(Iteration – 25 August 2020

Remotely Piloted Aircraft Systems (RPAS) Proof of Concept (POC)

Evaluation Report

June 2020

DISTRIBUTION:

- National Manager: Response & Operations
- District Commanders (involved in the PoC)
- RPAS Steering Group Members
- Evidence Based Policing Centre

Table of Contents

Table of Figures

List of Tables

1 Executive Summary

Remotely Piloted Aircraft Systems (RPAS), Unmanned Aerial Vehicles (UAV), Unmanned Aerial Systems (UAS) are terms used to describe drones and their systems in this report.

Remotely Piloted Aircraft Systems (RPAS) are one of the fastest-growing technologies in the world. RPAS have few barriers to operate (low cost, low-time requirement to qualify as an operator) and strong benefits as alternatives to current methods of policing for many purposes.

The primary objective of this proof-of-concept (PoC) is to conduct a rigorous assessment of the value added (benefits) which RPAS usage offers Police and the community compared to the standard practices (without RPAS) of Police in the situations where RPAS may be used.

This evaluation finds that RPAS can make a significant contribution to policing, and will make a tangible contribution to achieving a number of the goals, strategies and objectives in the Police Strategic Framework. It is recommended that each district has a fleet of approximately six Mavic 2 Enterprise RPAS. Given the large number of these craft that would be purchased, it is appropriate for centralised purchasing arrangements to obtain volume discounts. Centralised purchasing arrangements will also ensure that the Enterprise models, with the associated cyber protections, are the models purchased. There are also likely to be benefits from districts and regions (Northern, Central, Southern) having additional advanced RPAS capability.

1.1 Deployments During the PoC

During the period of the PoC there were 121 reports of operational deployment of RPAS. Districts used RPAS for:

- locating fleeing offenders
- situational awareness during tactical operations
- arson and crime scene photography
- photography of some accident and sudden death / suicide scenes
- photography of some serious crash scenes
- situational awareness during AOS operations.

In addition, case studies have been demonstrated which demonstrate the utility of RPAS for:

- SAR operations, particularly to look in locations that are difficult or dangerous to reach
- situational awareness during anti-social mass gatherings that could pose a risk to police staff and members of the public.

RPAS were not used for general monitoring purposes during the covid-19 lockdown.

1.2 District Requirements

The pattern of deployments across districts suggests that two RPAS per district can be productively employed in crash photography alone, and expansion of the use of RPAS to crime scenes may enable up to six RPAS to be employed productively (e.g., Bay of Plenty). The experience of Northland and Tasman suggests that additional RPAS could also be used productively on a wide range of other policing operations. The experiences of Bay of Plenty, Northland, and Tasman Districts also suggests that having sufficient RPAS dispersed across the district is important to ensure that a RPAS is available within a reasonable timeframe when required.

In total, it would be reasonable for districts to have a "fleet" of approximately six RPAS with the capability used in the PoC, with sufficient pilots trained that there was always a pilot available. Some districts may find that they need more than six RPAS, and some may find they can adequately utilise fewer. However, it is also likely that the demand for RPAS deployment will increase as experience is gained with their use.

1.3 Technology Issues

The current Police RPAS fleet is well suited to generalist use, including crime scene and serious crash photography. All RPAS used in the PoC were manufactured by the Chinese firm DJI, which manufactures high quality, high capability RPAS at relatively low cost. Lower capability models such as the DJI Mavic Air should be investigated as to their potential to provide a 'drone in every car', noting that these models do not have the cyber protections available in the DJI Enterprise models. As such, a specific risk assessment would need to be conducted on the use of these RPAS. Tactical operations require a greater stand-off capability, which at district level can be provided by the higher capability DJI Matrice 210 and DJI Matrice 300 RTK.

Tactical operations may also benefit from the use of micro drones for tasks such as clearing a building. These were not evaluated as part of the PoC.

Key risk controls that should be implemented with DJI RPAS are:

s.6(c) OIA

[redacted]

There may be benefit in considering adopting additional high specification RPAS for use at a regional (Northern, Central, Southern) level. This capability could include advanced quadcopters such as the Aeryon SkyRanger and fixed wing capability such as the Aerovironment Puma; both of these craft would enable inter-operability with FENZ and NZDF.

Restrictions on transporting batteries mean that commercial airline flights cannot be used for transporting the higher-capability RPAS. The distribution of higher capability RPAS amongst districts and regions should take account of the potential restrictions in transportation.

1.4 Regulatory Constraints

The Part 101 Rules provide potentially significant constraints on the utility of RPAS to Police. These rules interact with the Civil Aviation Act 1990 and the Search and Surveillance Act 2012 to create a wide range of circumstances in which using a RPAS may constitute trespass surveillance.

Part 102 certification is required for Police to be able to make best use of RPAS. In particular, CAA may grant privileges to fly over property without permission of the owner or occupier, placing RPAS on the same footing as manned aircraft. Police contracted an external SME to prepare the required manual of operating procedures, and this is now with the Civil Aviation Authority for approval.

Technical systems are required for storing imagery collected by RPAS to ensure that evidential requirements are met. There is a need to develop (with Police ICT) a "national storage capability" for all RPAS evidential and non-evidential data.

1.5 Part 102 Certification

Part 102 certification will potentially enable Police to fly "unshielded" at night, and beyond visual line of sight. Specific training will be required for both of these functions.

The organisational structure required with Part 102 certification is likely to require one full-time-equivalent staff member. An "app" needs to be developed for use on police devices to automate the flight planning required by the Part 102 procedures. There is also a need for software to enable centralised management and oversight of some aspects of the RPAS fleet and Police RPAS operations.

A single training provider should be appointed to provide consistency of training and approach across Police. This training should include the requirement to be able to fly in non-GPS mode, as situations will arise in which flying without GPS is necessary. Training should include police-specific operational constraints such as the Search and Surveillance Act 2012, and operational-specific training.

1.6 Delivering Against the Police Strategic Framework and Business Targets

Utilisation of RPAS is an area of innovation that can make a tangible contribution to achieving a number of the goals, strategies and objectives in the Police Strategic Framework.

In particular, adoption of RPAS by Police will enhance the following areas:

Goal: target and catch offenders. As demonstrated by a number of case studies in this report, RPAS enhance Police's ability to target and catch offenders. As discussed in Section 4.1, the first deployment during the proof of concept period resulted in the capture of an offender who would have otherwise escaped. The case studies in this report also provide examples of RPAS providing the best available evidence for establishing the cause of an accident or death.

Strategy: looking after our people. RPAS provide a modern innovative means of equipping and enabling police personnel. Whether undertaking a search, executing a tactical operation, or gathering evidence, RPAS enable staff to perform more effectively, obtain better situational awareness, and gather the best available evidence.

RPAS also ensure that police personnel are safe and feel safe. During a search, RPAS can be deployed to areas where it is unnecessarily dangerous for a person. During tactical operations, RPAS can provide enhanced situational awareness which will potentially avoid police inadvertently walking into dangerous and life-threatening situations.

Transformation programme: modernising our service delivery. RPAS can be part of the transformation of Police service delivery. The use of modern technology can find missing persons faster, can ensure that tactical teams deploy to the correct address, and deliver tangible benefits to the public in the form of substantially reduced road closure times in the event of a serious crash.

1.7 Proof of Concept Conclusions

This proof of concept resulted in the following key conclusions:

1. RPAS provide the opportunity to significantly enhance safety of SAR personnel (Page 9)
2. Key benefits from deploying a RPAS were:
    a. staff and SAR safety
    b. informed decision making/planning
    c. obtaining the 'best' evidence for the Coroner and investigation
    d. ability to demonstrate the challenging nature of the terrain to the Coroner
    e. forensic evidence was obtained before scene was disturbed. (Page 11)
3. In civil defence emergency settings RPAS images available within minutes provided accurate, timely and clear information that was key to decision-makers in planning their response and minimising risk to the public. (Page 15)
4. Additional higher-end RPAS capability is required by Police for SAR and civil defence purposes. (Page 20)
5. In AOS responses RPAS can significantly improve safety in tactical deployments and is able to confirm the layout of buildings and the tactical environment, and identify whether an armed offender is hiding in a location that would threaten a tactical team; and able to capture movement that would otherwise not been seen, including the potential escape of offenders.(Page 25)
6. Crime scene management is enhanced by utilisation of RPAS that are able to obtain photographs of crime scenes in a way that would not be possible using other means, are significantly cheaper and more time efficient than manned aircraft. (Page 34
7. Of the 121 RPAS deployments during this proof of concept approximately one third of flights were for road crash photography (34%), and approximately a further third were for crime scene (28%) and arson (7%) photography. AOS/STG comprised 13% of total operational deployments. All other uses combined comprised just 18% of total operational deployments. (Page 39)
8. The current Police RPAS fleet is well suited to generalist use, including crime scene and serious crash photography. However, due to cyber risk concerns, it is important that future purchases of drones are the DJI Enterprise series of drones, which enable additional protections to be implemented, including protections as simple as password protection of the drone and associated data. (Page 51)

2 Introduction

2.1 Background

On 12 June 2019, the Police Executive (Rōpū whakahaere (SLT) -SLT/19/28) approved a six-month proof-of-concept and evaluation of the use of RPAS in Northland, Waikato, Canterbury and Tasman Districts, and for significant search and rescue operations outside those districts.

At the time of this approval to conduct a PoC, the Police Executive also noted:

- Developing RPAS capability within Police offers significant benefits for Police, including creating efficiencies (time and money) to current processes and improved safety of police staff. RPAS enable situational awareness to be improved during high-risk operations and search warrants, allowing for improved decision making.
- RPAS are suitable for roles such as:
    - **Crime scene photography**, including the ability to map and photograph a crime scene without disturbing evidence. This would also valuable at serious crime scenes, such as a homicide, where an aerial reconnaissance could be used to inform an appreciation.
    - **Crash scene reconstruction and mapping:** a typical serious crash scene could be photo-surveyed accurately, considerably quicker than current methods, providing high resolution imagery and potential for 3D mapping. This would reduce the length of road closures and scene examinations with comparable accuracy in data to conventional survey methods.
    - **Search and rescue (SAR):** for locating missing persons or searching for deceased people, particularly if the aircraft are fitted with thermal imagery capacity (and at significantly reduced cost than operating a helicopter).
    - **Tactical situations** such as armed offender incidents: both for pre-planned operations where images could be obtained for planning purposes, or in support of operations where real-time, urgent deployment is required to assist with surveillance of a location, to minimise risk to staff while improving tactical decision making.
    - **Monitoring of crowds, mass gatherings, demonstrations:** provision of situational awareness during both organised events (wine/food festivals, formal protests, etc.) and impromptu events (mass disorder, boy racer events, parties, etc.).
    - **Tracking fleeing offenders** who are decamping on foot.
    - **Reconnaissance** to identify criminal activity, such as for the cultivation of cannabis in rural areas, either with the consent of landowners or with a search warrant.
- Other uses include surveillance, disaster response and management, and providing an aerial observation platform during criminal offending.

The purpose of the PoC approved by SLT is to verify the benefits of RPAS in a policing context, and with the capability aligned to Our Business with its vision to support the front line and equip and enable our people, ensure they are safe and feel safe, and modernise our service delivery

This document outlines the evaluation undertaken relating to the PoC.

This evaluation is not focused on the range and level of air support required, but rather the efficacy of using RPAS as a viable deployment option compared to other options available to Police.

RPAS, like computers, are becoming smarter (more functionality), lighter and more powerful (increased payloads, speed and functionality) and easier for operators to use ("point and click"). These characteristics are being driven by demands from professional SAR teams who want more powerful data transmission links, GPS2/GLONASS3 integration, integrated software development kits, more reliable platforms with redundant systems, weatherproof systems, heavier payload capacity, payload drop capacity, and lights for night-flying.1

New Zealand Police air support is centralised for helicopter and decentralised for RPAS.

2.2 Terms of Reference

To develop Police's understanding of utilising RPAS as appropriate; in particular, to establish:

- the broad use cases for RPAS.
- to what extent is use of RPAS more efficacious than other options *ceteris paribus*?
    - Do RPAS measurably improve Police operational effectiveness?
    - Do RPAS reduce operational risks?
    - Do RPAS improve cost efficiency?
- how RPAS usage might be developed to better meet the current and future needs of Police?

2.3 Research Questions

The specific research questions identified for this evaluation were:

- What have/do districts use RPAS for (1 November 2019 through 11 June 2020)?
- What RPAS capability is needed by districts/pilots/photographers?
- Does RPAS usage increase safety for police staff?
- Compare efficacy of RPAS usage to other options.
- To what extent can RPAS be used to maximise the benefits of air support to the delivery of frontline services?
- How can RPAS form an integrated part of the wider policing strategy, supporting the Police Strategic Framework and Business targets?
- To what extent do regulatory constraints, including civil aviation rules and privacy barriers, impact on the effective use of RPAS for policing?
- Identify the efficacy and/or impact of: operator training, equipment, weather conditions, supporting technology, public perceptions.

2.4 Out-of-Scope Issues

An evaluation of the cost-effectiveness of police use of miniature, small, medium and large RPAS to inform guidance and decision-making is not included in this evaluation.

Achievement of a lower cost air support service through centralised procurement and management is not within the scope of this evaluation.

[1] Eyerman et al, 2018, p.10

Understanding how developing RPAS technology can be delivered as part of police air support in the future is not included in the scope of this evaluation.

Beyond-visual-line-of-sight (BVLOS) RPAS operations are commented on, but are not part of this study.

Assessment of the security of RPAS equipment, data uploads, software and firmware downloads, and the storage of data collected is not included in this study.

Reasons for differences by districts in use of support tactics (whether to use air support or not) is not included in this evaluation. A comprehensive assessment of latent and patent demand for air support is not included.

This PoC evaluation does not explore the potential for RPAS collaboration between Police and other government agencies such as Justice, FENZ, Customs, Immigration, NZDF, DOC, Transport, and Maritime. Potential for interoperability with FENZ and NZDF is commented on where appropriate, but the benefits and risks of inter-agency collaboration on air support is not included.

2.5 Methodology

Between November 2019 and June 2020, data was collected in the following ways:

- Police RPAS operators submitted a log of every RPAS flight.
- Interviews with key personnel in the two districts that made the broadest use of RPAS during the trial.
- Canvas of specialist users such as Specialist Search, Organised Crime, AOS, Road Policing, Photography about their use of RPAS and any specific issues that they anticipated or experienced.
- Engagement with officials from CAA, FENZ, and representatives from other operational agencies such as those attending the All-of-Government RPAS Operations Group (AGROG) to learn about their RPAS usage and learnings.

Where appropriate, the information collected during this period was supplemented by case studies that occurred outside the formal evaluation period. These case studies have been selected because they demonstrate the potential value of RPAS for police operations.

This PoC has been undertaken and the evaluation documented with collaboration between the Response & Operations Group and the Evidence Based Policing Centre. Contracted subject matter expertise was provided by Dr Andrew Shelley.[2]

2.6 Report Structure

Sections 3, 4, and 5 present a range of case studies on the police use of RPAS. Some case studies are drawn from deployments that happened during the PoC, while others are from deployments outside the PoC or in other jurisdictions. Section 3 provides case studies related to SAR and civil defence, section 4 provides case studies related to tactical operations, and section 5 provides case studies for other policing activities including serious crash investigation, crime scene investigation, and an anti-social road user operation.

2 Dr Andrew Shelley is an expert in RPAS regulation and certification.

Section 6 presents data on deployments during the PoC, drawing lessons for potential nationwide use of RPAS by Police.

Section 7 details the current Police RPAS fleet, and then discusses issues identified with the DJI geo-fencing technology, and cyber security concerns. District and regional capability requirements are considered. An additional option of a micro-drone suitable for tactical use is presented – this could be appropriate for use at either a district (AOS) or regional (STG) level. Constraints on transportation of batteries for larger RPAS are detailed.

Section 8 considers regulatory constraints, focussing on the Civil Aviation Rules, the Search and Surveillance Act 2012, as well as storage of RPAS imagery in a manner that meets evidential requirements. The "Part 101" requirements of the Civil Aviation Rules can provide significant constraints on the ability of Police to use RPAS, including creating situations where the trespass surveillance provisions of the Search and Surveillance Act 2012 are triggered. Certification under Part 102 of the Civil Aviation Rules may provide significant benefits for the operational deployment of RPAS, as well as avoiding the trespass issues. Section 9 discusses additional issues associated with Part 102 certification, including human resourcing requirements, additional technological requirements, and training requirements.

Section 10 discusses RPAS as a component of air support, albeit at a decentralised level rather than the centralised air support capability provided by Eagle.

Section 11 provides conclusions to the research questions, and section 12 provides recommendations.

3 Case Studies: SAR and Civil Defence

RPAS can provide significant public safety benefits across a wide range of policing operations. This section outlines the key areas of use, providing examples of where RPAS have made a difference. Where possible, the examples are drawn from New Zealand experience, but where appropriate, examples have also been drawn from other jurisdictions.

3.1 Search and Rescue

Locating lost persons is probably the most innocuous use of RPAS in policing. RPAS are able to search areas of potential danger faster and more efficiently than people on foot or searchers with dogs.

In a 2018 study of more than 50 trials of SAR professionals (comparing teams **with** RPAS and teams **without** RPAS), the teams with RPAS found the victim sooner than the teams without RPAS.[3] Other findings in that study included the negative impact on team performance when they operated without customised training for RPAS SAR missions, clear tactics and operational protocols.

A study[4] of SAR professionals in Wales, Ireland, Denmark and Iceland found that RPAS-equipped teams performed better than standard practice (non-RPAS) teams "depended upon 3 key factors: the knowledge of the searchers about the search field, the accuracy of the orthomosaic map produced with the RPAS data, and the ability of the personnel involved to read RPAS maps and footage."[5]

3.1.1 Enhancing Safety of SAR Personnel

RPAS provide the opportunity to significantly enhance safety of SAR personnel, particularly in situations where the search is unsuccessful and therefore to have put SAR personnel in danger would have yielded no benefit. Two examples of this are provided by coastal searches in Taranaki and Muriwai Beach.

In 2016, prior to the PoC trial, a boat overturned early morning off Moturoa Island near Port Taranaki. Police were alerted when a survivor made shore. Aerial, water, land searches failed to locate a second man. A RPAS operated by a private company was then used in areas where it was unsafe to insert staff or would have been extremely time consuming to search.

The RPAS searched large main breakwater of Port Taranaki where it was likely a body may have ended up. The breakwater is constructed of large angular concrete blocks that are dangerous to search because of breaking waves, slippery surfaces and odd angles.[6]

The RPAS flew over the entire breakwater area in 30 minutes. The high definition (HD) footage could then be reviewed and the RPAS sent back to get close ups of any areas of interest. The area was also searched again by RPAS at low tide. In total the area was flown several times over two days. Unfortunately, the deceased was not located.

3 Eyernan et al, 2018.

4 Eyernan et al, 2018, p.8

5 Eyernan et al, 2018, p.8

6 Police had previously searched these manually in 2012 following another tragedy involving three people. This took four staff a whole day to clear with several near misses.

Figure 1: Port Taranaki Main Breakwater

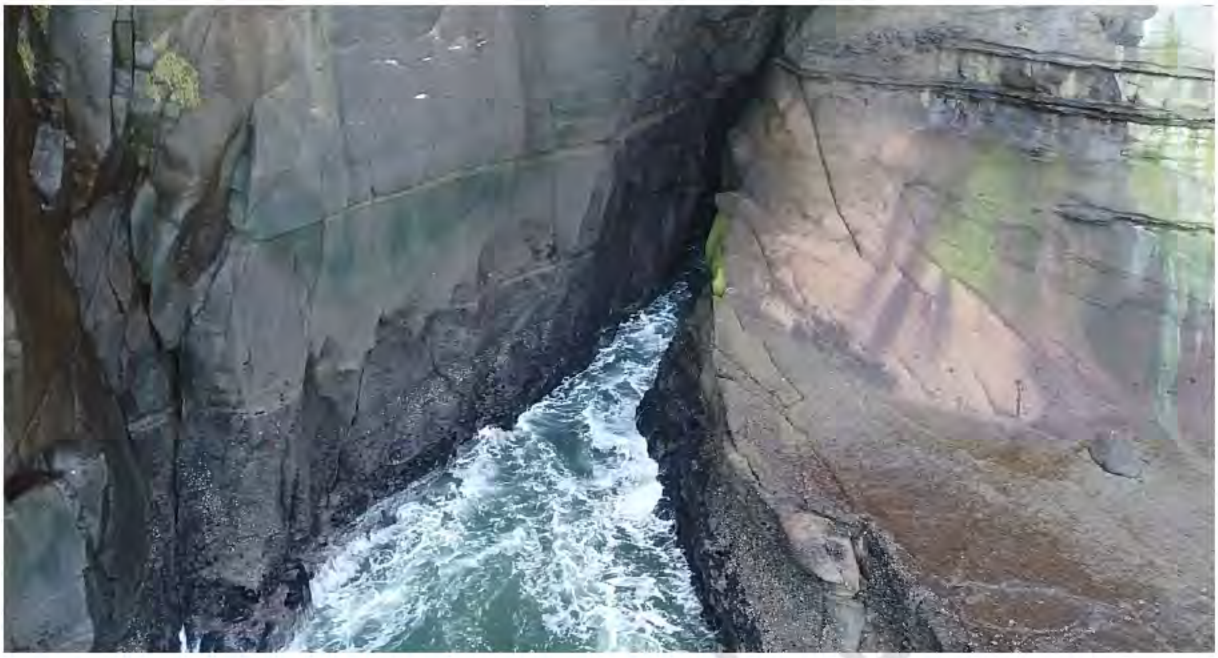
Note: Moturoa Island is to the right of the picture.
Photo: Simon O'Connor/Stuff. https://www.stuff.co.nz/national/115648968/tornadoes-snow-and-rain-on-taranakis-winter-weather-parade

In September 2019, a surfer had gone missing while surfing at Muriwai Beach. He was last seen by surf lifesavers below the gannet colony along a rocky stretch of coast. The next day the Police Eagle helicopter was deployed to search for the missing person but it had limited visibility of the area around the headland. It was also unsafe for lifesavers and SAR members to venture into the area because of large waves.

A RPAS was then deployed, with the police operator maintaining contact with Eagle to ensure separation between the RPAS and the helicopter. The RPAS was able to look into a sea cave and along the coastline and determine that the body was not in that area. An image of the sea cave taken by the RPAS is shown in Figure 2. Without the RPAS, this area of the coast may have not have been searched; if it had been, it would have been at the risk of surf lifesavers or SAR members. Because of the nature of the west coast, the body may have been missed if it was in that area, and never found.

The RPAS allows us to go into areas that are inaccessible due to their locations; it can also cover larger areas much more quickly than would be possible to search on foot.

Figure 2: Coastal Cave near the Gannet Colony at Muriwai Beach



A further example of a RPAS being used to avoid putting SAR personnel at risk was provided by a callout to a vehicle over a bank in the Christchurch Port Hills. The initial police unit on the scene was unable to locate the vehicle because of low cloud. Police SAR was dispatched and located the vehicle in a treeline down a bank. SAR members were unable to get to the vehicle because of a combination of the steep terrain, low cloud, and darkness. The vehicle was checked using thermal imaging, which confirmed (by the lack of heat signature) that it was unoccupied. The following morning, the vehicle was investigated using RPAS, which obtaining vehicle identification that confirmed this was a historic crash.

3.1.2 Body Recovery / Suicide Investigation

A missing person was located in his vehicle, having driven off a cliff s.9(2)(a) OIA [redacted]. The car was concealed in bush and found some two weeks after it had crashed. [redacted]

Initial attempts to recover the body were hampered by decomposition and attempts to recover the car were hindered by the unsafe 'balancing' of the vehicle in bush, on a steep cliff edge s.9(2)(a) OIA [redacted]

The RPAS was deployed from a river flat and provided key images of the vehicle *in situ*, both to assist planning and to provide forensic evidence. Images also assisted in the investigation to determine whether it had been a suicide or an accidental crash.

Key benefits from deploying a RPAS were:

- staff and SAR safety
- informed decision making/planning
- obtaining the 'best' evidence for the Coroner and investigation
- ability to demonstrate the challenging nature of the terrain to the Coroner
- forensic evidence was obtained before scene was disturbed.

3.1.3 Operation Simpson

Police were advised on a Monday that a woman was overdue from a hike in Mt Aspiring National Park after having advised friends that she intended to hike to Brewster Hut then on to the Blue Pools near Makarora. On the Monday evening, a police SAR officer flew the hut/linear features, but found nothing of interest.

On Tuesday, LandSAR, a dog team, and a helicopter were deployed. The first dog was injured, and was subsequently replaced by two more dog teams. The teams searched the loop to Makarora, creek heads, and routes of travel. As can be seen from the map of the extended search area, this is a very large area. Nothing was seen, so moved into extended search planning.

On Wednesday, Highland Heli from Dunedin was deployed to cover the open areas and also fly over the bush/creeks with its thermal/FLIR-equipped helicopter. The RPAS team deployed over specific identified areas.

Following these deployments, a large part of the search area was evaluated as low probability of area (PoA). Search teams covered the Fantail Creek south of the Brewster Track, and the Makarora River valley was eliminated.

On Thursday, search teams were deployed into the Pyke Creek area, to the north of the Brewster Track. One of the dog teams found the missing person's boots 20m from the creek. The RPAS team deployed over the area. CanyonSAR was requested, as was a Recco detector (which was provided free of charge).[7]

On the Friday morning, the Recco Heli operator noticed the pack 900m downstream from boots in a canyon. Shortly thereafter, the RPAS team advised that they had a hit in the same place (they were reviewing footage from day before while waiting for a commercial flight). CanyonSAR was then deployed and found the pack. Using avalanche poles as probes, CanyonSAR identified something that felt like a body in a waterfall on a ledge. s.9(2)(a) OIA [redacted] The family had just arrived at the staging area. The body was [redacted] able to be identified.

This incident highlights that helicopters and RPAS can be complementary assets. The only way to obtain rapid coverage of the search area was with a helicopter. However, the RPAS enabled ground teams to search areas rapidly that would be difficult, dangerous, or slow to search on foot.

This incident also highlights the importance of having a team of trained imagery analysts available to review imagery captured by the RPAS to identify features of interest.

7 The RECCO detector is a radar unit that is able to detect items of clothing or equipment that have a RECCO detector embedded. For more information see the RECCO website https://recco.com/.

Figure 3: Brewster Track, Fantail Creek and Pyke Creek, Mt Aspiring National Park

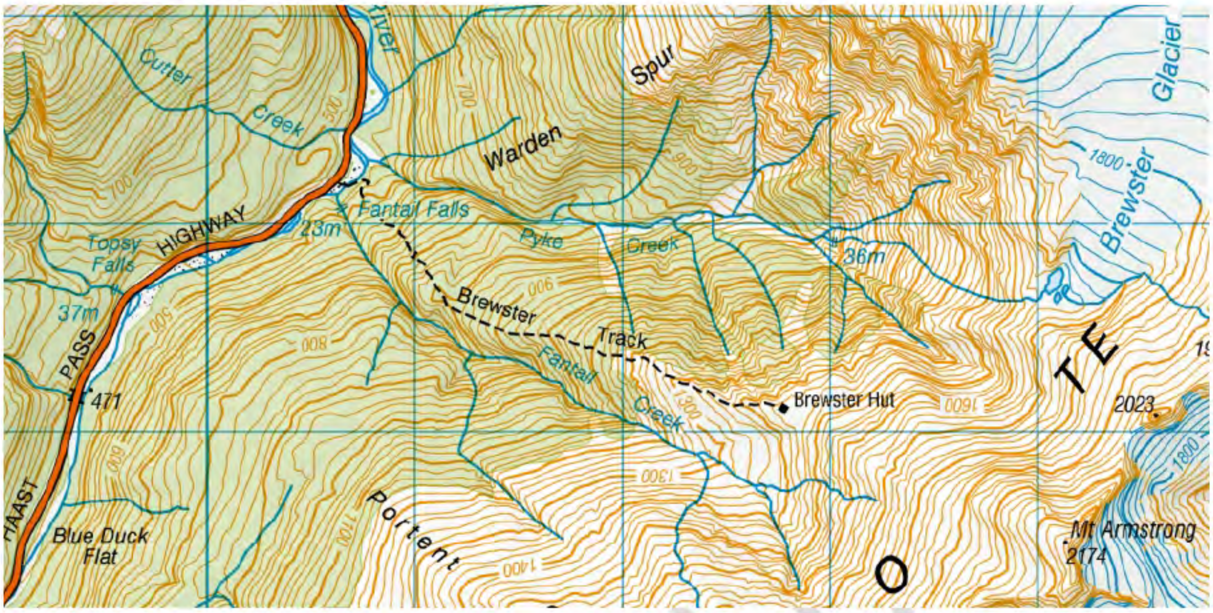


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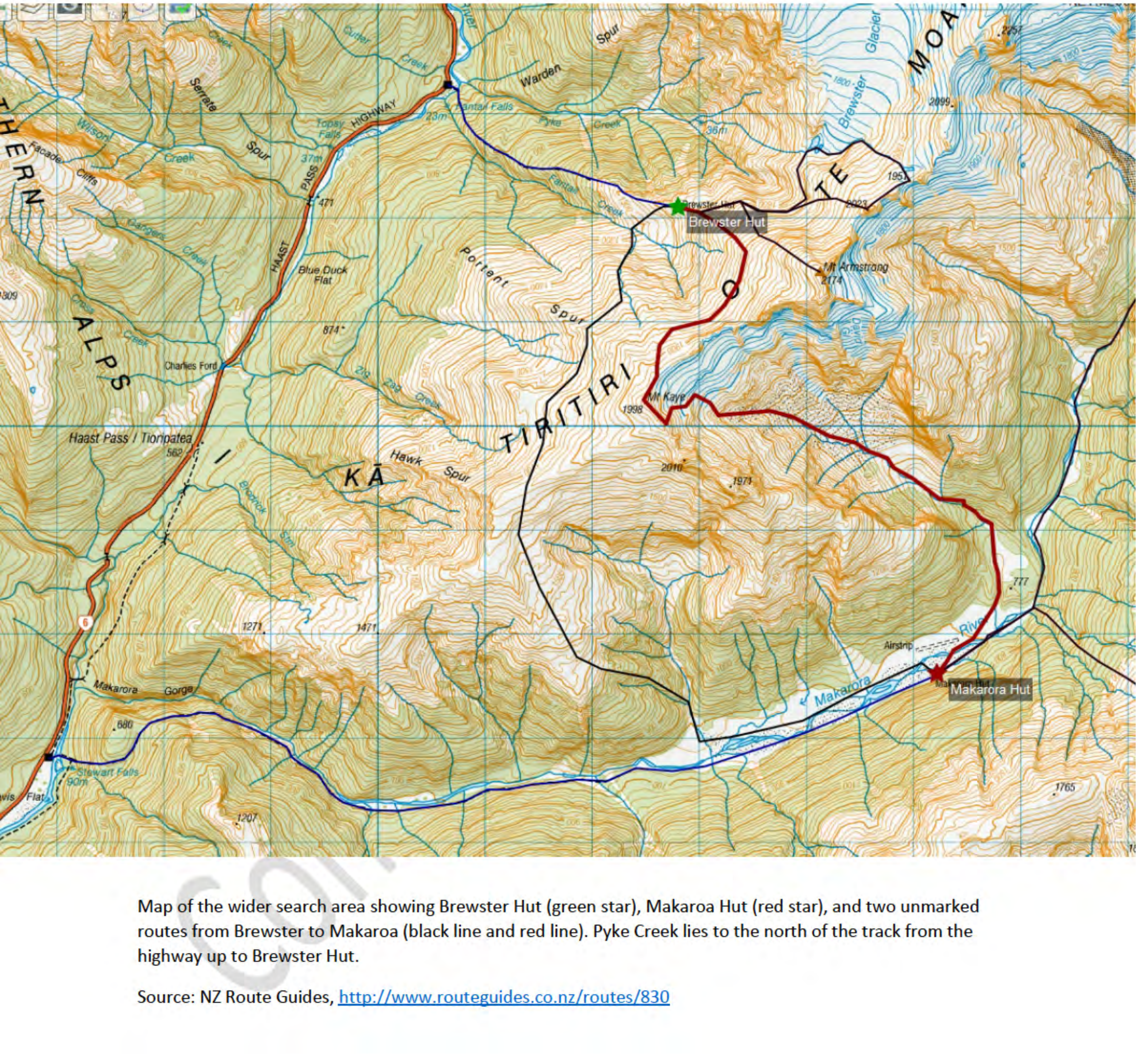
Figure 4: Wider Search Area for Operation Simpson



Map of the wider search area showing Brewster Hut (green star), Makaroa Hut (red star), and two unmarked routes from Brewster to Makaroa (black line and red line). Pyke Creek lies to the north of the track from the highway up to Brewster Hut.

Source: NZ Route Guides, http://www.routeguides.co.nz/routes/830

3.2 Civil Defence

The use of RPAS in a civil defence response is another innocuous but highly effective use. A RPAS can provide intelligence and situational awareness that is difficult to obtain from a manned aircraft (potentially due to weather or other hazardous conditions), providing information that can aid a more effective response to the situation.

Discussed below are two relevant situations: the West Coast floods, and the body recovery effort at White Island, both in early December 2019. Neither event was part of the proof of concept trial, but both provide valuable lessons.

3.2.1 West Coast Floods, December 2019

On the weekend of 7-8 December 2019 a significant rainfall event saw the West Coast receive more than three times its normal monthly rainfall. As a consequence of the rainfall, SH6 between Whataroa and Harihari was cut off by a major slip near Mount Hercules.

The Ross-based police officer was able to travel to the slip and obtain photographs that informed the Emergency Operations Centre (EOC) response. The pictures on the next page show:

- a photograph that the officer obtained from ground level on his iPhone (top left). From this vantage point it was impossible to determine the size or extent of the slip
- a photograph of the slip obtained from a local helicopter (top right)
- a photograph of the slip that the officer obtained with a Mavic 2 Pro RPAS, providing a clear view of the full extent of the slip.

The nature of the slip presented significant risks in assessment (in other words, the ground was unstable and dangerous, preventing closer inspection). The RPAS images provided accurate, timely and clear information that was key to decision-makers in planning their response and minimising risk to the public. The EOC planners had the images within minutes of them being taken. There was simply no other way to have those images (of high quality) in such a short time (almost immediately) to assist in developing the most efficient, effective, and safe response and recovery plan.

In this instance, there were also wider economic, safety and welfare implications associated with planning an efficient response to the slip. Settlements to the south of the slip were cut off with no road access, and appropriate plans could then be made to ensure that the welfare needs of these communities would be met.

While the ability to use the RPAS had significant benefits, there was a significant element of luck in that the officer happened to have the RPAS in the car at the time. The particular RPAS is shared between Greymouth and Ross, and was with the Ross-based officer. If the RPAS had been at Greymouth, there would have been considerable delay in travelling to the scene. If every officer in remote areas had a RPAS on hand (whether they are on duty or on call) then response times would be greatly enhanced. However, the Mavic 2 is likely to be too expensive for such widespread deployment.

Figure 5: Mount Hercules Slip

Ground level photo from Police iPhone.

Aerial Photo of slip from local helicopter.

Photo of slip taken from Police Mavic 2 Pro. Police vehicle visible in top left of photo.

While helicopter operators offered their services at a discounted s.9(2)(b) OIA [redacted], the photos they took were not nearly as clear or informative as the photos obtained from the Mavic 2 Pro.

The DJI "Mavic Mini" "Fly More Combo" is available at $899 retail,[8] whereas the basic Mavic 2 Enterprise is available at $3,599 retail.[9] Both RPAS have a 12MP camera, but the Mavic Mini lacks the security features of the Mavic 2 Enterprise (see the discussion of cyber issues later in this report). If cyber issues can be effectively addressed then the Mavic Mini would be more cost effective than the Mavic 2 Enterprise. However, both RPAS are potentially more cost effective than more than 2.5 hours of helicopter time s.9(2)(b) OIA [redacted] and the Mavic Mini is more cost effective than half an hour of helicopter time.

3.2.2 [R] White Island Body Recovery

s.6(c) OIA [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

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8 https://www.ferntech.co.nz/mavic-mini

9 https://www.ferntech.co.nz/drones/mavic-2-enterprise/

10 "Update: Eruption on Whakaari / White Island – recovery operation", press release, Police Media Centre, 10 December 2019. https://www.police.govt.nz/news/release/update-eruption-whakaari-white-island-%E2%80%93-recovery-operation

11 Mark Longley, "White Island eruption: E squadron, the elite SAS unit who helped bring the bodies back", Newshub, 13 December 2019. https://www.newshub.co.nz/home/new-zealand/2019/12/white-island-eruption-e-squadron-the-elite-sas-unit-who-helped-bring-the-bodies-back-from-white-island.html

s.6(c) OIA

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- [redacted]
- [redacted]

[12] Jamie Ensor, "White Island eruption: What police boat was doing so close to shore", Newshub, 12 December 2019. https://www.newshub.co.nz/home/new-zealand/2019/12/white-island-eruption-what-police-boat-was-doing-so-close-to-shore.html

[redacted] s.6(c) OIA [redacted]

s.6(c) OIA [redacted]

3.3 Conclusions: SAR and Civil Defence

RPAS can significantly enhance the effectiveness of ground-based searchers, searching areas that are difficult and time-consuming to access. RPAS can also provide significant safety benefits, being able to search locations that are dangerous for SAR personnel.

RPAS and manned aircraft have complementary roles in a search. Manned aircraft will still be required for searches of wide areas that are not suitable for RPAS. However, RPAS can search areas that are dangerous for manned aircraft (e.g. White Island), and impossible to traverse on foot. RPAS may also be able to operate in inclement weather conditions that would prevent a manned aircraft from operating.

Additional higher-end RPAS capability is required by Police for SAR and civil defence purposes. The current practice of relying on FENZ to provide capability is dependent on the availability of their operators and craft, and is vulnerable to multiple events happening at the same time.

To aid inter-agency interoperability, the higher-end RPAS capability would ideally be similar to that currently possessed by FENZ.

The possibility of smaller, cheaper, but ultimately less capable RPAS should be further considered as a means of increasing the likelihood that a RPAS is on-hand when required (e.g. for the Mount Hercules slip). This may be particularly relevant for districts where a significant proportion of the district is "remote" without timely access to a centralised RPAS capability.

4 Case Studies: Tactical

RPAS provide an ideal means of providing situational awareness in tactical situations. As the examples below illustrate, at times RPAS may be more effective than a manned aircraft, and are even capable of flying inside a building where an offender is located.

4.1 [S] The First Deployment in the Proof of Concept

s.6(c) OIA

[redacted]

[redacted]

[redacted]

s.6(c) OIA

[redacted]

s.6(c) OIA

[redacted]

[redacted]

[redacted]

s.6(c) OIA [redacted]

[redacted]

s.6(c) OIA [redacted]

s.6(c) OIA [redacted]

s.6(c) OIA [redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]

4.3 [S] Additional Deployments during the Proof of Concept

This section summarises a selection of deployments that occurred during the PoC. More deployments occurred than are described here; the cases selected have been chosen as they provide an illustrative cross-section of the situations in which RPAS have proved particularly useful.

s.6(c) OIA [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

s.6(c) OIA

[redacted]

[redacted]

[redacted]

4.4 The Need for Enhanced Standoff Capability

s.6(c) OIA

[redacted]

[redacted]

[redacted]

4.5 [S] Risks from a Non-Deployment

s.6(c) OIA

[redacted]

4.6 Future Potential

s.6(c) OIA

[redacted]

The Sacramento Police Department uses micro drones to provide real-time situational awareness of tactical situations.[13] One example was a hostage situation in October 2019, in which a man—wanted by police following a domestic violence incident—held eight people hostage. The man was located in a vehicle, although he was not the driver. He then led Police on a low speed chase, tracked by police helicopter. He pulled into a driveway, and armed with a handgun, grabbed a teenage girl who was also in the vehicle, and entered the house via an open garage. Both the man and the teenage girl were unknown to the seven other people in the house.

[13] Television channel ABC10, based in Sacramento, recorded an informative documentary on the Sacramento Police Department's use of micro-drones. Part 1 is an interview with Police Chief Daniel Hahn is available on YouTube at https://www.youtube.com/watch?v=Pwds8YwpU-k. Part 2 interviews the officer I charge of the micro-drone programme, and is available at https://www.youtube.com/watch?v=gPiRn7wUL5c.

Overnight, six of the hostages were released, and the remaining two escaped. After 24 hours of negotiations, the SPD decided to utilise the RPAS to determine the hostage taker's location. After finding in the attic of a bedroom, police deployed tear gas to his location and the man surrendered without further incident.[14]

In a subsequent interview, the Sacramento Police Chief referred to the RPAS' role in this incident. "The RPAS provides real time live information to the incident commander, and helps save lives through providing better information without putting officers in harm's way."

4.7 Conclusions: Tactical

RPAS can significantly improve safety in tactical deployments. A RPAS is able to confirm the layout of buildings and the tactical environment, and identify whether an armed offender is hiding in a location that would threaten a tactical team.

RPAS are able to capture movement that would otherwise not been seen, including the potential escape of offenders.

Manned aircraft are not always able to confirm the identity of the target when overhead; the lower altitude level of a RPAS may sometimes achieve target identification when a manned aircraft higher overhead cannot.

A manned aircraft, including Eagle, might not always be able to be overhead, even if planned for a particular mission. A RPAS can provide the intelligence that might otherwise have been provided by the manned aircraft.

In some situations there will be a need to deploy RPAS covertly. This might, at times, require the RPAS to be operated beyond the visual line of sight of the pilot.

There might also be a need for higher capability RPAS with cameras capable of providing a true standoff surveillance capability.

Micro-drones provide the potential for clearing buildings visually in a way that is much safer than using police personnel, and faster and more accurately than technologies currently used.

14 For more information on this hostage event see "Police Identify Kidnapping Suspect Who Held 8 People Hostage, Barricaded In An Oak Park Home," CBS Local, 31 October 2019, https://sacramento.cbslocal.com/2019/10/31/police-identify-kidnapping-suspect-8-hostages-eric-leyva/; "Man detained after 24-hour standoff at Sacramento County home," KCRA, 31 October 2019, https://www.kcra.com/article/daylong-sacramento-county-standoff-ends-mello-court/29645238#.

5 Case Studies: Photography & General

Collection of evidence at serious crash scenes, crime scenes, and other fatalities involves similar applications of RPAS. In all cases, the objective is to document the scene accurately, to an evidential standard, without disturbing the scene. RPAS are well suited to this task, being able to collect high resolution imagery of the entire scene without any disturbance. Depending on the location of the scene, there are times when RPAS may be the only means to document the scene effectively. However, there are also times when RPAS will also have limitations.

This section starts with examples of photography at arson sites, including a case study illustrating the benefits of using RPAS rather than a helicopter as the camera platform. The section then presents the potential benefits from using RPAS in serious crash photography. The benefits seen in serious crash scene photography overseas are briefly reviewed, and then a summary of the results from the trial undertaken by the Waikato Serious Crash Unit in 2015 is presented. That trial indicated significant benefits were available in the form of significantly enhanced data and imagery collection and time savings from road closures. The use of RPAS in cannabis recovery operations is then addressed, followed by an example of how RPAS were used in an anti-social road user operation in Timaru.

5.1 Arson

The image in Figure 9 below is of an arson scene in a self-storage facility in Auckland. This is one of a series of direct overhead, low altitude photographs.

Figure 9: Arson in South Auckland Self-Storage Facility, Overhead

s.6(c) OIA

[redacted]

The photographer noted that:

> *[These images] would have been difficult to obtain from a helicopter. To make direct overhead photographs from a helicopter is very difficult. It involves the helicopter banking hard and making a sharp turn over the scene with the photographer leaning out taking numerous photographs to try and get a direct overhead photograph of the scene. Using the drone I was*

> *able to place it directly over the shed and line up the scene so the building is straight I could then move the drone up or down to capture the damage. The overhead photograph shows how the fire has spread from the point of origin; this was useful for the fire investigation and also as evidence to prove where the fire originated from.*

The photographs took less than 10 minutes to take. The flight was also able to be flown as a shielded flight given a building in the vicinity that was higher than the operating height of the RPAS.

Figure 10 and Figure 11 below show another arson scene, this time on the South Island West Coast. Again there is a direct overhead photograph (Figure 10), but there is also an oblique angle photograph (Figure 11) showing an angle that would have been impossible to capture otherwise. The oblique angle photograph provides a clear indication of the damage inside the structure.

Figure 10: West Coast House Arson, Overhead

s.6(c) OIA

[redacted]

Figure 11: West Coast House Arson, Oblique

s.6(c) OIA

[redacted]

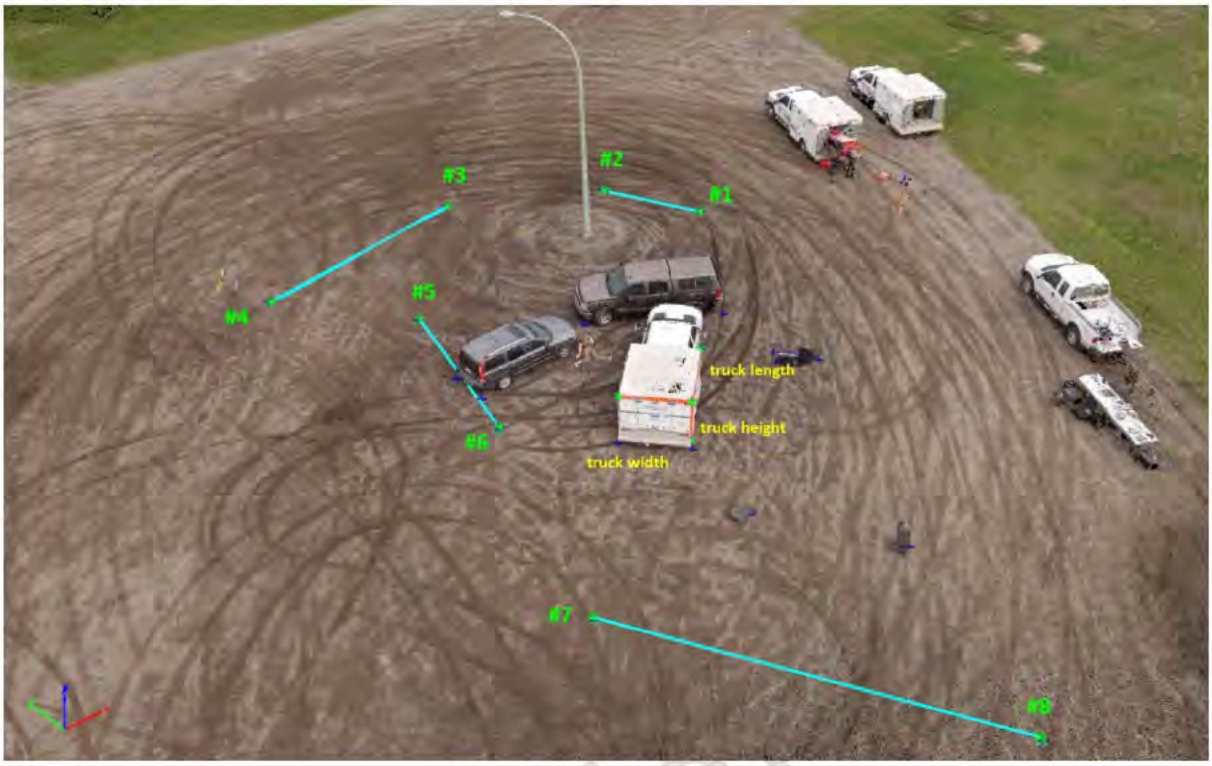
5.2 Serious Crash

5.2.1 Overseas Examples

In 2014 the Royal Canadian Mounted Police (RCMP) took part in a demonstration project to validate the use of RPAS for mapping and surveying serious crash scenes. Using a simulated accident scene, measurements taken from RPAS photography were compared to manual measurements and were found to be equally accurate. Images acquired by the UAVs were processed and the three-dimensional scene was reconstructed using the Pix4D mapper software.[15] To ensure accuracy and as a quality control measure, Pix4D also recommends placement of a number of ground control points with manual measurement of the distance between those points.

The width, length, and height of the RCMP truck were measured directly in the software, and the results matched the actual RCMP truck dimensions exactly.

[15] To see an interactive 3D reconstruction of the accident scene see "Collision and crime scene investigation with drones," Pix4D, https://www.pix4d.com/blog/accident-and-crime-scene-investigation.



Reconstruction of the simulated accident scene in Pix4D software. Location of ground control points are indicated by the numbers in green, with the blue lines indicating the manual measurements.

Software such as that developed by Pix4D can also be used to reconstruct the exact path of a vehicle's movements through an accident scene, based on a representation of the vehicle and the photographed skid marks.

The New York State Police Department conducted a year-long trial and demonstrated that using RPAS to map accident scenes resulted in a 75-80 percent reduction in mapping time, while maintaining the accuracy of traditional methods.[16]

In July 2018, the Queensland Police Forensic Crash Unit started a trial using RPAS for mapping crash scenes. On average, the time taken to map a scene was reduced by up to 50% compared to the existing method of using a robotic total station, a saving of approximately one hour per crash scene.[17]

5.2.2 NZTA / Police Serious Crash Trials (Waikato)

In 2015, the Waikato Serious Crash Unit undertook a trial using RPAS for scene investigations at fatal and serious crashes.[18] The results of this trial indicate that there are significant benefits available to

16 Mark Fisher, "Adding UAS to the Investigative Toolbox", *Police Chief Magazine*, https://www.policechiefmagazine.org/adding-uas-to-the-investigative-toolbox/

17 Queensland Police Service, *2018-19 Annual Report*, p. 51. https://www.police.qld.gov.au/sites/default/files/2019-09/AR_18.19_08_Performance.pdf. For a video report including interview comments from Assistant Commissioner Michael Keating, see https://www.traffictechnologytoday.com/videos/australian-police-using-drone-technology-to-halve-road-crash-delays-2.html.

18 *Serious Crash Scene Evaluation of New Evidence Collection Techniques and Development of Methodology for Trial*, prepared for NZ Transport Agency and NZ Police, Gray Matter Ltd, Hamilton, 29 November 2016.

both Police and the public, and suggest that the technology should be widely adopted for SCU investigations.

The trial involved the parallel collection of data by both current survey techniques (Sokkia) and by RPAS at seven crash sites. This enabled the efficacy of both techniques to be directly compared.

Consistent with the results of the overseas trials, the Waikato trials found that measurements made with the total station took an average of 126 minutes, while measurements with the RPAS took an average of 26 minutes, a reduction of 79 percent (consistent with the New York State Police Department trial).

Additional findings of the trial were that:

- accuracy of the data collected with the RPAS was at least as good as the data collected with the total station
- the data collected with the RPAS has the advantage of collecting information about the total site, including down banks
- more survey information was collected – the UAV captures all data below the flight path. Traditional survey methods only capture selected points, which can be limiting when investigating crashes
- RPAS provide photos and videos from above that show an overview of the crash site; currently, photos are only taken by a police photographer walking the site, which limits the views and number of photos taken
- records and demonstrates weather and road conditions more accurately than previously recorded
- RPAS provide more detailed survey information of crash sites, including areas which could not be surveyed previously, e.g. down banks/ cliffs
- plan production using Pix4D software matches the quality of the current evidential plans.

The trial did not quantify the total time to process the RPAS data and produce plans using Pix4D, or whether the total evidence production process was shorter or longer in duration than the traditional process.

The time savings at the accident scene can be expected to translate directly into shorter road closure times. The Phase 1 trial report estimates the value of the time savings to motorists, although does so in 2002 dollars. Updating to 2019 dollars, the value of the time savings to motorists is between $129,000 and $421,000 per year, in the Waikato Police District alone.

	Example 1: Crash on SH3 Te Kuiti[19]	Example 2: Crash on SH1 Huntly	
Assumptions (per Phase 1 Trial Report)			
Average time saving per crash	100	100	mins
Average vehicles per hour	300	1,200	vehicles per hour
Affected vehicles	500	2,000	vehicles
Detour route extra time	10	6	mins
Total delay	83	200	vehicle-hours
Road Type	Rural Other	Rural Strategic	
Period	Weekend	Weekday	
Values from Phase 1 Trial Report			
Delay cost per vehicle hour (2002 $)[20]	18.59	25.34	$/hour
Total cost per crash	1,549	5,068	$/crash
Annual saving for Waikato Police District	83,655	273,672	(assuming 54 crashes per year)
Adjusted Values to 2019 $			
Delay cost per vehicle hour (2002 $)	18.59	25.34	$/hour
NZTA 2019 Adjustment Factor[21]	1.54	1.54	multiplier
Total cost per crash	2,386	7,805	$/crash
Annual saving for Waikato Police District	128,829	421,455	(assuming 54 crashes per year)

These calculations assume that detours are relatively straightforward, adding only 6–10 minutes of extra travel time. Elsewhere in New Zealand there might not be any detour, or the detour might add considerably more to travel times. For example, a crash that closes the Desert Rd in the central North Island will add approximately 35 minutes to travel times between Rangipo and Waiouru.[22] A crash that closes Arthurs Pass will add approximately 1 hour 51 minutes travel time between Darfield and Greymouth.[23] A crash that closes part of SH1 through Auckland might cause traffic to back up for many kilometres and not clear for hours after the road has been reopened.

If the Waikato estimate of $129,000 and $421,000 per year is taken as an average per district, then across all districts the total value of travel time savings would be between $1.5m and $5m per year.

These estimated savings do not include the value of more accurate mapping, much enhanced imagery of the scene, and stronger evidence for court proceedings. If the investigator needs to analyse another

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19 The 2016 trial report referenced SH1 Te Kuiti, but Te Kuiti is on SH3.

20 "Appendix A4.3 Composite values of travel time and congestion", Economic Evaluation Manual, effective 1 July 2018, *New Zealand Transport Agency*, p. 5-209. https://www.nzta.govt.nz/assets/resources/economic-evaluation-manual/economic-evaluation-manual/docs/eem-manual.pdf

21 "Appendix A12 Update Factors, Effective from 1 December2019" https://www.nzta.govt.nz/assets/resources/economic-evaluation-manual/economic-evaluation-manual/docs/eem-update-factors.pdf.

22 Travel time calculations using Google Maps, 22 April 2020. This is during the Level 4 lockdown period, so travel times will be uncongested. From Rangipo to Waiouru via SH1 Desert Rd, the estimated travel time is 41 minutes. For the alternative route from Rangipo to Waiouru via SH46, SH47, National Park, SH4, SH49 incl Ohakune, the estimated travel time is 1h 16 minutes. The increase in estimated travel time is therefore 35 minutes.

23 Travel time calculations using Google Maps, 22 April 2020. From Darfield to Greymouth via SH73 Arthurs Pass, the estimated travel time is 2h 43 minutes. For the alternative route from Darfield to Greymouth via SH1 Amberley and SH7 Lewis Pass, the estimated travel time is 4h 34 minutes. The increase in estimated travel time is therefore 1h 51 minutes.

angle of the scene, or questions are raised by the defence, then the RPAS data enables that to be readily reconstructed.

5.3 Cannabis Recovery Operations

RPAS have been used by several districts as a useful tool in cannabis recovery operations. s.6(c) OIA [redacted] s.6(c) OIA [redacted]

[redacted]

s.6(c) OIA [redacted]

[redacted]

[redacted]

[redacted]

s.6(c) OIA

[redacted]

5.5 Conclusions

RPAS are able to obtain photographs of crime scenes in a way that would not be possible using other means, including helicopters. RPAS are also significantly cheaper than manned aircraft and significantly quieter than a helicopter.

Relevant images can be obtained in as little as 10 minutes, providing a significant time saving to the photographer.

RPAS can photograph areas of a scene that are difficult or impossible to photograph by traditional means, such as down a bank at a crash scene, or oblique angles into a burnt-out building.

RPAS are able to revolutionise the process of serious crash photography. Trials conducted in the Waikato region suggest that an average time saving of 100 minutes per crash can be achieved. The annual reduction in social cost from road closures and diversions is many times more than the cost of a RPAS.

RPAS can significantly enhance the safety of officers attending mass events, providing situational awareness and enabling a specific offender to be tracked until it is safe for staff to move in.

6 Deployments during the Proof of Concept

6.1 Introduction

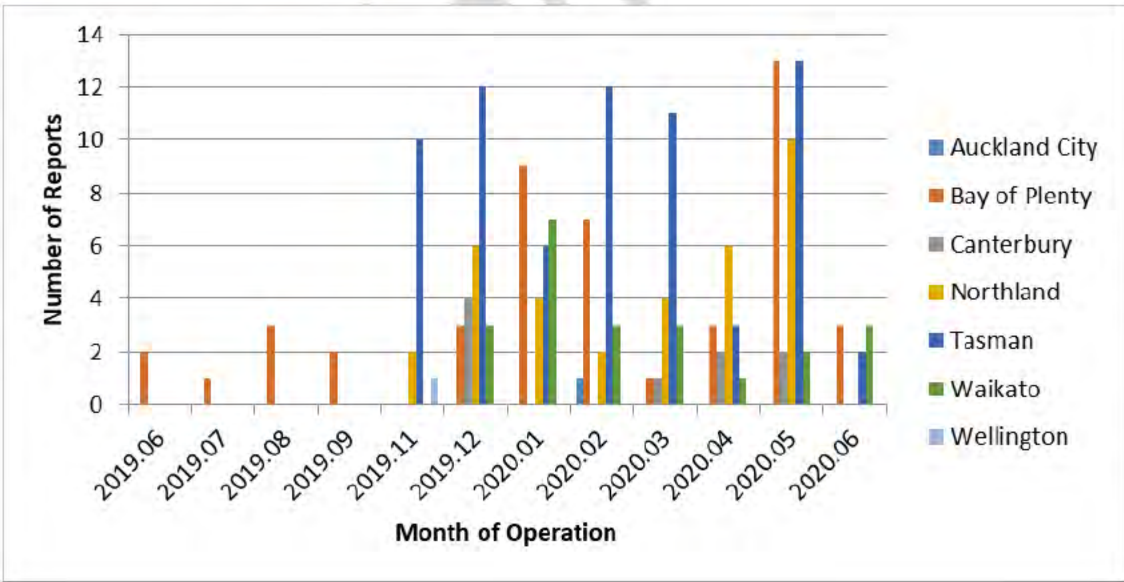
Sections 3, 4, and 5 presented a range of case studies demonstrating the utility of RPAS across a wide range of police operations. Those sections do not, however, establish how often RPAS capability might be used or which types of deployments RPAS will be most often used on. A "Drone Use Report" form was provided to districts so that each use of a RPAS during the PoC could be recorded along with pertinent information about the flight. A copy of this form is provided in Appendix A.

This section of the evaluation report analyses the data received from the drone use reports. Section 6.2 summarises the raw data, section 6.3 comments on the reporting of training flights by some districts (particularly Tasman) but not others, and section 6.4 analyses operational flights. Total operational flights per district are analysed, as is differences in the purpose of operational flights across the reporting districts. Given the potential significance of search and surveillance issues associated with police use of RPAS, the reported use of warrants is also analysed. Section 6.5 provides conclusions.

6.2 Raw Data

A total of 184 drone use reports were received. The chart in Figure 14 below shows the number of drone use reports by district by month. The Drone Use Report form was not released until November 2019, coinciding with the commencement of the trial. Eight drone use reports were received from Bay of Plenty District for the period before the PoC trial, so those were removed from the sample. One drone use report was a duplicate so also removed from the sample. There were therefore 175 reports within the PoC period.

Figure 14: Raw Drone Use Reports by District by Month



6.3 Training Flights

The drone use reports in Figure 14 are a mix of operational deployments and training flights. There is considerable variability between districts in the number of training flights recorded, reflecting both when the pilots were qualified and the perception of the type of use reports to be filed. Tasman District was the only district to consistently record training flights, recording 47 training flights over the period to 11 June 2020. All other districts recorded a total of only 2 training flights.

6.4 Operational Flights

6.4.1 Total Operational Flights by District

When training flights were removed from the sample, there was a total of 121 drone use reports from six districts. Figure 15 shows the proportion of total operational flights by district, and Figure 16 shows the number of operational flights by month and district. Four districts accounted for 95% percent of the operational drone use reports: Tasman and Waikato Districts each accounted for 18% of the operational flights reported, Northland accounted for 27%, and Bay of Plenty accounted for 32%.

Figure 15: Proportion of Operational Flights by District

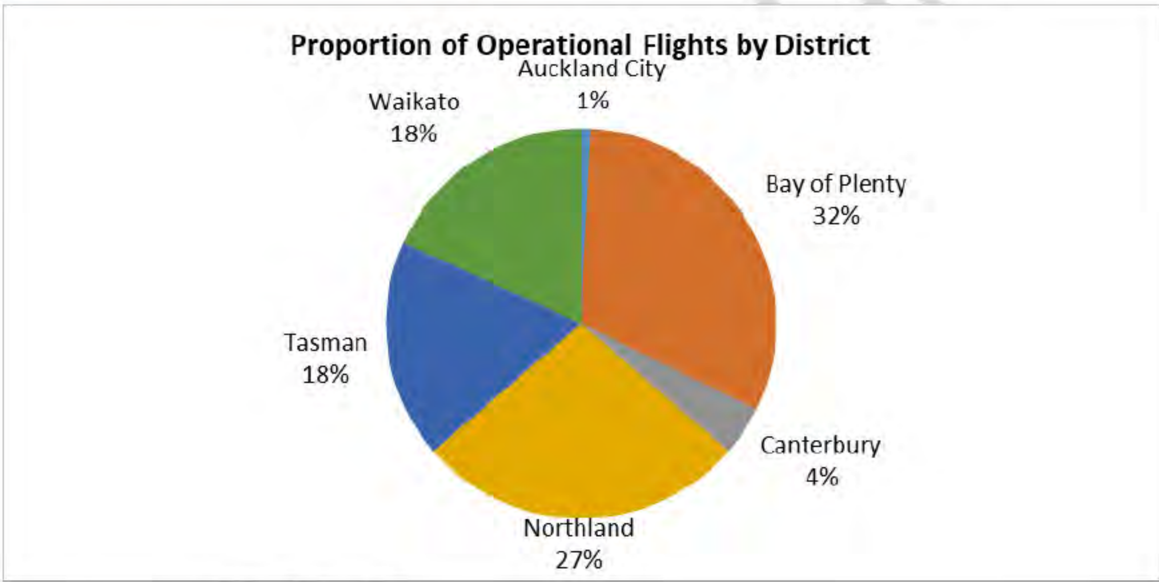


Figure 16: Operational Deployments by Month and District

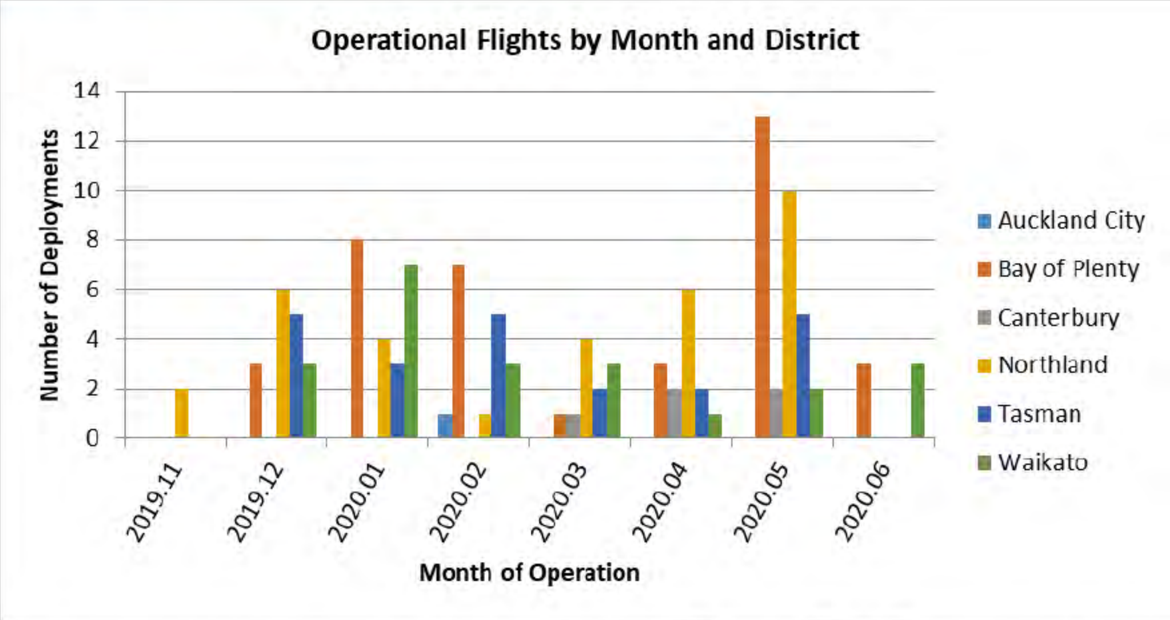


Table 1 provides some summary statistics to illustrate the difference in total deployments across the districts. The first cause of the difference in the number of deployments is the number of weeks since the start of each district's participation in the PoC. Waikato was able to commence immediately due to already having trained pilots, and began reporting after the Drone Use Report form was released. Northland was also able to begin immediately, also having some trained pilots, and retrospectively reported operational flights to the beginning of November 2019 (the Drone Use Report form was released on 20 November 2019, whereas the event in the case study in section 4.1 took place on 8 November 2019). Bay of Plenty and Tasman Districts could not begin the PoC until December 2019, and Canterbury could not begin until March 2020.

Table 1: Summary Statistics

		Bay of Plenty	Canterbury	Northland	Tasman	Waikato
Total Operational Flights		38	5	33	22	22
Date of First Reported Operational Use		12/12/2019	31/03/2020	8/11/2019	11/12/2019	7/12/2019
PoC commenced		1/12/2019	1/03/2020	1/11/2019	1/12/2019	1/12/2019
Weeks to 11 Jun 2020	[a]	27.6	14.6	31.9	27.6	27.6
Operational Flights / week		1.38	0.34	1.04	0.80	0.80
Number of RPAS	[b]	6	4	3	3	2
RPAS-weeks ([a] x [b])		165.4	58.3	95.6	82.7	55.1
Operational Flights / RPAS-week		0.23	0.09	0.35	0.27	0.40

Note: Auckland City excluded due to low number of operational drone use reports (1).

Normalising total operational drone use reports to the number of weeks in the PoC, Tasman and Waikato Districts had 0.8 operational flights per week, Northland had 1.0 operational flights per week, and Bay of Plenty had 1.4 operational flights per week. Canterbury only had 0.3 operational flights per week.

A second potential explanation is the number of RPAS available within the district. As a broad generalisation, a RPAS in one physical location can only be used at locations within a reasonable driving time of that location. In addition, a RPAS deployed on one job cannot simultaneously be deployed on another job. For these reasons, it is reasonable to assume that a district with a greater number of RPAS would be expected to have a greater number of operational flights.

Table 1 shows the RPAS capability for each of the districts, and calculates the number of "RPAS-weeks" for the district, which is simply the product of the number of RPAS and the number of weeks in the PoC trial. Bay of Plenty has twice as many RPAS as Tasman District, but in terms of operational flights per RPAS-week, the two districts were almost identical, with Bay of Plenty (possessing six RPAS) reporting 0.23 operational flights per RPAS-week and Tasman (possessing three RPAS) reporting 0.27 operational flights per RPAS-week. Northland with three RPAS reported 0.35 operational flights per RPAS-week, and Waikato with two RPAS reported 0.40 operational flights per RPAS-week. Canterbury reported just 0.09 operational flights per RPAS-week.

6.4.2 Purpose of Flight

Figure 17 shows the proposal of operational flights by purpose of flight. Approximately one third of flights were for road crash photography (34%), and approximately a further third were for crime scene (28%) and arson (7%) photography. AOS/STG comprised 13% of total operational deployments. All other uses combined comprised just 18% of total operational deployments. However, it is likely that these percentages are not representative of the pattern of deployment if RPAS were deployed across Police. In particular, two districts exclusively used their RPAS for crash and crime scene photography, which means that it is likely that the contribution of these activities to the total is overstated.

Figure 17: Proportion of Operational Flights by Purpose of Flight

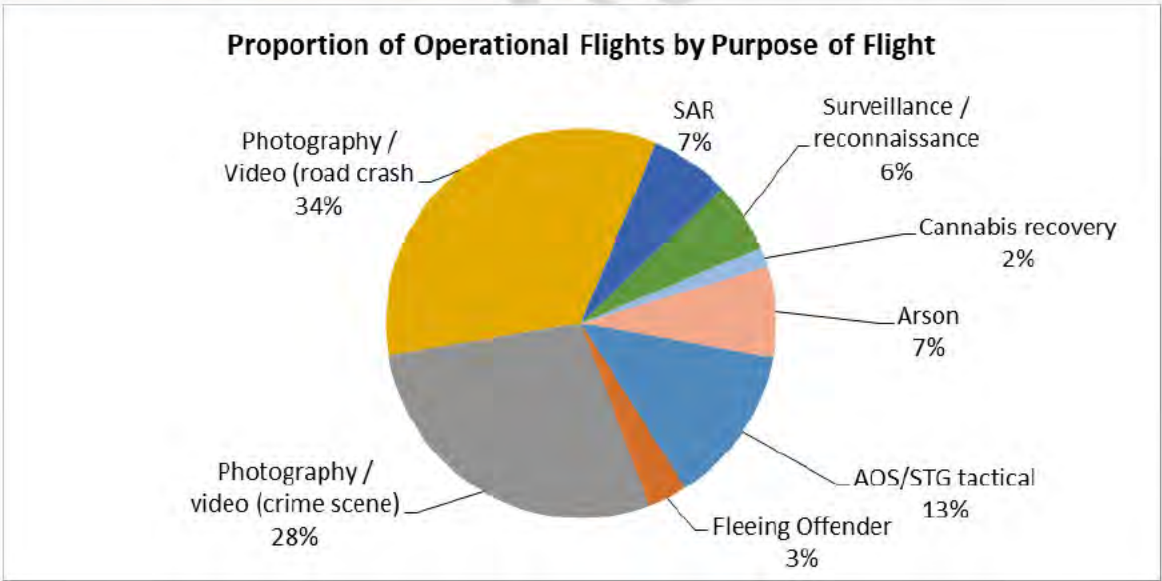


Table 2 below shows the number of flights by purpose and district. It is apparent that the four districts responsible for the majority of drone use reports can be further divided into two groups. Bay of Plenty and Waikato Districts primarily use RPAS for photography, both crime scene and road crash. Bay of Plenty had 61% of their drone use reports (23 of 38) for crime scene photography, and 37% of their drone use reports (14) for road crash photography. Waikato District had 95% of its drone use reports

(21 of 22) for road crash photography, possibly reflecting their history as the district where the trial discussed in section 5.2.2 was conducted.

Table 2: Number of Operational Flights by Purpose and District

Purpose of Flight	Auckland City	Bay of Plenty	Canterbury	Northland	Tasman	Waikato	Total
AOS/STG tactical			3	11	2		16
Fleeing Offender				3	1		4
Photography / Video (crime scene)		17	1	6	9	1	34
Photography / Video (road crash)	1	14		1	4	21	41
SAR			1	7			8
Surveillance / reconnaissance		1		3	3		7
Cannabis recovery					2		2
Arson		6		2	1		9
Total	**1**	**38**	**5**	**33**	**22**	**22**	**121**

Northland and Tasman Districts have a significantly different pattern of use to Bay of Plenty and Waikato. Operational drone use reports for photography were 64% for Tasman District and 27% for Northland District, compared to 97% for Bay of Plenty and 100% for Waikato. In a significant departure from other districts, 21% of Northland's operational drone use reports (7 out of 33) were for SAR events.

6.4.3 Warrant Requirements

As discussed in section 8.3, police use of RPAS may trigger provisions in the Search and Surveillance Act 2012 requiring a search warrant. Given the importance of search and surveillance requirements, the Drone Use Report form specifically requested information from the submitter on whether a warrant was obtained.

Table 3 shows the number of flights for which a warrant was or was not obtained by type of operation. The columns headed 'Yes' and 'Warrantless Search' are the 'as reported' responses. The columns marked 'No', 'Not Applicable' and 'Not Specified' underwent some processing from the raw responses, with rules applied as follows:

- Where the notes about the operation indicated that the operation was photography of a road crash, then any response that was not 'Yes' or 'Warrantless Search' was assigned to 'Not Applicable – Road Crash'.
- Where any notes about the operation indicated that the operation was conducted on private property but permission had been obtained from the owner or occupier then any response that was not 'Yes' or 'Warrantless Search' was assigned to 'Not Applicable – Permission'.
- Any remaining 'Not Applicable' responses were assigned to 'Not Applicable – Other'.
- Any remaining 'No' responses were left unchanged, and any remaining responses where the warrant question was unanswered was assigned to 'Not Specified'.

Table 3: Warrant use by type of Operation

Type of Operation	Yes	Warrantless Search (S&S)	No	Not Applicable	Not Specified	Total
AOS/STG tactical	5	7	-	4	-	16
Fleeing Offender	-	-	1	3	-	4
Photography / video (crime scene)	20	-	1	12	1	34
Photography / Video (road crash)	-	2	-	39	-	41
SAR	-	-	-	4	4	8
Surveillance / reconnaissance	2	-	-	3	2	7
Cannabis recovery	-	-	-	2	-	2
Arson	-	-	1	8	-	9
Total	**27**	**9**	**3**	**75**	**7**	**121**

In summary, 22% of flights (27 of 121) required a warrant, and 7% of flights (9 of 121) were conducted as part of a warrantless search. 62% of flights (75 of 121) did not require a warrant. Two per cent of flights (3 of 121) did not have a warrant, but insufficient information was provided to be able to establish the reason for no warrant. For 6% of flights (7 of 121), the question about whether a warrant was obtained was not answered; it is likely that no warrant was obtained for these flights.

The pattern of which types of operation required search warrants reflects what would generally be expected for each type of operation. Crime scene photography other than arson required a relatively high proportion of search warrants. Road crash photography had very few warrants, but tactical operations had a high proportion of warrantless searches.

While this data is not conclusive that warrants are always being obtained for RPAS flights, it does suggest that warrant requirements are being considered. Of note, Northland and Tasman Districts account for 12 of the 15 AOS tactical deployments, and both of these districts had received specific training on the application of the Search and Surveillance Act 2012 to RPAS operations.

6.5 Conclusions

An important question is what these statistics imply for the deployment of RPAS across Police. First, the geographic nature of the district is important. Waikato only possesses two RPAS, but being primarily focussed on a single purpose (road crash photography) in a district that is relatively easy to travel around has resulted in a high utilisation. Achieving the same number of operational flights in other districts might require more RPAS. For example, both the Bay of Plenty and Waikato Districts were part of the PoC trial for the same number of weeks, but Bay of Plenty had twice as many RPAS as Waikato, with the RPAS distributed across the district. Bay of Plenty reported operational flights at only two-thirds the number of road crashes as Waikato, but with the RPAS distributed throughout the district, total operational flights were higher in Bay of Plenty due to also being used for crime scene photography.

Northland and Tasman Districts made relatively light use of RPAS for crime scene and road crash photography, but were able to demonstrate a broader range of uses. Tasman District, in particular, is geographically very large, with long travel times between parts of the district. Northland also covers a large geographic area, with long travel times. These two districts might benefit from the higher number of RPAS utilised by Bay of Plenty. On the other hand, Bay of Plenty and Waikato have not yet expanded the use of RPAS outside the core area of photography.

At a rate of 0.2 tactical deployments per week across Canterbury, Northland, and Tasman, it could be assumed that across all 12 districts, RPAS could be deployed on approximately 125 tactical operations per year.[24] This will obviously vary according to the crime profile of individual districts, but these statistics nonetheless suggest that demand across Police could be significant.

The pattern of deployments across districts suggests that two RPAS per district can be productively employed in crash photography alone, and expansion of the use of RPAS to crime scenes may enable up to six RPAS to be productively employed (e.g., Bay of Plenty). The experience of Northland and Tasman suggests that additional RPAS could also be used productively on a wide range of other policing operations. The experience of Bay of Plenty, Northland, and Tasman Districts also suggests that having sufficient RPAS dispersed across the district is important to ensure that a RPAS is available within a reasonable timeframe when required.

In total, it would be reasonable for districts to have a "fleet" of approximately six RPAS with the capability used in the PoC, with sufficient pilots trained that there was always a pilot available. Some districts might find that they need more than six RPAS, and some might find they can adequately utilise fewer RPAS. However, it is also likely that the demand for deployment of RPAS will increase as experience is gained with their use.

[24] 0.2 deployments / week x 52 weeks / year x 12 districts = 124.8.

7 Police RPAS Fleet

This section starts by detailing the current Police RPAS fleet, and then discusses issues identified with the DJI geo-fencing technology, and cyber security concerns. District and regional capability requirements are considered. An additional option of a micro-drone suitable for tactical use is presented – this could be appropriate for use at either a District (AOS) or regional (STG) level. Constraints on transportation of batteries for larger RPAS are detailed.

7.1 Current Fleet

RPAS capability in districts involved in the proof of concept:

- Northland District
    - 2 x DJI Mavic 2 Enterprise Zoom (AOS / SAR)
    - 1 x DJI Mavic 2 Pro (Photography)
- Waikato District
    - 2 x Phantom 4 Pro RPAS, Hamilton-based (Photography)
- Canterbury District
    - 2 x DJI Mavic 2 Pro (one in CHC, one in Timaru) - Photography / SCU
    - 1 x DJI Mavic 2 Enterprise (CHC AOS / PNT)
    - 1 x DJI Mavic 2 Enterprise (CHC SAR / SSG)
- Tasman District
    - 1 x DJI Mavic 2 Pro (optical 20MP camera)
    - 1 x DJI Mavic 2 Enterprise (thermal/optical)
    - 1 x DJI Mavic 2 Enterprise (zoom)
    - Airframes based in Nelson, Blenheim and Greymouth, with the Nelson-based airframe to support DHQ (Serious Crash)

RPAS Capability within Other Districts:

- Auckland City
    - 1 x Phantom 4 Pro (Photography)
- Bay of Plenty District
    - 6 x DJI Mavic ZOOM RPAS.
    - Western Bay of Plenty (x2; 1 PNT, 1 Photography)
    - Rotorua (x2; 1 PNT, 1 Photography)
    - Eastern Bay of Plenty (Serious Crash)
    - Taupo (Serious Crash)

- Wellington District
    - 1 x DJI Mavic 2 Enterprise Zoom
    - 2 x DJI Mavic 2 Pro
- Police National HQ
    - 1 x Mavic Air
    - 1 x Mavic 2 Enterprise
    - 1 x Phantom 4
    - 2 x Mavic 2 Enterprise Zoom

All of the listed RPAS are small quadcopters able to provide high quality digital photography. The various models differ in their stand-off capability, the cyber security protections available, and the ability to manage firmware updates centrally. Key characteristics of these are other similar RPAS are summarised in Table 4 in Appendix B. Cyber security issues are discussed in Section 7.3 below.

Tasman District has committed to purchasing a DJI Matrice 300 RTK, described in more detail in Section 7.4 below. Tasman is expecting to take delivery of this RPAS in late June / early July; the exact timing is dependent on the recovery of sea freight post-covid 19.

7.2 s.6(c) OIA [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

s.6(c) OIA

[redacted]

7.3 Cyber Issues

RPAS are flying computers with intelligence, surveillance, and reconnaissance (ISR) capabilities that might connect to the internet. In the United States, considerable concern has been raised about Chinese-made RPAS, including those manufactured by DJI. An internet-connected RPAS could send data to a server located in China, and firmware updates could compromise the integrity of the RPAS and any police systems to which it is connected. Both the US Department of Defense and Department of Interior are banned from using Chinese-made RPAS.[25]

More prosaically, data (including imagery) collected by a RPAS might be stored in on board memory or on an SD-card. If a RPAS is lost or stolen then any data is potentially recoverable by a third party.

A full risk assessment has been conducted on the cyber issues associated with the utilisation of RPAS. For the most part, for the majority of policing, appropriate safeguards can be employed that allow DJI RPAS to be utilised. In particular, the DJI Enterprise series of RPAS have encrypted data transmission links and password-protected data storage. Some of the more expensive high capability RPAS

[25] For a summary of the US Department of Defense and US Department of Interior actions, see Andrew Shelley, "Addressing Security Concerns with Chinese Drones and DJI Products", 23 May 2020. https://www.academia.edu/43142234/Addressing_Security_Concerns_with_Chinese_Drones_and_DJI_Products

discussed below also have encryption (e.g. DJI Matrice and Aeryon SkyRanger) and appropriate levels of cyber protection.

s.6(c) OIA [redacted]

7.4 District Capability Requirements

The RPAS used in the trial have primarily been mid-range capability DJI Mavic 2 craft. These have impressive photographic capability, but are restricted to visual spectrum photography only, and are not intended for operation in adverse weather conditions. Operation Simpson (Section 3.1.3) and s.6(c) OIA [redacted] highlight the benefit of using RPAS with more advanced infra-red imaging capabilities. Both of these operations used a Matrice 200 series RPAS operated by FENZ. While the existing relationship with FENZ has worked well to date, as police demand for RPAS use grows, it will be incumbent on Police to have its own capability.

As discussed in Section 4.4, the proof of concept has identified a need for a higher capability RPAS deployed at district level. Capabilities particularly required are the ability for standoff at a greater range, which in turn requires higher resolution cameras with better zoom capabilities. Thermal imaging has also been identified as a useful requirement, both for night and SAR purposes.

Additional information on higher capability RPAS is provided in Appendix B. Due to cost considerations, the DJI Matrice 200 series and DJI Matrice 300 RTK are likely to be the appropriate higher capability RPAS. Where flight endurance and standoff capability are important, the Matrice 300 RTK will significantly outperform the DJI Matrice 200 series.

Until May 2020, the Matrice 200 series was DJI's sole series of industrial inspection RPAS. The Matrice 200 carries a single camera, and the Matrice 210 can carry two cameras including the XT2 thermal (FLIR) camera. This is the type of RPAS operated by FENZ in Operation Simpson and s.6(c) OIA [redacted]

Figure 19: Matrice 210

Figure 20: Matrice 300 RTK

In May 2020, DJI introduced the Matrice 300 RTK as the next generation of its industrial inspection RPAS. Of particular interest, the Matrice 300 RTK has an endurance of up to 55 minutes, and new camera payloads with a considerably higher resolution than the cameras available for the Matrice 200 series. With the H20 series camera, the Matrice 300 RTK is also capable of tracking a target automatically. Tasman District has committed to purchasing a Matrice 300 RTK, but had not taken delivery of the RPAS at the date of this report.

Both of the DJI Matrice variants have the same thermal camera capability, with a resolution of 640x512 pixels. This is also the maximum thermal camera resolution available on competing RPAS. Given this common standard across RPAS, it appears that the 640x512 resolution is the highest that does not attract US State Department export controls.

7.5 Regional Capability Requirements

Regional groups potentially require access to higher levels of capability for events that are regional or national in character, and which might require advanced ISR capabilities and extended endurance. Events of a regional or national character might occasionally have a national security focus, so it would probably be appropriate to use platforms that meet the relevant requirements. Two such platforms are the Aeryon SkyRanger quadcopter and the Aerovironment Puma fixed wing RPAS.

7.5.1 Aeryon SkyRanger

The Aeryon SkyRanger R60 was originally developed for the US military. Like the DJI Matrice 300 RTK, it is capable of tracking a target. However, with the SkyRanger, when the aircraft in flight needs to return to have its battery recharged, a replacement RPAS can fly out and assume the surveillance mission, locked on to the same target, before the returning RPAS departs the surveillance location. The R60 is also capable of flight in adverse weather conditions.

Figure 21: Aeryon SkyRanger R60

The Aeryon RPAS is considerably more expensive that the DJI RPAS. However, it has fully encrypted military-specification data links. It is understood that FENZ operates one Aeryon SkyRanger and NZDF might operate up to three.

7.5.2 Fixed Wing RPAS

All RPAS acquired to date have been "multi-rotor" RPAS, essentially small helicopters with multiple rotors. Multi-rotor RPAS are relatively easy to control, take-off vertically, and can hover in a set location. However, multi-rotor RPAS also have a relatively limited range and endurance. A fixed wing RPAS can fly much further and for much longer, providing enhanced ISR and situational awareness capabilities.

There are a large number of fixed wing RPAS available, but for police use it is important to have a platform that is robust and will have local support available. One option is the Aerovironment Puma, pictured in Figure 22 below. The Puma has a 2.8m wing span, weighs 6.8kg, and is hand-launched. It has 2.5 hour flight endurance, and a range of 20–60km depending on the antenna employed. Like the Aeryon Skyranger, the Puma is capable of active target tracking.

s.6(a) OIA [redacted]

If Police were to obtain capability such as that offered by the Puma, its cost and capability would make it appropriate to be a headquartered asset, for deployment as required in the Northern, Central, and Southern regions.

Figure 22: Aerovironment Puma

Source: https://www.avinc.com/uas/view/puma

Another option with a higher level of capability again is the Boeing/Insitu Scan Eagle and Boeing/Insitu Integrator. These aircraft are capable of flying for 18 hours or more depending on the particular model and payload.

7.5.3 Pilots

Adoption of the specialist platforms might require additional pilots at regional level. It is important that pilots have a high level of skill and an intuitive knowledge of the platforms so that they are able to operate at the highest level when an incident arises. It is likely to also be desirable that some time is spent on joint training and exercises with both FENZ and the NZDF. Whether this requires additional staff to be employed at regional level has not been evaluated as part of the PoC.

It is also possible that some advanced capabilities (such as the Boeing/Insitu aircraft) would be better suited to an external contracting model, as occurs with the current Eagle helicopter.

7.6 Additional Option: a Micro Drone

The tactical utility of a micro drone was discussed in Section 4.6. One example of a micro drone is the Emax Tinyhawk, shown in Figure 23 below; this is the RPAS utilised by the Sacramento Police Department.

Micro drones could be deployed by tactical units at both district (AOS) and regional (STG) level.

Figure 23: The Emax Tinyhawk

7.7 Battery Transportation

All RPAS discussed in this report use lithium-ion / lithium-ion polymer (LiPo) batteries as a power source. On rare occasions, batteries containing lithium-ion develop faults and can begin to combust spontaneously. Over the last two decades, there have been examples of such batteries from laptops, mobile phones, and RPAS catching fire on passenger aircraft. Given the potentially catastrophic nature of a fire on-board a passenger aircraft, there are now strict regulations as to the types of batteries that can be carried on an airline flight.

The Watt-hour (Wh) rating of a lithium-ion battery determines whether it may be carried on a passenger airline. The ICAO *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) stipulate that:

- Lithium-ion batteries must not be carried in checked-in baggage;
- Batteries with a Watt-hour rating of 100Wh or less may be carried in carry-on baggage;
- Batteries with a Watt-hour rating of more than 100Wh and not more than 160Wh may be carried subject to approval by the airline operator, and must be carried in carry-on baggage;
- Batteries with a Watt-hour rating of more than 160Wh are not permitted to be carried.

Air New Zealand stipulated these same restrictions.[26]

While the lower capability quadcopters have batteries that can be carried in carry-on baggage, the batteries for the higher capability quadcopters must not be carried on a passenger airline. The batteries may be carried on cargo flights, subject to additional specified packaging requirements. The batteries can also be carried on a private charter flight, subject to their presence being discussed with the pilot in command, and a plan being made for actions in the event that a battery starts smoking.

These restrictions mean that while the lower capability quadcopters can be readily transported on commercial airline flights, the higher capability aircraft (DJI Matrice 210, DJI Matrice 300 RTK, Aeryon SkyRanger) cannot. This strengthens the case for such capability to be available at district level (DJI Matrice 210, DJI Matrice 300 RTK) or regional level (all higher capability and fixed wing platforms).

7.8 Conclusions

The current Police RPAS fleet is well suited to generalist use, including crime scene and serious crash photography. However, due to cyber risk concerns, it is important that future purchases of drones are the DJI Enterprise series of drones, which enable additional protections to be implemented, including protections as simple as password protection of the drone and associated data.

Lower capability models such as the DJI Mavic Air should be investigated as providing the potential for a 'drone in every car', noting that these models do not have the cyber protections available in the DJI Enterprise models. As such, a specific risk assessment would need to be conducted on the use of these RPAS.

Tactical operations require a greater stand-off capability, which at district level can be provided by the higher capability DJI Matrice 210 and DJI Matrice 300 RTK.

Tactical operations might also benefit from the use of micro drones for tasks such as clearing a building. These were not evaluated as part of the proof of concept.

[26] For Air New Zealand's restrictions see https://www.airnewzealand.co.nz/travelling-with-lithium-batteries.

Key risk controls that should be implemented with DJI RPAS are:

s.6(c) OIA

[redacted]

There might be benefit in considering adopting additional high specification RPAS for use at a regional (Northern, Central, Southern) level. This capability could include advanced quadcopters such as the Aeryon SkyRanger and fixed wing capability such as the Aerovironment Puma: both of these craft would enable inter-operability with FENZ and NZDF.

Restrictions on transporting batteries mean that commercial airline flights cannot be used to transport the higher capability RPAS. The distribution of higher capability RPAS among districts and regions should take account on the potential restrictions in transportation.

8 Regulatory Constraints

Part 101 of the Civil Aviation Rules imposes significant constraints on the ability of all RPAS operators, including Police, to operate over property, at night, and in other circumstances in which RPAS could provide valuable intelligence or situational awareness.

In addition, the Search and Surveillance Act 2012 (SSA) regulates the ability of police to enter properties, conduct searches, and engage in surveillance. A RPAS is a visual surveillance device under the SSA. The SSA places clear restrictions on trespass surveillance. The civil aviation regulatory regime creates circumstances in which a UAS overflight will probably constitute trespass and circumstances in which it will not. Due to the unique rules applied to RPAS, a RPAS may be trespassing when a manned aircraft would not.

Part 102 certification, available under the civil aviation regulatory regime, can provide privileges to operate outside some of the Part 101 constraints. Privileges to fly over property might also alleviate some of the constraints under the SSA, placing RPAS on a similar footing to manned aircraft.

8.1 Part 101 of the Civil Aviation Rules

RPAS are considered to be aircraft and, as such, are operated under rules promulgated by the Ministry of Transport and implemented by the Civil Aviation Authority (CAA). The default rules that apply to RPAS operations are the Civil Aviation Rules Part 101. Some of the relevant Part 101 rules are:

- Do not fly over people without their consent.
- Do not fly over property without the consent of the occupier.
- Do not fly at night unless indoors or shielded.[27]
- Only fly within visual line of sight.
- Always give way to crewed aircraft.

By default, the operation of RPAS in accordance with these rules is deemed to be safe. However, these rules place a considerable constraint on the utility of RPAS operations.

8.2 Part 102 Certification

Part 102 of the Civil Aviation Rules enables the CAA to issue an Unmanned Aircraft Operator Certificate to an organisation with "privileges" to operate outside the Part 101 rules. Part 102 certification is granted on the basis that the organisation has procedures in place that reduce the risk of the proposed privileges to an acceptable level. One privilege available is flying unshielded at night. s.6(c) OIA [redacted]

[S] Another privilege is that available to fly over property without prior consent. The Civil Aviation Authority is understood to have been granting this as a routine privilege since early 2019. The

27 Shielded operations are conducted within 100m of, and below the top of, a natural or man-made object or structure. The underlying assumption is that manned aircraft are unlikely to be in this space, so it is relatively safe to operate a drone in this space.

standard procedure approved by the Civil Aviation Authority requires that notification is provided to the owner or occupier of a property, although at the operator's discretion that notification may be after the flight.

[R] The Civil Aviation Authority has also granted a more expansive privilege to FENZ to operate over private property without providing any notification if it is supporting a lawful surveillance operation from a law enforcement agency.

[R] Police has applied to the CAA for Part 102 certification. Privileges applied for include flying unshielded at night, flight over property without prior consent in a range of circumstances, flight beyond the visual line of sight of the pilot, as well as a number of other more technical privileges such as procedures to apply when operating within 4km of an aerodrome.

8.3 Aerial Trespass[28]

An important question for Police is when trespass occurs with RPAS. A related question is whether there are differences between overflight with RPAS and overflight with manned aircraft.

Trespass is grounded in Common Law, supplemented by the Trespass Act 1980. Under Common Law, whoever has the rights to an area of land also has the rights to everything under the land (to the centre of the earth) and to everything in the airspace overhead (to the "heavens"). This principle was confirmed by in the High Court in 2001. In *De Richaumont Investment Co Ltd v OTW Advertising Ltd*, Priestley J held that property rights "are absolute … [and] can only be diminished by creation of competing interests in the land, by contract, or most importantly by statute".[29]

In relation to airspace, the "competing interests" are created by s97 of the Civil Aviation Act 1990, which provides that:

> *No action shall lie in respect of trespass, or in respect of nuisance, by reason only of the flight of aircraft over any property at a height above the ground which having regard to wind, weather, and all the circumstances of the case is reasonable, so long as the provisions of this Act and of any rules made under this Act are duly complied with.*

The s 97(2) prohibition against actions in trespass has been tested in *R v Peita* and *R v Hertnon*,[30] both drug-related prosecutions. By way of background, in broad terms the minimum height for an aircraft is 1,000 feet above ground level in an urban area and 500 feet above ground level in a rural area,[31] except when conducting a take-off or landing. In *R v Peita*, an aircraft being used by police for aerial reconnaissance identified a cannabis plot. Anderson J held that:

[28] Aerial trespass with RPAS is also addressed in Andrew Shelley (2016) Proposals to Address Privacy Violations and Surveillance by Unmanned Aerial Systems, *Waikato Law Review*, Vol 24. See particularly pages 146-151.

[29] *De Richaumont Investment Co Ltd v OTW Advertising Ltd* [2001] 2 NZLR 831 (HC) at [39].

[30] *R v Peita* (1999) 5 HRNZ 250 (CA); *R v Hertnon* HC Palmerston North CRI-2007-031-536, 7 August 2009.

[31] Minimum heights are specified in CAR 91.311. The minimum height over a "congested area" of a city, town, or settlement, or over an open-air assembly of persons is 1,000 feet above the surface or any obstacle within a 600m radius. In any other area, the minimum height is 500 feet above the surface or any obstacle that is within a 150m radius.

> *"the aircraft is not to be regarded as having physically intruded on to the property by flying, not unlawfully, in navigable airspace above the property"*[32]

> *"There is nothing in this case to suggest that … the height of the aircraft above ground was not reasonable."*[33]

> *"the entry into airspace above the appellant's property was lawful in terms of s97(2) of the Civil Aviation Act 1990."*[34]

In *R v Hertnon*, a flight at 1,000ft above ground level (above the minimum height in that area of 500ft above ground level) was also found to be reasonable in terms of s 97(2).

The decisions in *R v Peita* and *R v Hertnon* have limited applicability to RPAS because the Civil Aviation Rules do not specify a minimum height for RPAS flight. However, these decisions highlight that in order to meet the requirements of s97(2) of the Civil Aviation Act 1990, the entry into the airspace above a property needs to be lawful and at a height that is reasonable given "all the circumstances of the case".

[S] It is clear that if a RPAS is operating under Part 101 of the Civil Aviation Rules then flight over property without prior consent is trespass; the lack of prior consent means that the relevant rule has not been complied with, and the protection against actions in trespass provided by s97(2) of the Civil Aviation Act 1990 is lost.

[S] Conversely, if CAA has granted a privilege to fly over property without prior consent, then it appears that the privilege so granted has the same status as a Civil Aviation Rule. While this has not yet been tested in court, if a "privilege" has the same status as a rule, it would then imply that so long as (a) the pilot was complying with the provisions of the written procedure as approved by the Civil Aviation Authority, and (b) the height of the flight was reasonable, then trespass would not be committed.

8.4 Search and Surveillance Act 2012

A RPAS with a camera is a visual surveillance device for the purposes of the Search and Surveillance Act 2012. This means that trespass surveillance is only permitted under limited circumstances specified in the Act:

- Offences punishable by a term of imprisonment of seven years or more;
- Offences against the Arms Act 1983; and
- Certain offences against the Psychoactive Substances Act 2013.

[S] It is apparent that it has a potentially significant impact on the legality of aerial searches or surveillance depending on whether a RPAS is operated under the Part 101 rules or under privileges granted by way of Part 102 certification. If operated under Part 101, any flights conducted over property without the consent of the owner or occupier are potentially trespass with the implication that any imagery obtained, whether or not recorded, is subject to the restrictions against trespass surveillance. However, if operated in accordance with a privilege granted by way of Part 102 certification, then there may be no trespass.

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32 *R v Peita* at [11].
33 *R v Peita* at [11].
34 *R v Peita* at [14].

[S] Notwithstanding the benefits of Part 102 certification for alleviating some of the constraints on trespass surveillance, Part 102 certification does not have any impact on the privacy-related requirements in s46 of the Search and Surveillance Act 2012. A warrant is still required to observe private activity in private premises, and to observe private activity in the curtilage of private premises beyond the time thresholds specified in that Act.

8.5 Systems to ensure that Evidential Requirements are met

Imagery collected by RPAS may be used in a number of ways including:

- real time situational awareness during an operation
- providing the information for which there are "reasonable grounds" to undertake an action or obtain a warrant
- obtaining evidence of a criminal offence.

In all three situations identified above, it is possible that imagery might need to be exhibited in court as evidence. Even with real time situational awareness, it is possible that imagery could be used in a court proceeding to justify why an officer decided to take a particular course of action. With imagery potentially being used for evidential purposes, it is important that it is managed in a way that ensures its integrity.

New Zealand Police collects digital data from multiple devices, e.g. helicopter cameras, iPhones, CCTV, for multiple purposes, e.g. evidence and ongoing investigations, and stores that data in multiple repositories, e.g. file directories and applications such as Axon.

Currently, Police stores such data in the following repositories:

- "Evidential" data for victim video statements and TASER footage is stored in Evidence.com (a cloud storage capability provided by Axon)
- "Evidential" serious crime interviews are currently stored on DVDs.
- "Evidential" forensic photography is stored at a district level on "attached" storage devices that are not connected or networked to the Police Enterprise Network.
- CCTV footage, some of it (Eagle Helicopter) is stored in evidence.com, some is stored randomly on Police shared drives, and a lot is not stored at all.

Footage captured by RPAS might be treated as forensic photography or as CCTV footage.

Police photographers already work with high quality digital imagery, albeit generally taken with handheld cameras rather than RPAS. To meet evidential requirements, existing procedures require original images to be saved in an un-altered format, with any edits being made to copies. All image storage and processing must be undertaken in accordance with the *Australia and New Zealand Guidelines for Digital Imaging Processes* published by the Australia New Zealand Policing Advisory Agency. These guidelines cover storage and capture of images, storage media, original and working copies, and image processing. All imagery collected by Photography is recorded on to permanent storage media and stored offline. Processing is performed on dedicated computers.

Conversely, as noted above, victim video statements and TASER footage are automatically uploaded to Evidence.com. The Evidence.com servers and image processing have been certified to ensure that the servers meet required security standards and that the images meet evidential requirements.

During the PoC these issues have been discussed, but no decisions have been made or steps taken to ensure that there is a single integrated process that applies to all RPAS footage. There remains a need to develop (with Police ICT) a "national storage capability" for all RPAS evidential and non-evidential data. Requirements for non-evidential data are likely to be less than those for evidential data, with evidential storage likely to require greater capability and features (and hence greater cost) than non-evidential data storage.

[IC] A separate investment proposal has proposed that Police will be going to the market shortly to identify storage capabilities to address both evidential and non-evidential storage needs. An additional requirement identified during the PoC is that internet capability in some parts of New Zealand is insufficient for the transfer of large volumes of data (such as high definition video files) to and from central storage. This issue will also need to be addressed as part of any storage solution.

8.6 Conclusions

The Part 101 Rules provide potentially significant constraints on the utility of RPAS to Police. These rules interact with the Civil Aviation Act 1990 and the Search and Surveillance Act 2012 to create a wide range of circumstances in which using a RPAS might constitute trespass surveillance.

Part 102 certification is required for Police to be able to make best use of RPAS. In particular, CAA may grant privileges to fly over property without permission of the owner or occupier, placing RPAS on the same footing as manned aircraft. Police contracted an external SME to prepare the required manual of operating procedures, and this is now sitting with the Civil Aviation Authority for approval.

Technical systems are required for the storage of imagery collected by RPAS to ensure that evidential requirements are met. There is a need to develop (with Police ICT) a "national storage capability" for all RPAS evidential and non-evidential data.

9 Certification, Resourcing, and Pilot Training

As discussed in the previous section, certification under Part 102 of the Civil Aviation Rules might provide significant benefits for the operational deployment of RPAS. Privileges to operate outside of the constraints of the Part 101 rules are granted on the basis of written procedures which mitigate the risk of the departure from the rules. As such, there is a strong expectation from the Civil Aviation Authority that pilots will receive appropriate initial training, ongoing (annual) recurrent training and competency assessment, and that pilots will comply with the written procedures. A single person is designated as having primary responsibility for all of the organisation's RPAS operations, and must be approved by the Civil Aviation Authority as suitable to hold that role.

This section describes the Part 102 organisational structure adopted for Police, followed by both human and technical resourcing requirements. Pilot training requirements under Part 102 certification are then discussed.

9.1 Part 102 Organisational Structure

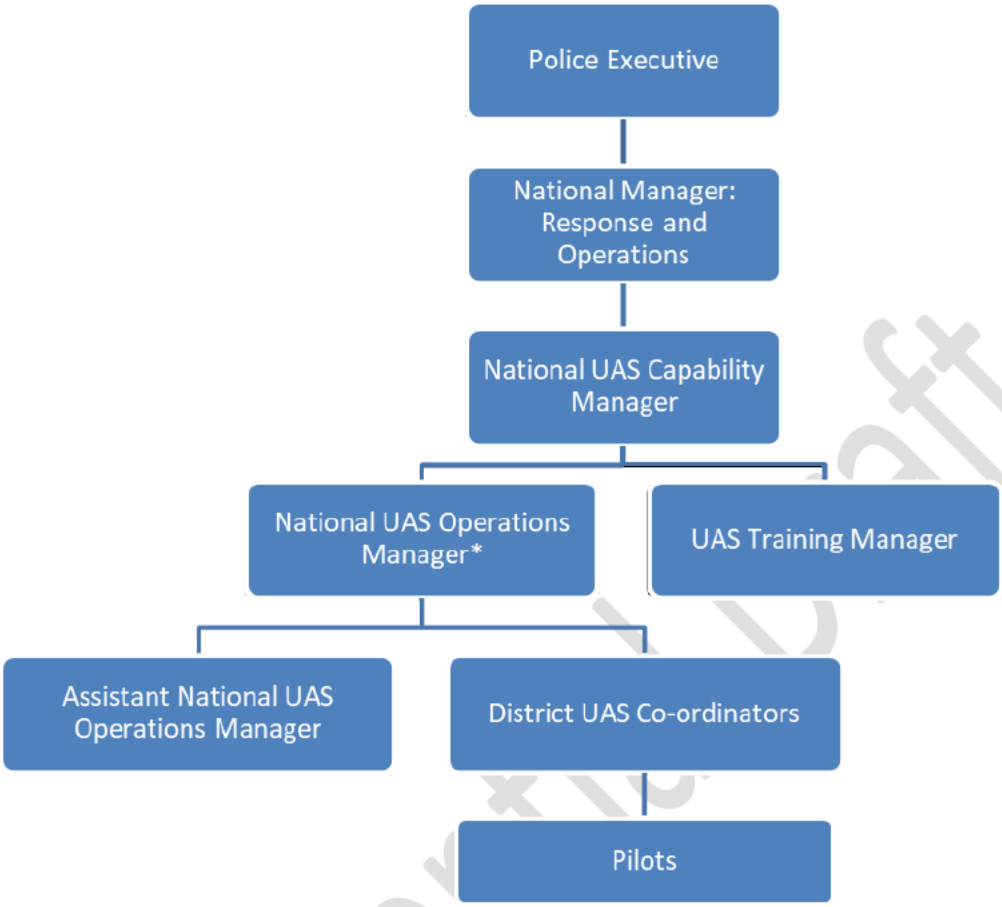
The organisational structure currently adopted for Part 102 certification is shown in Figure 24 below. The business owner for Part 102 certification is the National Manager: Response and Operations. Reporting to the National Manager: Response and Operations is the National UAS Capability Manager, who has responsibility for managing UAS capability as a whole, including the technological capability, operations, and operator training.

The National UAS Capability Manager has two reports: the National UAS Operations Manager and the UAS Training Manager. The National UAS Operations Manager has primary responsibility for all RPAS operations and is the person who must be approved by CAA. The roles of National UAS Operations Manager and the UAS Training Manager are currently held by the same person, but this could change if the required time commitments of the roles are sufficiently high.

Notionally reporting to the National UAS Operations Manager is an Assistant National UAS Operations Manager and District UAS Co-ordinators. The Assistant National UAS Operations Manager role ensures that there is always at least one person who can be contacted by pilots in the event of an accident involving a RPAS, or if pilots otherwise need to obtain authorisation for an activity. The district UAS Co-ordinators will not necessarily be RPAS pilots, but will have responsibility at a district level for co-ordinating RPAS acquisition, training, and deployment.

The top four layers of the organisational structure reflect the structure adopted by FENZ for its Part 102 operations. Having the same structure facilitates interaction between the two organisations, and supports a common All-of-Government approach to RPAS.

Figure 24: Organisational Structure adopted for Part 102 Certification



Position descriptions for the various roles are provided in Appendix D.

9.2 Resourcing Requirements

The introduction of a new capability with attendant management, training, and oversight responsibilities also means that there will be additional ongoing resourcing requirements in both time and budget. It is readily apparent from the position descriptions in Appendix D that the National UAS Operations Manager, in particular, has a significant range of responsibilities, and that discharging those responsibilities effectively will require significant time commitment. It is anticipated that, for an organisation the size of Police, the combined roles of National UAS Operations Manager and UAS Training Manager will require 1 full time equivalent staff member.

In addition to the people holding the relevant positions, there is also a requirement for technology to provide the information necessary to enable the appointees to be able to provide sufficient oversight of police RPAS operations. First, there is a need for information to be gathered about each deployment, with real time alerts to the National UAS Operations Manager in pre-defined circumstances that indicate a high risk that needs to be actively managed. The same information can be used to analyse deployments over time, including for trends relating to accidents and incidents associated with RPAS use. The Part 102 operating procedures manual includes a flight planning form that would ideally be converted to a cell phone app that can be deployed on police phones.

Second, there is also a need for a system that can both monitor and manage the technical aspects of the RPAS fleet. The DJI FlightHub software can monitor the maintenance status of the RPAS fleet, manage the deployment of firmware updates after they have been assessed as safe, s.6(c) OIA [redacted] Being able to monitor the maintenance status of the fleet and ensure that maintenance is performed according to schedule is a Civil Aviation Authority requirement under Part 102 certification. It is understood that the cost of the FlightHub software is in the order of $14,000 to $20,000 per annum. DJI FlightHub can be installed and run on a police server without sending data to the DJI cloud.

FENZ is trialling a management system called AvCRM which has been designed for unmanned aircraft operators in Australia. This system enables online job planning and risk assessments, escalating jobs for approval if required. This system also interfaces with the DJI cloud, enabling automated logs for the flight time of each aircraft and each pilot. The publicly advertised price for AvCRM is $4,000 per annum for 20 users. Given the anticipated number of Police RPAS pilots and RPAS, it is likely that this will have a similar cost to DJI FlightHub.

9.3 Pilot Training

9.3.1 General Pilot Training

One of the risk controls required by CAA when granting privileges to operate outside the constraints of Part 101 is that the pilots receive appropriate training. The Executive has previously decided that police RPAS pilots must have received training to a level that CAA deems appropriate for Part 102 level operations before they are authorised to fly a RPAS on police operations.

At this stage of maturity for police RPAS operations, this training can only be provided by external aviation training organisations certified by the CAA. To date, training providers have been engaged by districts as required. This approach has enabled the rapid roll-out of capability across the districts. However, given the lack of a mandated syllabus from the Civil Aviation Authority, there is a risk that pilots in different districts might have received different levels of training.

Standard RPAS pilot training delivered by CAA-approved aviation training organisations does not include any police-specific material, such as consideration of RPAS as visual surveillance devices. However, one of the contracted training providers has been able to provide this training, with a module on the application of the Search and Surveillance Act 2012 delivered by a trainer with expertise in this area.

9.3.2 Night Operations

Under Part 101, a RPAS is only allowed to fly at night if it is shielded (refer note 27 above) or indoors. While this may allow operation in some tactical scenarios, it will not allow search, surveillance, or situational awareness from a height higher than the top of trees or rooftops within 100m of the RPAS.

As a part of the Part 102 Certification, Police has applied for the privilege to fly unshielded at night. Operation at night has significant challenges associated with depth perception (and therefore being able to judge the distance of the RPAS from obstacles) and judging the orientation of the RPAS (and therefore being able to judge the direction that the RPAS will fly with a control input). CAA therefore requires additional training and a one time "night rating" for pilots approved to fly at night.

9.3.3 Beyond Visual Line of Sight

While RPAS are readily capable of flying beyond the line of sight of the pilot, the procedures required by the Civil Aviation Authority are likely to be exacting and relatively complex. Additional training will be required to ensure that pilots have the knowledge and skills to comply with whatever procedures are approved.

9.3.4 Operations-Specific Training

A review of training materials provided by the aviation training organisations shows that most of it is generic RPAS training material lacking specific application to Police. Appointment of a single nationwide training provider would enable police-specific training materials to be developed that would enhance the effectiveness of training delivered. Operational training is also required for specific use cases, such as tactical situations, search and rescue, and crash scene photography.

9.3.5 Non-GPS Training

All modern RPAS use GPS for stabilisation and holding an accurate position. However, there are situations in which the GPS will fail. GPS signals are weak and can be blocked by concrete and steel structures, by rock walls (such as in a gorge), or by high hills or mountains. Concrete and steel structures and rock walls can also reflect GPS signals so that the RPAS has a false GPS position: that will not be a problem if the RPAS remains in the one position, but if it is transiting across an area then a sudden significant change in GPS position as it switches from a false reflected signal to a correct signal could cause erratic behaviour.

An example of the effect on police operations is provided by a forensic photography operation in Auckland in December 2019. The photographer reported:

> *The scene was from a sudden death where a male has jumped from a crane. CIB requested that a photograph been taken from the height on the crane. I deployed the drone within the building site.*
>
> *Because of the large concrete towers directly around me the drone struggled to get an accurate GPS signal. As the craft flew it was reading its height incorrectly and was reading that it was 120 meters up its maximum height when it was only about 20 meters.*
>
> *I manged to take a few overhead photographs of the scene but could not take the drone any higher. I attempted to change the height setting for the drone and to also control the drone manually but it still would not let me go any higher. I switched the drone back to Auto but as I could feel the craft was not responding as it should I terminated the flight and brought it back down.*

s.6(c) OIA

[redacted]

This example highlights the importance of police RPAS pilots being able to fly in non-GPS mode. This is a challenging flight mode that requires specific training. Feedback from the districts that have undertaken pilot training and externally-administered flight tests during the proof of concept period also indicates that dedicated training time is required.

9.4 Conclusions

The organisational structure required with Part 102 certification is likely to require 1 full time equivalent staff member.

An "app" needs to be developed for use on police devices to automate the flight planning required by the Part 102 procedures.

There is also a need for software to enable centralised management and oversight of some aspects of the RPAS fleet and police RPAS operations.

Part 102 certification will potentially enable police to fly "unshielded" at night, and beyond visual line of sight. Specific training will be required for both of these functions.

Training should include the requirement to be able to fly in non-GPS mode, as situations will arise in which flying without GPS is necessary.

Training should include police-specific operational constraints such as the Search and Surveillance Act 2012, and operations-specific training.

A single training provider should be appointed to provide consistency of training and approach across Police.

10 RPAS as a component of Air Support

For the purpose of this report, "air support" (lowercase) is the use of aircraft to provide overhead imagery to support police operations. This might be provided by small RPAS as described in this report, or by manned aircraft (fixed wing or helicopters).

The Police Air Support Unit (ASU) uses helicopters with highly advanced optical and infra-red sensor equipment; this specialist capability is very expensive to operate, but used appropriately, has a significant impact on the efficacy of policing. The helicopter capability operated by ASU can also be used for tasks that are impossible with RPAS, namely transporting people and equipment; not only is this currently impossible, but it will remain impossible for the foreseeable future.

This section describes the role of small RPAS as an immediate component of air support. The possible future role of larger fixed wing RPAS is discussed, but a separate study would be required to assess the feasibility of such aircraft as a component of air support.

10.1 Small RPAS as a component of air support

RPAS are a complement to the existing air support resource of Eagle rather than a substitute for it. By its very nature, Eagle primarily operates from a fixed base, and must fly from that base to the location of interest.

RPAS provide a much lower level of capability that is low cost and potentially immediately available. s.6(c) OIA [redacted]

In a 2017 report[35] investigating demand for police air support in the United Kingdom (jurisdiction covering Wales and England), there was no evidence that demand for air support had reduced after introduction of RPAS to the police mix of air support options.

The case studies presented in this report reflect three air support scenarios: a RPAS is the appropriate form of air support; complementary use of manned aircraft and a RPAS; and a manned aircraft or Eagle is the appropriate form of air support. These three scenarios are described below.

Scenario 1: RPAS. In some instances a RPAS will be the appropriate form of air support. It is a low-cost and immediately available form of air support that has all the capabilities required for the job. As noted in the arson case studies, the RPAS may even be able to obtain scene photographs that would be impossible to obtain with a helicopter.

Scenario 2: Complementary Capabilities. In some instances both a manned aircraft and a RPAS will provide complementary capability. The speed and range of the manned aircraft will enable large areas to be searched, but the RPAS will be required for close surveillance or accessing areas that cannot be accessed by the manned aircraft. Three case studies that illustrate this complementarity are:

- The September 2019 search at Muriwai (Section 3.1.1), where Eagle was able to search long stretches of coastline, but a RPAS was able to search in areas where Eagle had limited visibility.

[35] HMICFRS 2017, p.75

- Operation Simpson, in which a search helicopter was able to discount large parts of the potential search area.
- s.6(c) OIA [redacted]

Scenario 3: Manned Aircraft / Eagle. In some instances a manned aircraft will be the only feasible option for air support. The Bell 429 utilised by Air Support has a maximum cruise speed of 150 knots (278 km/h). In comparison, even a high specification RPAS have much lower maximum speeds, and are unable to even reach the maximum legal open road speed of 100km/h.[36] RPAS also suffer from limited endurance (typically 25 minutes). The ability to fly long distances is also restricted by the requirement in the Civil Aviation Rules for the RPAS to remain within line of sight of the pilot. These factors collectively mean that a small RPAS is unsuited to tasks such as pursuing fleeing drivers. Accordingly, there are no case studies in this report where a RPAS has been used for an active fleeing driver pursuit.

The optimal mix of air support can be achieved by utilising RPAS where it is timely and efficient to do so, and utilising Eagle (or other contracted air support) where more advanced capabilities are required. RPAS are not appropriate at this point in time for following high speed vehicles or tracking vehicle movements across multiple suburbs. However, RPAS are highly effective as “flying binoculars” that provide situational awareness, and can be effective in situations where it would not be appropriate to utilise a helicopter.

10.2 Larger Fixed-Wing RPAS

In the medium term it is possible that larger fixed-wing RPAS may be able to undertake some of the tasks currently performed by Eagle, such as fleeing driver tracking. If they are able to do this at lower cost, then it may enable fleeing driver tracking to be expanded to locations such as Christchurch, Hamilton and Wellington. Such capability might also be able to be utilised for automatic number plate recognition for wanted offenders.

As with Eagle, it is likely that the sensor packages needed for the required level of capability would be subject to ITAR restrictions and require US State Department export approvals.

[R] The RPAS capability needed for such applications includes aircraft such as the Boeing/Insitu ScanEagle. Originally developed for fisheries patrol, this RPAS was adopted by the US Marine Corps as a key element of their ISR capability. The ScanEagle has also been adopted by the US Navy, the US Coastguard, the Australian Army, and the Australian Navy. It is understood that Queensland Police will receive a demonstration of the capability of the ScanEagle in July 2020.

If a feasibility study were to be conducted, it would need to address issues such as:

- Concept of operations – altitude, location, airspace

[36] The Aeryon SkyRanger has a maximum speed of 50km/h, and the DJI Matrice 200 series and Matrice 300 RTK have a maximum speed of 82km/h. For more information on these drones see Appendix B.

- Whether the available technology allows for launch on request or whether a persistent overflight would be required
- Required imaging capability and whether that would trigger ITAR restrictions
- Whether aircraft would be Police owned and operated aircraft or a private contractor would be used
- Ongoing maintenance and airworthiness requirements
- Required approvals from the Civil Aviation Authority
- Likely costs
- Identification and management of privacy issues including imagery recording, storage, and deletion
- Identification and management of any other issues arising from the Search and Surveillance Act 2012
- Provision of live imagery to the relevant DCC and NCCC
- Relationship to the existing Air Support Unit; and
- Public perception.

This evaluation of these issues and this level of capability is outside the scope of this report.

11 Conclusions

The research questions posed at the start of this evaluation are:

- What have/do districts use RPAS for (1 November 2019 through 11 June 2020)?
- What RPAS capability is needed by districts/pilots/photographers?
- Does RPAS usage increase safety for police staff?
- Compare efficacy of RPAS usage to other options.
- To what extent can RPAS be used to maximise the benefits of air support to the delivery of frontline services?
- How can RPAS form an integrated part of the wider policing strategy, supporting the Police Strategic Framework and Business targets?
- To what extent do regulatory constraints, including civil aviation rules and privacy barriers, impact on the effective use of RPAS for policing?
- Identify the efficacy and/or impact of: operator training, equipment, weather conditions, supporting technology, public perceptions.

This section summarises the answers to each of the above questions, with reference to earlier parts of this evaluation report where appropriate.

11.1 Districts use of RPAS

During the period of the proof of concept, districts have used RPAS for:

- locating fleeing offenders
- situational awareness during tactical operations;
- arson and crime scene photography
- photographing some accident and sudden death / suicide scenes
- photographing some serious crash scenes
- situational awareness during AOS operations.

In addition, case studies have been demonstrated which demonstrate the utility of RPAS for:

- SAR operations, particularly to look in locations that are difficult or dangerous to reach
- situational awareness during anti-social mass gatherings that could pose a risk to police staff and members of the public.

RPAS were not used for general monitoring purposes during the covid-19 lockdown.

11.2 Required Capability

The capability required for effective use of RPAS includes both the RPAS themselves, and back-end equipment for processing and disseminating imagery.

The PoC has demonstrated that small RPAS such as the DJI Mavic are capable of delivering significant benefit to frontline policing in a wide range of operations. Given the outcomes of the PoC and the evaluation of cyber issues, it would be appropriate for each district to have a fleet of approximately six Mavic 2 Enterprise RPAS. Given the large number of these craft that would be purchased, it would be appropriate for centralised purchasing arrangements to obtain volume discounts. Centralised purchasing arrangements would also ensure that the Enterprise models, with the associated cyber protections, were the models purchased.

The PoC also identified a need for greater stand-off capability and infra-red imagery for night operations, which translates to a requirement for higher capability RPAS such as the DJI Matrice 200 series and DJI Matrice 300 RTK. On a number of occasions, Police has partnered with FENZ to be able to utilise its RPAS (and pilots), but that is not a sustainable model when FENZ has limited resource that might be committed elsewhere. Tasman District, which participated in the PoC, has already committed purchasing a DJI Matrice 300 RTK.

During training courses, pilots identified a need to be able to add particular 'apps' to police phones or devices. These apps include Airshare, Airways New Zealand's "IFIS" app for pre-flight information, potentially mapping applications, and the DJI app required for the RPAS. During the trial, pilots were loading these apps on personal devices because the apps were not approved for police devices. The security of third party apps cannot be guaranteed, so it might be appropriate to provide stand-alone police devices specifically for using these apps.

During the PoC the ability to process and disseminate imagery has been limited. Police photographers are able to use RPAS footage as another source of digital imagery, and process it according to their standard processes. Non-photography staff do not necessarily have access to stand-alone desktop computers for downloading and storing imagery, and they might not be aware of the existing best practice procedures.

In a tactical or SAR situation, the ability for the commander or other personnel to view the imagery in real time is limited to being able to "look over the shoulder" of the pilot and observe what is on the flight controller screen. It is understood that the ability exists to be able to connect the flight controller to a HD TV, enabling others on site to view the live feed without interrupting the pilot.

11.3 Safety of Police Staff

Small RPAS have demonstrated ability to increase the safety of Police staff. This has arisen in:

- **SAR operations**, where RPAS have been used to avoid placing police and other search staff in dangerous locations. For example, in one case study, a RPAS was able to inspect sea caves at Muriwai rather than having SAR staff in a small boat in dangerous sea conditions.
- **Tactical operations**, where RPAS provide a significantly improved level of situational awareness compared to having no air support. In one case study, the absence of air support enabled an offender to get behind an AOS cordon. Other case studies demonstrated the ability to confirm the location of an offender, and to observe buildings that had not yet been cleared while staff were clearing another building.
- s.6(c) OIA [redacted]

11.4 Efficacy of RPAS usage

The efficacy of RPAS depends on what they are being used for. Searching large areas, or traversing long distances quickly, can currently only be performed by manned aircraft. However, RPAS are able to obtain direct overhead photography in a way that is very difficult with helicopters, can reconnoitre locations that are difficult or impossible with manned aircraft, and perform mapping and surveying operations (e.g. for serious crash) that cannot be performed with manned aircraft.

RPAS also have complementary capabilities to a Delta team. A case study was presented in which a RPAS was able to observe a fleeing offender and direct officers to intercept the individual, with the Delta team unable to pick up the scent of the individual when they arrived. However, this action is only possible when the offender is "in the open". If the offender is in bush or taking advantage of other cover then they might not be observable by RPAS, and a Delta team might be the only option for tracking the individual.

Used in the appropriate circumstances, RPAS will significantly improve the ability of police to locate people of interest and provide relevant intelligence and situational awareness, while also improving safety.

11.5 Maximising the benefits of air support

Small RPAS are a key component of maximising the benefits of air support for the delivery of frontline services. RPAS are relatively low cost and have a narrow range of capability compared to manned aircraft. For example, RPAS cannot (at least currently) transport people from one location to another, travel faster than a fleeing driver, or search large areas.

However, the capability that RPAS do have can be utilised to deliver significant operational benefits in the circumstances identified in this report. The use of manned aircraft in many instances would be prohibitively costly. In addition, as discussed above, there are some circumstances in which RPAS are more effective than manned aircraft.

The benefits of air support can be maximised by utilising each type of air support in the role(s) that it is best suited for. Three air support scenarios were identified: in some situations RPAS will be the preferred form of air support due to cost and capability; in other situations manned aircraft and RPAS will provide complementary capabilities; and in other situations manned aircraft will be the only feasible option for air support.

11.6 Delivering Against the Police Strategic Framework and Business Targets

Use of RPAS is an area of innovation that can make a tangible contribution to achieving a number of the goals, strategies and objectives in the Police Strategic Framework.

In particular, adoption of RPAS by Police will enhance the following areas:

Goal: target and catch offenders. As demonstrated by a number of case studies in this report, RPAS enhance the ability of Police to target and catch offenders. As discussed in Section 4.1, the first deployment during the PoC period resulted in the capture of an offender who would have otherwise escaped. The case studies in this report also provide examples of RPAS providing the best available evidence for establishing the cause of an accident or death.

Strategy: looking after our people. RPAS provide a modern innovative means of equipping and enabling police personnel. Whether undertaking a search, executing a tactical operation, or gathering evidence, RPAS enable staff to perform more effectively, obtain better situational awareness, and gather the best available evidence.

RPAS also ensure that police personnel are safe and feel safe. During a search, a RPAS can be deployed to areas where it is unnecessarily dangerous for a person. During tactical operations, RPAS can provide enhanced situational awareness which will potentially avoid police inadvertently walking into dangerous and life-threatening situations.

Transformation programme: modernising our service delivery. RPAS can be part of the transformation of Police service delivery. The use of modern technology can find missing people faster, can ensure that tactical teams raid the right address, and deliver tangible benefits to the public in the form of substantially reduced road closure times in the event of a serious crash.

11.7 Regulatory Constraints

11.7.1 Civil Aviation Regulatory Constraints

Part 101 of the Civil Aviation Rules includes a number of provisions that can constrain the ability to use a RPAS on police operations. Notwithstanding those constraints, the PoC was conducted solely under Part 101 and readily demonstrated significant benefits to Police.

Operational effectiveness can be further improved by way of certification under Part 102 of the Civil Aviation Rules, which will enable 'unshielded' operation at night, flight over third-party property, and operation in low flying zones when required. Flight beyond visual line of sight of the pilot may also be possible if the applicant is able to demonstrate that they can do so safely. Police has applied for Part 102 certification.

11.7.2 Privacy / Search and Surveillance Act

There are no significant privacy barriers with the Police use of RPAS. RPAS are a visual surveillance device for the purposes of the Search and Surveillance Act 2012 and subject to the same privacy constraints as any other visual surveillance device. This means that a warrant is normally required for observation of private activity in private premises, and time thresholds exist for the observation of private activity in the curtilage of private premises. This did not impose any unreasonable constraints on police use of RPAS during the PoC.

11.8 Operator Training

Operator training conducted during the PoC trial demonstrated a variable standard of training across the contracted organisations. Although all training organisations were certified aviation training organisations under Part 141 of the Civil Aviation Rules, the quality and content of the courses varied considerably. All training providers delivered training on the Civil Aviation Rules, but only one was able to deliver training tailored to police operational circumstances. The same training provider had the expertise to deliver training on the Search and Surveillance Act. In addition, not all training providers ensured that pilots were competent to fly in conditions where GPS is not available.

In addition to the initial qualification training provided by the contracted training providers, there is also a need to develop role-specific training for police pilots. There is not yet a clear picture of what that training should "look like". In particular, it is unclear whether the best model for police RPAS pilots is to develop pilots within each specialist area such as AOS, serious crash, SAR, etc, or whether it is better to develop generalist pilots that can be called on as required. A strength of the Police organisation is that districts are able to trial the model that best fits their individual circumstances.

11.9 Technology Issues

11.9.1 Equipment

The current Police RPAS fleet is well suited to generalist use, including crime scene and serious crash photography. However, because of cyber risk concerns, it is important that future purchases of drones are the DJI Enterprise series of drones, which enable additional protections to be implemented, including protections as simple as password protection of the drone and associated data.

Lower capability models such as the DJI Mavic Air should be investigated as providing the potential for a 'drone in every car', noting that these models do not have the cyber protections available in the DJI Enterprise models. As such, a specific risk assessment will need to be conducted on the use of these RPAS.

Tactical operations require a greater stand-off capability, which at district level can be provided by the higher capability DJI Matrice 210 and DJI Matrice 300 RTK.

Tactical operations might also benefit from the use of micro drones for tasks such as clearing a building. These were not evaluated as part of the PoC.

Key risk controls that should be implemented with DJI RPAS are:

- s.6(c) OIA [redacted]
- [redacted]
- [redacted]
- [redacted]

There might be benefit in considering adopting additional high specification RPAS for use at a regional (Northern, Central, Southern) level. This capability could include advanced quadcopters such as the Aeryon SkyRanger and fixed-wing capability such as the Aerovironment Puma; both of these craft would enable inter-operability with FENZ and the NZDF.

Restrictions on transporting batteries mean that commercial airline flights cannot be used to transport higher capability RPAS. The distribution of higher capability RPAS amongst districts and regions should take account on the potential restrictions in transportation.

11.9.2 Support Systems

Additional technology systems are required to support police use of RPAS. Pilots have identified apps that are useful for RPAS operations that cannot be installed on police devices. Efficient implementation of the systems required for Part 102 certification will require an app to be developed for police devices to automate planning and post-flight reporting.

Additional systems will be required to provide centralised management and oversight of the RPAS fleet. DJI Enterprise RPAS can be coupled with the DJI FlightHub software to provide centralised tracking of the maintenance status of RPAS, centralised control of firmware upgrades, and ensuring that the RPAS data is uploaded to a police cloud server rather than a cloud server located in a foreign country.

Finally, standardised and consistent processes and technology is required for the storage and management of both evidential and non-evidential data.

11.9.3 Weather Conditions

All aviation is affected to some degree by weather conditions. Small RPAS are generally not weather proof, so cannot be used in rain. Larger RPAS might be partially weather proof, but they are still not fully waterproof and care must be exercised when using them in in rain.[37]

Small RPAS are also more affected by the wind than larger more powerful RPAS. At its simplest, it takes more wind energy to move a 9kg RPAS (such as the DJI Matrice 300 RTK) than it does to move a small 900g RPAS (such as the various DJI Mavic models).

These weather limitations mean there will probably be times when RPAS cannot be used to map and clear a serious crash scene, or cannot be used for a search.

11.10 Public Perceptions

During the PoC, media coverage of the use of RPAS in police operations included:

18 November 2019	Northland Police use drone to locate fleeing offender.[38]
27 November 2019	High drama on Mangonui Harbour as AOS storms catamaran.[39]
12 December 2019	FENZ drone launched from Deodar at White Island.[40]
25 January 2020	Drone used in search for body of missing teen.[41]
8 February 2020	USAR drone used in search for missing hunter on West Coast.[42]
14 February 2020	Police use drone in search for missing British tramper.[43]
s.6(c) OIA [redacted]	[redacted]
24 March 2020	Private drone pilot used to help search for crashed paraglider.[45]
22 May 2020	Police use USAR drone in search for missing trampers in Kahurangi National Park.[46]

37 For example, the UK Air Accident Investigation Board reports that between X and Y there were 10 in-flight motor failures of the Matrice 210, all resulting in a crash. After investigation, it was established that

38 https://www.nzherald.co.nz/technology/news/article.cfm?c_id=5&objectid=12285565

39 https://www.nzherald.co.nz/northern-advocate/news/article.cfm?c_id=1503450&objectid=12288907

40 https://www.newshub.co.nz/home/new-zealand/2019/12/white-island-eruption-what-police-boat-was-doing-so-close-to-shore.html

41 https://www.stuff.co.nz/national/119041313/search-for-missing-swimmer-in-dunedin-continues

42 https://www.stuff.co.nz/national/119234886/search-fails-to-find-missing-hunter-in-brutal-west-coast-terrain

43 https://www.bbc.com/news/uk-england-essex-51500453

44 s.6(c) OIA [redacted]

45 https://marlboroughweekly.co.nz/drone-rescue-for-paraglider/

46 https://www.stuff.co.nz/national/300018368/aerial-and-ground-searches-grow-as-tramper-search-intensifies

23 May 2020	Drone deployed to find body down a cliff at Cape Farewell.[47]
25 May 2020	Northland carjacking with baby in the back seat. Drone used in search but unable to find driver.[48]
2 June 2020	Body of missing tramper found with aid of drone 500m downstream from river crossing point[49]

There was no negative media coverage of police RPAS use during the PoC. This suggests that, to the extent members of the public may have been aware of police use of RPAS, none were sufficiently concerned that they sought to bring the issue to the attention of media or politicians. If so, this is consistent with surveys of public perceptions of police use of drones conducted in the United Kingdom. In 2016, an online survey of the British public conducted on behalf of the Royal Aeronautical Society found that 91% of respondents were in favour of RPAS being used for emergency response, and 83% if respondents were in favour of drones being used for police surveillance generally.[50] Similarly, in 2017 a further online poll of 2000 UK adults found 86% of respondents in favour of RPAS being used for emergency response, and 79% of respondents in favour of RPAS being used for "police assistance".[51] In 2019, a survey of 1,520 UK adults found that 87% of respondents were in favour of RPAS being used for search and rescue, 84% of respondents in favour of RPAS being used for "observing fires, spills and other emergencies," and 80% of respondents in favour of RPAS being used for "identifying and tracking criminals".[52]

47 https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12334327

48 https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12334462

49 https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=12336394

50 ComRes (2016) Royal Aeronautical Society Drones Polling. http://comresglobal.com/wp-content/uploads/2016/06/160513_Royal-Aeronautical-Society_DronesPolling_Tables.pdf

51 Nesta (2017) Drones in our cities by 2020, predict a quarter of people - rising to half by 2024, 15 December 2017. https://www.nesta.org.uk/press-release/drones-in-our-cities-by-2020-predict-a-quarter-of-people-rising-to-half-by-2024/

52 Elaine Whyte and Joanne Murray (2019) Building Trust in Drones, PWC. https://www.pwc.co.uk/intelligent-digital/drones/building-trust-in-drones-final.pdf

12 Glossary

AOS Armed Offenders Squad

ASU Air Support Unit

CAA Civil Aviation Authority

DJI Chinese firm Dai Jing Innovations, a leading manufacturer of consumer and professional RPAS.

Drone An unmanned aircraft, usually remotely piloted. See also RPAS, UAS, UAV.

EOC Emergency Operations Centre

FENZ Fire and Emergency New Zealand

FLIR Forward Looking InfraRed, also refers to FLIR Systems Inc., the leading manufacturer of FLIR technology.

GPS Global Positioning System

ISR intelligence, surveillance, and reconnaissance

ITAR International Traffic in Arms Regulations

MP megapixel

NZDF New Zealand Defence Force

NZDT New Zealand Daylight Time

POA Probability of Area

RCMP Royal Canadian Mounted Police

RPAS Remote Piloted Aircraft System

SFP Safe Forward Point

UAS Unmanned Aerial System

UAV Unmanned Aerial Vehicle

USAR Urban Search and Rescue, a specialist taskforce within FENZ

13 References

Note: not all websites referenced in this report are included in the list below.

ABC10 Originals (2020a) Sacramento Police Department rolling out cutting edge micro-drones, Part One, YouTube, 11 February 2020. https://www.youtube.com/watch?v=Pwds8YwpU-k.

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Appendix A: "Drone Use Report" Form used for Data Collection

During the Proof of Concept pilots were asked to complete a "drone Use Report" to provide data on each operational deployment. This appendix shows the form.

"Drone" use Report

RESET FORM

Pre-flight

1. Basic flight details

District:

Launch date:

Launch time:
24-hour clock

Launch location:
Provide an accurate and easily identifiable location - ideally, GPS coordinates.

Pilot name/s:
List all pilots

Observer/s:
List all observers

2. Airspace classification

Select appropriate airspace from the drop-down box above

Click here for NOTES on AIRSPACE

3. AirShare

Did you file a flight plan using AirShare?

3.1. Restricted airspace

Was permission obtained?

3.2. Uncontrolled aerodromes

Was permission obtained?

3.3. NOTAM - Read and filed? YES ◯ NO ◯

4. Purpose / context for drone use

Select from the drop-down box above or, if "OTHER", describe below

OTHER:

5. Submit Comms event via radio, Mobile Responder or desktop—Event code 4H

Code 4H and relevant text, including "UAS", "UAV", "Drone" or "RPAS"

If "NO" - explain why in "NOTES" on page 4

YES ◯ NO ◯

6. Search and Surveillance warrant

Has a warrant been obtained?

No warrant required because:

Post-flight

7.

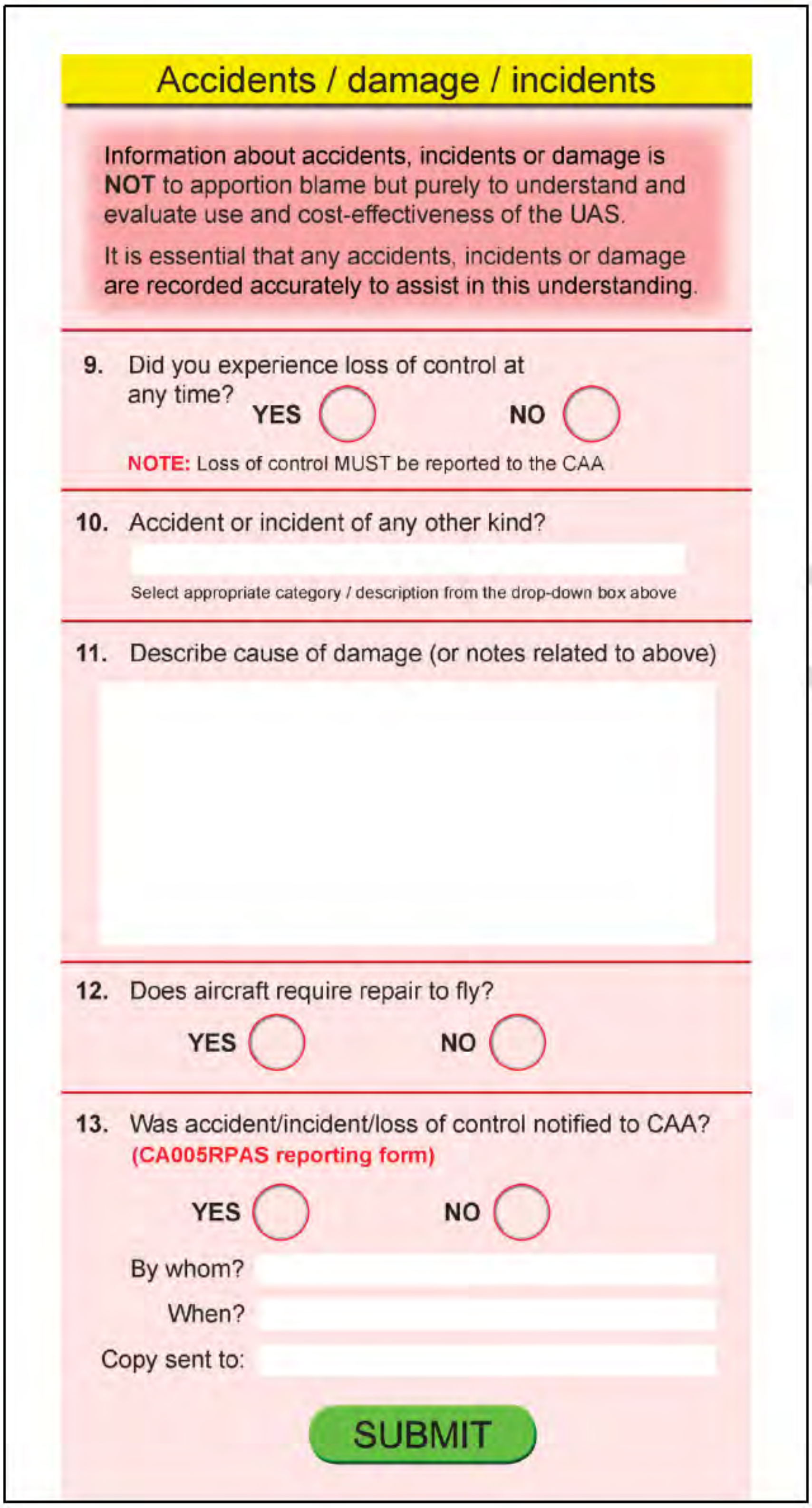
Finish time:
24-hour clock

Record the time the purpose was achieved and/or you went 10/3

8.

Did the aircraft achieve the intended purpose

YES ◯ NO ◯



Accidents / damage / incidents

Information about accidents, incidents or damage is **NOT** to apportion blame but purely to understand and evaluate use and cost-effectiveness of the UAS.

It is essential that any accidents, incidents or damage are recorded accurately to assist in this understanding.

9. Did you experience loss of control at any time? **YES** ◯ **NO** ◯

NOTE: Loss of control MUST be reported to the CAA

10. Accident or incident of any other kind?

Select appropriate category / description from the drop-down box above

11. Describe cause of damage (or notes related to above)

12. Does aircraft require repair to fly?

YES ◯ **NO** ◯

13. Was accident/incident/loss of control notified to CAA? **(CA005RPAS reporting form)**

YES ◯ **NO** ◯

By whom?

When?

Copy sent to:

SUBMIT

The final page of the form provides pilots with notes on airspace, as well as a space for providing additional notes about the flight.

Airspace notes

https://www.airshare.co.nz/maps

Control Zones (CTR)
Control Zones are managed by Air Traffic Control and extend from ground level to a specified altitude. No UAS operations in control zones without ATC clearance unless a shielded operation.

Military Operating Area (MOA)
Require specific approval of administering authority.

Low Flying Zones (LFZ)
Extend from ground level to 500ft AGL. No operation in low flying zones under Part 101

Temporary restricted airspace
Urgent requests to close airspace (temporary restricted airspace) must follow procedure; it might or might not involve ATC, depending on whether airspace is controlled.

ATC

ATC is strictly for operating in controlled airspace.

Airshare
Airshare is only required for control zones. Airshare will give an automatic approval outside of a control zone and that approval means nothing – it is dan-gerous because pilots think it counts as a clearance. Also, for many ops Airshare will not be timely.

NOTES:

RETURN TO FORM

Appendix B: Potential Quadcopter Platforms

This appendix sets out a range of potential RPAS that could be utilised for at various levels of capability.

Table 4 summarises key features for a range of lower capability quadcopters, including relevant RPAS manufactured by DJI.

Table 5 summarises higher capability quadcopters. There are only two major brands providing the requisite level of capability: China-based DJI, and Aeryon systems from the United States. Summary commentary and images of the relevant craft are provided in Figure 19, Figure 20, and Figure 21.

Table 6 summarises the capabilities of the cameras that are available for the higher capability quadcopters.

Table 4: Lower Capability Quadcopters

Company	Model	Country	Encryption	Weight (max)	Range	Flight Time	Weather Proof	Visual Camera Resolution	Visual Camera Zoom	Thermal Camera Resolution	Thermal Camera Zoom	Battery Size Voltage	Battery Size Capacity	Battery Size Wh
DJI	Mavic Air	China	No(WiFi)	0.43g	80m	21 min	ns	12MP	ns	---	---	11.55 V	2375 mAh	27.4
DJI	Mavic Pro Platinum	China	No	0.74kg	7km	30 min	ns	12.3MP	ns	---	---	11.4 V	3830 mAh	43.6
DJI	Mavic 2 Enterprise	China	Yes*	1.1kg	7km	29 min	ns	12MP	2x optical 3x digital	160x120		15.4 V	3850 mAh	59.3
DJI	Phantom 4 Pro V2.0	China	ns	1.375kg	8 km	30 min	ns	20 MP	ns	---	---	15.2 V	5870 mAh	89.2
Yuneec	Typhoon H	China	ns	1.95kg	1.6km	25 min	ns	12.4MP	ns	---	---	14.8 V	5400 mAh	79.9
Yuneec	Typhoon H520	China	ns	2.0kg	1.6km	28 min	ns	20 MP	ns	2.13MP	ns	15.2 V	5250 mAh	79.8
Autel	EVO II	China	ns	1.2kg	9km	40 min	ns	48MP	8x	640x512	ns	11.55 V	7100 mAh	82.0
Parrot	Anafi Work	France	ns	0.45kg	4km	25 min	ns	21MP	3x digital	---	---	11.1 V	2700 mAh	30.0
Parrot	Anafi Thermal	France	ns	0.45kg	4km	26 min	ns	21 MP	3x digital	160x120	ns	11.1 V	2700 mAh	30.0
Draganfly	X4P	Canada	ns	2.5kg	2km	15 min	ns	20MP	3.6x optical	640x512	ns	11.1 V	1350 mAh	15.0
Draganfly	Commander	Canada	ns	2.7kg	2km	25 min	ns	20MP	3.6x optical	640x512	ns	14.8 V	6750 mAh	99.9

Notes: Yes = feature is available; Yes* = feature is available but not known to be validated by GCSB or FVEY partners; ns = not specified = likely No; --- feature is not available.

Table 5: Higher Capability Quadcopters

Company	Model	Country	Encryption	Weight (max)	Range	Flight Time	Weather Proof	Visual Camera		Thermal Camera		Battery		
								Resolution	Zoom	Resolution	Zoom	Voltage	Capacity	Wh
DJI	Matrice 200/210	China	Yes*	6.14kg		24 min	IP43	20MP	30x	640x512	8x	22.8V	2 x TB55 7660 mAh	175 ea
DJI	Matrice 300 RTK	China	Yes*	9kg	8km	55 min	IP45	20MP	23x hybrid optical 200x max	640x512	8x	52.8V	2 x TB60 5935 mAh	313 ea
Aeryon	SkyRanger R60	United States	Yes	5kg	3km-10km	50 min	IP53	20MP	30x optical 60x digital	640x512	4x	??	??	??
Aeryon	SkyRanger R70	United States	Yes	8.5kg	8km	40-50 min	IP54	20MP	30x optical 60x digital	640x512	4x	??	??	??
Aeryon	SkyRaider R80D (ITAR controlled)	United States	Yes	8.5kg	8km	40-50 min	IP54	20MP	30x optical 60x digital	640x512	4x	??	??	??

Notes: Yes = feature is available; Yes* = feature is available but not known to be validated by GCSB or FVEY partners; ns = not specified = likely No; --- feature is not available.

Table 6: DJI Camera Systems for Matrice Series

Camera Model	Applicable UAS	Visual Camera		Thermal Camera		Link
		Resolution	Zoom	Resolution	Zoom	
Zenmuse Z30	DJI Matrice 200/210	2.13MP	30x optical 6x digital	---	---	https://www.dji.com/nz/zenmuse-z30/info#specs
Zenmuse XT2	DJI Matrice 210	12MP	1x, 2x, 4x, 8x	640×512 336×256	1x, 2x, 4x, 8x 1x, 2x, 4x	https://www.dji.com/nz/zenmuse-xt2/specs
Zenmuse H20	DJI Matrice 300 RTK	20MP (zoom) 5184 × 3888 12MP (wide) 4056 x 3040	23x hybrid optical 200x max	---	---	https://www.dji.com/nz/zenmuse-h20-series/specs
Zenmuse H20T	DJI Matrice 300 RTK	20MP (zoom) 5184 × 3888 12MP (wide) 4056 x 3040	23x hybrid optical 200x max	640x512	1x, 2x, 4x, 8x (digital)	https://www.dji.com/nz/zenmuse-h20-series/specs

s.6(c) OIA

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Appendix D: Part 102 Position Descriptions

This appendix provides position descriptions for key roles within the Part 102 organisation, reproducing the relevant pages from the Part 102 Unmanned Aircraft Operations Manual.[54] Position descriptions are provided for:

- **Appendix D.1 National UAS Capability Manager;**
- **Appendix D.2 National UAS Operations Manager;**
- **Appendix D.3 Assistant National UAS Manager; and**
- **Appendix D.4 UAS Training Manager.**

[54] Note that the copyright statement at the bottom of the pages reflects the intellectual property rights of Aviation Safety Management Systems Ltd in pre-existing intellectual property. The entire manual has also been marked 'IN CONFIDENCE'.

D.1 National UAS Capability Manager

4.3 National UAS Capability Manager

Purpose

4.3.1 To define the duties and responsibilities of the National UAS Capability Manager.

Scope

4.3.2 The person with overall management responsibility for NZ Police UAS capability.

Duties and Responsibilities

4.3.3 The National UAS Capability Manager is responsible for overall management oversight of NZ Police UAS capability, including:

- Reporting on the status of NZ Police UAS capability and operations to the Executive;
- Ensuring that adequate personnel are in place to manage NZ Police UAS operations, including ensuring that the positions of National UAS Operations Manager and Assistant National UAS Manager are both occupied, except during the process of appointing a new individual to one of these positions, at which point one of these positions may be temporarily vacant;
- Recommending the acquisition of national capability to the Executive, including airframes, supporting IT infrastructure, and any other capability that should be held at a national level; and
- Recommending the adoption, change, and approval regarding the use of UAS by NZ Police.

D.2 National UAS Operations Manager

4.4 National UAS Operations Manager

Purpose

4.4.1 To define the duties and responsibilities of the National UAS Operations Manager.

Scope

4.4.2 The person with primary responsibility for NZ Police UAS operations.

Reports To

4.4.3 The National UAS Operations Manager is responsible to the National UAS Capability Manager for carrying out the duties and responsibilities detailed in this procedure.

Duties and Responsibilities

4.4.4 The National UAS Operations Manager is responsible for:

- Overall management of UAS operations, including flight operations and supporting ground operations, in accordance with this exposition;

Regulatory

- Liaison with the Civil Aviation Authority;
- Continued compliance with Civil Aviation Authority regulatory requirements;
- Ensuring regulatory approvals remain valid;
- Managing the process for amendment of the NZ Police exposition, including applying to the CAA for approval of changes to this exposition which require prior CAA acceptance (paragraph 5.2.4, page 5-2);
- Ensuring that this manual remains up-to-date, that a current copy is lodged with CAA, and that a current copy is held in the Operations Folder;
- Ensuring that in the event that the Unmanned Aircraft Operator Certificate held by New Zealand Police expires or is revoked that the certificate is immediately surrendered to the Director of Civil Aviation (paragraph 5.1.5, page 5-1);
- Ensuring that if the Unmanned Aircraft Operator Certificate held by New Zealand Police is suspended that the certificate is immediately produce the certificate to the Director of Civil Aviation for appropriate endorsement (paragraph 5.1.6, page 5-1);
- Retention of documents including:
  - personnel records (paragraph 5.5.6, page 5-6); and
  - flight records.

Operations

- Supervising pilots and ground crew as applicable;
- Issuing NOTAMs, and authorising pilots to issue NOTAMs, in accordance with the procedure in section 7.7 (page 7-15);
- Preparing and publishing emergency situation action plans, and normal and emergency checklists;
- Maintaining the inventory of controlled documents and managing the document control system;

- Approving controlled forms and completion of controlled records relating to flight operations;
- Implementing any corrective and preventative actions resulting from internal reviews of flight operations or ground support activities;
- Ensuring pilots are aware of their responsibilities in respect of daily/pre-flight inspections;
- Arranging for and conducting pilot training;
- Ensuring UAV technical logs are completed after each flight or series of flights;
- Ensuring the UAV logbooks are maintained accurately;
- Ensuring all applicable flight records, logs and documents are retained to support maintenance inspections and overhauls as required;

Maintenance

- Maintenance of UAV, facilities, equipment, publications and materials for the conduct of operations;
- Management and application of a tracking system to record and monitor the status of UAV and components, including periodic inspections, scheduled and unscheduled special inspections, component finite and overhaul lives and other maintenance events;
- Overseeing maintenance schedules for the UAV, and modifying the schedule as appropriate after review of maintenance records;
- Ensuring defect incidents are investigated and appropriate action is taken;
- Ensuring UAV's are withdrawn from service when required maintenance has not been accomplished and cannot be deferred;
- Ensuring the standards and procedures contained in the maintenance programme are adhered to;

Occurrence Investigation

- Ensuring NZ Police reports accident and incident information to the CAA in accordance with CAR Part 12;
- Conducting accident occurrence investigations in accordance with the procedures in Section 11 of this manual and CAR Part 12;
- Quarantining records relating to an accident or serious incident and notifying the CAA accordingly;

Qualifications

4.4.5 The National UAS Operations Manager is not required to be a current NZ Police UAS Pilot or to hold an approved UAS pilot qualification. However, the National UAS Operations Manager is required to have completed the ground\theory component of such a qualification.

4.4.6 The National UAS Operations Manager must be acceptable to the Director of Civil Aviation. This will be established by way of a Fit and Proper Person application to the CAA.

D.3 Assistant National UAS Manager

4.5 Assistant National UAS Manager

Purpose

4.5.1 To define the duties and responsibilities of the Assistant National UAS Manager.

Scope

4.5.2 The Assistant National UAS Manager is responsible for ensuring NZ Police UAS operations comply with all applicable Civil Aviation requirements, and for monitoring compliance of NZ Police personnel with the exposition for Remotely Piloted Aircraft operations.

Reports To

4.5.3 The Assistant National UAS Manager is responsible to the National UAS Capability Manager for effectively and efficiently carrying out the duties and responsibilities detailed below.

Duties and Responsibilities

4.5.4 The Assistant National UAS Manager is responsible for:

- As agreed with the National UAS Operations Manager, assisting the National UAS Operations Manager with management of NZ Police UAS operations;
- Carrying out the duties of the National UAS Operations Manager in the event of the absence or temporary unavailability of the National UAS Operations Manager.

Qualifications

4.5.5 The Assistant National UAS Manager is not required to be a current NZ Police UAS Pilot or to hold an approved UAS pilot qualification. However, the National UAS Operations Manager is required to have completed the ground\theory component of such a qualification.

4.5.6 The Assistant National UAS Manager must be acceptable to the Director of Civil Aviation. This will be established by way of a Fit and Proper Person application to the CAA.

D.4 UAS Training Manager

4.6 UAS Training Manager

Purpose

4.6.1 To define the duties and responsibilities of the UAS Training Manager.

Scope

4.6.2 The person nominated appointed to oversee training for NZ Police UAS operations.

Reports To

4.6.3 The UAS Training Manager is responsible to the National UAS Capability Manager for effectively and efficiently carrying out the duties and responsibilities detailed below.

Duties and Responsibilities

4.6.4 The UAS Training Manager is responsible for:

- Developing Operator Training Programs;
- Maintaining Operator Database and currency schedules;
- Set Training schedule and calendar;
- Manging the annual refresher training process (Section 6.4);
- Demonstrating a positive commitment to the NZ Police Health & Safety Policy and associated procedures.

Qualifications

4.6.5 The UAS Training Manager must be acceptable to the Director of Civil Aviation. This will be established by way of a Fit and Proper Person application to the CAA.