A COMPARISON OF STANDARD FIXED-WING VS MULTIROTOR DRONE PHOTOGRAMMETRY SURVEYS

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KEY QUESTIONS

• What detail, scale and accuracy are needed? For change analysis the data capture must be repeatable/comparable/coregistered
• How often? (Some sites will need more frequent/fine scale data capture than others)
• What are the budget constraints?
• Safety – can you take off & land safely?
• What are the dependencies?
  • Ground Control (existing and additional)
  • Resources (Aircraft (planes and drones), pilots, experts (spatial scientists, surveyors, geomorphologists, engineers…))
  • Time constraints/expectations/commitments
KEY FACTORS

- Coverage – How large is the project area?
  Rule of thumb: multirotor: <200 ha (perhaps 500 ha), fixed-wing: <3000ha, manned aircraft: >3000ha (every project is different!)

- Resolution – Spatial and Temporal (flying height, camera quality, flight planning)

- Accuracy (ground control density and distribution, Total Station vs Differential GNSS survey or direct georeferencing)

- Outputs (orthos, digital surface models (DSMs) (vs digital elevation models (DEMs))

- Post processing (calibration? accuracy assessment? artefacts resulting from shadows, water, blurry images and vegetation?)
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FLIGHT PLANNING

MULTIROTOR

• VLOS range is 300-500 m (perhaps more with a large drone)

• Perhaps 10-20ha per flight (@120 m)

• Flying time is usually <25 min (some claim 45 min)

• Max payload is around 6-7 kg but most can carry <1 kg

• Can fly slowly (2.5-6 m/s ideal) or stop for image capture

• Can do oblique (aim for max 20° between consecutive photos, ideally 15°, ensure sufficient overlap by taking more images than you need)

FIXED-WING

• VLOS range is 1 km (perhaps more on a perfect day)

• Perhaps 100-150 ha per flight (@120 m)

• Flying time is usually <45 min upto to 90 min

• Max payload is around 10 kg but hand launch drones usually require <1 kg

• Fly faster so use a fast shutter speed to avoid blur (<=1/1000th of a second)

• Oblique only possible with a gimbal or banking shot
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- multirotor (30 m)
- fixed-wing (120 m)
- Standard Aerial (LISTMap – Tas Gov)
- Satellite (GoogleEarth- Digital Globe)
# DRONE SURVEY OPTIONS

<table>
<thead>
<tr>
<th>Map Scale</th>
<th>Flying Height</th>
<th>Resolution</th>
<th>Accuracy*</th>
<th>Aircraft Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine (&lt;1:100)</td>
<td>20-50 m</td>
<td>1-2 cm</td>
<td>XY: 1-2 cm Z: 1.5-3 cm</td>
<td>Multirotor drone</td>
</tr>
<tr>
<td>Medium (~1:200)</td>
<td>50-100 m</td>
<td>2-3.5 cm</td>
<td>XY: 2-3 cm Z: 3-4 cm</td>
<td>Fixed-wing (or multi-rotor) drone</td>
</tr>
<tr>
<td>Large (~1:500)</td>
<td>100-120 m</td>
<td>3-5 cm</td>
<td>XY: 3-6 cm Z: 4-9 cm</td>
<td>Fixed-wing drone</td>
</tr>
<tr>
<td>Standard (&gt;1:500)</td>
<td>600+ m</td>
<td>&gt;5 cm</td>
<td>XY: &gt;5 cm Z: &gt;5 cm</td>
<td>Manned aircraft</td>
</tr>
</tbody>
</table>

* Accuracy is indicative and is dependant on target area, survey control quality, density and distribution
CHANGE - CAPTURE FREQUENCY

• Some sites will need more frequent/fine scale data capture than others

• The frequency of data capture is dictated by the range of applications for which the data will be used

• Event-based monitoring provides insight into the impact of storm events, high tides, etc

• Flying at regular intervals enables change monitoring, however it is difficult to ascertain the cause of changes

• Change detected may be an accumulation of multiple large scale event-based changes or it may be a gradual change that is only detectable over time (i.e. detectable once the change exceeds the threshold of the change detection possible for that data resolution)
CHANGE – DECIDING ON SCALE

• Key question: ‘what scale of change are you expecting to monitor?’

• Ultra-fine scale monitoring (2-5 cm):
  • expensive but allows for more detailed change analysis
  • requires costly intensive mapping missions to produce detailed (and accurate) snap shots of the terrain (and vegetation surface)
  • in areas where small changes can have large long term impacts fine scale monitoring can provide critical insight into the cause and impact of changes such as erosion

• Courser scale monitoring:
  • is suitable where changes greater than 5-10 cm are anticipated
  • more cost effective and provide valuable insight into changes across larger areas

• Combining the two approaches can allow ongoing monitoring of the entire area (e.g. coastline) supplemented by fine scale mapping of focus sites to give insight into changes elsewhere that portray similar characteristics

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