

# Unmanned Aerial Vehicles

USING ADVANCED TECHNOLOGY FOR FOREST  
ROAD & LANDING CONSTRUCTION

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# What are UAVs and why are they of interest?

- Aircraft that do not have a pilot on board
- Origins in the early 1900s
- Relatively easy way to obtain information
- Aerial photography, digital elevation modelling

# How do they work?

- Consists of two parts: drone and control system
- Flight path is determined through an app
- Drone is launched
- Flight and photographic data is recorded
- Drone returns to pre-set home base coordinates

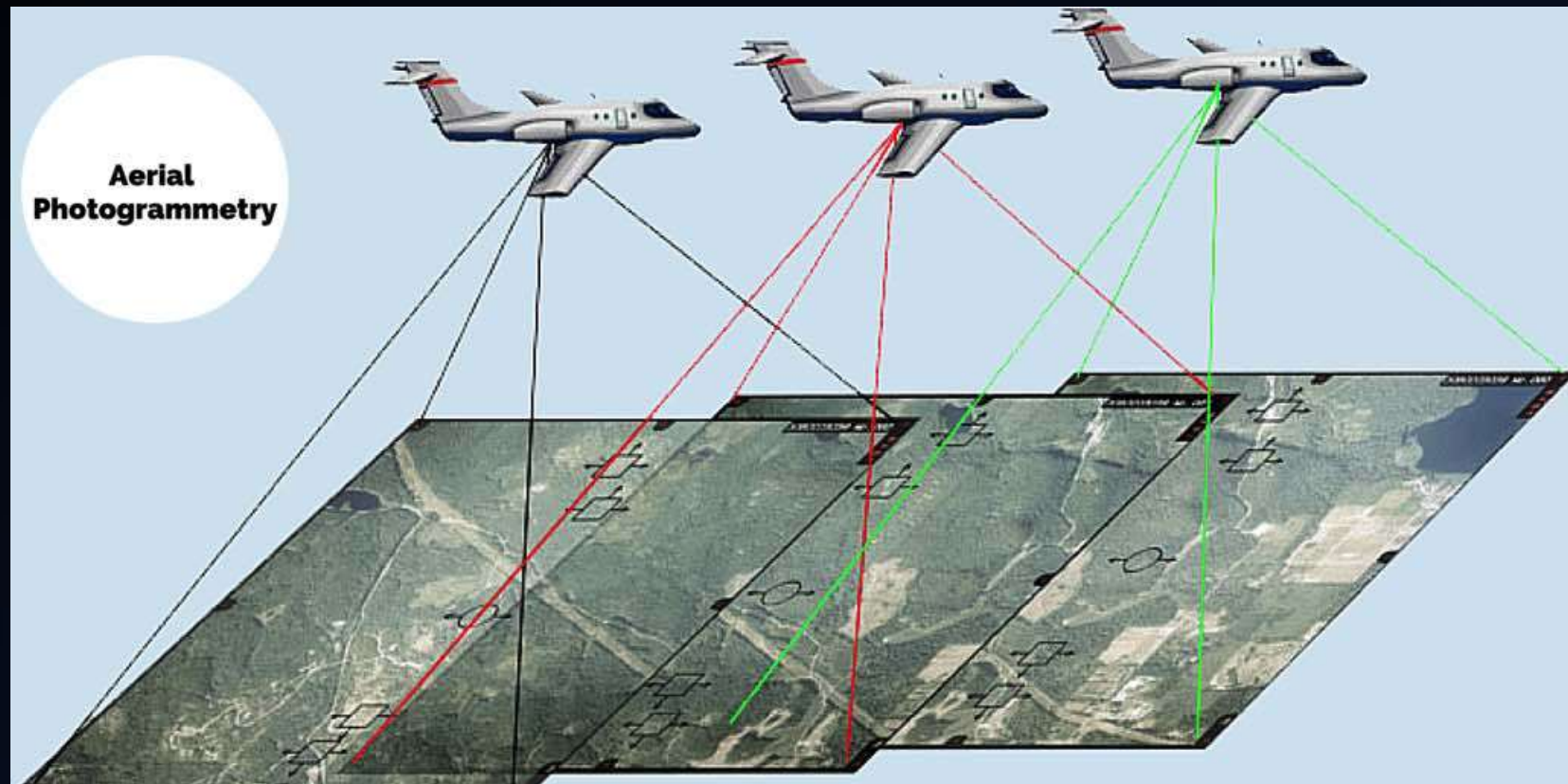


<https://www.camerasdirect.com.au/dji-phantom-4-pro>

# Photogrammetry

- Making measurements from photographs to determine positions of surface points
- Spatial resolution is one of the most important parameters when it comes to determining survey accuracy
- Ground Sampling Distance (GSD) = the size of the pixel in the field
- GSD depends on the quality of the drone's camera

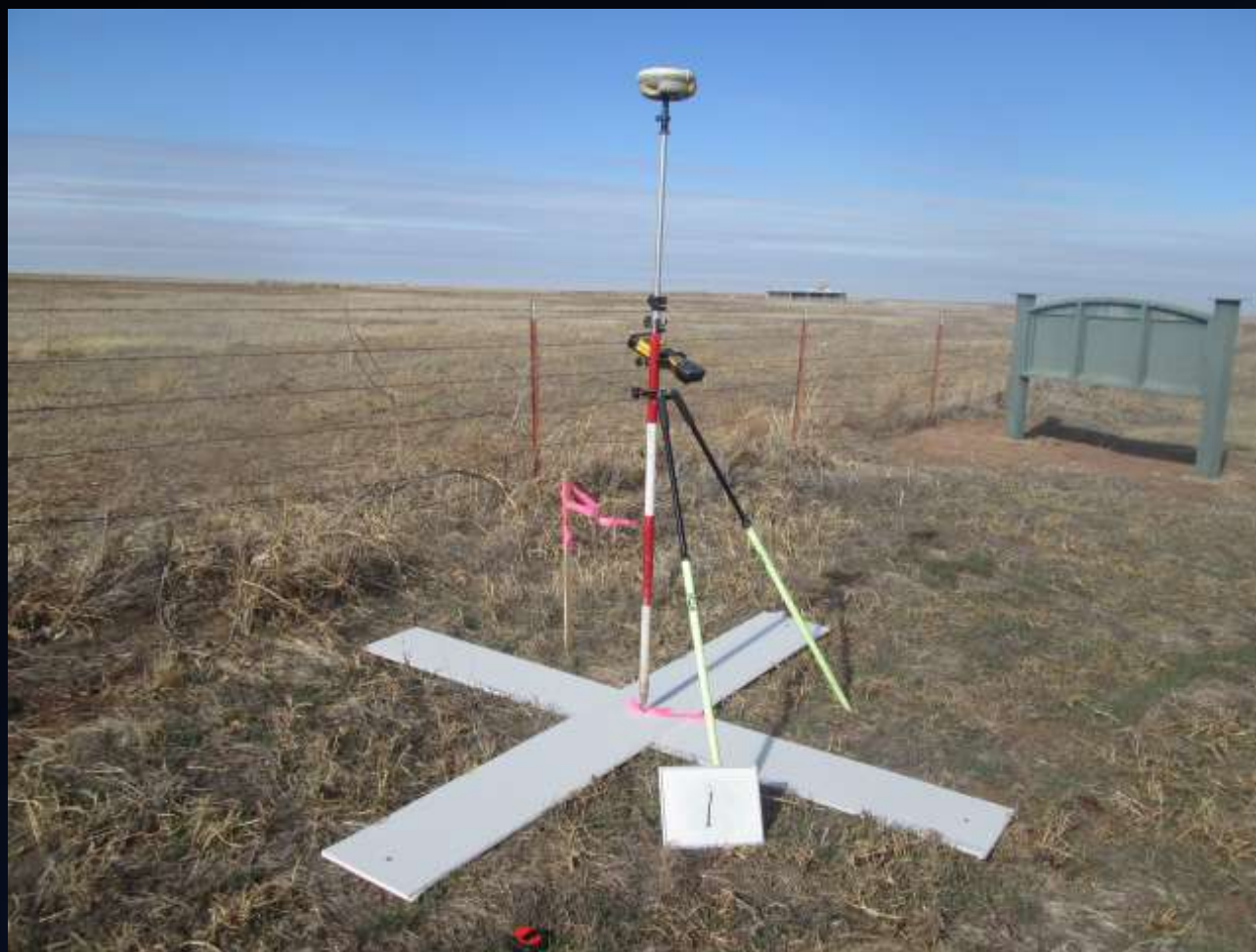
# What is photogrammetry?



[http://www.gisresources.com/basic-of-photogrammetry\\_2/](http://www.gisresources.com/basic-of-photogrammetry_2/)

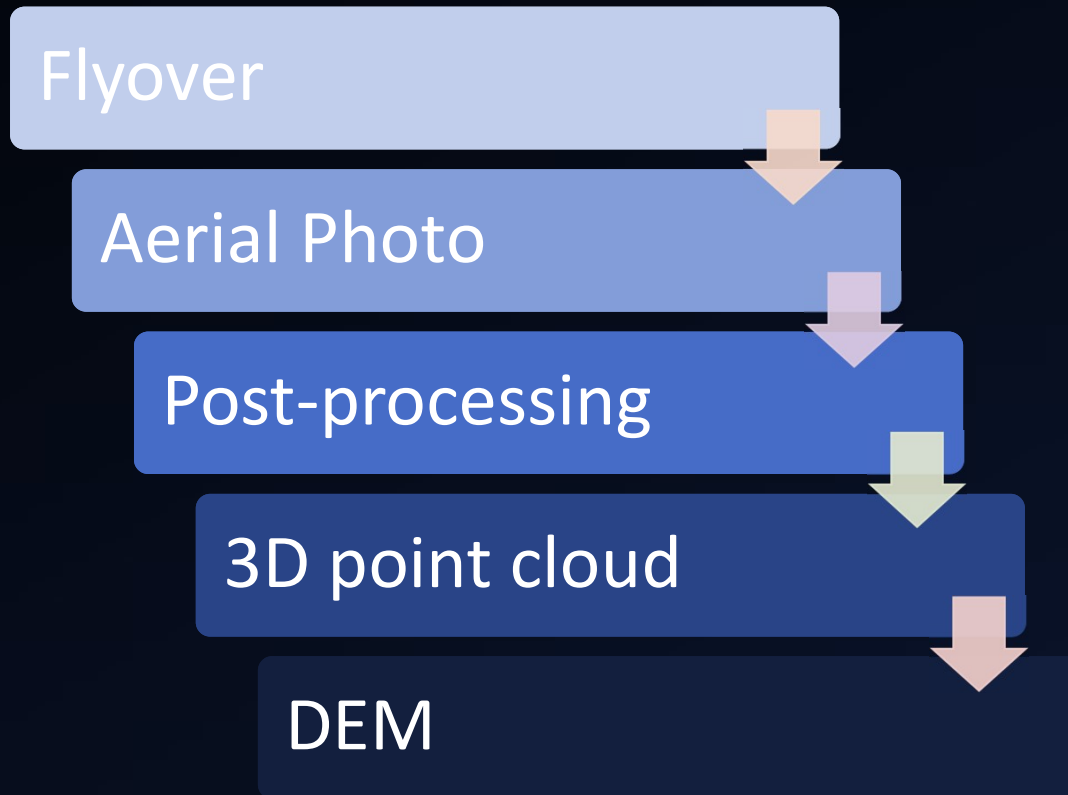
# Relative vs. Absolute Accuracy & Ground Control Points

- Software can generate models (3D point clouds, DEMs etc.) with good relative accuracy
- Fitting this model to a geodetic coordinate system accurately is more difficult
- Drones do contain GPS units, however these aren't quite accurate enough to give the centimetre-precision required
- Ground control points are visual markers whose coordinates are known and measured with surveying equipment (e.g. total station)



<https://www.heliguy.com/blog/2015/07/22/can-you-use-your-drone-for-geospatial-mapping/>

# Workflow





# Research: UAVs applied to stockpile & roading problems

## STOCKPILES (Arango et al. 2015)

- Assessed the difference in volume in stockpile measurements
- Total station vs. UAV
- 2.88% vs. -0.67% deviations
- True volume measured by onsite engineer

## SKID TRAILS (Pierzchala et al. 2014)

- UAV assessed extent of shift in material during harvest
- Pre-harvest LiDAR DTM vs. post-harvest UAV flyover
- Provided an effective visual assessment
- Ease of UAV on steep terrain vs. sending a surveyor to walk the area

# Current research: background

## WHY MIGHT UAVS BE USEFUL IN NZ?

- 1/3 of NZ's forest estate is on erodible steep land
- NES will require a higher standard of earthworks
- 14,000 small-scale woodlot owners in NZ – represent 90% of the 'wall of wood' availability
- Do UAVs tend to be cheaper than total-station surveys?

## SOIL MANAGEMENT

- Comparison of pre- and post-harvest terrain models to determine change in soil volume
- Could have applications with regards to significant rainfall events
- Useful for council resource consents/follow ups?  
Company policy to avoid culpability?



Rien Visser, *Environmental Practices in Plantation Forestry* lecture

## ROAD DESIGN

- For low-risk sites, minimal design input is required from engineers
- For high-risk sites, design-and-build is the standard approach
- Could a faster survey method reduce design time?
- Does the forest need to be clear-felled first? What about a new forest?



Rien Visser, *Environmental Practices in Plantation Forestry* lecture

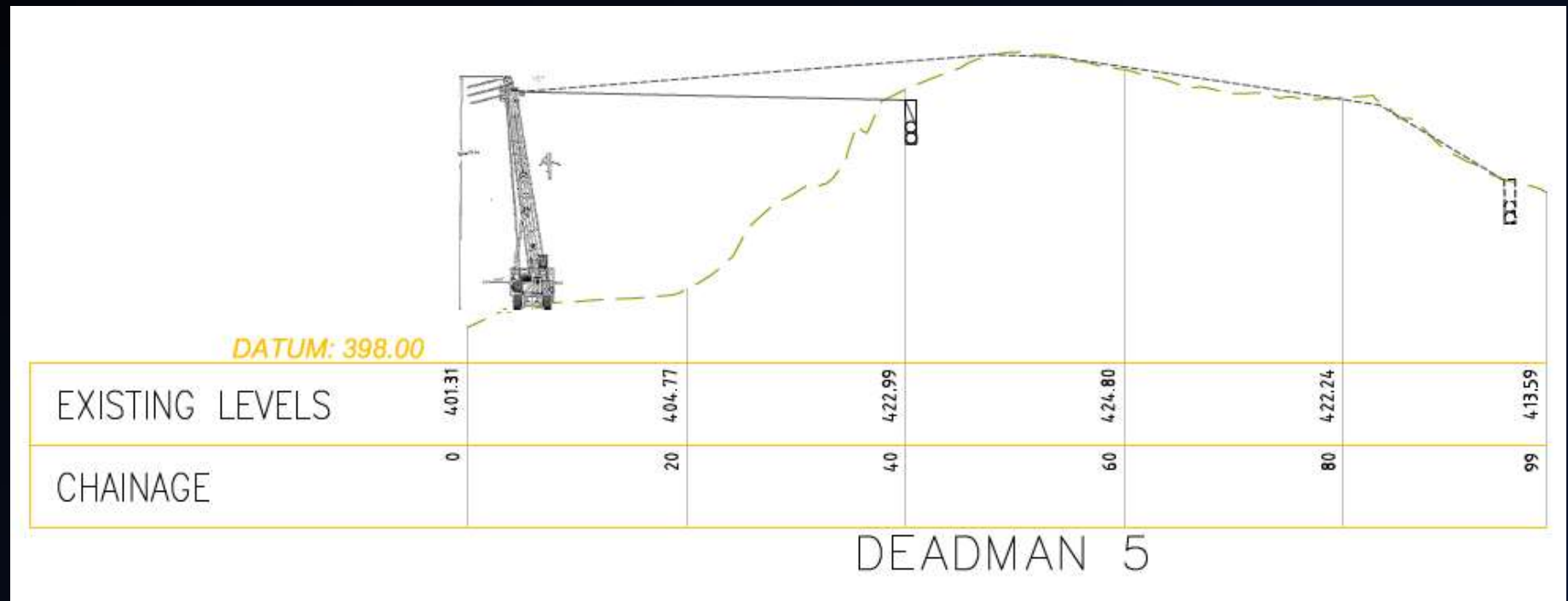


## YARDER POSITIONING

- For particularly difficult landings (small size, steep terrain etc.)
- Having an accurate DEM can speed up the planning process
- Deadman locations can be tested
- Could make positioning a yarder quicker if pre-determined coordinates are known



# DEADMAN POSITIONING



# Summary

- Photogrammetry is the key process that allows aerial photos to be turned into DEMs
- UAV technology has multiple potential uses in forestry
- Stockpiles and roading are perhaps the easier applications
- However, use for other purposes may be possible with more research
- Processing time and additional equipment need consideration



<https://www.mountaindrones.net/services?lightbox=datatem-ifhfuw8e>

QUESTIONS?

