Using a drone and photogrammetry software to create orthomosaic images and 3D models of aircraft accident sites

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Presentation Outline

• How the AAIB started using drones
• The uses and benefits of drones at accident sites
• Photogrammetry - example orthomosaic and 3D model of an accident site
• How photogrammetry software works
• Photogrammetry measurement accuracy
• Photogrammetry with ground-based images
• The Future
How the AAIB started using drones

DJI Phantom 2 Vision, Feb 2014

DJI Phantom 2 Vision Plus, July 2014

DJI Inspire, Sep 2015

X5 camera upgrade (Pro)
First use of an AAIB drone at an accident site March 2014
Surveying site and tree damage

Runway numbers

Wreckage
Surveying runway marks
Uses for a drone at an accident site

- Wreckage survey
- Wreckage search
- Tree/object height determinations
- Flight path reconstruction/visualisation
- Site safety assessments
Flight path visualisation
Site safety (video)
Benefits of drones over manned aircraft

• Less expensive to operate
• Drones can be deployed immediately on arrival
• Images and video viewed live on site
• Investigator has full control over images taken
• Drone can be flown close to trees and wreckage without disturbance from rotor downwash
• Operate in low cloud and low vis conditions
• Drone can be programmed to take overlapping geo-tagged images for photogrammetry
Photogrammetry - Orthomosaic

Constructed from 59 images taken from a height of 50m (165 ft)
40 megapixel mosaic
100m x 190m area
Orthomosaic – zoomed in
A link to this video will be added after 8 December 2016 after the investigation report has been published.
How photogrammetry software works

Projected position of 3D point

2D Keypoint

Focal length

Camera position

overlapping images

New camera position

2D Keypoint
How photogrammetry software works
How to capture images for photogrammetry

Drone programmed to fly a grid pattern taking overlapping images
How to capture images for photogrammetry

Actual grid pattern flown and images taken (red dots)
59 images captured in 7 minutes
3D mesh
Import into Google Earth
Photogrammetry - Measurements
Measurement accuracy trial

DJI Inspire Pro
40 m height
10 min flight
75 images
105 x 98 m area

Bullseye
28 cm dia
## Measurement accuracy trial

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<th>Tape Measurement (m)</th>
<th>Pix4D Measurement (m)</th>
<th>Difference (m)</th>
<th>% Difference to tape</th>
<th>Pix4D Measurement with scale 1-2 added (m)</th>
<th>Difference to tape with scale 1-2 added (m)</th>
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</table>
Using DJI Osmo gyro-stabilised 4k video camera with extension stick
Photogrammetry with ground based images

35 images using Canon Powershot G11 still camera (10 MP images)
Photogrammetry vs laser scan

Laser scan

Pix4d using drone
Benefits of photogrammetry

• 3D model of accident site
  • Useful for briefing people
  • Useful for ‘re-visiting’ the site when writing the report or re-analysing ground marks
  • Useful for obtaining site measurements (saves time onsite)

• Orthomosaic of accident site
  • Serves as a wreckage plot (saves you time on site drawing one)
  • Use it as a map to organise recovery
  • Use it to search for missing wreckage
The Future

• Large drones
  • Fly long distance to remote or hazardous accident sites

• Delivery drones

• Micro drones
  – Follow-me drones
The Future – Micro drones

Micro drone 2.0, $85