Can a Constellation of CubeSats Create a Capability?

Satisfying Australia’s Future Need for Multi-Spectral Imagery

Presenter
Iain Cartwright

Co authors
Leon Stepan
David Lingard
Strength from Numbers?
The Problem

Every Day

Area: 7.7M km² = 2.9M miles²

GA: Continuity of Earth Observation Data for Australia, Hudson 2011
Public Good Collection Contribution

43%
S. Tsitas (Uni Cranfield/UNSW):

- 8kg 6U satellite Cubesat, with equivalent mission capability of 150kg satellite.
Collection Planning & Analysis Workstation (CPAW)

Constraints & Resources:

- Data
- Downlink
- Battery
- Cloud
Public Good only

Area of Interest Collected Per Day ≈ 43%
Public Good
+4 CubeSats

Area of Interest Collected Per Day ≈ 60%
Public Good
+12 CubeSats

Area of Interest Collected Per Day ≈ 91%
Ground Station Network Downlinks

Example: single satellite 24 hours
Area of Australia – 7.74M km²
Area Collected – 4.18M km²
Percentage – 54% (down from 93%)

20 satellites & Cloud Constraint
Conclusions

• Medium Resolution/Whole of Australia/Daily Revisit

• System performance is dependent upon both the space and ground segments.

• **Suitable to CubeSats** vs. Large infrastructure.

• 12 x 6U CubeSats contributed 48% making 91% of requirement.
Further Work

• Emergency Response Case

• Higher fidelity system model
Thank you.
Happy Birthday!
Roger Franzen
Additional Slides

• Cloud Free 93%
• Constellation Design
• GSN temporal characteristics
• Resources
Area of Australia – 7.7M km²
Area Collected – 7.2M km²
Percentage – 93%

20 satellites
## Constellation Design

<table>
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<th>Variant</th>
<th>Orbital Planes</th>
<th>Sats Per Plane</th>
<th>Total Sats</th>
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<td>B</td>
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<tr>
<td>E</td>
<td>2</td>
<td>10</td>
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GSN Downlink Opportunities (2/3)

02:32 GMT

UNCLASSIFIED
Resource: Power

- Solar Cell Charge (Max): 35W
- Background Sunlit: 4W
- Background Eclipse: 8.8W
- Payload: 22W
- Downlink: 10W