

UAV capacity and capability - Workflows and Data Collection

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Overview

Firetail Environments is a premier and specialist UAV operator in central Victoria providing specialised drone and aerial services in photogrammetry, multispectral and LiDAR disciplines with an extremely good reputation in developing appropriate solutions for your required outcomes and delivering those outcomes in a collaborative way with clients.

There are numerous options in delivering appropriate UAV outcomes depending on the questions and investigations being posed. Firetail prides itself on understanding the intended outcomes and developing the required workflows and deliverables to provide the most appropriate data for your project.

1. Standard video and photopoint collection of target area -

This can be manually flown with ad-hoc data captured but is harder to replicate and relies on a good pilot. This data may also be planned for capture and replication at prescribed intervals for comparisons over time

2. Photogrammetry data collection (standard RGB imagery) -

Mapping data collected and processed for GIS applications i.e. importing to arcGIS or similar for data assessment including inundation levels, vegetation cover across flood plain/canopy assessment.

This option is more sophisticated and can be combined with the above data (obtained at the same time). It provides more accurate mapping data and is embedded with GIS positioning and elevation data, allowing for a deeper analysis of data and scenario.

3. Multispectral Photogrammetry -

This can be collected simultaneously and again provide a much deeper analysis including plant and surface reflection data that can be utilised across many formulae to obtain a greater understanding of your scenario and obtain better analytical data for your objective.

Standard RGB imagery is always collected with this option resulting in RGB (standard) images along with Red Edge (NDRE) and Near Infrared (NDVI) bands captured for formulaic analysis.

4. LiDAR or Light Detection and Ranging data collection -

This option is extremely advanced and detailed, utilising laser and range based remote sensing to create surface models of target areas. Based on its method and laser integrated sensing, it is a more advanced ability to penetrate through the vegetative canopy to provide a more detailed elevation model of your target area.

5. Ongoing services

Ongoing services to deliver spray, seed or fertiliser treatments are extremely efficient and provide capacity to cover large areas quickly, providing target treatments safely, quickly and efficiently. Utilising leading drone technology, onground delivery of products and materials can be applied in tandem with precision positioning and multispectral mapping data providing the ability to target specific areas and species identified through the mapping process resulting in savings in time and product.

Understanding Photogrammetry and Output Options

Photogrammetry is the process of a drone capturing a large number of high-resolution photos over an area. These images overlap such that the same point on the ground is visible in multiple photos and from different vantage points.

In a similar way that the human brain uses information from both eyes to provide depth perception, photogrammetry uses these multiple vantage points in images to generate coordinate referenced maps including 2D or 3D mapping data, plant reflectance data, LiDAR point clouds and thermography maps that enable end users to engage and analyse the captured data for more effective decision making and documentation uses.

The result: a high-resolution coordinate referenced reconstructions that contain elevation and terrain information, high resolution imagery, plant reflectance values, thermal and 3D data for every point on the map, enabling data interpretation of the resulting outputs.

Drone systems that use photogrammetry are cost effective and provide outstanding flexibility in terms of where, when, and how data is captured.



Multispectral imaging captures light in red, green, blue, near-infrared and red edge wavelengths to produce colour and colour-infrared images of target areas. The most common form of interpreting this data is with **NDRE (Normalised Difference Red Edge)** and **NDVI (Normalised Difference Vegetation Index)** indexes but the most important element is understating which of these and other detailed formulae to apply to your dataset in order to achieve the desired analysis and imaging.

Multispectral imaging is a great tool for gauging the health of plants by remote means through multispectral photogrammetry.

With the proper equipment, plant reflectance imagery can be collected with a drone and processed to create map overlays that can give a wealth of potentially cost saving information.

Multispectral imaging helps the decision making and assessment process easier by delivering plant health and vegetation health data when looking at particular impacts or land use actions.

Changes in reflectance can indicate the stress levels and activity levels in vegetation and plant communities and allow opportunities for more detailed and specific decision making practices actively responding to the state of the plant community.

There are huge benefits to environmental impact management and other applications, especially when the use of chemicals, weed treatment, vegetation restoration and other activities such as nesting habitats and plant health assessment. The multispectral imagery is processed with specialised software into useful information such as canopy cover, greenness, pest damage and disturbance maps etc. For best results, Firetail uses precision positioning and absolute reflectance workflows in order to provide detailed replicability across intervals and data collections.



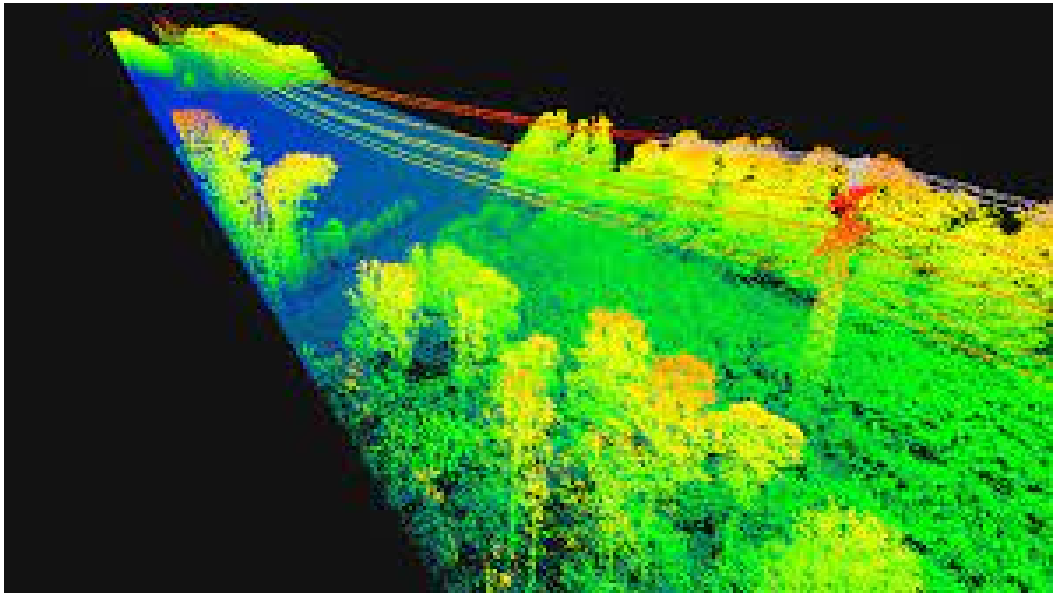
comparison between standard RGB imagery and multispectral image processing identifying vegetation health attributes.

LiDAR, or Light Detection and Ranging involves the deployment of LiDAR equipped UAV systems to collect precise and detailed data about the target area.

This technology is much more detailed and advanced when compared to other terrain modelling photogrammetry and uses highly accurate laser and sensing to measure distances inside the target area by emitting laser pulses and measuring the time taken for them to reflect back, providing highly accurate 3D point cloud data and processing this data into coloured maps and models.

LiDAR from drones offers numerous applications, including topographic mapping, vegetation analysis, infrastructure inspection, flood modelling, and urban planning. It provides valuable data for industries such as agriculture, forestry, construction, and conservation.

The advantages of using LiDAR from drones include its speed, mobility, and ability to reach inaccessible areas. It allows for faster data collection compared to traditional methods and can cover large areas efficiently. The high-resolution, detailed data collected by LiDAR enables better decision-making, resource management, and problem-solving in various fields.



On Ground Drone and Aerial Services

Firetail provides custom and detailed on ground drone solutions for environments and agriculture applications. These services include spraying of treatment and amendment products and the broadcasting of native and pasture seed, compost pellets and fertilisers.

Firetail specialises in difficult projects, drawing on skills and knowledge of both environment and agriculture industries to deliver logistical and on ground outcomes through detailed job planning and a deep understanding of technical requirements to target specific areas or species.

Firetail uses precision positioning and mapping to plan projects appropriately and efficiently. These services provide:

- Targeted and efficient folia applications,
- Treatment of difficult weed infestations,
- Native seeding of erosion areas,
- Over seeding and reinforcing of revegetation,
- Spreading of compost and fertiliser reducing compaction etc.

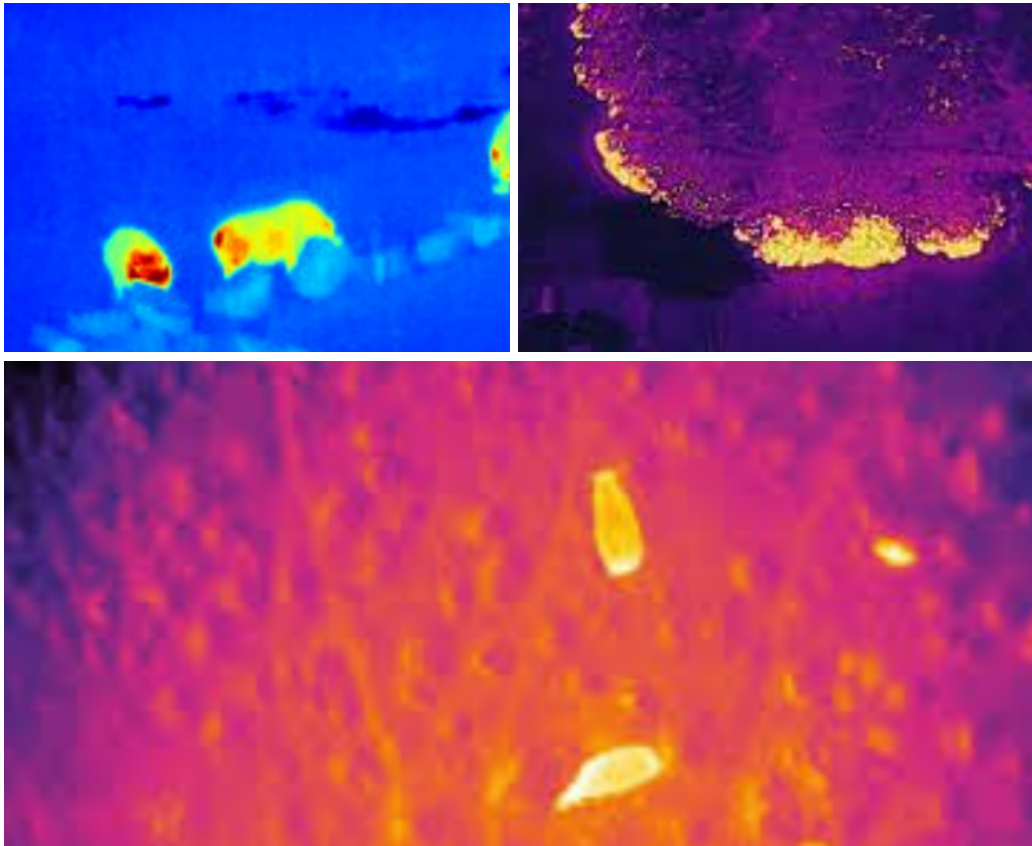


Thermal Assessments and Environmental Management

Using drones for thermal inspections of assets, environmental conditions and to locate vertebrate species provides a safe, efficient, and cost-effective solution for identifying specific areas of interest or other targets.

Drones can access optimal positioning for asset inspections and remote areas to create thermal maps and imagery to identify targets, analyse fire operations or wildfire and provide assistance in counts or identification of vertebrate species in conservation or pest management.

Utilising this method, missions can swiftly scan large areas, and capture real-time thermal data enabling real time information in a format that can be revisited to create baseline data and build upon historical inspections to create a more accurate timeline of your project and enables data to be accessed on demand. Additionally, the high-resolution thermal images captured by drones can be analysed and processed into comprehensive reports, providing detailed insights into the condition of structures and facilitating informed decision-making in a fraction of the time it takes for conventional inspection or monitoring practices.

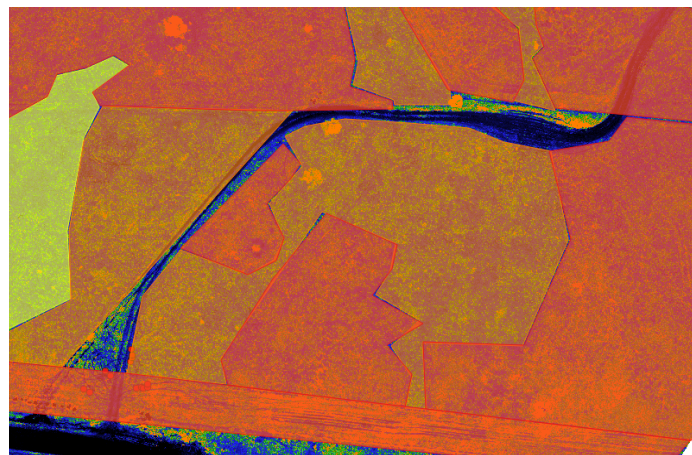
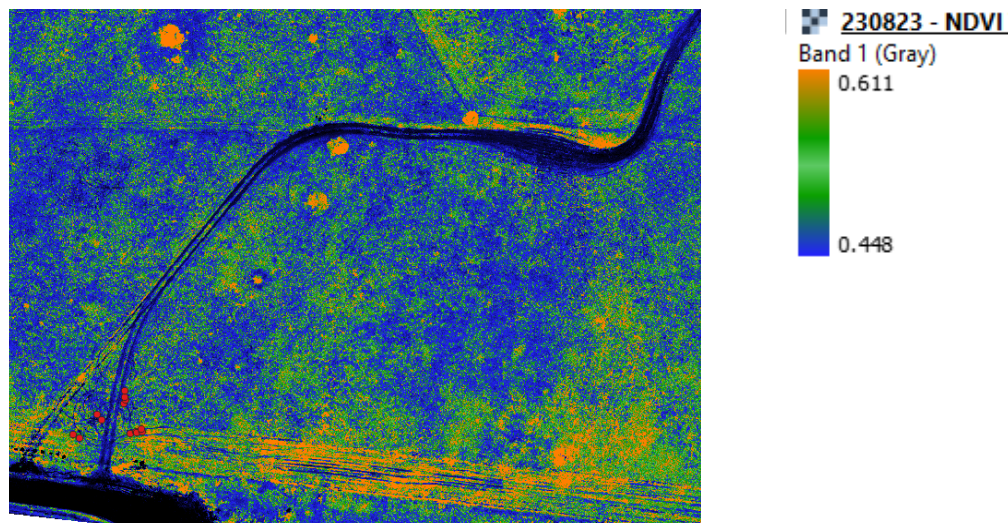


Group training and workshops

Drawing on vast experience in technical skills, engineering, design and tertiary teaching, Firetail offers custom training and designing of drone systems, workflows and skills training in engaging the most appropriate data and workflows from your drone fleet.

These offerings include:

- Creating appropriate management and workflows with drone fleets
- Understanding photogrammetry
- Concepts in multispectral data collection and GIS analysis
- Using ground control points for precision drone surveys
- Advanced GIS training for drone survey analysis
- Managing and piloting on-ground drones for delivery of environmental outcomes



TARGET SPECIES DENSITY	AREA (ha)
HIGH DENSITY (RED)	1.578058
MODERATE DENSITY (AMBER)	0.715684
LOW DENSITY (YELLOW)	0.291682