Unmanned Aircraft Systems (Drones)

Overview & Use

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Plan

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Terms

DJI M350

- The term drone refers to an unmanned vehicle
- Drones receive commands remotely – they can carry out a range of tasks from taking aerial photos/videos to military operations.
- Unmanned Aircraft Systems (UAS) – FAA term.
- FAA has accepted the term "drone".
- Small Unmanned Aircraft Systems (sUAS) – FAA term for small drones (0.55 lbs – less than 55 lbs).
- Unmanned Aerial Vehicles (UAV) – globally known term

Drone Types

Different types of drones are used for various purposes:

1. Fixed-wing drones: longer flight time and high flight speed benefiting from their aerodynamics and design – they are best for covering (e.g. mapping) large areas.

2. Single-rotor helicopter drones: powerful and durable – They are suited to carry large payloads and fly more efficiently. Usually they use gas engines.

3. Multi-rotor drones: widely used – excellent control – vertical take off – best for aerial photography and aerial inspection. Low flight time if powered by batteries. They can be Tricopter, Quadcopter, Hexacopter, Octocopter.

4. Fixed-wing hybrid VTOL drones: fixed wing drones modified to take off and land vertically. They are designed for mapping, power line inspection, surveillance, agriculture, and rescue operations.


HAWK1


www.jouav.com

How are drones powered?

Batteries: lightweight but expensive, short lifespan and can be hazardous.

Gasoline: Long flight time, higher flight speed but potentially dangerous and drones can be noisy.

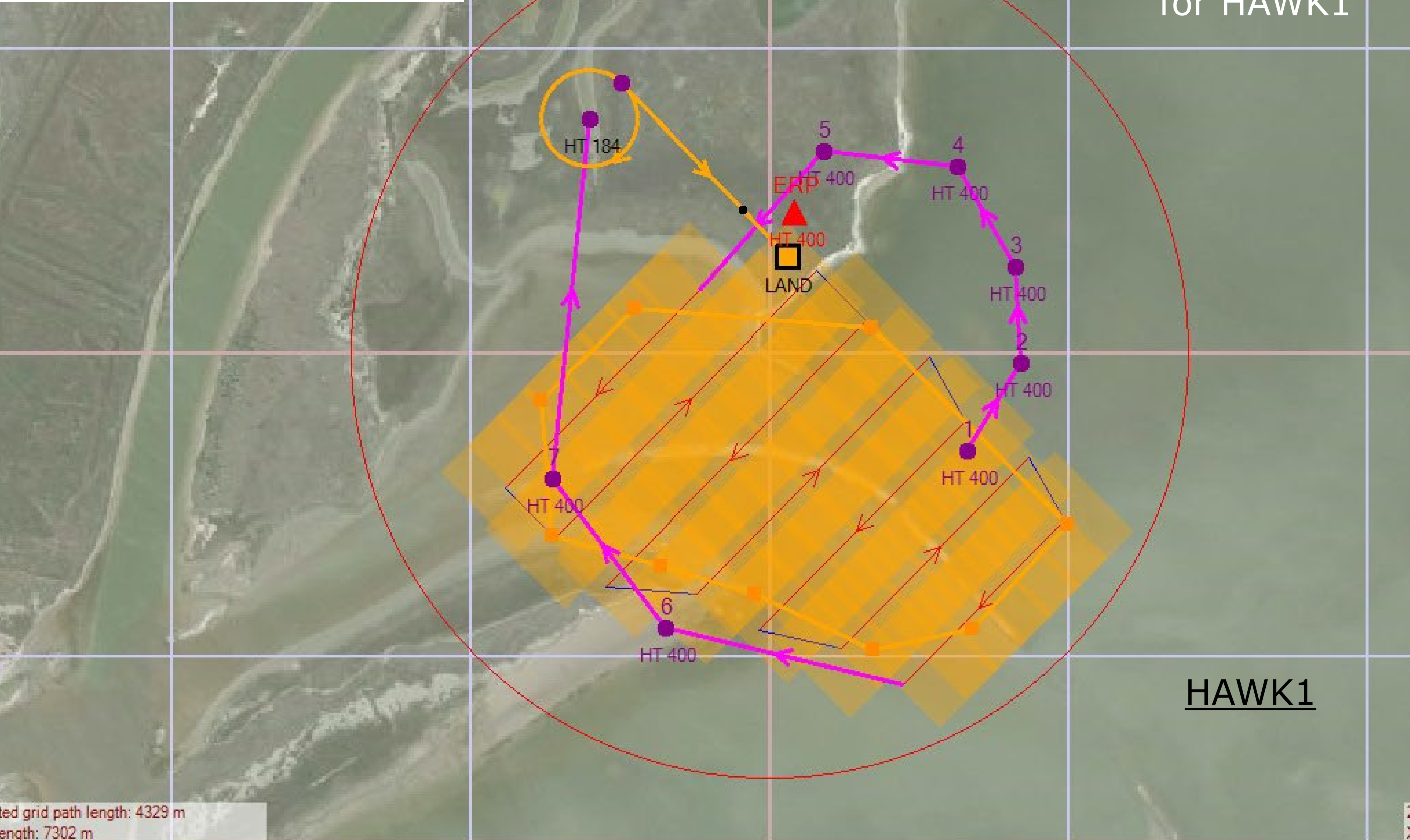
Hydrogen: long flight time, environmentally friendly, works at low temperature but produces a lot of heat.

Solar: long flight time while the sun is available, low operating cost.

How are drones flown?

- Flying drones manually: drone pilots have full control of the aircrafts and are responsible of every drone movement – Pilots must be skilled. Continuous training is recommended.
- Flying drones autonomously: drones execute predefined plans and perform specific maneuvers to complete tasks with minimal to no human intervention. This requires advanced flight control systems, sensors and software algorithms.

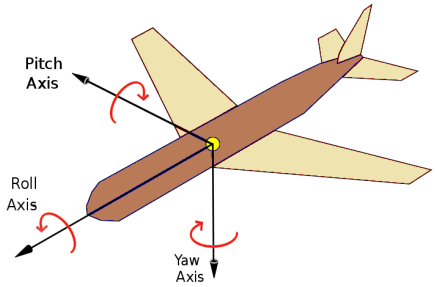
Typical Plan for HAWK1



HAWK1

Main parts of a drone

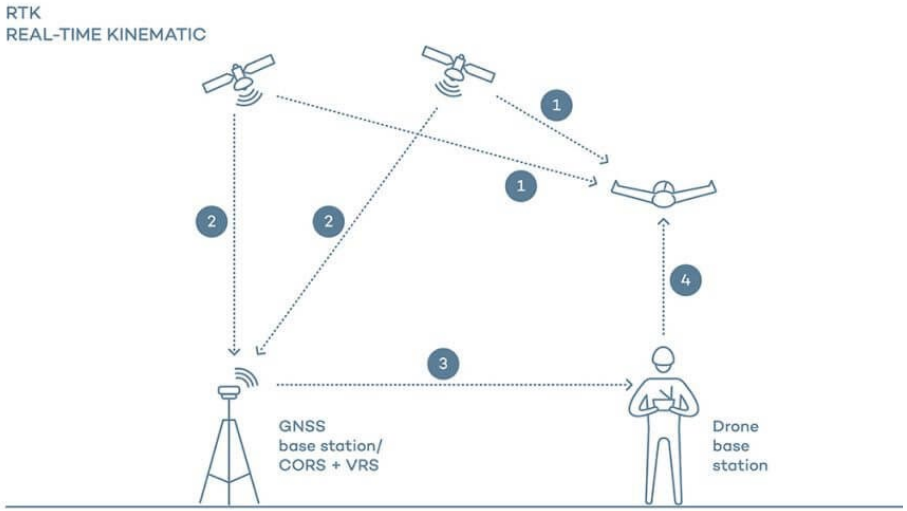
- Frame
- Motors
- Propellers
- Flight Controller
- Electronic Speed Controller
- Inertial Measurement Unit
- GPS Module & antenna
- Payload (e.g. camera)

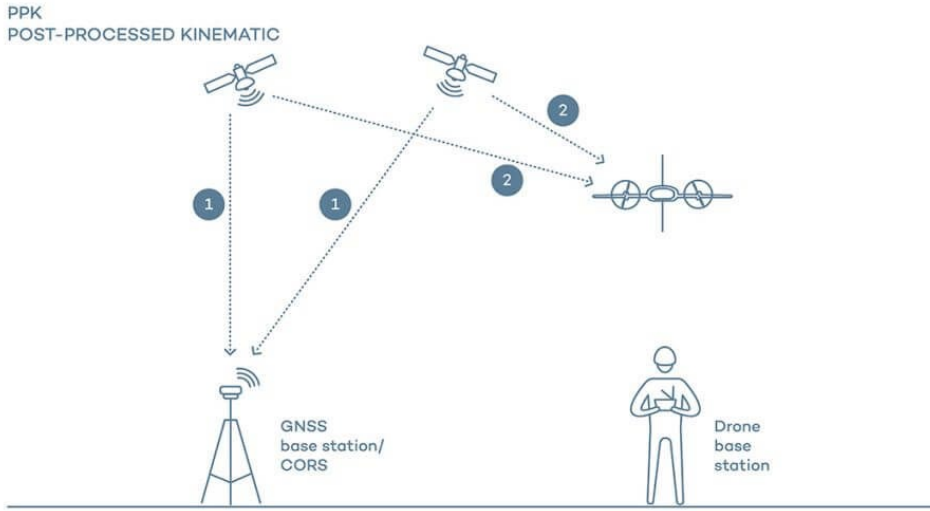


GPS modes

Drones use Global Navigation Satellite Systems (GNSS) for positioning.

- Single mode
- Differential mode: Real Time Kinematic (RTK) & Post Processing Kinematic (PPK)





Source: Wingtra

Payload (sensor) types

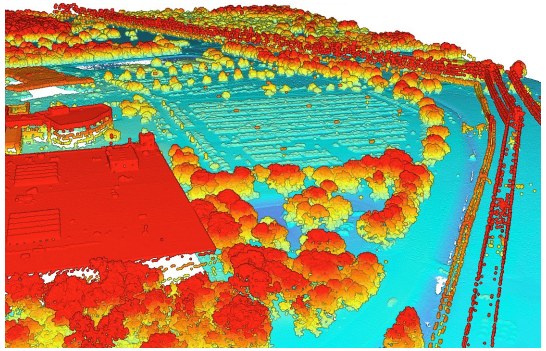
Optical cameras: they produce photos & videos

Thermal cameras: they produce photos & videos

Multispectral cameras: they produce multi-band images

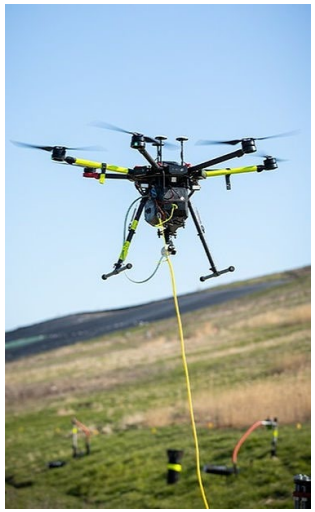
Lidar sensors: they produce 3D point cloud data

Sniffer sensors: sense leaks of gases



Point cloud

Thermal photo



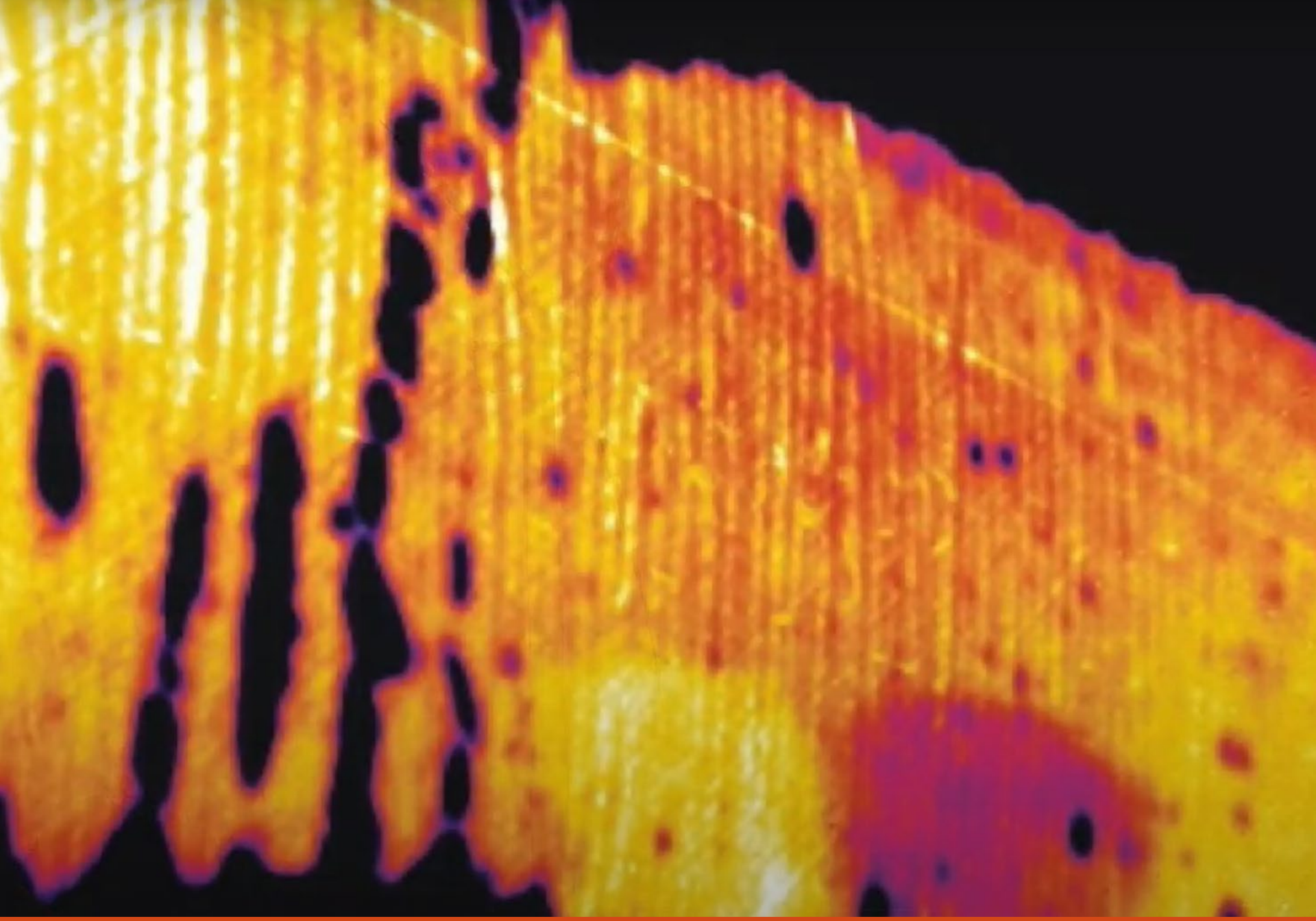
Sniffer drone

Orthoimage

How drones are used?

- Drone inspection: powerlines, telecommunication towers, wind turbines, roofs, solar panels, oil & gas infrastructure (e.g., flare towers, off-shore rigs, pipelines)
- Drone mapping: photogrammetry & Lidar technology
- Agriculture: monitoring crop conditions
- Wildlife
- Search and rescue
- Transportation of goods
- Human transportation – are we ready for this? Check Hexa from Lift Aircraft Inc - Texas


Safety is a big concern, Slow, Costly

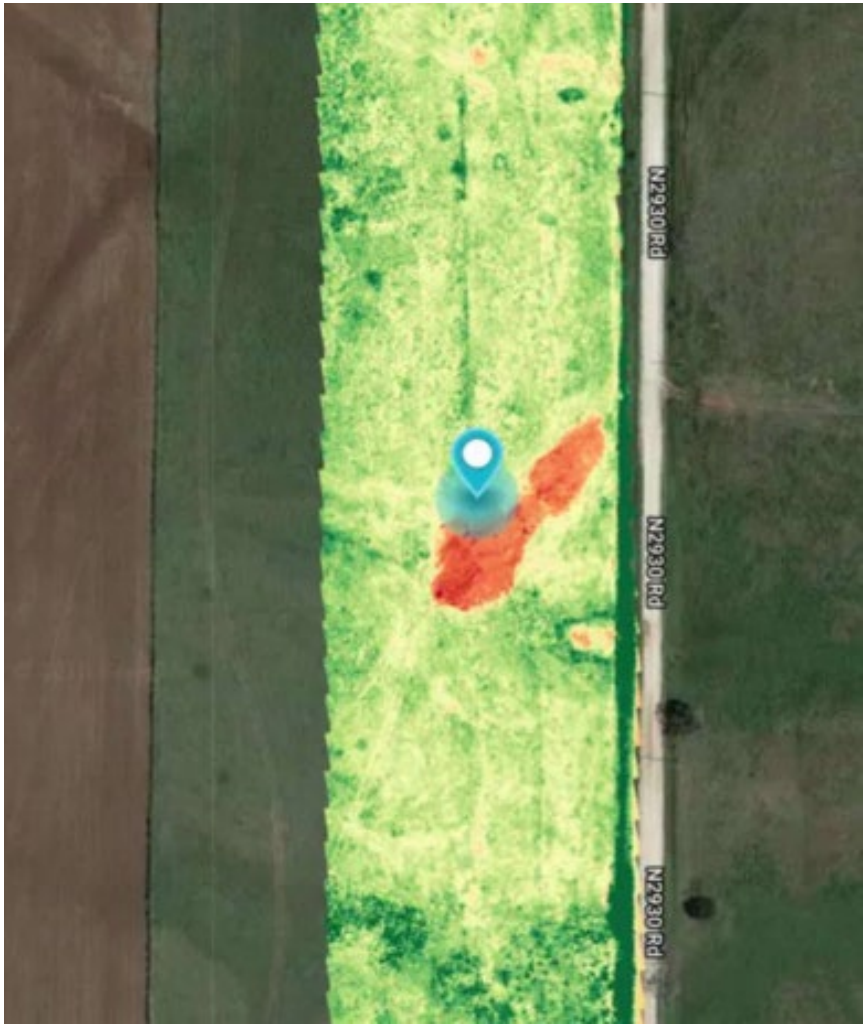


More details and better data can be captured when appropriate sensors are used

Multispectral image

- Multiple bands from various regions of the electromagnetic spectrum are captured
- True color composite and false color composites can be created

Using false color composites provide a clear picture of the extent of a leak from underground oil pipe



Other Drone Systems & Use

Sniffer Drones: Methane, Nitrogen Dioxide (NO2), Carbon Monoxide (CO), Fine Particle Matter (PM2.5), Ozon at ground level

Specialized inspection drones:

- Elios 3 systems for confined spaces

- Powerline inspection drones

Examples of Use – UHCL students/staff

Bird Survey

Prescribed Burn at UH Coastal Center

3D Oil Tanks

Regulations

sUAS are subject to the **Federal Aviation Administration (FAA)** oversight and enforcement.

Regulations vary depending on purpose:

- Commercial use: Remote pilot with a Part 107 License is required
- Recreational use: there are **9 requirements** including flying for recreational purposes, following FAA rules and taking The Recreational UAS Safety Test (Trust)

How can you become a remote pilot?

- Create an account on IACRA to obtain your FAA Tracking Number (FTN) at: https://iacra.faa.gov/IACRA
- Create an account on PSI and schedule your test at: https://faa.psiexams.com/faa/login
- Find a testing center in your area on PSI and apply for a Remote Pilot Knowledge Test
- Fees: $175.
- Photo ID with signature and address on it is required to take the test.

Questions?