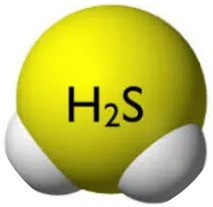
Multi-gas array



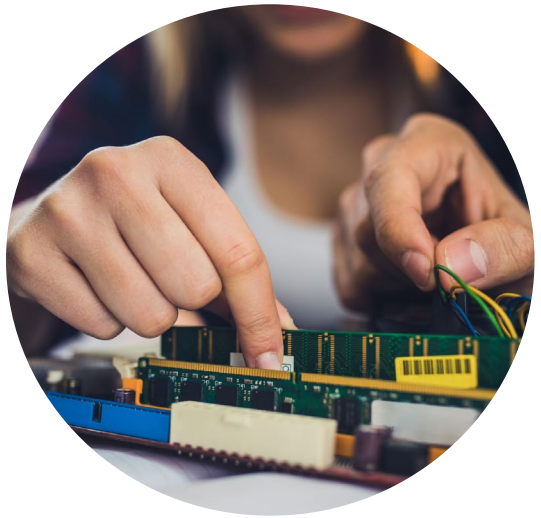
CH4



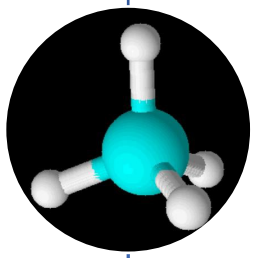
VOC



H2S



Redundant Arrays



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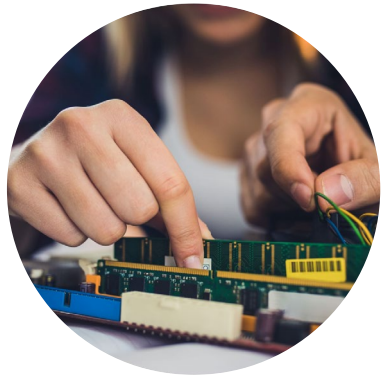
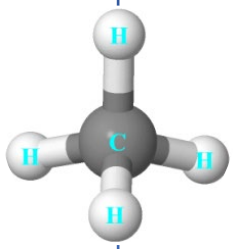
Detector 1

Detector 2

Detector 3



Multi-gas Redundant Array



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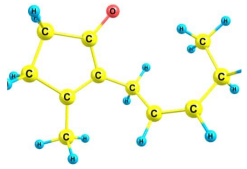

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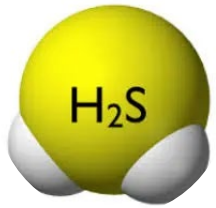

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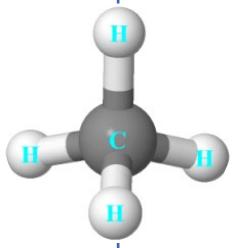

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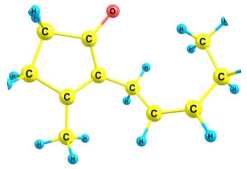

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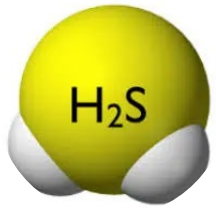

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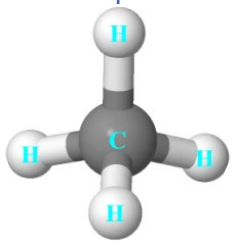

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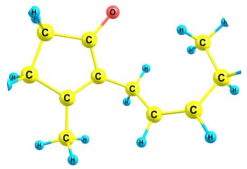

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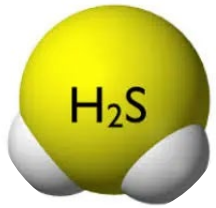


H2S

Commercial solutions available now

- Tuned laser reflects a diffused beam from methane
- 20K
- Flown over entire area
- Collects
- Difficult to post process
- Bulky system
- Must be pointed directly at methane

Commercial solutions available now

- Tuned laser reflects a diffused beam from methane
- 67K
- Instant feedback to pilot
- Must be pointed directly at methane

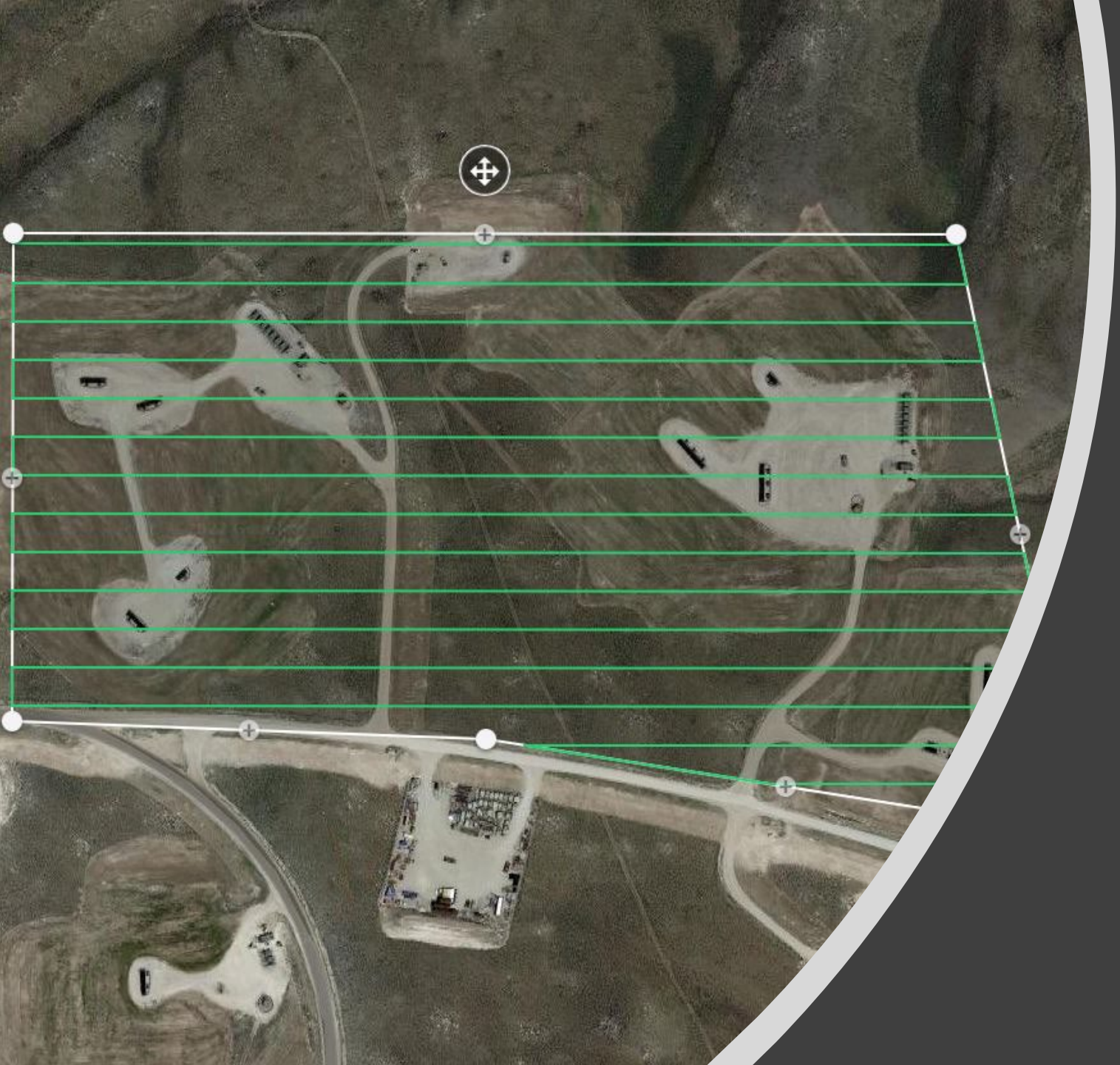
A test of lasers and sniffers

Terrain Following

- Drone stays as calculated altitude
- Obstacle avoidance
- Fully automated
- No need to walk

Waypoint Mission

- Can use terrain following
- An “orbit” can be programmed
- Perfect for automated OGI missions



Grid Mission

Multi gas test site

How drones can benefit landfills

- No boots on the ground
- Fully automated flights pending FAA regulations
- Price for this tech is dropping
- Safety – trips, exposure, snakebites

Thank you!

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