

An aerial photograph of an industrial facility, likely a water treatment plant, set in a vast, arid landscape. The facility features several large green cylindrical storage tanks, smaller green rectangular structures, and several green pumpjacks. The ground is a mix of dirt and sparse vegetation. In the background, there are rolling hills and a range of blue mountains under a clear blue sky with a few wispy clouds. The image is overlaid with a semi-transparent white geometric shape that frames the text.

LEAK DETECTION

UTILIZING SMALL UNMANNED
AERIAL SYSTEMS (sUAS)

PRESENTED BY
MATT HALKER

of








HALKER
CONSULTING

Agenda

- Introduction
- Who we are
- Why we need leak detection
- Traditional methods of inspection
- Benefits of sUAS inspection
- What we do
- Capabilities
- Conclusion
- ***Presentation Intent- To inform and communicate the reality of todays technology***



Introduction- Matt Halker and Company

- CSM Grad – BSPE 
- Worked for Operators in GOM, SJB and PRB 
- Started company in 2006 
- Upstream engineering need 
- Designed 400+ multiwell facilities, small scale midstream systems, central processing facilities, and field development engineering
- Grew company to 125 people, wrote articles and won awards- Then our market crashed 
- Now under new management and growing again 
- Added drone inspection in late 2016 

Who We Are



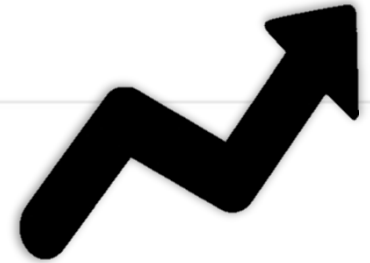
People company



Safety, Integrity,
Collaboration, and
Achievement



We listen to our
customers and speak
their language



We always strive to
increase our
customers value

Why We Need Leak Detection

- **Leak Detection and Repair (LDAR)**
 - EPA has determined that leaking equipment is the largest source of emissions from facilities
 - Different kinds of facilities require different frequency of inspection
- **Reducing Product Losses**
 - Lost product translates to loss of revenue
- **Decreasing Community Exposure**
 - Chronic health effects can result from long-term exposure to emissions from leaking equipment that is either not identified as leaking
- **OOOOa (QUAD Oa)**
 - established emission standards for the control of the greenhouse gases and volatile organic compounds (VOC)

Traditional Methods of Inspection

- Visual Inspection on Foot
 - High Risk
 - Trained technician
 - Handheld cameras require close proximity
 - Time consuming
- Manned Aircraft
 - Expensive
 - Not always the best data
 - Noise pollution
 - Coordination with land owners

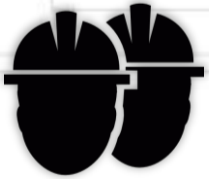


Benefits of sUAS Inspection



QUALITY & ACCURACY

Visual sensor provides 3-5cm accuracy. Hundreds of millions of points to use for design, calculations, & certifications. Ultra high resolution imagery.



SAFETY

Reduced time on-site. Collection occurs away from actual components.



SPEED & COST SAVINGS

Millions of survey grade points collected per second. Substantially reduced collection / inspection time. Decreased time deliverable turn-around time.



MULTIPLE SENSORS

High Resolution Visual, Thermal, and Optical Gas Imaging
Future Sensors: Moisture, RMLD

Benefits of sUAS Inspection



REPEATABILITY & PERSPECTIVE

GPS connectivity allows for sUAS to record data from exactly the same spot each time inspection is required. This also allows for a perspective that is traditionally not possible with human inspection.



REMOTE AREA ACCESABILITY

Pipelines run through some of the most remote locations, requiring off-road vehicles or manned aircraft for traditional inspection. sUAS allow for close proximity inspection of lines and high quality data capture.



EASILY SHAREABLE DATA

Data collected can be used to generate reports that are easily shared across different sectors, making it easier for professionals in any industry to easily interpret and share relevant data.

What We Do

- We operate a fleet of sUAS with multiple remote sensors



DJI Phantom 4 Pro
(Visual)



DJI Matrice 600 Pro
(Visual, Thermal & OGI)



Infrared Cameras Inc HALO
(OGI)

- Providing three separate capabilities:
 - Autonomous Pipeline Inspection
 - Semi-Autonomous Facility Inspection
 - Automated 3D Mapping

CAPTURE

PROCESS

ANALYZE

REPORT

Capabilities – OGI Gas Detection



- Methane gas detection from an aerial platform
- Commercially available technology
- ICI Mirage HC
 - Utilizes same technology as the FLIR GF320 OGI camera; designed for UAV
 - Delivers optimum solutions for the detection of Methane and other hydrocarbon gases
 - Collects Radiometric Temperature Data
 - Weighs <765 Grams without a lens
 - Compact and portable
 - Commercially available

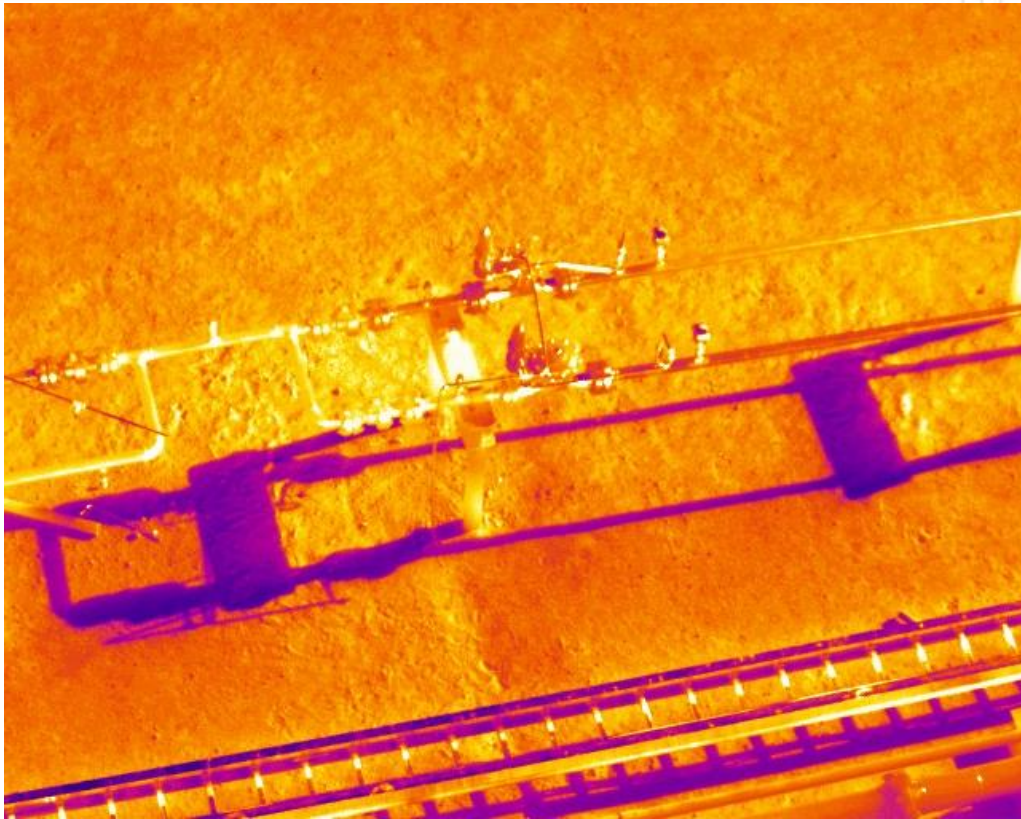
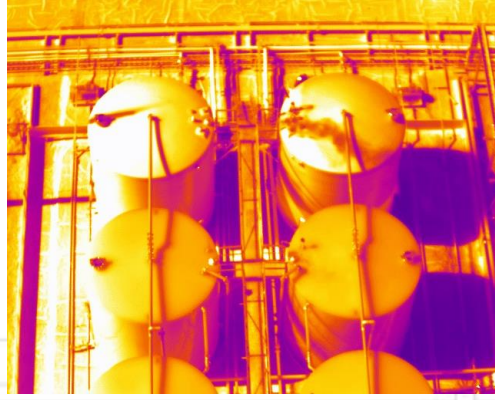


DJI Matrice 600 Pro



HALO by Infrared Cameras Inc

Capabilities – OGI Gas Detection



Capabilities – Fluid Detection with IR

- Able to detect 70° produced water leak detected at ½ GPM in <math><45^\circ</math> environment
- Temperature differentials shown through color gradient



DJI Matrice 600 Pro

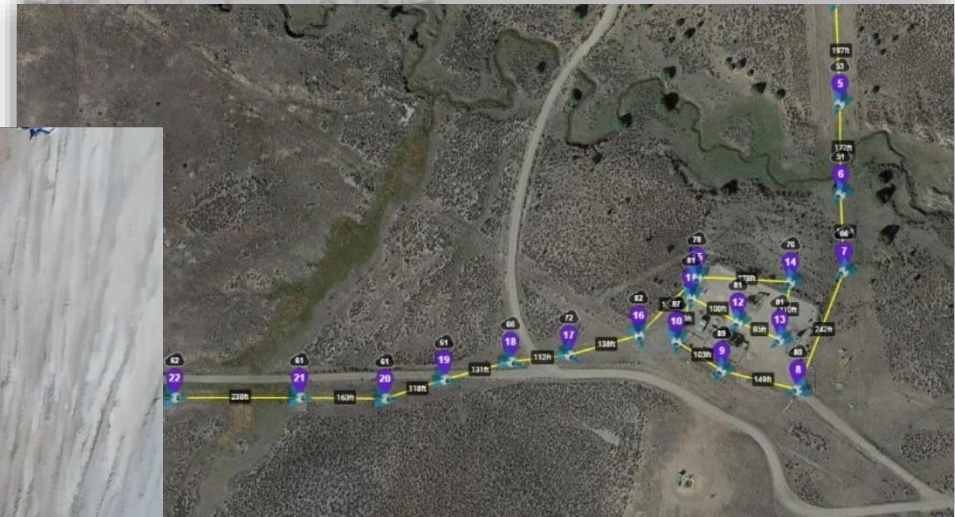


Capabilities – Autonomous Pipeline Inspection

- Operation controlled by GPS coordinate driven flight plans
- High Resolution Footage
 - 1" CMOS Sensor
 - 4k video
 - 20MP photography



DJI Phantom 4 Pro



Capabilities – Autonomous Pipeline Inspection

- Leak shown in red below
- Leak from in between two eastern most tanks

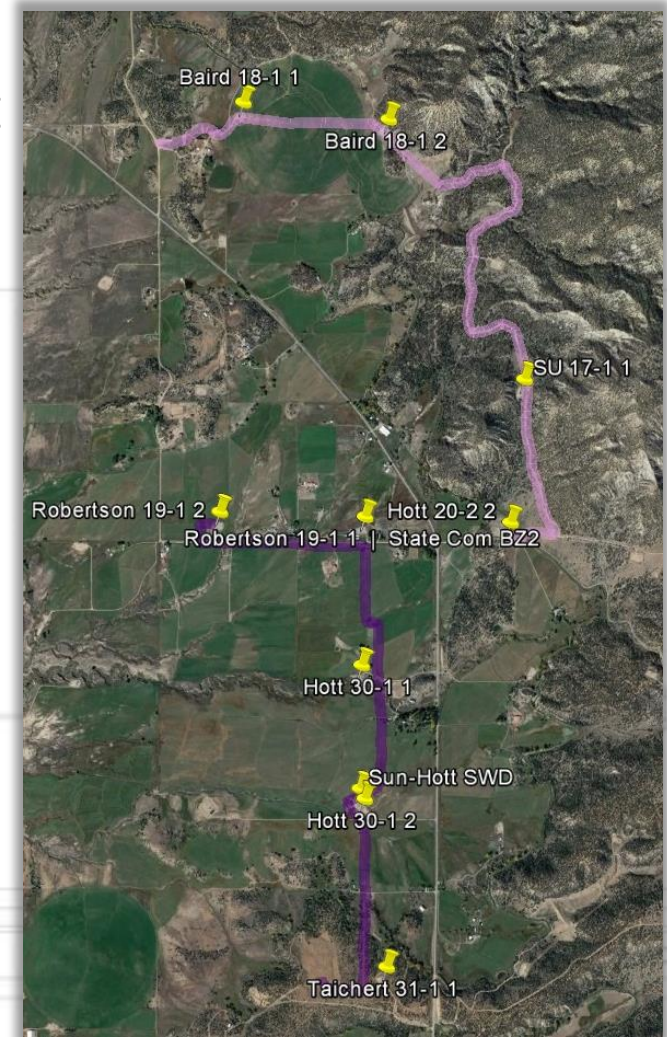


DJI Phantom 4 Pro

- Imagery generated from 4k HD video

Capabilities – Autonomous Pipeline Inspection

- Plan – section out the field
- Build large scale GPS coordinates flight plan
- Designate multiple efficient battery replace & recharge locations
- Capture baseline data section by section
- Compile data and stitch results for seamless path viewing
- Analyze data path by path
 - Create database of captured information
 - Use this database to create baseline & compare future datasets
- Flag problem areas
- Generate work orders for follow up



Capabilities- Aerial Facility Inspection

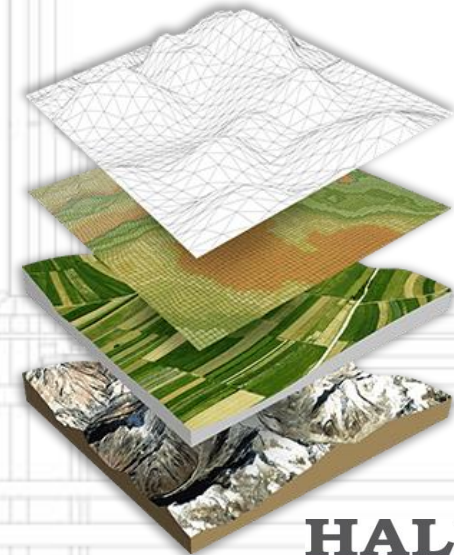
- Pre-program flights with 3D flight plan
- Create baseline footage of oil and gas facilities
- Store footage in database
- **Sensor Selection:**
 - Visual – Provides visual irregularity detection and baseline reference
 - OGI – Detect and locate source of methane gas leaks
 - Thermal – Displays temperature differential revealing hot/cold areas
 - RMLD (Remote Methane Leak Detection) – Monitor, locate, and quantify volumetric leak rates of methane
 - Moisture – Highlights relative humidity levels in various soils



Capabilities- Automated 3D Mapping

Use of high resolution digital cameras and orthophotography for production of 2D & 3D models

- Orthomosaic and Point Cloud Models
- Reduced time on-site for data collection
- Collection occurs away hazardous components
- Rapid deliverable turn-around time



Capabilities- Automated 3D Mapping

- Orthomosaic image
 - an aerial photograph geometrically corrected such that the scale is uniform
 - the photo has the same lack of distortion as a map
 - can be used to measure true distances, having been adjusted for topographic relief, lens distortion, and camera tilt



Orthomosaic

Original 2D Aerial Imagery

Capabilities- Automated 3D Mapping

- 3D Point Cloud Model
 - For use in engineering drawings
 - plot plan creation, mechanical piping model, TVCS calculations, brown field development, accurate measurement
 - Translational tool to communicate between field operations and corporate engineering
 - Transactional exhibit representing physical reality at given point in time



Data Storage Platform

- Online portal allowing for easily sharable data
- Visual and OGI capable
- Report generating



Conclusion

1. Autonomous Pipeline Inspection

- Finding a needle in a haystack

2. Aerial Facility Inspection

- Decreasing profit loss while increasing safety

3. Automated 3D Mapping

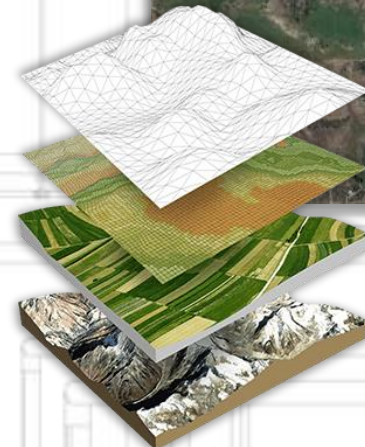
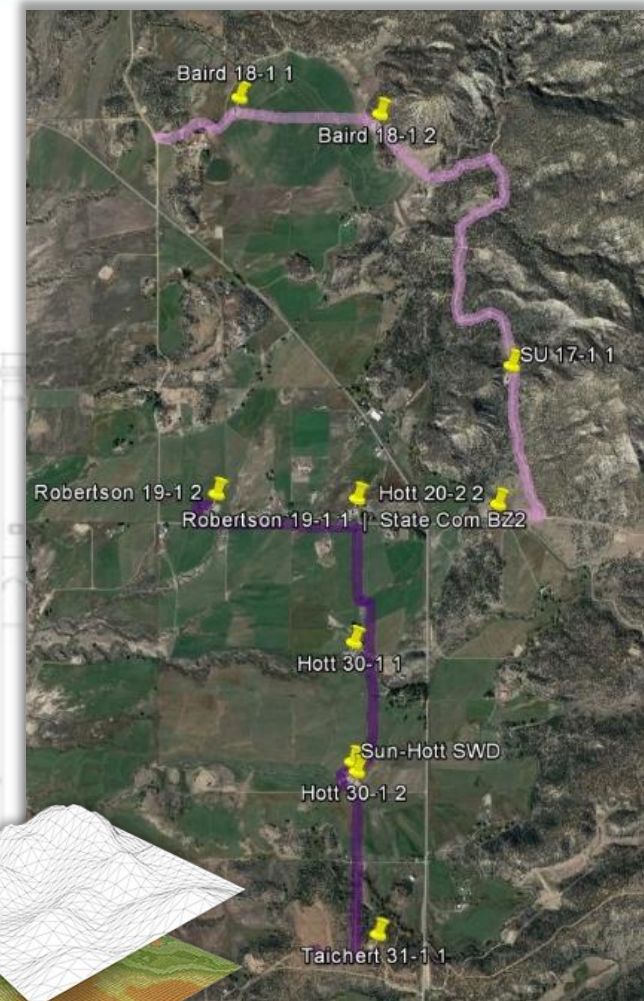
- Building model as-built isometric drawings

4. Data Storage Platform

- Centralized data storage and information communication

Concentration of Technology

- 3 – 4 sensors on single aircraft
- Single flight path





HALKER

C O N S U L T I N G

Agility. Innovation. Collaboration

Denver Location: 7936 E. Arapahoe Ct., Suite 3200 Centennial, CO 80112 303-515-2700

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