Drones – Benefit Study
Key findings

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Lawrence McIlrath
Director
• Understand the potential benefits of drones
• MoT and MBIE

• Purpose
  • Process
  • Findings
  • Insights
Presentation structure

- Basic information and data
- Results
  - Sectoral findings
  - Two future scenarios
  - Interviews
- Concluding remarks
Limitations and caveats

- High level picture – several unknowns and data gaps
- Focus is on the ‘benefit side’
  - Net benefits
  - Risks
  - Trade offs and substitutions
  - Ecological considerations
- Technical considerations
  - Guidance, navigation and control
- Interviews, judgement and assumptions
- Broad vs deep focus
Not a new technology

- First used in a military context (100 years ago)
- Three user groups – Military, leisure, commercial/business
Valuable contribution - international

• Several studies on drones – different audiences
  • Government-focused studies tend to be more conservative

• Globally – positive outlook
  • Globally: addressable value US$127bn_{2015}
  • Europe: €10bn by 2035 growing to €15bn by 2050
  • Productivity gains in UK industries: £16bn by 2030
  • USA – impact of integrating drones into National Airspace System: US$82bn by 2025

• Large numbers!
• Increased use of the opportunity
  • Lift in penetration (drones/10,000 people)*

Government and commercial

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<th>2025</th>
<th>2035</th>
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<td>3.8</td>
<td>7.9</td>
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Leisure

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<tr>
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<th>2015</th>
<th>2025</th>
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<td>98.3</td>
<td>134.5</td>
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2015 and 2025

*Eurostat, 2018
The benefits are distributed across the entire economy.
Drones in New Zealand

- No official data
  - Different estimates and approaches
  - 77,600 drones (estimate)

- Commercial users
  - Estimated annual turnover $162m - $194m
  - Average sales - $108,000/year
  - R&D spend - $28,000/year
  - Mixed use
    - 1 in 7 operates UAVs as core business
    - 1 in 3 offer UAV as part of their operations

- Turnover over ten years (2% cagr, PV at 6%)
  - $1.3bn - $1.8bn
Current commercial users

- **Ad hoc applications/Value**
- **NZ important sector**

- **Low value ($150 - $250)**

- **Existing industry (limited use)**

Sectors serviced by UAV operators:
Drones used as part of research: Endeavour Fund – two $1m each
  - Drone Flow: Aerial monitoring system for better river management
  - Reducing impact of LED streetlights on cultural and ecological values
  - Drones enable but are not critical to the processes

Current users: $28,000/year

Zephyr Airworks
  - Air-taxi

https://cora.aero/
- Exciting landscape
- Many moving parts
Part 1: Findings

Generic process

Consider economic sector’s current operations
- Consider drones’ potential to add (lift productivity/lower cost or increase output)
- Express the change in number terms

Assess the potential change (e.g., cost savings or lift in output)

Distribute over time (uptake levels and intensity)

Express in Present Value terms

Look at the sensitivities
Important points

- Must be realistic
  - A degree of informed judgement
  - Scaled to take a conservative position
- Informed by the engagements and literature*

- Wide range
  - Uptakes and benefits/outcomes

- Considerations

- Net change (where possible)

Drones touch many parts of the economy

Findings

Annual (Low) $279m
Annual (High) $430m
25 years (Low) $1.2bn ($4.6bn)
25 years (High) $4.9bn ($7.9bn)
Wide reach across the economy

- 65% of NZ employees and 55% of businesses are in sectors that could use drones
- High profile ‘opportunities’
  - Parcels, pizzas and prescriptions
  - More about the technology than the benefits...

- Relative to:
  - Improve productivity
    - Lower costs
    - Better quality
  - Enhanced safety
  - Moving people – changing the economic geography
Sectors covered and considered

- Agriculture
  - Sheep and beef
  - Dairying
  - Other agriculture
  - Forestry
- Electricity
- Construction
- Other transport (postal)
- Airports
- Public safety (SLS, SAR, Fire)
Examples of sectors not covered

<table>
<thead>
<tr>
<th>Issue</th>
<th>Sector</th>
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<td>Risk of double counting</td>
<td>Agriculture support services</td>
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<td>Professional services (included with other sectors)</td>
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<td>Small sector or small effect</td>
<td>Mining and quarrying</td>
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<td>Oil and gas extraction</td>
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<td>Education</td>
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<td>Real estate</td>
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<tr>
<td>Limited immediate use</td>
<td>Manufacturing (e.g. good and beverage)</td>
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<td>Finance and insurance</td>
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<td>Accommodation</td>
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<tr>
<td>Terrestrial drones better suited</td>
<td>Water, drainage</td>
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<tr>
<td></td>
<td>Some agriculture like viticulture</td>
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<td></td>
<td>Road transport (large goods)</td>
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<td>Importing goods</td>
<td>Equipment manufacturing (drones and accessories imported)</td>
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Findings - Dairying

- Dairying
  - Improved yields from better pasture management
  - Improved fertiliser use (precision agriculture)
  - Sectoral responses:
    - Several available alternatives – satellite imaging
    - “The issue is not getting good pasture information, it is making good decisions with that information”
    - Questions around uptake...

Extra product: $1.3bn - $1.6bn
Fertiliser and chemicals: $68m - $113m

* Over 25 years
Findings - Forestry

- Space extensive with (some) drone use
- Improved disease control
  - *Dothisroma* and *Cyclaneusma* – improved yield
- Lag between improved treatment and benefits
  - Improves yields during different growth stages

Cost savings: $99m*
Improved yields: $12m*

* Over 25 years
• Transpower is already using drones
• Benefits arise from cost savings, improved reliability and reducing unplanned outages
• Network covers 105,000km and 82% is in rural areas
• Main benefits – reducing unplanned outages and cost savings
• Using Value of Lost Load and SAIDI

Cost savings: $10m - $41m
Improved reliability: $13m - $151m

* Over 25 years
Findings – Construction

- Contribute towards lifting productivity
- Two impact layers – direct and indirect:
  - Direct: Surveyors, geologists, engineers – better information, faster and cheaper
  - Indirect: builders, drivers, operators - spill over gains from better resources
- Assist with large events e.g. Kaikoura earthquake

Gains: $690m - $1.1bn*

* Over 25 years
Findings - Airports

- NZ aviation sector – VA $10bn (economic impact per year)
- Airport operation support high value assets to operate
- Immediate role of drones somewhat limited
  - Wild life management, runway checking and perimeter monitoring (alternatives)
  - Labour substitution

Cost savings: $1.5m - $2.5m
Findings – Public Safety: SAR

- Search and Rescue
- Surveillance and intelligence, assistance, \( \rightarrow \) situational awareness
- Civil rights(?)
- Used to supplement activities, not displace
  - Human interface is still required
- Applied risk profile (incidents per 10,000 with assumed improvement 1%, 3% and 5%)

Lives saved, rescued or assisted: $599m - $1.0bn
Avoided fatalities: $10m - $16m

Over 25 years (3% scenario)
Findings – Public Safety: Fire

- Surveillance and intelligence – situational awareness
- Cost of fires:
  - Cost in anticipation
  - Cost or response
  - Cost as a consequence

In anticipation: $42m - $73m
Response: $58m - $102m
As a consequence: $161m - $282m

Over 25 years
• Sizeable gains
  • $1.2bn to $4.9bn – 25 years

• Aspirational
  • $4.6bn to 7.9bn

• Compared to the IoT*
  • 16% to 22%

*NZ IoT Alliance
Part 2: Future Scenarios

- Improving regional connections
- Delivery of goods using drones
Improving regional connections

- Airports are important regional assets
- Facilitate connections, generating economic benefits
- Regional dynamics – ATR/Q300, Air Chathams, Whangarei Airport

- Potential change – assume drones change demand
  - Focus on rural population: +5% - 10%
  - Benefits: $40m/y and $58m/y

10 years*: $236m - $519m
25 years*: $641m - $1.4bn

*6% discount rate
• Often quoted area – weight x volume (payload)
• Lots of technical and practical issues
• Largest saving – substituting labour costs
• Using NZ Post information: labour costs $317m - $425m (incl contractors)
• Potential gains:

10 years*: $140m - $213m
25 years*: $282m - $529m

• Emissions?

*6% discount rate and 10% scenario
Large upside potential!
• Industry engagements
  • Mixed success
  • Wide coverage (20 entities contacted)
  • Mixed ‘messages’
Interesting observation

- Tensions about outlook!
  
  “Solution looking for a problem”

  “Great technology”
Synthesis of the points raised

1. Combined technology
   1. Part of a solution
   2. Payload, range/endurance, stability and weather

2. Regulatory environment
   1. Safety vs enabling new activity
   2. Safety events (Heathrow; nuisance vs deliberate acts?)
   3. Cross-over between areas (flying/handling chemicals)
3. Markets/Industries want a proven solution

- Existing relationships
  - Drone at periphery of ‘core business’
  - Incremental improvements (vs disruptions)

- Willingness/ability to respond to drone products
  - Getting clients to pay for the service at an appropriate price point
  - Cost absorbed as part of wider business offering (vs drones as a service)

- Generally low barriers to entry
  - Technical capability developed over 18 months
  - Getting scale is an issue
4. Competing against alternatives
   • Pressure/inconvenience to change not great enough
     • Reduce cost vs increase productivity/information
     • Substitutes (existing way of doing things)
   • Reliability (weather, robustness, durability)

5. Two-speed sector
   • Leisure and commercial
   • Commercial is small (in # terms; Airshare’s database = 7,000)
   • Not operating in sectors with potential benefits.
• Large potential

• Not guaranteed
Thank you

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Gartner Hype Cycle for Emerging Technologies, 2017

- Commercial UAVs

Gartner Hype Cycle for Emerging Technologies, 2018

- Flying Autonomous Vehicles