

UAV Drones for leakage and pipeline surveillance

*Andrew Bambridge
GM Engineering & Operations
Tas Gas*



INITIAL SET UP

- DJI Matrice 300 RTK UAV/Drone
- U10 Laser methane detector
- Zenmuse H20 high-definition camera (wide angle and 23 x zoom)
- High capacity rechargeable batteries and charger with hot swap capability
- Dual gimbal connector for various attachments
- Samsung EVO hand held display tablet
- Storage cases, spare propellers, chargers, leads, etc.

Total equipment and set up costs <\$100K

SUPPORT SYSTEMS

- *Software storage servers for quite large image and video files storage*
- *The uploading of the pipeline alignment to the device to automate the flight path, features, special crossings, HCA areas and any historical data points*
- *Setting of flight parameters such as offsets to alignment, exclusion areas and heights*
- *Creation of the Flight Plan Log and Record*
- *Determining the launch and land sites to best utilise the flying hours*
- *Land owner and farmer liaison*



SPECIFICATIONS

- Unfolded (LxWxH): *810×670×430 mm*
- Folded (LxWxH): *430×420×430 mm*
- UAV Weight: *Approx. 3.6 kg (without batteries)*
Approx. 6.3kg (with two batteries)
- Max Take off Weight: *9kg*
- Hovering Accuracy: *Vertical: ±0.1 m*
Horizontal: ±0.3 m
- Max Speed: *23 m/s*
- Max Wind Resistance: *12 m/s*
- Max Flight Time: *55 min from on board battery system*
15 km from launch site (30km of pipeline)



U10 REMOTE METHANE LEAKAGE DETECTOR

Uses Tuneable Diode Laser Absorption Spectroscopy (TDLAS)

Measures reflected light from the laser beam and detects absorption of light by different molecules, and therefore can detect and show CH₄ when present

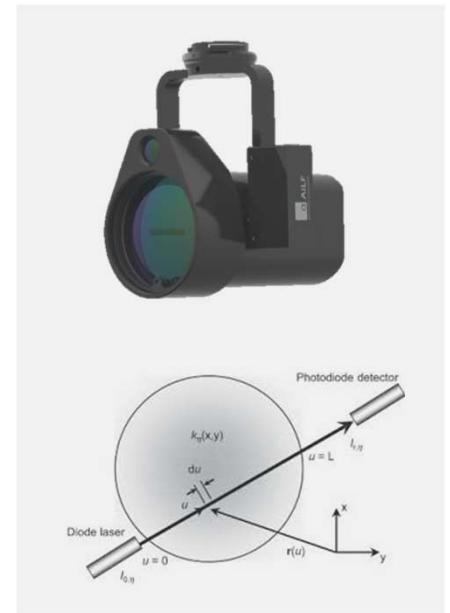
Beam intensity is 1M diameter at 100M distance

Capable of down to 5ppm at 100M. The closer the more accurate the readings will be

Pulses every 0.25sec which allows a travel speed of between 5-10M/S

The App on the tablet displays real time any detection, location and concentration

Identifies a leak point, and also can be used to determine the gas cloud direction, size and concentration





The drone has the flexibility to be deployed quickly close to a chosen location to gain an overview of the pipeline integrity from the air, and at a distance.



The on board camera has zoom in/out (x23) and range finder capability and relays back real time still pictures and video footage.



The digital inspection results provides the live view and records the footage on file for record keeping and condition comparisons.

The use of the drone augments traditional inspections undertaken by vehicle and occasional foot patrols.



It improves efficiency while protecting workers from hazardous environments (terrain and ground conditions, livestock, fences, hedges, watercourses, etc). Avoids a lot of travel time between access points and also back-tracking at special crossings (rivers, rail lines, etc).

PILOT TRAINING RESTRICTIONS

Two Tas Gas Field Technicians selected and undergone training and assessment

- *Civil Aviation Safety Authority (CASA) operator accreditation and registration (Remote Piloted Aircraft Operator's Certificate (ReOC) and associated weight limitation)*
- *Qualified to 'Fly First Person View' (FFPV) i.e. Out of site*
- *No higher than 120M above ground level*
- *30M away from people*
- *Single drone per operator*
- *Not fly above populated areas*



- *Not fly within controlled air space*
- *Only fly on days of good visibility*
- *Not fly near areas of emergency operations (Emergency services, etc)*
- *Keep records / logs of all flights (Retain for 3 years)*
- *Complete a risk assessment and flight plan*

For the GPV pipeline the use of the drone is most suitable being mostly in a rural location, many separate parcels of land (fences, ditches, access points, livestock), 300+ different landowners/farmers, and multiple special crossings (rail lines, highways, rivers, etc).



PIPELINE AND FACILITIES – LEAKAGE SURVEYS

- *End to end pipeline leakage survey – Five Yearly*
Recent quote for walking survey with FIM leak detector
- *High Consequence Area – Annual Survey*
- *Ad-Hoc – Pre and post work activity surveys*
- *Stations, special crossings, above ground features leakage surveys*
- *Incident Management - Remote identification and assessment*
 - *Indicative size and location of any loss of containment*
 - *Gas cloud size and direction*
- *Ability to determine size and location of leaks and also record and compare leakage rates*
 - *Drop pin on the video and map to allow on site further assessment*





αone In-Flight (GPS)

GPS, 30, HD, 2.4G, 69% 8.88V, 69% 8.87V, 28m:52s

ON 15% ppm.m 0.0

A 50

U10-Core

Maldon

Google

H.S. 0.0 m/s H.AGL 6.7 m DRC N/A

V.S. 0.0 m/s V.P.S 47 m D 31.8 m

FPV

20:43:15



PIPELINE INSPECTIONS AND SURVEILLANCE

Replaces the helicopter and fixed wing pipeline patrols

Undertake close inspections even across cropping areas, or farm livestock are present

Ability to observe integrity issues from afar and close up

Weed management and land owner issues minimised

Ad-hoc site and pipeline surveys pre, during and post work activities

Speed of survey

During and post natural events looking for erosion, scouring or other ROW damage

Lone worker risks of walking the alignment with fences, rivers, livestock, etc

Close inspection of above ground special crossings

2023-09-19 10:30:46
36.757227°S 142.242028°E 514.490ft



2023-09-21 13:43:16

36.842622°S 142.393492°E 536.821ft



Questions?



