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The Prevalence of Violence and Aggression towards Remotely Piloted Aircraft Pilots and their Ground Crew

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Abstract

Remotely Piloted Aircraft (RPA) are unmanned aircraft (UA) which are controlled by a pilot on the ground from a ground control station or by using a handheld flight controller. RPA are used both recreationally, or commercially as a tool to support goods and services provided. Narrative-based accounts from those within the sector report a rising number of events of violence and aggression from the public towards RPA pilots and their ground crew. However, these concerns are based on social media reports, news articles, and anecdotal accounts, rather than through empirical research. Although current literature around public acceptance of UA sometimes includes those within the sector, the focus of extant research is squarely on the interests of the public rather than from the perspective of the RPA crew. The main purpose of this research is to identify how widespread or prevalent violence and aggression towards RPA pilots and their ground crew is; and, if identified, to ascertain the nature of these threats and aggression towards RPA pilots and ground crew.

To address these questions, an online survey was undertaken which generated 337 responses, 293 of which were valid and comprised the sample. A mixed-method approach was taken to balance richness of data (qualitative, for describing experiences) and generalisability (quantitative, for user and flight characteristics). Given the wide range of data collected, a similarly wide range of analyses were used. This included an overall grounded theory approach to the qualitative data utilising both content and thematic analysis. The quantitative data utilised chi-squared goodness of fit tests, single sample t-tests, and regressions (linear, ordinal logistic, and binary logistic).

This research identified 52.90% of participants had experienced violence and aggression during RPA operations, with the nature of these events being predominantly anger and verbal aggression. This research also revealed a small number of events (24) where the instances of violence and aggression involved firearms. Additionally, this research determined that professional RPA users with higher flight hours were more likely to experience violence and aggression while flying an RPA. Interestingly, this research identified that there was no single RPA application (e.g., photography) that attracted significantly more threats of violence and aggression than any other application. This suggests that violence and aggression towards RPA users may be a threat for the whole RPA sector rather than just one area.

This thesis provides implications for aviation regulators, the police, and government agencies associated with public privacy regulations. One critical implication for both the aviation regulator and the police is to recognise the danger to public safety of an RPA pilot or crew member being distracted by angry members of the public. Although the intent from the public member may not directly be towards interference of the aircraft, the consequences of the angry public members actions may jeopardise the safety of the aircraft. For this reason, this research recommends further investigation into dealing with malicious behaviour towards the RPA and RPA user from the public.

This research also determined the majority of these threats against RPA users were unreported to the aviation regulator or to the police. The implication of this, is that neither organisation will have an overall understanding about what is occurring in the sector and, therefore, will be unable to address this safety concern. Both organisations should encourage RPA users to report events of violence and aggression and explain the benefits for the RPA sector in reporting these issues. One possible reason identified in this research for violence and aggression towards RPA pilots and their ground crew was confusion around privacy regulations. A further recommendation from this was the benefit of education for the public around privacy regulations along with what the public can do in the event of misconduct by an RPA user.

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Table of Contents

Abstract i

Acknowledgements iii

List of Tables vii

List of Figures ix

List of Appendices x

Chapter 1 Introduction 1

Chapter 2 Literature Review 5

2.1 Unmanned Aircraft Terminology 5

2.2 Basic Remotely Piloted Aircraft Flight 6

2.2.1 Visual Line of Sight (VLOS), Extended Visual Line of Sight (EVLOS), and Beyond Visual Line of Sight (BVLOS) 6

2.2.2 Unmanned Aircraft Altitude 7

2.3 Barriers to Entering the Unmanned Aircraft Sector 8

2.4 Current Applications and Expected Growth 9

2.4.1 General Current Applications 9

2.4.2 The Future of Unmanned Aircraft 11

2.5 Violence and Aggression in the Sector 12

2.6 Where Anger comes from 13

2.7 The Limitations in Current Literature 14

2.8 Public Acceptance Research 15

2.8.1 Public Knowledge of Unmanned Aircraft 15

2.8.2 Public Perspective of Acceptable and Unacceptable Unmanned Aircraft Applications 17

2.8.3 Unmanned Aircraft Applications – Public Perspective 20

2.8.4 Unmanned Aircraft Operators – Public Perspective 21

2.8.5 Unmanned Aircraft Flight Locations – Public Perspective 21

2.8.6 Unmanned Aircraft Concerns – Public Perspective 22

2.9 Aggression within Other Areas of Aviation 24

2.10 Possible Solutions to Improving Public Acceptance 25

2.11 Summary of the Literature Review 26

Chapter 3 Methodology 28

3.1 Paradigm **28**

3.2 Materials **28**

3.3 Procedure **30**

3.4 Analysis **30**

Chapter 4 Results **32**

4.1 Definitional Notes **32**

4.2 Demographic Variables **33**

4.3 Research Question 1 ..... **37**

4.3.1 User Perspectives 37

4.3.2 Linear Regressions 43

4.3.3 Remotely Piloted Aircraft Pilot and Ground Crew Experiences of Violence and Aggression 47

4.4 Research Question 2 ..... **50**

4.4.1 Grounded Theory 51

4.5 Research Question 3 ..... **71**

4.5.1 - Binomial Logistic Regression 76

4.5.2 Ordinal Logistic Regression 78

4.6 Research Question 4 ..... **82**

4.7 Research Question 5 ..... **86**

Chapter 5 Discussion **89**

5.1 The Prevalence of Violence or Aggression Against Remotely Piloted Aircraft Users **89**

5.2 An Aviation Safety Concern **89**

5.3 Company Legitimacy and Communication **91**

5.3.1 Legitimacy 91

5.3.2 Communication 92

5.4 Education – De-escalation techniques for Remotely Piloted Aircraft Users **93**

5.5 Education – The Public **94**

5.5.1 Education - Basic Remotely Piloted Aircraft Knowledge 94

5.5.2 Education - The Danger of Distraction 95

5.5.3 Education - Public Privacy 95

5.6 Reporting **96**

5.7 Remotely Piloted Aircraft User Perceptions **97**

Chapter 6 Conclusion 98

Chapter 7 Limitations and Future Research 100

Appendices 128

List of Tables

Table 2.1 Examples of Minimum Flight Altitudes 7
Table 2.2 Abbreviated Table from Appendix A – The Public's perspective 18
Table 4.1 Recreational and Commercial Flight Hours 33
Table 4.2 Participants Usual Application 34
Table 4.3 Remotely Piloted Aircraft Sector Perspectives 41
Table 4.4 Linear Regression Social Acceptance 44
Table 4.5 Linear Regression Sector Issue 47
Table 4.6 RPA Pilot and Ground Crew Most Recent and Worst Events 47
Table 4.7 Recency and Number of Events of Violence and Aggression 48
Table 4.8 Participant Type 49
Table 4.9 Level of Violence and Aggression Experienced by Pilot or Ground Crew 50
Table 4.10 Grounded Theory – Description of Violence and Aggression Event(s) 54
Table 4.11 The Number of Most Recent and Worst Events of Violence and Aggression 56
Table 4.12 Most Recent and Worst Events of Violence and Aggression 57
Table 4.13 Prior Prevention Carried out to Avoid Threats? 58
Table 4.14 The Aggressor 59
Table 4.15 Describing the Aggressor 60
Table 4.16 Application during Event 61
Table 4.17 Event Location 62
Table 4.18 Nature of Threat 64
Table 4.19 Pilot's Actions during Threat 67
Table 4.20 Potential Triggers for Aggressor's Anger 68
Table 4.21 The Outcome 69
Table 4.22 Event Characteristics 71
Table 4.23 What did the Aggressor Discover First? 73
Table 4.24 Application During Event 73
Table 4.25 Location of Event 75
Table 4.26 System of Identification 76
Table 4.27 Experienced Violence and Aggression while flying an RPA 78
Table 4.28 Level of Violence and Aggression 80
Table 4.29 Financial loss from event of violence and aggression 82
Table 4.30 Changes to time spent flying RPA 82

Table 4.31 Changes made to Remotely Piloted Aircraft Operations.....83
Table 4.32 Conflict Resolution and Event Reporting.....86

List of Figures

Figure 4.1 Remotely Piloted Aircraft Sector Perspectives 38

List of Appendices

Appendix A Acceptable and Unacceptable Uncrewed Aircraft Applications 128
Appendix B New Zealand Participants by Region 137
Appendix C International Participants by Country 138
Appendix D New Zealand/International - Violence and Aggression towards Remotely Piloted Aircraft Pilots and Ground Crew - Survey Flow 139

Chapter 1 Introduction

Globally, unmanned aircraft (UA) are unique in that they are part of the traditional aviation sector, yet are increasingly being utilised in roles more diverse and outside of the traditional aviation sector. With roles ranging from disaster response, infrastructure monitoring, agriculture, and photography, UA can now be purchased at affordable prices and are more easily available to those who previously could not access the airspace above without the significant finance or time involved in crewed aviation (Hartley et al., 2022; Tepylo et al., 2023a; Tepylo et al., 2023b). Most roles require the UA to fly low level to carry out tasks, such as inspecting infrastructure and buildings, real estate photography, and the delivery of items, all of which may mean the aircraft is flying significantly lower than traditional aircraft and, therefore, may be more widely identified by the general public (Bamburry, 2015; Ogan et al., 2019; Tepylo et al., 2023b; Watkins et al., 2020). This should not discount from the fact that there are more sophisticated UA operations that are more akin to conventional aviation.

Despite the advantages of utilising the airspace above (previously only available to crewed aviation) there are risks associated for the UA crew members, in particular, exposure to the public. Predominantly, the UA pilot and/or their visual observers are located within close proximity to the UA making them easily identifiable and accessible to the public. This puts the UA crew at risk should a member of the public become agitated with the UA operation. This is a key factor to recognise that contrasts to that of crewed aviation. If a member of the public is unhappy with a manned aircraft, they are unable to immediately approach the pilot in that moment and often may not have the ability to specifically identify the pilot at all. The only alternative in this scenario may be for the member of the public to contact the police or the regulatory authority and lay a complaint. Conversely, in the UA situation, the UA pilot and ground crew may bear the brunt of a disgruntled member of the public through verbal abuse, threats, or even violence, and, perhaps more concerningly, while the UA is in the air. This has been raised as an issue by an industry body (UAVNZ, 2023a), but not scientifically investigated.

Alarmingly, the current body of literature shows attitudes towards UA are unfavourable, with research participants believing that the public should take measures against the UA or the UA pilot (Anania et al., 2019; Graham et al., 2021). Research conducted by Graham et al. (2021)

also found that 27.9 percent of participants indicated they would locate the pilot to address their concerns.

One might say, provided this discussion was calm and civilised, this sounds like a sensible option. However, it is crucial that the member of the public waits for the UA to land first as consideration needs to be given to the continued safe operation of the UA and the safety of other members of the public should the UA be unable to land immediately (Moskowitz et al., 2018). Some regard also needs to be given to the battery life of many UAs and to the operators who are involved in legal employment, as their time and money is of equal importance to others who are employed. Consideration could also be given to the inability for a person to look at a UA and know without doubt that it is operating illegally. A phone call to the police or the aviation regulator may be a safer option for all.

The body of literature related to UA operations overwhelmingly addresses the issue of public acceptance rather than the UA crew themselves. This is supported by the amount of research around the public's welfare around UA, the publics perspective on and more specifically, acceptance of UA, all of which has been extensively and widely researched around the world (Aydin, 2019; Tan et al., 2021). The United States of America (USA) and Canada have had over 8000 participants involved in public-focussed UA research (Anania et al., 2019; Aydin, 2019; Graham et al., 2021; Markowitz et al., 2017; Nelson et al., 2019; PytlikZillig et al., 2018; Reddy & DeLaurentis, 2016; Tepylo et al., 2023a; Zhu, 2019). Over 18,000 participants from throughout Europe and the United Kingdom (UK) have also participated in public-centred UA research (Del-Real & Díaz-Fernández, 2021; Eißfeldt et al., 2020b; Klauser & Pedrozo, 2017; Komasová et al., 2020; Lidynia et al., 2018; Miron et al., 2023; Oksman & Kulju, 2022; Smith et al., 2022; Upadrasta & Leitner, 2023). Australian research has included over 600 participants, Malaysia has had 667 participants, and Singapore has had 1,050 participants, all pertaining towards the wellbeing of the public (Clothier et al., 2015; Stokes et al., 2020; Tan et al., 2021; Yunus & Techanamurthya, 2023; Za'im Sahul Hameed et al., 2023). In total, over 28,000 participants have been questioned around the public's knowledge of, attitudes towards, and support for UA. Overall, acceptance of UA has been widely covered from the public's perspective.

With the progression of the UA sector, the requirement for public understanding and support of all UA increases. Current research addresses public acceptance of UA with a focus on four

areas: (1) the public's general attitudes, (2) locations perceived as acceptable for UA to operate, (3) applications deemed acceptable for UA, and (4) the protection of the public's right to privacy and safety (Cawthorne & Juhl, 2022; Clarke & Bennett Moses, 2014; Clothier et al., 2015; Eißfeldt et al., 2020a; Melo et al., 2023; Stampa et al., 2021; Stokes et al., 2020; Strive Insight, 2021; Tan et al., 2021; Volovelsky, 2014; Weynand, 2021; Zhu, 2019; Zhu et al., 2020). Although some research includes UA users, industry regulators, or industry organisations, these studies are also focussed on the public rather than on the UA crew (Aydin, 2019; Finn & Wright, 2016; Komasová et al., 2020). What is currently missing from research around public acceptance is the UA crews' perspective based on real-life events and their perceived experiences.

Threats towards UA pilots and ground crew are a serious concern for a sector expected to continue to expand over the next few years (Bennett & Co Corporate and Commercial Law, 2021; Deloitte Touche Tohmatsu Limited, 2018; Howe, 2022; McKinsey & Company, 2021). Recently, there has been increasing discussion around the public's understanding and perception of UA with concerns for personnel involved with UA operations (Crumley, 2022; Murphy, 2020; Pilot Institute, 2021; Sandys, 2023; UAVNZ, 2023b; Wright, 2017). Academic literature around the UA pilot and crew is limited to military UA pilots in terms of their psychological health during combat situations (Saini et al., 2021; Wallace & Costello, 2017). Despite the wide range of literature, there does not appear to have been an examination of civilian UA pilots and ground crews, in terms of them conducting operations. Despite a significant amount of research giving prominence to the public perspective of acceptance of UA, there is an absence of current research from the UA users' perspective. It is essential to consider this perspective as the operators are those most affected by public acceptance.

There have been studies that examine UA users (Alamouri et al., 2023; Henderson, 2022a, 2022b; Henderson & Shelley, 2023; Walton & Henderson, 2023); however, none of these address threats against UA pilots and ground crew, instead focussing on topics like regulatory frameworks and operational risk mitigations. The absence of research focussing on the user becomes problematic for quantifying and qualifying if there is indeed a problem that might inhibit future growth in the UA sector and, if so, the nature of that problem. In the absence of such information, it is impossible for government agencies and industry bodies to play a constructive role in addressing any issues.

There is an apparent gap in the literature in relation to UA users and their experiences (if they have them) of violence and aggression during flight. With continued growth in the industry, it is concerning if UA pilots, and their ground crew are dealing with aggression and violence from the public. This has a direct impact upon operational safety but may also have less apparent impacts upon the overall wellbeing of operational staff within the sector. This research looks to add balance to the discussion on UA public acceptance by examining what the UA pilots and their ground crews are actually experiencing.

This research aims to examine the following questions:

1) How widespread or prevalent is violence and aggression towards Remotely Piloted Aircraft (RPA) pilots and their ground crew?

2) What is the nature of threats and aggression towards RPA pilots and their ground crew?

3) What user or flight characteristics influence levels of aggression towards RPA pilots and their ground crew?

4) What impact, if any, does violence and aggression have upon RPA pilots and their ground crew?

5) What pathways forward, if any, exist for RPA pilots and their ground crew to moderate this issue?

Chapter 2 Literature Review

This literature review first clarifies the commonly used terms when referring to UA before discussing some basic conditions of flight which includes flying visual line of sight (VLOS), extended visual line of sight (EVLOS), beyond visual line of sight (BVLOS), and common altitudes flown. Next some of the barriers to UA flight are discussed before continuing on with current UA applications and potential future applications. Social media and news reports alluding to the anger and aggression towards those in the UA sector is discussed before examining in a broad sense where anger may come from. Some of the unaddressed gaps in current literature have been discussed before examining current literature exploring public acceptance of UA from the public's perspective. This thesis will then discuss aggression within other areas of aviation and possible solutions to violence and aggression raised in current literature.

2.1 Unmanned Aircraft Terminology

Worldwide, unmanned aircraft (UA) are known by various terms as for example, remotely piloted aircraft (RPA), remotely piloted aircraft system (RPAS), unmanned aerial / aircraft system (UAS), unmanned aerial vehicle (UAV), or more commonly as drones (BalmuȘ, 2023; Sandbrook, 2015; Tan et al., 2021). More broadly, the terms UA, RPA, and UAV are used to describe the aircraft, and the terms UAS and RPAS are used to describe the aircraft and the ground-based system controlling the aircraft. In the context of this research, the terms UA and RPA are used. While previous research has used various terms interchangeably, this research offers the following stipulative definitions, e.g., see (Pap, 1964): UA is used in this research when referring to an aircraft without an onboard pilot, while RPA will be used when specifically discussing an aircraft without a pilot onboard but which is controlled by a pilot on the ground within the vicinity of the aircraft. Furthermore, this research does not examine UA that can be flown from an enclosed operator station many miles away or based in another country, such as military drones like the MQ-9 Reaper. As a further clarification, the term *sector* will be used when discussing recreational, commercial, and governmental UA as a whole (de Miguel Molina & Segarra Oña, 2018).

The most common type of RPA is the quadcopter design which can be adapted to be used for many different tasks, however, there are also helicopters, larger multirotor aircraft (e.g., hexacopters or octocopters), fixed-wing aircraft, and lighter-than-air aircraft. Multirotor RPA

have the ability to carry out vertical take-off and landing (VTOL), normally have electrical motors powered by batteries, and are generally used for shorter flight time tasks (Bogue, 2023). Hydrogen fuel cells may also be used as a source of power and may extend the flight time of the RPA (Bogue, 2023). Fixed-wing RPA can also be launched via catapult, may have a combustion or jet engine, and are more likely to be used for longer flight time tasks such as an aerial survey (Bogue, 2023).

2.2 Basic Remotely Piloted Aircraft Flight

2.2.1 Visual Line of Sight (VLOS), Extended Visual Line of Sight (EVLOS), and Beyond Visual Line of Sight (BVLOS)

Small civilian RPA are primarily flown using visual line of sight (VLOS). When an RPA is flown under VLOS, the RPA and the surrounding airspace are continuously visible to the RPA pilot throughout the flight. This must be achieved with their eyes, with the assistance of glasses or contact lenses but without the assistance of binoculars, goggles, or electronic devices (Anicho et al., 2024; Federal Aviation Administration, 2020; Sándor, 2023). Distances at which an RPA pilot can see the aircraft vary for a number of reasons, such as meteorological conditions, background, pilot experience and ability, pilot position (such as standing on a hill or platform), and the size, colour, and speed of the RPA (Hartley et al., 2022; Sándor, 2023; Wallace et al., 2019). Because of these variabilities, maximum VLOS distance has been noted to vary widely from a few hundred metres to approximately two kilometres (Dolgov, 2016; Hartley et al., 2022; Sándor, 2023; Wallace et al., 2019).

One method that may be used to extend the distance an RPA can been seen is extended visual line of sight (EVLOS) which uses one or more visual observers who are in constant communication with the pilot. At the point where the pilot loses VLOS with the RPA, under EVLOS, the observer continues to maintain VLOS with the RPA (Hartley et al., 2022). However, there are several operations, such as forestry, wildfire monitoring, or power line and railway monitoring, where the RPA pilot may be unable to practicably maintain VLOS or use EVLOS and will therefore require the RPA to be flown beyond visual line of sight (BVLOS) (Anicho et al., 2024; Hartley et al., 2022; Merz et al., 2024). Currently, RPA flying BVLOS under most countries regulations requires a regulatory approval or waiver as situational awareness will be reduced (Anicho et al., 2024; Wallace et al., 2019). There are several types of BVLOS scenarios which are dependent on the task required to be performed. At the lower

end of the risk spectrum, there may an RPA out of VLOS of the pilot due to an object such as a building but remaining within the vicinity. In this scenario the pilot maintains visual contact with the airspace around the RPA but not with the aircraft (Civil Aviation Safety Authority [CASA], 2024). Tasks requiring long-distance BVLOS involve the pilot flying the RPA remotely some distance away and will require increased hazard mitigations for regulatory approval (Terkildsen et al., 2021; Van der et al., 2023). The type of flight operation required will depend on both the application being carried out by the UA, and the regulations or regulatory approvals around that activity as will the altitude flown by the UA discussed in Table 2.1 below.

2.2.2 Unmanned Aircraft Altitude

While conventionally manned aircraft measure altitude above mean sea level (AMSL), UA, which are predominantly flown closer to the ground, measure altitude above ground level (AGL) (Agüera-Vega et al., 2024; Nebula, 2018). Worldwide, regulations in many countries require UA to fly at altitudes of 400 feet (120 metres) AGL or lower. Should the UA require higher altitudes, this may require exemptions or approvals (Henderson, 2022a; Henderson et al., 2019). However, altitude generally is dependent on the application for which the UA is used for. Table 2.1 below shows the variability of altitudes an UA may fly at, relative to the application at which it is flying.

Table 2.1
Examples of Minimum Flight Altitudes

Journal article	Application	Explanation	Minimum altitude feet (ft) (AGL)	Minimum altitude metres (m) (AGL)
(Saitoh & Kobayashi, 2021)	Research	Animals - horses	98.4	30
(Duporge et al., 2021)	Research	Wildlife data collection - altitude dependent on species	16.4	5

(McRae et al., 2019)	Search and Rescue	High altitude mountainous terrain	8200	2500 [1]
(Andriolo et al., 2023)	Aerial survey	Litter monitoring on coasts and rivers. (DJI Phantom 4 Pro)	59.0	18
(Colorado et al., 2017)	Aerial survey	Landmine detection	1.6	0.5
(Galle et al., 2021)	Research	Volcanic gas plume measurement	6560	2000 [2]
(Hentschke et al., 2018)	Spraying	Crop spraying	1.0	0.3
(Saini & Singh, 2021)	Infrastructure inspection	Railroad track inspection	36.1	11
(Chonpatathip et al., 2023)	Aerial survey / Infrastructure Inspection	Road construction	295.2	90

[1] Altitude above mean sea level 8,400 meters (27,552 feet)
[2] Altitude measured above take-off position due to terrain
Note. Conversion used to convert meters to feet was 3.280. Altitudes are an example only. In a practical setting altitude is dependent on the specific type of UA and environment UA flown in.

Most civilian UA are also reasonably lightweight and must remain within VLOS. Therefore, weather also plays a part in both the ability to fly and the altitude at which they can be flown at. UA flight and altitude may also be restricted by poor visibility, high or low temperatures, high winds or generally extreme weather conditions (Gao et al., 2021; Roseman & Argrow, 2020).

2.3 Barriers to Entering the Unmanned Aircraft Sector

UA can be flown recreationally or may be used as a tool in the workplace to achieve improved efficiency, productivity, and quality of product or service, however, there are some unique barriers before flying a UA especially when used for commercial purposes. The initial financial outlay will depend on the application the UA will be used for and may range from purchasing a small and affordable recreational UA for a few hundred US dollars to spending hundreds of

thousands US dollars for a commercial venture to purchase the aircraft along with a range of sensors, cameras and equipment to use professionally (Da-Jiang Innovations [DJI], 2024a; Khalifa et al., 2023). Some additional equipment required may be light detection and ranging (LiDar), thermal sensors, conflict and avoidance detection, gas sensor technology, animal tracking devices, infrared thermal imaging cameras, along with a range of different camera capabilities, all of which add onto the initial UA purchase cost (Khalifa et al., 2023). Some sectors such as healthcare will require specific specialist equipment and supporting infrastructure and other sectors may require extra staff for administration purposes (Bradley et al., 2020).

One challenging step for entering the UA sector, particularly as a commercial operator, is gaining the understanding where the application required fits in with aviation regulations and what are the obligations of the UA crew. Both those flying for recreational and commercial purposes need to consider safety hazards associated with flight with commercial operations likely to need in-depth prior safety risk mitigation planning (Alamouri et al., 2021). According to Leger Marketing Inc (2021), 81 percent of Canadian UA users surveyed did not have a background in aviation. The significance of this means the user may be unaware of everyday barriers to all aircraft such as weather conditions, airspace limitations, maintenance requirements, and the required pilot training and currency to maintain safety standards (Ito et al., 2022; Sah et al., 2021). One further barrier for prospective UA operations is the limitations of the aircraft. Those UA utilising battery power may have very limited battery charge meaning flight times may be 30 minutes or less with some of the smaller UA capable of carrying weights less than a few kilograms (Sarkar et al., 2020; Sudbury & Hutchinson, 2016).

2.4 Current Applications and Expected Growth

2.4.1 General Current Applications

UA are used both recreationally and as a tool in a wide range of applications across many sectors crucial to society. Industries such as construction, infrastructure, disaster response, and in farming utilise UA to improve organisational safety, reduce expenses and enhance the quality of the product or service (Johnsen et al., 2020; Khalifa et al., 2023; Umar, 2021; Urdaneta et al., 2022). UA can be used in construction for initial site survey or inspection during the building stages. UA can also be utilised to proactively identify potential hazards together with monitoring the worksite and structure as the construction progresses. This ensures not only the

safety of the structure, but the safety of personnel by decreasing the need for workers to climb to heights for inspections (Howe, 2024; Melo et al., 2017). Additionally, UA can also be used for inspection of infrastructure, such as bridges, roads, dams, electrical transmission lines and railway tracks. Detailed images or video can be taken to identify areas of concern, potentially, with greater efficiency and cost-effectiveness, had inspections been carried out using helicopters (Collins, 2021; Ogan et al., 2019). Additionally, the ability for a UA to carry a range of different survey equipment gives the operator access to light detection and ranging (LiDAR), thermal infrared sensors, photogrammetry, and still or video images, all of which enhances the quality of the data able to be gathered (Mohsan et al., 2023; Watkins et al., 2020).

Operational roles, such as maritime surveillance, search and rescue, and disaster response, use UA to locate and support those in need using a mixture of radar, electro-optic, and infra-red systems (Bogue, 2023). UA deployed for search and rescue can be dispatched rapidly and can cover distances faster than rescuers on the ground and cover areas too dangerous for ground rescue crews (Collins, 2021; Rajan et al., 2021; Van Tilburg, 2017). UA can also support firefighting in high-rise buildings by providing imagery to enhance firefighters' situational awareness or be used to identify hotspots providing real-time data in wildfire assessment (Bogue, 2023; Majumdar et al., 2024). Advantages may also be gained by saving time and labour when using UA in industries such as farming and forestry, the delivery of goods and services, and for aerial photography and cinematography. The ability to collect and analyse large amounts of data can greatly decrease costs in the farming industry while improving efficiency and allowing for faster and improved decision making (Urdaneta et al., 2022; Yaqot & Menezes, 2021). The agricultural, horticultural, and forestry sectors also use UA extensively to monitor growth, conduct research, crop seeding, and crop spraying of agrochemical materials (Bogue, 2023; Hartley et al., 2022). The ability to save time and labour while also improving safety allows companies to achieve better results, attain improved safety standards, and often save the organisation money. On an individual level, an UA may also be used in applications such as sports and car racing cinematography, a choreographed drone light show, or for leisure activities such as drone racing or private photography (Cooke et al., 2021; Diaz, 2015; O'Malley, 2021).

2.4.2 The Future of Unmanned Aircraft

With worldwide growth expected in the UA sector in the future, there are likely to be many technological advances in a number of different areas. This section will look at three factors that could have a considerable effect on the sector. These are, the legal changes expected with the Federal Aviation Administration (FAA) reauthorisation bill, section 930, which was signed into USA law in May 2024, the recent fifth-generation (5G) cellular network innovations, and growth in the number of applications utilising swarm technology. The United States of America (US) FAA reauthorisation bill, section 930, instructed the FAA to finalise a law to enable UA to fly long-distance BVLOS (McNabb, 2024; Plaza, 2024). Currently most countries regulations require a waiver or exemption if UA organisations wish to fly BVLOS. Often these waivers are for BVLOS where the UA is within the vicinity of the pilot who has the surrounding airspace in view, but outside the view of the pilot or observer due to an object such as a building or powerline (Civil Aviation Safety Authority [CASA], 2024). Currently in many countries, operations requiring long-distance BVLOS are likely to be restricted to a small number of operations (Van der et al., 2023; Wallace et al., 2019). Once enacted, this law may push UA growth further and influence the rest of the world to follow should the new rule be proven to be effective. Recently the United Kingdom Civil Aviation Authority (UKCAA) granted permission for the company *heliguy* to operate long-distance BVLOS using DJI's Doc ecosystem. This authorisation allows *heliguy* to remotely operate UA in airspace the UKCAA deems a low risk of manned aviation aircraft entering, and this may potentially be a precursor to the UK introducing long-distance BVLOS laws similar to the USA (United Kingdom Civil Aviation Authority, 2024; Willoughby, 2024). The operational efficiencies gained by the ability to fly long-distance BVLOS have the potential to substantially benefit industries such as those monitoring infrastructure, forestry, and those requiring high-resolution surveillance or mapping data (Hartley et al., 2022; Merz et al., 2024; Van der et al., 2023).

An innovation also likely to impact the sector is the upgrade to the 5G network. Currently UA utilise the fourth-generation wireless (4G) and long-term evolution (LTE) networks for the transmission of control signals between the transmitter and the UA, and, for sending images from the UA to stakeholders on the ground (Dash et al., 2023). A typical UA uses a controller which incorporates a transmitter, which sends a signal via radio frequency to the UA, and receiver, which receives signals from the UA. Most UA communicate via the 2.400 to 2.483 gigahertz (GHz) and the 5.725 to 5.850 GHz radio frequency ranges (Flak, 2021). Due to multiple UA operating in these ranges there has been the possibly of interference and control

issues. Between 2018 and 2021, cellular companies worldwide began implementing their 5th Generation Mobile Network (5G), a wireless network capable of supporting RPA (Global System for Mobile Communications Association [GSMA], 2019; Liu et al., 2022). The 5G network gives UA some major benefits that were unavailable prior such as increased distances between the ground controller and the UA. The 5G network also provides greater bandwidth and lower latency which means the UA can send large quantities of higher quality data within a minimal amount of time onto data centres on the ground. (Dash et al., 2023; Liu et al., 2022). Although there are currently still weaknesses with UA and 5G, such as the load on the UA battery, the small range of the 5G network, and the expense involved in setting up 5G, there are substantial benefits for industries where real-time data and video uplink abilities are needed such as disaster response, television, infrastructure monitoring, or construction safety inspection (GSMA, 2019; Korada & Somepalli, 2022; Shawky, 2023).

One further innovation that may benefit the sector is the increase in applications using multiple UA, colloquially called a drone swarm. A drone swarm can complete a task more efficiently and cost effectively (Chen et al., 2020) (better reference). Although this technology is already being utilised it is expected the number of tasks being carried out using this method may see growth with different applications utilising this. Applications that may benefit from drone swarms may be infrastructure inspection, agricultural surveying, disaster response, forest fire monitoring, and package delivery (Wei et al., 2024). Swarms are designed to have multiple UA collect information, consolidate the data, then send this back to the controller. Individual UA within the swarm may also be carrying out different tasks in parallel to support the overall task the swarm is designated to carry out (Chen et al., 2020). Overall, all three of these innovations may seem small scale, nevertheless, these innovations may mean improved safety, increased efficiencies and overall, a better-quality service or product for the organisations utilising them. However, advancements in technology that lead to greater use of UA including activities such as the drone swarms discussed above may lead to greater public frustrations with UA.

2.5 Violence and Aggression in the Sector

Research around UA pilot and ground crew safety tends to come from studies around UA remote identification (RID) technology. UA remote RID is designed to protect public privacy by allowing the public to identify the UA and access information about it along with its pilot. While New Zealand does not currently have remote ID, there are many countries worldwide

that do, and it is currently under discussion as to whether this exacerbates violence and aggression against the UA user (Belwafi et al., 2022; Sciancalepore, 2024). Otherwise, most discussions around threats towards UA pilots and ground crew tends to be from word-of-mouth, social media, and newspapers. Unfortunately, often information around events of violence and aggression is not shared until situations escalate. Interestingly, no one user seems to be spared with both those that use UA recreationally and those that use UA professionally seemingly experiencing similar threats of anger and physical aggression from the public (Hogan, 2024; Pulysses, 2023; Sandys, 2023). Experiences and UA applications involved tend to vary widely, such as the public shooting at UA operated by police or package delivery services (Arthur, 2024; Rogelberg, 2024), angry members of the public using remote ID to locate and physically threaten agricultural pilots (Col_Clucks, 2024), and the public shooting at real estate UA (Hunt, 2019). Remarkably, even the possibility of jail time if caught under countries such as USA law does not seem to be a deterrent to stop these events from occurring (Arthur, 2024; Gary, 2023). Disappointingly, support in this area generally only comes from recreational or professional organisations rather than formally through laws or aviation regulations. There is also very little support by way of advice or knowledge on how to handle these situations (Dukowitz, 2024). The primary aim of this research is to investigate if this is a significant issue in the sector and if so, to gain insights and, data on what is occurring.

2.6 Where Anger comes from

There are a number of reasons why a member of the public may get angry with the majority of reasons not predictable, nor, within the UA pilot's control. Research around exactly what anger is and why it occurs is varied and uses a thesaurus of language, however, most research indicates it is an unpleasant feeling emerging as the result of a condition or circumstance that has been evaluated by the individual as negative (Blair, 2012; Harmon-Jones & Harmon-Jones, 2023; Martin, 2020). Aggression, which can be physical or verbal, has been defined as "where the intent is to harm another person or thing" (Martin, 2020, p. 102). Although aggression may be a result of anger, there are other circumstances such as hunting or in competition where aggression may not have been caused by anger (Martin, 2020). In many circumstances, anger will often achieve a goal in addition to drawing attention to the issue the aggressor feels strongly around. When championing against a social injustice, often the aggressor feels somewhat justified to express the emotion (Demetriades et al., 2024). Alternatively, for some, the foundations of this anger may be a normal part of a person's fight or flight response within

the sympathetic nervous system (Peters et al., 2018). On a wider level, anger may be caused by something in the aggressor's personal life; a situation, their perceived injustices, or simply by a lack of understanding (Demetriades et al., 2024; Lenferink et al., 2024; Martin, 2020; Rupar et al., 2024). In terms of anger in the UA sector, the situation with the UA may be the trigger escalating what is already occurring in aggressor's life. Alternatively, the UA could also provoke general annoyance by the noise it creates when someone is enjoying the sounds of nature or the assumption of a loss of personal privacy when image recording is being performed (Gunson, 2018; NZME, 2015). Although UA have been in use for many years, it is only in recent times that their popularity has gained traction, so it is possible that that there is still a lack of public understanding around what the civil aviation rules allow UA to do. This section has highlighted some of the complexities related to how and why people experience anger. However, it is also important to consider these issues within context in the following sections which discuss the current public acceptance literature.

2.7 The Limitations in Current Literature

There has been an increasing amount of research into public acceptance of UA over recent years with two key limitations. The first limitation is that research in this area has essentially been studied solely from the public's lens. While there are some studies that have used participants within the UA sector, research outcomes in this area are predominately skewed towards public wellbeing rather than a balanced focus between the public and the UA users (Aydin, 2019; Graham et al., 2021; Markowitz et al., 2017; Nelson et al., 2019; Stolz et al., 2023; Tan et al., 2021; Zhu et al., 2020). With growth in the UA sector likely over the next few years in both recreational and commercial use of UAs, it is vital that the discussion around public acceptance of UA is balanced and objective (Höhrová et al., 2023; Kapustina et al., 2021; Stanković et al., 2021). This research aims to take a heterophenomenological approach (Dennett, 2007) using sector participants to understand the realities of public acceptance of UA along with measures to support these sector participants in the future.

The second key limitation is the difficulty for the public to visually identify and know with certainty if a UA operation is legal or illegal, friend or foe. With research findings discussing UA applications the public deem acceptable and unacceptable; it is vital that this limitation is discussed in order to take this research from theory to practice. Currently, with the exception of military UA such as the MQ-9 Reaper, UA can be easily purchased online and used

commercially in activities as diverse as infrastructure and construction inspection, agrichemical application, aerial survey, or aerial photography alongside several recreational uses (Collins, 2021; Da-Jiang Innovations [DJI], 2024a; Diaz, 2015; Grubesic et al., 2024). The ability for anyone to purchase a UA makes it difficult for the public to identify with certainty the UA's purpose from merely looking at the UA in their vicinity. This is compounded by the distances and vantage points a UA can be seen from, which could be anywhere from hundreds of metres to kilometres away (Hartley et al., 2022; Wallace et al., 2019). The UA could be a recreational user flying for pleasure, a local government office looking for water leaks, an electricity company checking power lines, or road company ensuring safety of the infrastructure (Collins, 2021; Grubesic et al., 2024; Höhrová et al., 2023; Kapustina et al., 2021). Identification of the UA and/or the user needs consideration otherwise even those operating within the law may end up being judged unfairly.

2.8 Public Acceptance Research

Research on UA does not tend to clarify how the aircraft is controlled and, sometimes, groups' RPA and electric vertical take-off and landing (eVTOL) together. For these reasons, despite the fact many studies are likely discussing RPA where the aircraft is crewed by a pilot on the ground using a flight controller, this section discusses UA in a general sense. This section (Section 2.8) discusses current research around; where the public acquire their knowledge of UA from, UA applications which the public deem acceptable or unacceptable, before touching on major world events which may have had an effect on public opinions since 2014 (which appears to be roughly the point where UA usage began to grow exponentially). Following on from this is a further discussion on UA applications, UA operators, and flight locations, which the public deem acceptable. To finish this section there is a discussion on some of the public concerns recent literature has identified as being those with the greatest apprehension around UA.

2.8.1 Public Knowledge of Unmanned Aircraft

With the notable quantity of research looking into public acceptance of UA, it is perhaps important to first consider how the public develops their knowledge of UA. Several articles suggest the public understand the most commonly used term *drone* and have an understanding of what they are. That said, it appears that an in-depth knowledge about them is limited, as is an understanding of the technical capabilities of UA (Nelson et al., 2019; Tan et al., 2021; Tepylo et al., 2023a). This is despite researchers finding a sizeable number of participants who

knew someone who used UA either in a recreational or commercial capacity (Nelson et al., 2019; Upadrasta & Leitner, 2023). Several researchers found the public lack awareness of knowledge deficiencies around UA while others report the public are aware of this shortcoming and rate themselves to have a low level of knowledge around UA (Aydin, 2019; Klauser & Pedrozo, 2017; Upadrasta & Leitner, 2023). However, past research has usually found that the public's knowledge of UA predominantly comes from social media, movies, television, and the conventional news media platforms (Boucher, 2016; Oksman & Kulju, 2022; Reddy & DeLaurentis, 2016; Tan et al., 2021; Upadrasta & Leitner, 2023; Yunus & Techanamurthya, 2023). Furthermore, it is interesting to note that researchers found between 65 to 80 percent of the public's knowledge was gained from these sources (Aydin, 2019; Upadrasta & Leitner, 2023; Yunus & Techanamurthya, 2023). Consequently, public knowledge may / may not be crucial for the acceptance of UA.

Research has found that those with lower levels of knowledge around UA see UA as less beneficial in comparison to those with higher levels of knowledge (Upadrasta & Leitner, 2023). Nevertheless, some research suggests that, overall, greater public knowledge of UA means a greater acceptance of UA (Upadrasta & Leitner, 2023; Za'im Sahul Hameed et al., 2023). This theory is refined by Tepylo et al. (2023a) and Smith et al. (2022) who suggest that greater knowledge around UA does not correspond with a higher level of public acceptance but, rather, a greater ability for the public to identify risk, providing the ability to assess whether they supported or disagreed with certain applications.

The main areas of confusion around UA relate to whether there is someone in the aircraft, the scale of UA operations in the country, and exactly how UA operations work (Klauser & Pedrozo, 2017; Stolz et al., 2023; Tan et al., 2021). Participants interviewed in Stolz et al. (2023) research were unclear about how exactly UA package delivery would work, which may have added to the concerns around UA delivery. Questions highlighted in this research were: the number of UA required for package delivery, the number of packages carried by one UA, what the sky could look like with UA delivery, and how the customer would receive packages. These questions indicate information the public has access to and provide a glimpse as to where the confusion lies. Smith et al. (2022) made the observation around UA research that the general public's exposure to UA may predominantly be with recreational UA in public spaces, such as beach fishing, photography, or filming, where privacy may not have been considered (Smith et al., 2022). They add, "people are also asked to give a view on drone uses to which they have

no tangible exposure and little inkling of how they might work" (Smith et al., 2022, p. 8). Upadrasta and Leitner (2023) surmise that public education on the capabilities and benefits of UA may increase trust in the future. One final caveat to research on public knowledge is how this knowledge is measured where participants may be required to self-report UA knowledge when, in reality, they may not understand what they do not know (Smith et al., 2022). This would lead to issues of self-generated validity (Yunus & Techanamurthya, 2023).

When considering possible differences in demographics, male and younger participants tended to have more knowledge of UA than female participants. This corresponded with more UA support from both male and younger participants (Aydin, 2019; Tan et al., 2021). Those with lower education or those who were in a higher age group corresponded to lower support for UA. In addition, the urban public was more accepting than suburban or rural public, and, most surprisingly, those involved with the crewed aircraft industry were also reported to have less acceptance of UA (Aydin, 2019; Reddy & DeLaurentis, 2016; Sabino et al., 2022; Tan et al., 2021). Significant research has been carried out on the public's opinion of UA worldwide. Considering this discussion around public knowledge of UA, the remainder of this section will discuss what the public has said they will or will not accept.

2.8.2 Public Perspective of Acceptable and Unacceptable Unmanned Aircraft Applications

Table 2.2 below is an abbreviated list of acceptable and unacceptable UA applications from the public's perspective. A full list of acceptable and unacceptable applications from the public's perspective, the research perspective, and country where the research was carried out, has been included in Appendix A. The focus of research on public acceptance of UA sways heavily towards the public's general perception of UA rather than how the public would identify an UA's application in practice. Table 2.2 illustrates several similarities, regardless of region, between the data regarding what UA applications the public is willing to accept, and what applications the public finds less acceptable.

Table 2.2
Abbreviated Table from Appendix A – The Public's perspective

Region	Acceptable UA applications	Unacceptable UA applications
United States of America and Canada	Disaster / Emergency response Agricultural purposes Environmental support Government purposes Infrastructure and building support Package delivery Photography/Video	Surveillance Package delivery Photography/Video Government purposes Recreational Commercial purposes
United Kingdom and Europe	Government purposes Disaster / Emergency response Infrastructure and building support Agricultural purposes Government purposes Photography / Video Scientific research Environmental support Package delivery	Package delivery Photography/Video Surveillance Recreational
Singapore and Malaysia	Government purposes Disaster/Emergency response Agricultural purposes Environmental support Package delivery Photography / Video Infrastructure and building support Recreational	Recreational Photography/Video Surveillance
Australia	Shark surveillance	

Note. See Appendix A for expanded table

Research around public acceptance of UA shows opinions vary depending on the circumstances. Differences in opinion depend on: the user, as, for example, the government, or commercial, industrial, or recreational users; the UA's application; the location where the UA is being used; costs to the public; the benefits versus the risks; and the UA characteristics (Tan et al., 2021; Tepylo et al., 2023b). Reddy and DeLaurentis (2016) found that the majority of acceptance or resistance to UA to be conditional depending on the UA's purpose. Stolz et al. (2023) research narrowed this down by saying that even within a UA application, such as videography, acceptance is still dependant on the purpose for which the videography is being used. As an example, the author notes that "…people would judge tobacco advertising images harsher than drone-shot news broadcasts" (p. 846). Tepylo et al. (2023a) found attitudes were dependent on the term used to describe UA with most men and women indicating they *felt* either neutral or excited about UA technology. Interestingly, Yunus and Techanamurthya (2023) found Malaysian participants had quite different opinions to the majority of the participants worldwide. Their research found that certain applications, such as recreational photography, videography, and drone racing had stronger support than disaster relief. This may have been due to participants gathered from schools and universities with an age distribution of 13 to 21 years. Hence, this may be one example of a possible reason why some themes were included in both acceptable and unacceptable UA applications.

Smith et al. (2022) also raised concerns around the public's level of knowledge around UA and cautioned around public acceptance researchers influencing participants' responses subject to what and how much information was shared in the research. Although other research methods, such as focus groups, have been used, several studies have used Likert-style questioning to ascertain UA application public approval on a sliding scale rather than open questions that may also have influenced a participant into taking a position on an application they may not have felt strongly about or written about in an open question (Kreitchmann et al., 2019). Consideration also needs to be given to the participant's understanding or lack of understanding of a specific UA application along with their personal experiences, both of which may influence their opinions (Yunus & Techanamurthya, 2023).

2.8.2.1 Major World Events since 2014

One further aspect to be mindful of is the timeline between research articles. Literature included in Appendix A was published between 2014 to early 2025 and recorded the most recent public

attitudes to UA. There is very little research earlier than this specifically focused on public acceptance around UA (Sabino et al., 2022). Some of the major events during this time which may have influenced UA research along with public opinion of UA could have been the Ukraine war in 2022 where UA have been used for reconnaissance and to drop munitions (Chávez & Swed, 2023), COVID19 where UA were used in China for surveillance (Mohsan et al., 2022). Two further international events which may have influenced the publics opinions around UA were George Floyd and the Black Lives Matter movement in 2020 which decreased trust in the police and government (Boudreau et al., 2022), along with a number of recent natural disasters locally and worldwide such as Turkey - Syria earthquake in 2023 where over 50,000 people lost their lives (Oliveira et al., 2024).

2.8.3 Unmanned Aircraft Applications – Public Perspective

Although, fundamentally, acceptance varies with UA application, there are several overall agreed applications that the public perceives as acceptable or unacceptable. Broadly speaking, UA are generally not accepted by the public unless the application benefits the greater society rather than the individual - recreationally or commercially (Aydin, 2019; Sabino et al., 2022; Smith et al., 2022; Tepylo et al., 2023a). Applications with the greatest public support tend to be associated with disaster response, search and rescue, and emergency response. Following these, were UA operations involved in science and research, conservation, agriculture, construction, and the inspection of infrastructure (Eißfeldt & Biella, 2022; Reddy & DeLaurentis, 2016; Smith et al., 2022; Tan et al., 2021; Tepylo et al., 2023a). There were moderate levels of acceptance for the use of UA at public beaches in the context of surf lifesaving and high support of UA when used for beach shark surveillance (Del-Real & Díaz-Fernández, 2021; Stokes et al., 2020). Stokes et al. (2020) found 78 percent of participants were unconcerned around privacy when UA were used in shark surveillance and that UA were preferred over the use of helicopters or aeroplanes for beach shark surveillance.

Research carried out between 2015 and 2022 found selected government uses of UA, such as in the military, along with use by police when used to benefit society had moderate to positive acceptance levels by the public (Klauser & Pedrozo, 2017; Reddy & DeLaurentis, 2016; Sabino et al., 2022; Smith et al., 2022; Tepylo et al., 2023a). However, the public did not support UA used in punitive roles such as traffic fines or parking tickets (Sabino et al., 2022; Tan et al., 2021). Evidence was conflicting when it came to applications such as parcel delivery: some

research reported positive support and some reported polarising views towards package delivery (Reddy & DeLaurentis, 2016; Smith et al., 2022; Stolz et al., 2023). Although research participants saw clear benefits to package delivery, there were still concerns around job losses and questions around how package delivery would work (Stolz et al., 2023). Smith et al. (2022) also found that the less knowledge a participant had on UA the more accepting they were of UA use in retail situations. Support was also contradictory with applications involving photography or videography, ranging from low to moderate public support depending on the purpose of the images. Photography or videography for advertising or news media tended to have less acceptance than photography or videography that added to the community good such as a sporting event (Eißfeldt & Biella, 2022; Smith et al., 2022; Tan et al., 2021). Generally, very little support came for any applications that benefited the individual such as recreational or entertainment purposes (Smith et al., 2022; Stolz et al., 2023; Tan et al., 2021).

2.8.4 Unmanned Aircraft Operators – Public Perspective

The public also has strong opinions on who they believe should operate UA. In general, Sabino et al. (2022) systematic review that covered 15 countries found higher levels of support for government use of UA as opposed to commercial or recreational UA users. The country of research did not appear to affect the type of publicly acceptable applications (see Table 2.2). Despite this, one interesting difference for publicly acceptable operators of UA is that the country of research does affect who the public deem to be acceptable UA operators. In the USA, participants are most concerned about government use of UA as opposed to commercial or recreational use, which is unsurprising given that Nelson et al. (2019) reported the US public's trust in the police has wavered since 2014 and the Black Lives Matter police reforms. This contrasts with participants questioned in Singapore who supported government users with higher approval levels above those that were commercial or recreational users (Tan et al., 2021). Canada had a high level of public support specifically for firefighters and researchers with both receiving over 80 percent support alongside the police and government agencies, which were supported to a lesser degree (Tepylo et al., 2023a).

2.8.5 Unmanned Aircraft Flight Locations – Public Perspective

The public also has some firm convictions on acceptable and unacceptable locations for UA to fly. Tan et al. (2021) found some support for UA use around industrial areas. However, overwhelmingly, the public had very little support for recreational or commercial UA flights in

residential areas around private housing (Klauser & Pedrozo, 2017; Reddy & DeLaurentis, 2016; Tan et al., 2021).

2.8.6 Unmanned Aircraft Concerns – Public Perspective

Although the public can often see many benefits of UA, such as emergency response, improved accessibility for isolated citizens, and less traffic congestion and emissions, public perception is still very much a key barrier to public acceptance of UA (Oksman & Kulju, 2022; Sah et al., 2021). Sabino et al. (2022) found the most common concerns among the public were "misuse, violation of privacy, malfunction/damage, safety, noise and legal liability" (p. 6). Other areas of concern are collisions between UA, the UA falling from the sky, cybercriminals, and UA being used as a weapon (Tepylo et al., 2023a). This section will look at the public's concerns around privacy, safety, illegal activities, along with general concerns around UA.

Privacy is a commonly reported public concern highlighted in a number of research papers examining public acceptance of UA. Alamouri et al. (2023) reported 44 percent of UA operators had flights affected due to privacy concerns from the public. One area of focus regarding UA privacy is on law enforcement. Research around public acceptance of police use of UA tends to differ with the emphasis of acceptance dependent on task. Some researchers reported there was general acceptance of police use with the exception of tasks that impacted the individual, specifically enforcing speed or parking rules (Klauser & Pedrozo, 2017; Tan et al., 2021). Others reported privacy was a concern with police use of UA for surveillance (Aydin, 2019; Sakiyama et al., 2017). Anania et al. (2019) research around police use of UA for video surveillance reported 86 percent of participants had concerns around the public's privacy. Boucher (2016) participants felt it may not always be clear exactly why the surveillance is being carried out and who is watching them - it could be the police or someone with unethical intentions. In general, cameras in the community were largely accepted if they were police; however, commercial businesses or private individuals using UA for surveillance were viewed as less acceptable (Klauser & Pedrozo, 2017).

The concern around privacy increases with commercial and recreational use of UA with 95 percent of Klauser and Pedrozo (2017) participants expressing concern for privacy and indicating they would like protections in place. In most cases, the public does not see surveillance of any nature, in any area, as being acceptable with recreational use of UA more

strongly linked with privacy concerns than commercial UA use (Klauser & Pedrozo, 2017; Reddy & DeLaurentis, 2016; Upadrasta & Leitner, 2023). Privacy reservations from the public stem from questions around how regulations are enforced, especially as UA applications expand; concerns around the illegal use of UA; and how to keep the public safe with many not wanting UA flying over their homes (Eißfeldt & Biella, 2022; Oksman & Kulju, 2022; Tepylo et al., 2023a). Tan et al. (2021) found some of the public's unease revolved around the lack of ability to identify if a UA is filming or not. Specifically, when it comes to parcel delivery, privacy is a topic well discussed with concerns around delivery drones flying over private spaces and possibly recording images without consent (Chang et al., 2017; Famula et al., 2022; Zhu et al., 2020). Overall, Nelson et al. (2019) research found 82 percent of participants felt UA invades public privacy and that regulations do not adequately protect the public's privacy, indicating this is a notable concern from the public around UA use.

Early research on the public's risk perception of UA was fairly positive, reporting the public considered the safety risk of UA to be similar to other technology completing the same tasks (Clothier et al., 2015). However, since Clothier et al. (2015) research, public safety concerns around both commercial and recreational UA with fears around the safety of UA and their potential for accidents have been identified (Klauser & Pedrozo, 2017; Komasová, 2024; Upadrasta & Leitner, 2023). Some of the concerns highlighted have been the misapplication of the UA, the possibility of the aircraft falling, and the possibility of unauthorised or untrained pilots (Tan et al., 2021). The public also has several concerns around the safety of UA package delivery. Common concerns in this area are the safety of people underneath the UA, the safety of the property below, and the safety of the package being delivered. Further concerns are the possibility of UA faults, inaccuracies, or malfunctions where goods may be damaged or left in another location (Zhu, 2019; Zhu et al., 2020).

A further concern from the public around UA was the possibility of the UA being used illegally. Eißfeldt and Biella (2022) found the greatest concern among their participants was the UA being used unlawfully. Some of the apprehensions participants had were around UA used in crime, such as following victims or capturing images of children; being used as weapons or to harm; or for illegal surveillance purposes (Boucher, 2016; Lidynia et al., 2018). More specifically, public concerns around illegal use of UA with package delivery revolved around the UA used to carry illicit drugs, transport illegal goods, the UA being damaged by members of the public, packages being stolen or delivered to the incorrect addresses, and the UA being

used in violence against people (Zhu, 2019; Zhu et al., 2020). The exploitation of UA for terrorism was also high on the list of concerns the public has around UA being used for illegal activities (Boucher, 2016; Klauser & Pedrozo, 2017)

Research on public acceptance of UA also raises a number of general concerns the public has about UA. Noise is one prominent concern commonly reported from research around public acceptance of UA (Aydin, 2019; Eißfeldt & Biella, 2022; Komasová, 2024). Job losses also bring apprehension with applications such as parcel delivery by UA replacing a delivery driver (Boucher, 2016; Stolz et al., 2023). Yaqot and Menezes (2021) summarised this concern, pointing out that it could become employment only for the wealthy, decreasing the labour-intensive employment that is usually carried out by wage-earning citizens, making it harder for them to find work. Other secondary concerns around UA discussed include animal welfare, insurance responsibilities, damages and injuries caused by the UA, airspace overcrowding, concerns with safety with children's use of UA, and environmental harm. Lesser concerns were with noise pollution, nuisance to wildlife and the public, and the UA's ability to complete the task. (Aydin, 2019; Boucher, 2016; Eißfeldt & Biella, 2022; Stokes et al., 2020; Stolz et al., 2023; Upadrasta & Leitner, 2023). What the research does not show is what the public actually do when UA are flying in applications where they are not happy. One area that is interesting is that although there are significant consistencies between countries around what are publicly acceptable uses of UA, other than small consistencies between male and female views there is very little consistency of views between demographics in research in age, education, knowledge or ethnicity.

2.9 Aggression within Other Areas of Aviation

Although violence and aggression towards UA pilots and ground crew have not been widely researched, threats towards both pilots and flight attendants have been discussed in a significant amount of literature. The aviation industry has considerable experience with aggression towards flight crew spanning many years with some of the most serious threats resulting in the hijacking of the aircraft (Porat, 2024). Harsher penalties introduced along with tighter security measures and more stringent laws which, when combined, has decreased the number of hijackings. However, there remains a number of reported threats towards flight crew (McLinton et al., 2020; Porat, 2024). Threats against flight crew are reported to be predominantly verbal abuse with some crew reporting that they felt threats could have escalated to physical

aggression towards them. Some also reported they had experienced sexual harassment and sexual assault from passengers (Gale et al., 2019; McLinton et al., 2020). Some of this abuse has been correlated with depression, disrupted sleep, degraded work performance, along with injury to crew, and the possibility of harmful health effects (Gale et al., 2019; McLinton et al., 2020). Solutions to these threats suggested within research have been tighter regulations, research into the factors causing passenger anger, along with airline training in early recognition of passenger anger and de-escalation techniques for flight crew to use in flight (Coyle et al., 2021; Derrickson & Tripathi, 2022; McLinton et al., 2020).

There appears to be no academic literature on threats towards aviation security or flight check-in staff, but incidents are recorded in media sources such as newspapers. Research including aviation security staff tends to focus towards protecting the flight crew rather than protecting the aviation security staff (Derrickson & Tripathi, 2022). While newspaper and online articles suggest aggression towards both of these groups occur e.g., (Associated Press, 2022; "At Kuala Lumpur airport, passenger punches staffer amid check-in dispute," 2024), it is unclear why aggression towards these groups is not included in the literature. However, there may be a number of reasons for this. This thesis suggests that it could be a combination of employees accepting that it is in the culture of the job, the requirement for secrecy in their job, or a culture of underreporting of occurrences. Although the context of other threats within the aviation sector is not the same as those towards UA, some of these experiences may be similar as could some of the solutions.

2.10 Possible Solutions to Improving Public Acceptance.

Many solutions to improving public acceptance have been suggested in research with the understanding that acceptance is multifaceted and there may be need for a combination of approaches to approving public acceptance. One widely agreed solution suggested to help in this area is by increasing and improving public knowledge (Tan et al., 2021). The majority of the current literature around public acceptance shows that the public predominantly learns about UA from social media, the news, or from television (Nelson et al., 2019; Oksman & Kulju, 2022; Tan et al., 2021). Often these platforms only show negative stories around UA such as “Boy in hospital after drones fall from sky at Orlando holiday show” or “Quebec plane fighting L.A. fires grounded after being struck by drone” (Shingler, 2025; Tsui et al., 2024). Improving the knowledge the public understands about UA along with increasing the number

of positive stories the public sees may lessen the level of concerns around safety, privacy, and risk where the public may see benefits of UA outweigh their concerns. If someone is unfamiliar with the capabilities of UA it is difficult for them to understand the threats posed or the trade-offs of UA accurately. (Nelson et al., 2019; Stolz et al., 2023; Zhu et al., 2020). On the whole, education needs to be focussed on providing information to the public so that they can make improved decisions around UA.

Privacy was one concern around UA mentioned often. Although there is literature that opposes and supports UA use in surveillance, Boucher (2016) reported for surveillance to be supported it needs to be unnoticeable to the public. Some of these participants felt if they were unaware of the UA, it would be comparable to current methods of surveillance such as CCTV or the general public's cell phones which often are not noticed. One further suggestion for lessening privacy concerns for the public is transparency in operations. Often the public are unsure of the purpose of the UA or if it has the ability to capture images. Several studies have suggested this may be alleviated by giving the public the ability to identify the operator and if the drone has videography or photography equipment onboard (Komasová, 2024; Oksman & Kulju, 2022)

The level of safety also has considerable concerns from the public. To alleviate some of these concerns suggestions included for the UA only approved for VLOS flight, for the UA to avoid crowds, and for increased monitoring and regulations (Klauser & Pedrozo, 2017; Komasová, 2024; Smith et al., 2022; Tan et al., 2021). Further possible solutions which were suggested to alleviate concerns about the possibly of the UA falling from the air were backup systems, regular technical inspections for UA (Stolz et al., 2023). Additional suggestions were to restrict where UA could fly using geofences, permanent no-fly zones, and barring flights at night (Stolz et al., 2023). On the whole, other suggestions for improving public acceptance were compulsory pilot licencing, compulsory UA registration, and mandatory insurance for damages to persons and property by the UA. Many also felt public acceptance would also improve if consequences for malicious UA pilots were similar to that of drivers on the road (Boucher, 2016; Komasová, 2024; Smith et al., 2022; Stolz et al., 2023).

2.11 Summary of the Literature Review

UA, known colloquially as drones, have become a valuable tool in several industries as well as in a number of recreational pursuits. UA are already utilised in a diverse range of applications

however with future growth likely UA are expected to be utilised in more industries worldwide. The manner in which UA are flown, such as within VLOS or further, the altitude flown, and the barriers experienced by those who wish to enter the sector, are changeable and dependent on the task for which the UA will be used for. Nonetheless, one area where current literature shows consensus is in that of public acceptance of UA. Regardless of country of research, similarities in publicly acceptable applications for UA, such as disaster / emergency response, infrastructure and building support, and publicly unacceptable applications for UA, such as recreational purposes and surveillance are consistent worldwide. One gap in this literature is that public acceptance of UA focuses on acceptance from the public's perspective. This thesis aims to address this gap by examining public acceptance of UA from the user's perspective.

Chapter 3 Methodology

3.1 Paradigm

This thesis takes a post-positivism approach that argues the researcher cannot be completely independent from the research (Clark, 1998; Ryan, 2006). Where positivist research uses experiment and observation to gain a full understanding of the topic, this research carries out an exploratory study which is guided by the research questions being addressed. Data collected as part of this research uses an objective measurement and utilises the researcher's knowledge and experience to interpret that data, using methods that can be replicated but where there may be individual differences due to having different researchers (Ryan, 2006; Wildemuth, 1993). This thesis takes a heterophenomenological approach by focussing on the subjective realities of RPA users and studying them using an objective perspective (Dennett, 2007). Deng and Henderson (2022) also take a heterophenomenological approach when studying travel mode choice. They provide the example that many travellers are scared of or actively avoid air travel despite that being objectively the safest mode of transport. It is more important for those travellers that they fear air travel than that air travel is safer than other modes. In the same sense, this thesis argues that it is more important to understand what RPA users think they experience and why they think they have those experiences, as that is what will ultimately drive their behaviour and attitudes, not objective truths. To help realise overall the epistemological approach to study, a mixed methods research approach has been used. Qualitative data has been gathered to provide rich accounts from participants about their experiences (if any) with violence and aggression while conducting RPA operations. This is complemented by quantitative analysis to examine the influence of user and flight characteristics, and to provide generalisability where statistically significant. Both methods of research contribute to the overall picture and address the research questions. The next section provides more details on how the survey was developed with these aims in mind.

3.2 Materials

A survey was developed to examine violence or aggression towards RPA pilots and their ground crew. The survey consisted of three sections: (1) demographic questions, (2) Likert questions measuring the RPA user perspective towards violence and aggression in the sector, and (3) questions asking about the participants most recent occurrence and worst occurrence. The survey questions were influenced by questions from previous literature on public acceptance from the public's point of view along with discussions with both the Civil Aviation Authority

of New Zealand (CAA) subject matter experts and UAVNZ members. Two versions of the survey were developed, a New Zealand version which had 65 questions, and an international version with 61 questions. Questions were identical for both the New Zealand version and the international version aside from four additional questions in the New Zealand version covering region, how the participant heard about the survey, how did the participant report the event to the CAA, and what rule part the participant was operating under. These questions were designed to support both the CAA and UAVNZ, New Zealand's professional UA organisation, to gather information to support the New Zealand UA sector. Both organisations viewed the survey questions prior to distribution and supported the researcher by including the survey link in each organisation's newsletters. Under the ethics approval for this research, only anonymised and aggregated data was shared in return with these organisations upon completion of the research. A full list of questions for the survey can be found in Appendix D.

The survey was voluntary and anonymous with participants required to confirm understanding on the participant information sheet before continuing with the survey. Because the survey included questions which had the potential to bring back uncomfortable experiences there were a number of mental health organisations contact details included on the participant information sheet. After agreeing to the information sheet, participants could select which version applied to them. The survey was open worldwide between 1 February 2024 to 29 April 2024. Very few questions were compulsory in the questionnaire. This research was approved by the Massey University Ohu Matatika 1 Ethics Panel, Approval number OM1 23/52

This study carefully tried to avoid the issue of self-generated validity, where research measuring attitudes or behaviours ends up influencing participants perspectives. This may occur when participants are compelled to answer questions or engage with research for which they may have had no previous opinion on (Chandon et al., 2005; Sandberg & Conner, 2011). This research endeavoured to avoid self-generated validity by allowing participants the ability to skip questions if they had no opinion on that question topic, and by including qualitative questions where participants could answer in their own words. Additionally, Likert questions, which could also be skipped over, included topics which RPA users would likely already have an opinion on. A further strategy to avoid self-generated validity was asking RPA representatives from the Civil Aviation Authority of New Zealand, and the executive committee of UAVNZ to pilot the survey and obtaining feedback on questions, which did result in changes before the survey was launched.

3.3 Procedure

This survey was administered online using Qualtrics. Participants were recruited via several different methods and from there a snowball method was used by asking participants to share the survey. Initial methods of participant recruitment used were: social media posts in UA specific groups, the industry professional body UAVNZ advertised the survey in the organisation's newsletter, CAA advertised the survey in their mail out information updates, emails from the researcher were sent directly to CAA Part 102 operators which are publicly available on the CAA website, emails from the researcher were sent directly to those that expressed interest from events the researcher attended (UAVNZ Symposium 2023, UAVNZ Conference 2023, and the New Zealand Aerospace Summit 2023), emails sent directly to international UA organisations and, international UA magazines; and via LinkedIn messages.

Participation in the research was voluntary and could be discontinued at any time while completing the survey. To take part in this study, participants were required to speak and understand English, be 16 years or older (or alternatively the age of consent in their local country), either currently fly RPA, have flown RPA, or have worked as a member of a ground crew for an RPA operation.

3.4 Analysis

This research uses explorative mixed methods research, utilising both qualitative and quantitative methods. Charmaz's constructivist approach to grounded theory guided determination of the most appropriate analysis method for the qualitative research. (Birks et al., 2019; Charmaz & Thornberg, 2021; Chun Tie et al., 2019). A mixture of content and thematic analysis was used to analyse the qualitative questions (Braun & Clarke, 2006; Chun Tie et al., 2019; Elo & Kyngäs, 2008). All data was transferred to a master raw data excel spreadsheet and those surveys which were incomplete were transferred to a further exclusion's excel spreadsheet. Data in the raw data master was then cleaned up and quantitative and qualitative data was separated to be analysed separately. The Likert questions were first analysed graphically then further analysis was carried out using IBM statistical package for social sciences (SPSS), Version 29 (IBM Corp, Released 2023). Both a one-sample t-test and a chi-squared goodness-of-fit test were carried out (Cohen, 1988; Sheskin, 2020). Likert questions were treated as both parametric and non-parametric. The one-sample t-test was used

to assess if participants views were significantly different to a hypothesised mean, in this case neutrality. The chi-squared-goodness of fit test was to assess if the distribution of views was different from statistical chance alone. Three different types of regression were run: (1) linear regressions (Cohen, 1988; Weisberg, 2014) were run to examine whether user characteristics could predict Likert scale opinions, (2) a binomial logistic regression (Box & Tidwell, 1962; Cohen, 1988) was run to see whether it was possible to predict if a user had experienced violence or aggression based upon their user characteristics, and (3) an ordinal logistic regression (Pregibon, 1981) was used to examine whether user characteristics could predict the level of violence or aggression experienced.

The qualitative data was analysed using content and thematic analysis. There were several questions where participants gave concise responses. These questions were analysed using content analysis as the participants supplied one-or two-word answers. Qualitative data where participants gave a more detailed answer were first divided up into categories using content analysis before being further analysed using thematic analysis where they were divided into themes and sub-themes.

Chapter 4 Results

This section starts with a reminder definitional note and a participant demographic section. This results section is then divided into five further sections addressing each research question.

4.1 Definitional Notes

In previous sections the term UA has predominately been used because research around public acceptance is broad regarding aircraft type. Often researchers will include advanced air mobility (AAM) into the research alongside UA where the pilot will be in a ground control centre some distance away. This research focuses on RPA which are controlled by a person on the ground within the vicinity using a handheld flight controller or ground control station.

In this section the term *aggressor* will be used to describe the member of the public threatening the RPA pilot or ground crew. The term *victim* will be used to describe the research participant (RPA pilot or ground crew). However, it is recognised by the researcher in a number of these circumstances that the aggressor may have felt they were the true victim. This research studies the participants (RPA pilot or ground crew) subjective realities using an objective scientific method while understanding that this research reflects one part of multiple perspectives in the discussion around public acceptance of RPA (Gelman & Hennig, 2017; Morgan & Drury, 2003).

In this section the word *event* is used when referring to the event of violence and aggression towards the RPA pilot or their ground crew. Unless otherwise stated, this section treats the participants *most recent* event and *worst* events of violence and aggression as separate events and will be reported as a total events unless otherwise stated. There were two questions which were compulsory in the participants questionnaire, the first asked if the participant had experienced violence and aggression while flying an RPA or operating as a ground crew for an RPA, and the second, if the participant had experienced violence and aggression worse than their most recent experience. If a participant answered no to either of these questions the survey completed. Otherwise, all other questions were not compulsory therefore the number of *not answered* questions has been included in results.

4.2 Demographic Variables

There were 337 participants that took part in the survey. From the sample of 337 total participants, 44 were excluded due to being incomplete. Leaving a total of 293 remaining sufficiently answered surveys. Of those, 36 were female, 253 were male and four participants preferred not to say. The youngest participant to complete the survey was 16, the oldest participant to complete the survey was 100 years, the median age was 44 years with a median interquartile range (IQR) of 33 years and 57 years.

A total of 190 participants who selected the New Zealand version of the survey and were asked the region in New Zealand they were from. Of these, 134 participants were from North Island regions, 54 participants were from South Island regions, and two participants did not state what region they were from. A full list of regions is listed in Appendix B. The 103 participants who selected the international version of the survey were also asked what country they were from. The three countries with the largest participation in the international version were the United Kingdom (43, 41.75%), United States of America (25, 24.27%), and Australia (20, 19.42%) participants (percentages are of the number of international participants). A full list of participant countries is included in Appendix B. From the sample of 293 usable questionnaires, nine (3.07%) participants identified as not current; 88 (30.03%) participants identified as recreational RPA users; 101 (34.47%) participants identified as semi-professional RPA users, where less than 50 percent of their work time is spent on activities related to RPA; and 93 (31.74%) participants identified as professional RPA users, where more than 50 percent of their time is spent on activities related to RPA. There were two (6.83%) participants that did not answer this question.

The participants RPA flight hours have been separated into recreational and commercial RPA flight hours and are shown below in Table 4.1.

Table 4.1

Recreational and Commercial Flight Hours

	Hours flown				
	Median	**Lower quartile**	**Upper quartile**	**Minimum**	**Maximum**
Recreational	10	2	35	0	2000
Commercial	22	4	100	0	1500

Note. Seven participants did not report RPA hours

Participants usual RPA application was analysed using content analysis and divided up into concepts of operation. This is presented in Table 4.2 below.

Table 4.2
Participants Usual Application

Application	**Concepts of operation**	**Description**	**No. of participants**
			***n* = 293**
Agricultural / Horticultural	Agricultural spraying	Using RPA in the farming / forestry / orchard industries	21 (7.17%)
Asset inspection	Civil structures inspection Infrastructure inspection	Using RPA to fly around or over (close to) infrastructure	23 (7.85%)
Construction	Construction monitoring Building inspection	Using RPA in the construction industry	7 (2.39%)
Emergency / Search & Rescue / Disaster response	Disaster assessment Emergency management Search & Rescue Fire & Emergency	Supporting emergency services for communities in need	19 (6.48%)
Environmental monitoring	Plant health Environment (rivers)	Monitoring for environmental purposes	4 (1.37%)
Fishing	Fishing	Use of RPA to catch fish	2 (0.68%)
Flight training / Testing	Pilot training Examiner	RPA Pilot training or testing	25 (8.53%)
Military	Military Defence	Armed forces of a country	3 (1.02%)

Research & Development	System development Testing & Acceptance Demonstrations	Research and development of RPA technology	16 (5.46%)
Real estate	Real estate photography	Use of RPA to sell private or commercial property	5 (1.71%)
Recreational	RPA racing FPV* HD** Videos (private) Model flying Stunt flying	Use of RPA for enjoyment purposes outside employment	89 (30.38%)
Scientific research	Scientific research	Use of RPA for research (other than in the development of RPA)	9 (3.07%)
Surveillance	Intelligence, surveillance, reconnaissance operations	Monitoring people or places	11 (3.75%)
Surveying	Surveying Photogrammetry Geotechnical surveying Mapping Infrared imaging Thermal imaging Three-dimensional (3D) mapping LiDAR	Mapping and survey using LIDAR, photogrammetry, thermal imaging etc	110 (37.54%)
Uncategorised	FPV* Flying Stunts Fog dispersal Part 102 pilot	Applications that are individual and do not fit in or it is unclear which above categories they fit.	14 (4.78%)

Did not answer question	Not applicable	Not applicable	2 (0.68%)

* FPV = First person view
** HD = High definition
Note. Several participants had more than one usual application.

4.3 Research Question 1

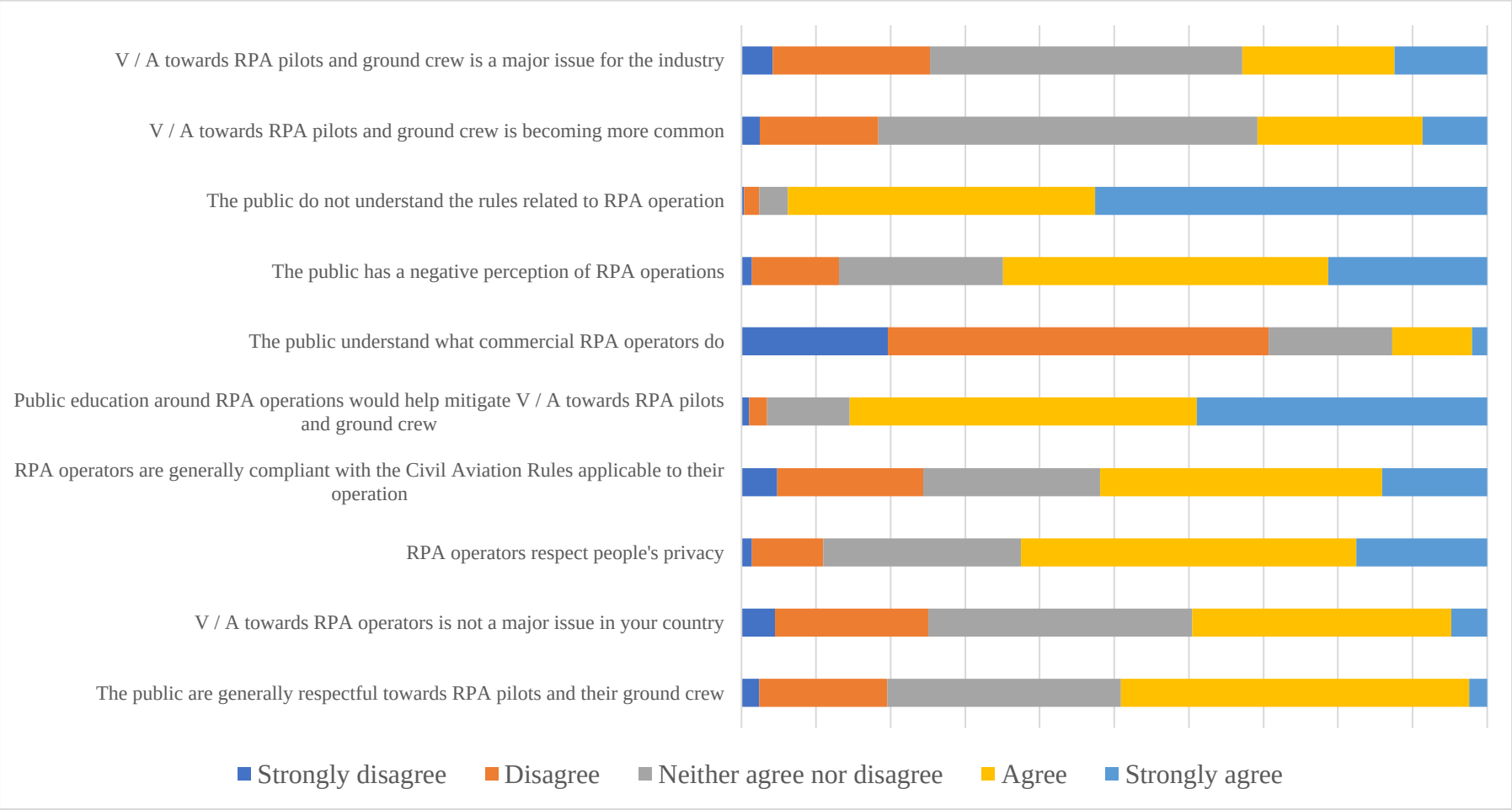
How widespread or prevalent is violence and aggression towards remotely piloted aircraft (RPA) pilots and their ground crew?

4.3.1 User Perspectives

The ordinal data Likert questions were treated as interval data by assigning numbers from one to five (Aydin, 2019; Laerd Statistics, 2018). Each Likert question was then analysed sequentially using parametric and non-parametric statistical tests utilising the statistical program, SPSS (IBM Corp, Released 2023). The order of the Likert questions in the survey has remained the same as in Figure 4.1 below. The Likert questions have been displayed first pictorially in the stacked bar column in Figure 4.1 below then statistically in Table 4.3 below this. A Bonferroni correction was made in Table 4.3 to correct for "probability (ρ) values because of the increased risk of a type 1 error when making multiple statistical tests" (Armstrong, 2014, p. 502).

Firstly, Figure 4.1 below presents RPA user's opinions on public acceptance of RPA visually. This graph illustrates the majority of RPA users either agree or strongly agree that the public do not understand the rules related to RPA operations. Also depicted is a large portion of RPA user's either agree or strongly agree that public education around RPA operations would help mitigate violence and aggression towards RPA pilots and ground crew. One further item of note is the quantity of RPA users selecting neither agree nor disagree for the Likert questions; *violence and aggression towards RPA pilots and ground crew is a major issue for the industry*, *violence and aggression towards RPA pilots and ground crew is becoming more common*, and to a lesser degree, *violence and aggression towards RPA operators is not a major issue in New Zealand*.

Figure 4.1
Remotely Piloted Aircraft Sector Perspectives



Note. V/A = Violence and aggression

4.3.1.1 Single Sample t-test

Next, Table 4.3 below shows results from the single sample t-test and the Chi squared goodness of fit test. To clearly depict RPA users' opinions on public acceptance of RPA two statistical tests were carried out. Firstly, a single sample t-test was carried out on the Likert responses which were compared to a hypothesised mean of neither agree nor disagree, or neutral on a 5-point Likert scale. This revealed if RPA user's opinions were significantly different from the neutral point. However, because the t-test only provides a measure of central tendency (a single value that represents the middle of a set of data), a Chi-squared goodness of fit test was carried out to assess if the RPA user's opinions were evenly distributed across the 5-point Likert scale or if they tended to cluster to one level of agreement more. These tests were carried out to present an overall picture of RPA user opinions.

H_0 (null hypothesis) = The mean score of the sample is not statistically significantly different from the hypothesised mean
H_A (alternate hypothesis) = The mean score of the sample is statistically significantly different from the hypothesised mean

The mean in the single sample t-test shows the mean level of agreement with each statement in the Likert scale. The standard deviation shows how dispersed participants answers are. With an exception to the question, *the public understand what commercial RPA operators do*, Collectively, the mean score for all questions was above the expected neutral score of 3. Of note was the statement *the public do not understand the rules related to RPA operations*, which had a mean of 4.44 with a large effect size. This signals RPA users strongly believe the public does not understand RPA operations. Also of note was the statement *public education around RPA operations would help mitigate violence and aggression towards RPA pilots and ground crew*, which had a mean of 4.20 and a large effect size. This indicates RPA users strongly believe educating the public on RPA would help with understanding. Of particular interest along with these are the statements, *violence and aggression towards RPA pilots and ground crew is a major issue for the industry*, and *violence and aggression towards RPA operators is not a major issue*, both of which were statistically significant but with mean scores very close to neutrality (3.16 and 3.15, respectively) and both had small effect sizes. This suggests that while there may be an issue with violence and aggression against RPA, collectively RPA users do not feel strongly either direction about this issue.

While effect sizes vary, all statements achieved statistical significance indicating that users have an opinion on each statement that is statistically different from neutrality.

4.3.1.2 Chi-squared Goodness of Fit tests

H_0 (null hypothesis) = Participants are evenly spread across the categories according to statistical chance

H_A (alternate hypothesis) = Participants are spread across the categories differently to what would be expected by chance alone

Each Likert question was also analysed using chi-squared goodness of fit tests. For these tests, which report if the distribution is different to statistical chance alone, the mode is reported as the measure of central tendency showing the largest grouping, which may be neutrality. Of note regarding RPA user's opinions towards the public's understanding of RPA, *the public do not understand the rules related to RPA operations*, had a mode of agree with a large effect size. This indicates RPA users have a strong belief that the public does not understand rules around RPA operations. Also of note was the statement, *the public has a negative perception of RPA operations* which had a mode of strongly agree with a medium effect size. This should be taken alongside the statement, *the public understand what commercial RPA operators do*, which had a mode of disagree with a medium effect size. These combined findings suggest RPA may think that the public has a negative perception because they do not understand what RPA are doing. Regarding how to fix this was the Likert question, *public education around RPA operations would help mitigate violence and aggression towards RPA pilots and ground crew*, which achieved a mode of strongly agree with a medium effect size.

Table 4.3 below reports the statistical test results from both the single sample t-test and the Chi-squared goodness of fit along with the effect sizes for both statistical tests.

Table 4.3
Remotely Piloted Aircraft Sector Perspectives

Variable	Measures of central tendency	Statistical tests	Effect size
Violence and aggression towards RPA pilots and ground crew is a major issue for the industry	M = 3.16 (SD = 1.029) Mode = Neither agree nor disagree	t (288) = 2.631** χ^2 (4) = 113.820***	d = 0.155 V = 0.314
Violence and aggression towards RPA pilots and ground crew is becoming more common	M = 3.19 (SD = 0.890) Mode = Neither agree nor disagree	t (288) = 3.571*** χ^2 (4) = 203.993***	d = 0.210 *V = 0.420*
The public in my country do not understand the rules related to RPA operations	M = 4.44 (SD = 0.699) Mode = Agree	t (290) = 35.070*** χ^2 (4) = 361.354***	d = 2.056 V = 0.557
The public has a negative perception of RPA operations	M = 3.72 (SD = 0.974) Mode = Strongly agree	t (290) = 12.584*** χ^2 (4) = 142.694***	d = 0.738 V = 0.350
The public understand what commercial RPA operators do	M = 2.24 (SD = 0.959) Mode = Disagree	t (289) = -13.414*** χ^2 (4) = 200.586***	d = -0.788 V = 0.416

Public education around RPA operations would help mitigate violence and aggression towards RPA pilots and ground crew	M = 4.20 (SD = 0.807) Mode = Strongly agree	t (289) = 25.310*** χ^2 (4) = 263.034***	d = 1.486 V = 0.476
RPA operators in my country are generally compliant with all the Civil Aviation Rules applicable to their operation	M = 3.37 (SD = 1.095) Mode = Strongly agree	t (290) = 5.729*** χ^2 (4) = 86.784***	d = 0.336 V = 0.273
RPA operators in my country respect people's privacy	M = 3.68 (SD = 0.920) Mode = Strongly agree	t (290) = 12.548*** χ^2 (4) = 164.172***	d = 0.736 V = 0.376
Violence and aggression towards RPA operators is not a major issue in my country	M = 3.15 (SD = 0.952) Mode = Neither agree nor disagree	t (290) = 2.649** χ^2 (4) = 134.687***	d = 0.155 V = 0.340
The public in my country are generally respectful towards RPA pilots and their ground crew	M = 3.30 (SD = 0.864) Mode = Strongly agree	t (290) = 5.834*** χ^2 (4) = 213.725***	d = 0.342 V = 0.429

Note. Significance levels indicated by *p ≤ 0.05, ** p ≤ 0.01, *** p ≤ 0.001 after applying Bonferroni correction (Armstrong, 2014)
Note. d = Cohen's d, *V* = Cramer's V.
Note. Cohen's d – The strength of the difference for single sample t-test, small effect = 0.2, medium effect = 0.5, large effect ≥ 0.8 (Cohen, 1988)
Note. Cramer's v – A measure the strength of association for Chi-squared goodness of fit, small effect = 0.1, medium effect = 0.3, large effect = 0.5 (Cohen, 1988).

4.3.2 Linear Regressions

Three Linear regressions were carried out to assess associations between the three dependent variables: RPA users' views on social acceptance, RPA users' views on pilot responsibility, and RPA users' views on whether violence and aggression is a major issue. All of these were measured using a composite scale formed from combining the results for agreement with related statements studied. The statements included in each of the composite measures are stated in the preamble for each regression.

Social acceptance was defined as the public's perception of RPA as viewed by the RPA user. Pilot responsibility was defined as the RPA pilot's views on compliance and respect for public privacy by the RPA users. Sector issue was defined as RPA pilots views on if violence and aggression towards RPA pilots and ground crew, is a concern for the sector. Each regression included the same set of independent variables composed of, user and flight characteristics, specifics of which are listed in their regression functions below.

Linear regressions were chosen to examine the RPA users' views (measured using Likert scale data and treated as continuous) could be predicted based upon, user and flight characteristics. Linear regressions allowed the ability to test whether any user or flight characteristic could achieve statistical significance as a predictor of user opinions, and, if so, whether these are positive or negative in terms of direction (Cohen, 1988).

4.3.2.1 Social Acceptance

Social acceptance included Likert questions around the public's perception of RPA, if the public are generally respectful of RPA, and if public education on RPA would help mitigate violence and aggression against RPA. Likert questions around the public's understanding of the RPA rules and what commercial RPA do was also included in this group.
The formula below shows the regression function.

Y = Social acceptance

$Y = \delta\ (\text{Intercept}) + a1 + a2 + a3 + a4 + a5 + a6 + a7 + b + c + \log(d)$

a1 = Surveying as a usual RPA application

a2 = Photography / Videography as a usual RPA application

a3 = Asset Inspection as a usual RPA application

a4 = Spraying / Washing and Pest Control as a usual RPA application

a5 = Recreational as a usual RPA application

a6 = Training / Testing / Research & Development as a usual RPA application

a7 = Other (Includes Uncategorised / Unclear / Emergency and Search & Rescue / Surveillance / Fishing / Research)

b = Whether the participant has experienced violence and aggression before while flying RPA

c = User type (recreational / semi-professional /professional)

d = Total RPA Flight hours (continuous data / Logarithm)

Responses for "a1" through to "b" were binary, while "c" was ordinal. Responses for constant "d" were transformed using a logarithm to compensate for heteroscedasticity in the variable.

The omnibus test revealed that the regression function was statistically significant, $\chi^2(10) = 54.714$, $p < 0.001$. The full statistical results are shown in table 4.4 below. These indicate that only two of the variables had enough predictive power to achieve statistical significance. These were when the user's ordinary RPA activity was flight testing / research & development and when the user has experienced violence and aggression before, of which both had a significant negative impact upon how the user viewed public acceptance.

Table 4.4

Linear Regression Social Acceptance

Variable	**β**	**χ2**
Intercept [1,2]	2.518***	397.566
Surveying [1,2]	0.047	0.458
Photography [1,2]	-0.093	2.128
Asset Inspection [1,2]	0.094	0.644
Spraying [1,2]	-0.058	0.237
Recreational [1,2]	0.015	0.039
Flight Testing / Research and development [1,2]	-0.347***	10.962
Other [1,2]	0.123	1.834

Has experienced violence and aggression [1]	-0.388***	40.479
User type [3]	0.020	0.129
Total RPA flight hours [4]	-0.041	0.557

*, **, ***, denote statistical significance at $p < 0.1$, 0.05 and 0.01, respectively
[1]. Categorical variable, where those within the category (i.e. response = 1) is the test variable

[2]. RPA user's usual application
[3]. Ordinal Variable, where 1 = recreational, 2 = semi-professional, 3 = Professional
[4]. Logarithmic variables to compensate for heteroscedasticity in the variable response variable.

4.3.2.2 RPA Pilot Responsibility

Pilot responsibility included Likert questions regarding RPA operators respecting privacy and flying in compliance with the civil aviation regulations.
The formula below shows the regression function.

Y = RPA pilot responsibility
Y = δ (Intercept) + a1 + a2 + a3 + a4 + a5 + a6 + a7 + b + c + log(d)

a1 = Surveying as a usual RPA application
a2 = Photography / Videography as a usual RPA application
a3 = Asset Inspection as a usual RPA application
a4 = Spraying / Washing and Pest Control as a usual RPA application
a5 = Recreational as a usual RPA application
a6 = Training / Testing / Research & Development as a usual RPA application
a7 = Other (Includes Uncategorised / Unclear / Emergency and Search & Rescue / Surveillance / Fishing / Research)
b = Whether the participant has experienced violence and aggression before while flying RPA
c = User type (recreational / semi-professional /professional)
d = Total RPA Flight hours (continuous data / Logarithm)

Responses for "a1" through to "b" were binary, while "c" was ordinal. Responses for constant "d" were transformed using a logarithm to compensate for heteroscedasticity in the variable.

The regression function failed to achieve statistical significance, $\chi^2(10) = 15.471$, $p = 0.116$, hence variable-specific results have been omitted.

4.3.2.3 Violence and Aggression as a Major Issue

Violence and Aggression as a major issue included Likert questions asking if violence and aggression towards RPA is or is not a major issue and if violence and aggression towards RPA is becoming more common.

The formula below shows the regression function.

Y = Violence and aggression as a major issue

Y = δ (intercept) + a1 + a2 + a3 + a4 + a5 + a6 + a7 + b + c + log(d)

a1 = Surveying as a usual RPA application

a2 = Photography / Videography as a usual RPA application

a3 = Asset Inspection as a usual RPA application

a4 = Spraying / Washing and Pest Control as a usual RPA application

a5 = Recreational as a usual RPA application

a6 = Training / Testing / Research & Development as a usual RPA application

a7 = Other (Includes Uncategorised / Unclear / Emergency and Search & Rescue / Surveillance / Fishing / Research)

b = Whether the participant has experienced violence and aggression before while flying RPA

c = User type (recreational / semi-professional /professional)

d = Total RPA Flight hours (continuous data / Logarithm)

Responses for “a1” through to “b” were binary, while “c” was ordinal. Responses for constant “d” were transformed using a logarithm to compensate for heteroscedasticity in the variable.

The omnibus test revealed that the regression function was statistically significant, $\chi^2(10) = 66.519$, $p < 0.001$. The full statistical results are shown in table 4.5 below. There were several statistically significant predictors, including if a participant’s usual application was photography, or flight testing (pilot or RPA) / research and development of RPA, if a participant has experienced violence and aggression while flying an RPA before, or if the participant had higher total RPA flight hours.

Table 4.5
Linear Regression Sector Issue

Variable	β	χ^2
Intercept	2.184***	143.208
Surveying [1,2]	-0.110	1.231
Photography [1,2]	0.197*	4.607
Asset inspection [1,2]	-0.015	0.008
Spraying [1,2]	-0.302	3.113
Recreational [1,2]	0.159	2.000
Flight testing / Research and development [1,2]	0.317*	4.380
Other [1,2]	-0.245	3.486
Has experienced violence and aggression [1]	0.492***	31.152
User type [3]	0.035	0.199
Total RPA flight hours [4]	0.271***	11.665

*, **, ***, denote statistical significance at $p < 0.1$, 0.05 and 0.01, respectively
[1]. Categorical variable, where those within the category (i.e. response = 1) is the test variable
[2]. RPA user's usual application
[3]. Ordinal Variable, where 1 = recreational, 2 = semi-professional, 3 = Professional
[4]. Logarithmic variables to compensate for heteroscedasticity in the variable response variable.

4.3.3 Remotely Piloted Aircraft Pilot and Ground Crew Experiences of Violence and Aggression

Table 4.6
RPA Pilot and Ground Crew Most Recent and Worst Events

Variable	Most recent event ***n* = 293**	Worst event ***n* = 155**	Total events ***n* = 448**
Yes	155 (52.90%)	28 (18.06%)	183 (40.85%)
No	138 (47.10%)	127 (81.94%)	265 (59.15%)

Note. Questions within the survey were not compulsory therefore after indicating yes to experiencing a threat, participants were not required to answer all questions included in the survey.

Of 293 total participants, 155 (52.90%) indicated yes, they had experienced aggression, intimidating behaviour, a negative reaction while flying (recreationally or commercially), or whilst operating as a ground crew for an RPA operation. Of the 155 who has experienced

violence or aggression, 28 had experienced a worst event than their most recent, which is further explicated later in this section.

Participants were asked about recency of their most recent event, and if within the last five years they had experienced other occurrences of being verbally or physically threatened while flying or operating as a ground crew of an RPA.

Table 4.7
Recency and Number of Events of Violence and Aggression

Variable	No. of events
	***n* = 155**
How long ago	
Within the past month	14 (9.03%)
More than a month ago, but less than six months ago	37 (23.87%)
More than six months ago, but within the last year	28 (18.06%)
More than one year ago, but less than three years ago	55 (35.48%)
Over three years ago	16 (10.32%)
Not reported	5 (3.23%)
Within last 5 years how many events (other than most recent event)	
Never, this was the only time	52 (33.55%)
1-2 times	44 (28.39%)
3-5 times	27 (17.42%)
6-9 times	11 (7.10%)
10-19 times	3 (1.94%)
20 or more times	6 (3.87%)

Note. Survey opened 1st of February 2024 and closed 29 April 2024.
Note. Survey questions relevant to most recent event of violence and aggression only.

Of the 155 most recent events, 79 (50.97%) occurred within the last year, with 91 (58.71%) of participants experiencing more than 1 event of violence and aggression.

Of the 155 participants that indicated yes to experiencing at least one event of violence and aggression while flying an RPA there were 28 (18.06%) participants who indicated yes, they had experienced aggression, intimidating behaviour, a negative reaction worse than their most

recent occurrence. This research has treated participants most recent occurrence and worst occurrence as separate events. Table 4.8 below shows these events.

Table 4.8
Participant Type

Variable	Most recent	Worst	Total events
	***n* = 155**	***n* = 28**	***n* = 183**
RPA pilot	140 (90.32%)	24 (85.71%)	164 (89.62%)
RPA ground crew	10 (6.45%)	3 (10.71%)	13 (7.10%)
Not reported	5 (3.23%)	1 (3.57%)	6 (3.28%)

From 183 total events, 164 (89.62%) the victim of the aggression, intimidating behaviour, or a negative reaction while flying RPA, was the RPA pilot.

This section indicates violence and aggression towards RPA pilots and their ground crew while flying has become more prevalent within the last three years (134, 86.45% of events), with the most events (79, 50.96% of events) occurring within the last year (until survey closure on the 29 April 2024).

4.4 Research Question 2

What is the nature of threats and aggression towards RPA pilots and their ground crew?

Participants were asked to classify the level of aggression experienced during the event on an ordinal scale. The results are presented in Table 4.9 below.

Table 4.9

Level of Violence and Aggression Experienced by Pilot or Ground Crew

Level of aggression	No. of events
	***n* = 183**
Anger (expression general annoyance or displeasure towards the pilot, the support crew, or the RPA)	67 (36.61%)
Verbal aggression (language directed at the pilot, the support crew, or the RPA in a threatening or harmful manner, e.g., use of strong language, profanity or use of inappropriate gestures)	50 (27.32%)
Threats of physical violence or aggression towards the pilot or the support crew (threatening physical harm, e.g., kicking, hitting, using weapons other than a firearm)	9 (4.92%)
Threats of physical violence or aggression towards the RPA (threatening to damage or destroy the aircraft, e.g., kicking, hitting, using weapons other than a firearm)	8 (4.37%)
Actual physical violence or aggression towards the pilot or the support crew (causing physical harm, e.g., kicking, hitting, using weapons other than a firearm)	4 (2.19%)
Actual physical violence or aggression towards the RPA (causing damage or destroying the aircraft, e.g., kicking, hitting, using weapons other than a firearm)	4 (2.19%)
Threats of physical violence or aggression towards the pilot or the support crew using firearms (e.g., threatening to shoot the pilot or ground crew)	3 (1.64%)

Threats of physical violence or aggression towards the RPA using firearms (e.g., threatening to shoot the RPA down)	16 (8.74%)
Actual physical violence or aggression using firearms towards the pilot or the support crew (e.g., shooting at the pilot or ground crew – may include shots that did not hit their target)	1 (0.55%)
Actual physical violence or aggression using firearms towards RPA (e.g. shooting at the uncrewed aircraft – may miss or hit the RPA)	4 (2.19%)
Other	8 (4.37%)

The majority of events, 117 (63.93%), involved either anger or verbal aggression. Anger was defined as expressing general annoyance or displeasure towards the pilot, the support crew or the RPA. Verbal aggression was defined as language directed at the pilot, the support crew, or the RPA in a threatening or harmful manner such as the use of strong language, profanity or the use of inappropriate gestures. A notable number of events, 16 (8.74%), involved threats of physical violence or aggression towards the RPA using a firearm, such as threatening to shoot the RPA down.

Qualitative data was used to further describe the nature of the event of violence and aggression.

4.4.1 Grounded Theory

Grounded theory has been used in this research where qualitative data on the lived experiences of RPA pilots and ground crew was collected. This data has been analysed using content and thematic analysis, resulting in the development of a theory from the data (Braun & Clarke, 2006; Chun Tie et al., 2019; Elo & Kyngäs, 2008). This research follows Charmaz's constructivist approach to grounded theory where the researcher's aviation background has been used to analyse participants real world experiences flying RPA (Birks et al., 2019; Chun Tie et al., 2019). Studies currently available on public acceptance of UA are incomplete as only the public perspective of the narrative has been considered and often this opinion is paper based and theoretical rather than through authentic experiences. Charmaz's grounded theory approach recognises the value of the researcher's prior experience and knowledge and acknowledges the subjectivity of the participants may be different to that of the public which has been widely studied.

Charmaz and Thornberg (2021) provide guidelines for constructivist grounded theory, which have been used as a basis for this section of the research. Research on public acceptance towards UA focusses on public safety and security but does not consider the UA pilot or ground crew's welfare or the common good that comes from many RPA applications. A number of articles identify acceptable and unacceptable applications for UA on paper, however, do not consider exactly how in a real-world situation a member of the public could identify what the UA is doing to know if it's an acceptable or unacceptable application.

In the initial stages of this study the researcher gained knowledge in the area by speaking to RPA pilots and ground crew who had experienced violence and aggression while flying an RPA. A survey was then developed which included a section for qualitative data. Content analysis was used in the initial coding using *wh* question words (who, where, why, what was the threat, what was the RPA activity, what was the RPA user's actions, was their prior preventions in place, and what was the outcome) as a preliminary step to analysis. Content analysis was also used in the intermediate-focussed coding to identify the aggressor and the application which the RPA was carrying out during the event (Elo & Kyngäs, 2008). Thematic analysis was used in the advanced stage of analysis to examine, preparations the pilot and/or ground crew had conducted prior to prevent the event, where the RPA was when the event occurred, what the threat towards them was, what the resulting actions were, why the RPA pilot believes the aggressor may have acted in this way, and the outcome after the event (Braun & Clarke, 2006; Chun Tie et al., 2019).

Content analysis, which can be used in quantitative and qualitative analysis, is a structured method of analysis, involving identifying commonalities and keywords from the data and creating categories (Vaismoradi et al., 2013). In exploratory research where there is little research, such with this research, content analysis is useful for reporting and quantifying commonalities in the data. Thematic analysis, which can only be used in qualitative analysis, involves identifying and analysing themes in the data and focusses on the richness within the qualitative data (Braun & Clarke, 2006).

Table 4.10 below presents the process that qualitative data underwent. All initial coding (*wh* question words) were analysed via content analysis. The initial code, the aggressor (who)

underwent further content analysis. The remaining initial codes (wh question words) were analysed further using thematic analysis.

Table 4.10
Grounded Theory – Description of Violence and Aggression Event(s)

Grounded theory				
Content analysis	**Content analysis**	**Content analysis**	**Thematic analysis**	**Thematic analysis**
Prior prevention			Notification / Permission, Pre-flight planning, RPA pilot / crew identifiable, Landed ASAP, Unable to notify	
The aggressor	Group, Individual	Perceived male, Perceived female, Unclear		
RPA application (during threat)			Agricultural / Horticultural, Asset inspection, Construction, Emergency & disaster response, Flight training / Testing, Mapping, Photography / Videography, Real estate, Recreational, Search & Rescue, Surveying, Uncategorised	
Where			Private Property, Commercially Owned Land, Government Owned Land, Public Area, Unclear	
Threat			Verbal Aggression, Threat of Physical Aggression, Physical Aggression, Written Aggression, Unclear	Questioning, Anger, Intimidation, Used Police as Threat, Towards RPA, Towards Pilot / Crew, Threat to Shoot RPA, Threat to Shoot Pilot / Crew, Unclear

Pilot actions		Attempted to Calmy Diffuse Situation, Spoke Firmly to Aggressor	Provided Information / Education, Used Legal / Police as Threat, Asked Aggressor to Leave, Used General Threat, Unclear what was said
Why		Aggressor Perceived Spying / Privacy Concerns, Aggressor had Noise Concerns of RPA, Aggressor had Concerns for Animals, Aggressor had Concerns about Use of Information, Near property (Not further specified), Unclear	
Outcome		Threat not resolved, threat partially resolved, threat resolved	

Note. This data is sourced from the qualitative question, *please briefly describe what happened in your most recent (worst) occurrence of being verbally or physically threatened*. This question was asked for both the most recent and worst events.
Note. Most recent event and worst event qualitative data has been included

An initial content analysis was carried out on the qualitative descriptions of the event and common themes were grouped together before each theme was further analysed using content analysis or thematic analysis. The most recent events and worst events have been collected separately and have been combined. These events have been treated as separate events from here on with n = 183 as one participant may have experienced a most recent event and worst events. Although the most recent and worst events have been treated as separate events they are still considered as one participant. Table 4.11 below shows the number of *most recent* and *worst* events of violence and aggression.

Table 4.11
The Number of Most Recent and Worst Events of Violence and Aggression

Variable	No. of participants	No. of statements	Definition
	***n* = 293**	***n* = 547**	
Most recent event of violence and aggression	155 (52.90%)	471 (86.11%)	Have you ever experienced aggression / intimidating behaviour / a negative reaction while flying (recreationally or commercially), or whilst operating as a ground crew for a remotely piloted aircraft operation?
Worst event of violence and aggression	28 (9.56%)	76 (13.89%)	Have you ever experienced aggression / intimidating behaviour / a negative reaction worse than your most recent occurrence?
Total events of violence and aggression	**183**	**547**	

Note. Most recent and worst have been treated as separate events

Table 4.12 presents the common themes from the content analysis of the qualitative data.

Table 4.12
Most Recent and Worst Events of Violence and Aggression

Variable	No. of events	No. of statements	Definition
	***n* = 183**	***n* = 547**	
Prior prevention	29 (15.85%)	30 (5.48%)	Actions participants took prior to flight to avoid conflict
The aggressor	114 (62.30%)	117 (21.39%)	The member of the public threatening the RPA pilot or ground crew
RPA application during threat	38 (20.77%)	38 (6.95%)	The application the RPA carried out during the event
Where	47 (25.68%)	47 (8.59%)	Where the RPA was during the event
Threat	121 (66.12%)	186 (34.00%)	What was the threat to the RPA, the pilot, or the ground crew was
Pilot / ground crew actions	38 (20.77%)	41 (7.50%)	What the pilot or ground crew did after the (initial) event
Why	55 (30.05%)	56 (10.24%)	Why the participant believes the aggressor was angry.
Outcome	31 (16.94%)	32 (5.85%)	What occurred after the event
No comment	21 (11.48%)	Not Applicable	Participants who selected “Yes” they have experienced violence and aggression while operating a RPA but did not describe the occurrence. This group is mutually exclusive and is not included in other sections

A thematic analysis was carried out on the theme of prior prevention which included 30 statements from participants most recent and worst event detailing the preparation and planning carried out by the RPA pilot or ground crew prior to the flight. This is shown below in Table 4.13.

Table 4.13
Prior Prevention Carried out to Avoid Threats?

Theme	No. of events	No. of statements	Example
	***n* = 183**	***n* = 547**	
Notification completed / Permission granted	15 (8.20%)	16 (2.93%)	"…permission to fly was given by the local Iwi/Hupu who owned the land…", "…allowed per our part 102, no permission needed…", "…landlord was with me…"
Pre-flight planning	5 (2.73%)	5 (0.92%)	"There was no flight restriction in this location on any flight map.", "…the operation was in accordance with all rules, regulations, and laws."
RPA pilot / Crew identifiable	7 (3.83%)	7 (1.28%)	"Wearing branded hi-vis jacket.", "…I was in my work uniform and sign written vehicle…", "..wearing full fire uniform, high viz etc."
Unable to notify	1 (0.55%)	1 (0.18%)	"This situation never occurs when we do a letter drop … however we can't always do that…"
Landed as soon as possible	1 (0.55%)	1 (0.18%)	"…as soon as she was sighted we all grounded our drones as safety and quickly as possible…"

A further content analysis was carried out on the theme describing the aggressor which included 117 statements from participants most recent and worst event. Table 4.14 below presents these.

Table 4.14
The Aggressor

Theme	No. of events	No. of statements	Examples
	***n* = 183**	***n* = 547**	
An official(s)	9 (4.92%)	9 (1.65%)	"…a member of a local council.", "…called tower…", "A ranger for a national body…", "…by a security gaurd [sic]…"
Nearby resident / Property	24 (13.11%)	24 (4.39%)	"…nearby property owner…", "…Approached by a local farmer…", "…by an unknown nearby neighbour…"
Neighbour	33 (18.03%)	33 (6.03%)	"…the back property owner…", "…neighbouring property farmer…",
Public member(s)	50 (27.32%)	51 (9.32%)	"…a lady walking her dogs…", "A family in the general public…", "A couple came…", "…member of the public."

Note. Events are not mutually exclusive between themes. Some events included in more than one theme.

Of note was in a total of 57 (31.15%) of events the aggressor was either a neighbour or a nearby property owner. In 50 (27.32%) of events the aggressor was a member of the public.

These statements also included detail about the number of aggressors and the perceived gender of the aggressor involved in the threat. These are presented below in Table 5.15.

Table 4.15
Describing the Aggressor

Variable	No. of events
Group / Individual agressor[1]	**n = 183**
Group	21 (11.48%)
Individual	92 (50.27%)
Unclear	4 (2.19%)
Perceived gender of aggressor	
Female	25 (13.66%)
Male	27 (14.75%)
Unclear	65 (35.52%)

[1]. More than one aggressor was considered a group

In 92 (50.27%) of events the aggressor was alone. Although a large number of events did not include the perceived gender of the aggressor, of that that did, the numbers of female 25 (13.66%) and male 27 (14.75%) are very similar.

Two survey questions included information around the application the RPA was engaged in during the event. The first came from details included in the qualitative question, *please briefly describe what happened in your most recent (worst) occurrence of being verbally or physically threatened*. Details around the RPA's application were included in 38 statements which were thematically analysed giving descriptions of the event of violence and aggression during participants most recent event and worst event. Some of these statements are presented below in Table 4.16. Additional information on RPA application during an event of violence and aggression can be viewed in the results for research question 3, Table 4.24.

Table 4.16
Application during Event

Concepts of operation	No. of events	No. of statements	Examples
	***n* = 183**	***n* = 547**	
Asset inspection	6 (3.28%)	6 (1.10%)	"Conducting power line inspections…", "…working at a telecommunication asset where I was surveying the site and surrounding property…", "…performing [a] automated mission over a warehouse roof…"
Construction	3 (1.63%)	3 (0.55%)	"I had to monitor a construction job…", "…asked to do monthly aerial surveys for the construction site.",
Agricultural / Horticultural	1 (0.55%)	1 (0.18%)	"…a survey flight over a kiwi orchard…"
Emergency search and rescue & Disaster response	6 (3.28%)	6 (1.10%)	"…conducting flight operations following a flooding event…", "…Disaster zone doing a mapping flight …damaged road.", "…flying hot spot detection at a major fire event.", "…carrying out a SAR flight searching for a lost dog…"
Photography / Videography	5 (2.73%)	5 (0.91%)	"…filming a building for the owner of the building…", "Filming a beach at sunset…", "…filming above private land with permission…"

Recreational	3 (1.63%)	3 (0.55%)	"…flying foam models…", "…fly model aircraft from a lifestyle block."
Real estate	4 (2.19%)	4 (0.73%)	"…taking photos of a property for a real estate agent."
Surveying	4 (2.19%)	4 (0.73%)	"…while surveying a property…", "…drone would be mapping their farm…", "…survey mapping as part of a subdivision development project…", "…during a night thermal activity…"
Flight training / Testing	3 (1.64%)	3 (0.55%)	"Test flights…", "…was only practicing for my 101 licenses.", "…doing a routine engine check…"
Uncategorised	3 (1.64%)	3 (0.55%)	"…while flying FPV in a shielded operation."

A thematic analysis was carried out on the qualitative question describing the event of violence and aggression for both most recent and worst events. There were 47 statements which included information about where the RPA was operating when the threats occurred. Details on the location of the event are shown below in Table 4.17.

Table 4.17
Event Location

Theme	Description	No. of events	No. of statements	Examples
		***n* = 183**	***n* = 547**	
Operating over private property	Privately owned land	11 (6.01%)	11 (2.01%)	"…from a lifestyle block…", "…over private property…", "Was flying a rural lot…"

Commercially owned land	Land owned for commercial operations	2 (1.09%)	2 (0.37%)	“Flying on an adjacent site…subdivision development project…”, “…was carried out in an empty failed development site in New Zealand.”
Government owned land	Land owned by local or central government that is not normally available to the general public	4 (2.19%)	4 (0.73%)	“…while flying over a substation…”, “Operating over council property…”
Public area	Land that is open and accessible to the general public	25 (13.66%)	25 (4.57%)	“…at a public park…”, “…beach at sunset, drone pointing out to sea.”, “…flight over a flat empty field with no structures or people on it."
Unclear	The comment does not detail specifically where the RPA was flying	5 (2.73%)	5 (0.91%)	“Flying next to a sports field…”, “Operating near an un-controlled airport…”, “I was flying in a shielded area.”

The survey question asking participants to describe the event included 186 statements detailing the nature of the threat for the most recent and worst events A thematic analysis was carried out on these and included in Table 4.18 below.

Table 4.18
Nature of Threat

Theme	Subtheme	No. of events	No. of statements	Examples
		***n* = 183**	***n* = 547**	
Written aggression	Not applicable	4 (2.19%)	5 (0.91%)	"…using social media to insult our operations…", "…made a vexatious complaint to the local council regarding noise."
Verbal aggression	Questioning	26 (14.21%)	27 (4.94%)	"…approached me asking if I was recording media from the drone…", "Being challenged…", "…questioned whether I was legal to fly."
	Used police as the threat	13 (7.10%)	13 (2.38%)	"Threatened to call police to arrest me.", "They called cops…", "…if I don't land the drone right away they will call the police."
	Anger	73 (39.89%)	73 (13.35%)	"Verbal altercation strong language including shouting…", "…stormed across the street to shout at us", "Verbally accosted me by no physical threats", "…was verbally abusive."
	Unclear	4 (2.19%)	4 (0.73%)	"I got confronted…"

Threat of physical aggression	Threat to shoot RPA	19 (10.38%)	19 (3.47%)	"…told me I was lucky my UAV wasn't shot down.", "…showed me a shot gun shell and told me he'd use it to shoot down the drone.", "…threatened to shoot down RPAS unit…"
	Towards RPA	2 (1.09%)	2 (0.37%)	"…he said he would smash the controller and the drone."
	Towards Pilot / Crew	2 (1.09%)	2 (0.37%)	"…told if I don't laned [sic] right now they were going to *Smash my head in*…"
	Threat to shoot pilot / Crew	1 (0.55%)	1 (0.18%)	"…threatened with a gun."
Physical aggression	Intimidation	23 (12.57%)	24 (4.39%)	"…by driving their vehicle aggressively at myself whilst I was piloting the craft…", "…he flew into our airspace and landed within 15m of us.", "…came out of their house from the other side of the road with a firearm…", "…and drove around to the site and came at us with a baseball bat. They didn't hit us…"
	Towards RPA	9 (5.81%)	9 (1.65%)	"…rocks were thrown at the aircraft.", "…UAS shot at…", "…he attempted to

				shoot down the drone with a bow and arrow…", "…let their dog off leash to chase and attempt to destroy it"
	Towards Pilot / Crew	5 (3.23%)	5 (0.91%)	"They tried to take the drone off me. I resisted…He proceeded to punch me and then lift my co worker up and throw him into a hedge.", "…through a glass bottle at the van and it went through an open window and hit my passenger."
	Unclear	1 (0.65%)	1 (0.18%)	"…physically threatened"
Unclear	NA	1 (0.65%)	1 (0.18%)	"…with a clear bias against DRONES, largely ignorant of legacy model aeroplane hobbyists, seeing to limit my operations"

There were 41 statements which described the victim's actions during the event included in the qualitative survey question asking the participant to describe the event. A thematic analysis was carried out on these statements. Results to these actions are shown below in Table 4.19.

Table 4.19
Pilot's Actions during Threat

Theme	Subtheme	No. of events	No. of statements	Examples
		n **= 183**	***n*** **= 547**	
Attempted to calmly diffuse situation	Provided information / Education	28 (15.30%)	29 (5.30%)	"Once I talked about the survey mapping flight I was doing…", "…I tried to explain the UK CAA rules for drones…", "I showed him the flight route and pictures.", "I explained I was certified, authorised by CAA and the flight was authorised by ATC…"
	Unclear what was said	5 (2.73%)	5 (0.91%)	"I asked her to please give me a moment to safely land my drone and then we could talk…", "I tried to calm the guy down to no avail.", "It took a long time to calm him down…"
Spoke firmly to aggressor	Asked aggressor to leave	1 (0.55%)	1 (0.18%)	"…I asked him to leave very politely…"
	Provided information / Education	1 (0.55%)	1 (0.18%)	"…I had the proof to show the person…"
	Used legal / Police as threat	3 (1.64%)	3 (0.55%)	"…what are you hiding that you are so paranoid about, do I need to call the police?", "…I ask the police to press

			charges for harassment or get them to leave me alone."
	Used general threat	2 (1.09%)	2 (0.37%)	"…reminded him that he was 5 miles from civilisation, making threats against someone he didn't know…", "…how do you think it looks for a random man to appear from the bush…"

There were 56 statements included in the qualitative question asking participants to describe the event which gave clues as to why the aggressor was angry. These statements were thematically analysed into themes and are presented in Table 4.20 below.

Table 4.20
Potential Triggers for Aggressor's Anger

Theme	No. of events	No. of statements	Examples
	***n* = 183**	***n* = 547**	
Aggressor concerns for animals	2(1.09%)	2 (0.37%)	"…concerned about flying in the vicinity of her nervous horses.", "…near a neighbouring property that had horses."
Aggressor had concerns about use of information	1 (0.55%)	1 (0.18%)	"…think we performing surveying for building a landfill…"
Aggressor had noise concerns of RPA	7 (3.83%)	7 (1.28%)	"…because of others previous noise.", "Noise level and disturbance was their main issue."
Aggressor perceived spying / Privacy concerns	33 (18.03%)	33 (6.03%)	"…complained that we were invading her privacy…", "…accused me of flying around his house &

			spying…", "…was annoyed his backyard was being photographed.", "…of being sued for spying or disrespecting people's privacy."
Near property (not further specified)	6 (3.29%)	6 (1.10%)	"…accused of flying over their property, not actually within 100 metres.", "…was upset that we were flying near her land."
Lack of communication / understanding	3 (1.64%)	3 (0.55%)	"She did not know we have already asked for his permission.", "…was upset that we were flying near her land."
Unclear	4 (2.19%)	4 (0.73%)	"The community thought it was witchcraft…", "…likely complainant was engaged in a criminal enterprise."

There were 32 statements which described the outcome of the threat which was included in the qualitative question asking participants to describe the event. A thematic analysis was carried out on these statements and are displayed in Table 4.21 below.

Table 4.21
The Outcome

Theme	No. of events	No. of statements	Example
	***n* = 183**	***n* = 547**	
Threat resolved	7 (3.83%)	7 (1.28%)	"The council conducted noise testing which allowed for continuing use of the field.", "…the person accepted we

			knew what we were doing and that there had been no wrong doing."
Threat partially resolved	11 (6.01%)	11 (2.01%)	"…cops take our crew to police office for checking our permits and papers.", "…walked off mumbling saying it's against the rules." "…he was disgruntled but left us along."
Threat not resolved	13 (7.10%)	14 (2.56%)	"Halted my flight at that point.", "We moved on and [come] back later.", "We put the gear in the van and left the area."

4.5 Research Question 3

What user or flight characteristics influence levels of aggression towards RPA pilots and their ground crew?

Several questions were asked about the characteristics of the flight and user when the event of violence and aggression occurred. Table 4.22 below presents the characteristics of the flight and user during the event.

Table 4.22
Event Characteristics

Variable	No. of events
	***n* = 183**
Number of People with Participant (during event)	
No other person with participant	66 (36.07%)
1 other person with participant	55 (30.05%)
2 other people with participant	25 (13.66%)
3 other people with participant	4 (2.19%)
4 other people with participant	2 (1.09%)
5 or more other people with participant	11 (6.01%)
Number of other people not reported by participant	20 (10.93%)
Altitude (feet)[1]	
0 feet to 100 feet	62 (33.88%)
101 feet to 200 feet	53 (28.96%)
201 feet to 400 feet	40 (21.86%)
400 feet and above	6 (3.28%)
Altitude not reported by participant	22 (12.02%)
Stage of Flight	
Pre-flight	15 (8.20%)
During flight	126 (68.85%)
Post flight	31 (16.94%)
Did not answer this question	11 (6.01%)
Commercial Operation	
Yes	112 (61.20%)
No	63 (34.43%)

Did not answer question	8 (4.37%)
RPA Type	
A fixed-wing uncrewed aircraft	17 (9.29%)
A fixed-wing vertical take-off and landing (VTOL) uncrewed aircraft	3 (1.64%)
A single-rotor uncrewed aircraft (i.e., uncrewed helicopter)	4 (2.19%)
A multi-rotor uncrewed aircraft (i.e., quadcopters, hexacopters, etc.)	148 (80.87%)
Other	1 (0.55%)
Did not report aircraft type	10 (5.46%)
Mass (weight) **(g = grams / kg = kilograms / lbs = pounds)**	
Less than 250g	24 (13.11%)
More than 250g but not more than 2kg (4.4lbs)	77 (42.08%)
More than 2kg (4.4lbs) but not more than 15kg (33lbs)	63 (34.43%)
More than 15kg (33lbs) but not more than 25kg (55lbs)	4 (2.19%)
More than 25kg (551lbs) but not more than 150kg (331lbs)	5 (2.73%)
More than 150kg (331lbs)	1 (0.55%)
Participant did not report aircraft weight	8 (4.37%)

Note. Questions within the survey were not compulsory
Note[1]. All altitudes have been converted into feet

Overall, 121 (66.12%) events occurred when the RPA pilot or ground crew was either alone or with one other person with 126 (68.85%) events happening during flight. In 115 (62.84%) of these events the RPA was below 200 feet (60.96 meters) above the ground. These results also found that in 148 (80.87%) of events the participant was flying a multi-rotor uncrewed aircraft where in 101(55.19%) of events the RPA was 2 kg or lighter. During 112 (62.20%) of events the RPA was engaged in a commercial operation.

Table 4.23 shows what the RPA user believes the aggressor discovered first during the event.

Table 4.23
What did the Aggressor Discover First?

Variable	Total events
	***n* = 183**
The remotely piloted aircraft	125 (68.31%)
The pilot or ground crew	34 (18.58%)
I am unsure	18 (9.84%)
Question not answered	6 (3.28%)

In the majority of events, 125 (68.31%), the RPA pilot or ground crew believed the aggressor (member of the public) saw the RPA first before the RPA pilot or ground crew member.

The survey included a qualitative question asking, *when this event occurred, what type of flight was the remotely piloted aircraft being operated for*. Of the 183 events, 171 (93.44%) answered this question. This data was not available for 12 (6.56%) of the 183 events. A content analysis was carried out on this data and applications were grouped into similar concepts of operation. Several RPA were carrying out more than one activity simultaneously, such as an RPA being used for survey and photogrammetry in one flight, therefore both activities have been included. It is recognised in this section of the survey the participant may have generalised the application to remain anonymous, for example, may have written photography when the UA was taking photos for construction. Table 4.24 presents the applications the RPA users were flying during the event of violence or aggression.

Table 4.24
Application During Event

Application	Description	Total events
		***n* = 183**
Asset inspection	Inspections for infrastructure such as road, powerlines, pipelines etc.	11 (6.01%)
Agricultural / Horticultural	Applications in the animal and food farming / forestry industries	4 (2.19%)

Emergency search and rescue & Disaster response	Supporting emergency services for a community need	5 (2.73%)
Military	Use within the armed forces of a country	1 (0.55%)
Photography / Videography	Use of RPA to capture images	61 (33.33%)
Recreational	Use of RPA for enjoyment purposes outside employment	32 (17.49%)
Research and development	Research and development of RPA technology	4 (2.19%)
Real estate	Use of RPA to sell private or commercial property	4 (2.19%)
Surveillance	Monitoring people or places	1 (0.55%)
Surveying	Mapping and Survey using LIDAR, Photogrammetry, thermal imaging etc includes Geotechnical Surveying.	49 (26.78%)
Flight training / Testing	RPA Pilot training or testing, Testing of the RPA equipment	8 (4.37%)
No application stated	The participants did not specify an application during event	12 (6.56%)

Note. Applications are not mutually exclusive. Some participants may have been included in more than one theme.

The three largest applications associated with an event of violence and aggression while flying an RPA were photography / videography with 61 (33.33%) of events, surveying with 49 (26.78%) of events, and recreational RPA flying with 32 (17.49%) of events.

Participants were asked questions around where the event of violence and aggression occurred. Table 4.25 presents the locations in which the event of violence or aggression occurred.

Table 4.25
Location of Event

Variable	No. of events
	***n* = 183**
Geographic Location	
A rural area	55 (30.05%)
A semi-rural area	40 (21.86%)
An urban area (town / city)	76 (41.53%)
Other	2 (1.09%)
Did not answer this question	10 (5.46%)
Site-Specific Location[1]	
Over private land (your private property or other private property with the owner / occupier's consent)	77 (42.08%)
Over public land that does not require consent (e.g. council parks that automatically allow RPA flights)	69 (37.70%)
Over public land that requires consent from a local or central government agency, where consent had been obtained)	23 (12.57%)
Over a conservation area (e.g., forest, wildlife, beach, park, etc.)	6 (3.28%)
Within the vicinity of a public event	3 (1.64%)
Within 4km of a designated aerodrome	14 (7.65%)
Low-level flying (i.e. at a height that will be closer to people and property occupiers)	14 (7.65%)
Other	9 (4.92%)
Did not answer this question	11 (6.01%)

Note[1]. More than one location may have been selected

The geographic location where an RPA pilot or ground crew was most likely to experience violence and aggression was in an urban area (town / city) with 76 (41.53%) events taking place here. More specifically, 98 (53.55%) of events which occurred over public land, and 77 (42.08%) of events occurred over private property with occupier's consent.

Participants were asked if they had a system for the public to identify them as legitimate when flying RPA and if so what this system or systems were. A content analysis was then carried out

on participants method of identification grouping similar methods together. Table 4.26 displays the system of identification the RPA user utilised.

Table 4.26
System of Identification

Identification	No. of events
	n **= 183**
System for Identification	
Yes	111 (60.66 %)
No	57 (31.15 %)
Did not answer question	15 (8.20%)
Method of Identification	
Company branded vehicle	53 (28.96%)
Cones / Barriers / Roped off areas	21 (11.48%)
Equipment	8 (4.37%)
Hi Visibility clothing / Company branded clothing	94 (51.37%)
RPA pilot identification / Documentation	17 (9.29%)
Personnel (e.g. security, spotters)	9 (4.92%)
Prior flyers drop / Prior notification	9 (4.92%)
Signage	43 (23.50%)
Training / Safety manuals	5 (2.73%)
Did not answer the question	16 (8.74%)

Note. More than one method of identification may have been selected

In 111 (60.66 %) of the events, the user had a system of identification such as high-visibility or company-branded clothing 94 (51.37%), or a company branded vehicle 53 (28.96%) close by. In 90 (49.18%) of events the user made it clear that there was some kind of professional operation being carried out by using cones / barriers / roped off areas, equipment, personnel, signage, or a flyer drop prior to flight.

4.5.1 - Binomial Logistic Regression

Participant Experience of Violence and Aggression while Flying RPA

A binomial logistic regression was carried out to examine whether it is possible to predict if a participant has experienced violence or aggression based upon certain user and flight

characteristics as independent variable. These independent variables are listed in the formula below. The binomial logistic regression was chosen because the dependent variable has a yes or no answer (i.e., dichotomous) (Box & Tidwell, 1962).

H_0 (null hypothesis) = User and flight characteristics do not predict whether a participant has experienced violence and aggression during an RPA operation

H_A (alternative hypothesis) = User and flight characteristics do predict whether a participant has experienced violence and aggression during an RPA operation

The formula below shows the regression function.
Y = Participant experienced violence or aggression while flying RPA (binary)
Y = δ (intercept) + a1 + a2 + a3 + a4 + a5 + a6 + a7 + c + log(d)

a1 = Surveying (participants usual application)
a2 = Photography (participants usual application)
a3 = Asset Inspection (participants usual application)
a4 = Spraying / Washing and pest control (participants usual application)
a5 = Recreational (Usual Flying) (participants usual application)
a6 = Flight Training / Testing / R&D (participants usual application)
a7 = Other (participants usual application)
c = User type (recreational / semi-professional / professional)
d = Total RPA hours (Continuous data / Logarithm)

Responses for “a1” through to “a7” were binary, while “c” was ordinal. Responses for constant “d” were transformed using a logarithm to compensate for heteroscedasticity in the variable.

The omnibus test revealed that the regression function was statistically significant, $\chi^2(9) = 19.925$, $p = 0.018$. The full statistical results are shown in the table 4.27 below. The results below provide evidence to reject the null hypothesis. There were only two variables had enough predictive power to achieve statistical significance. These were user type (recreational, semi-professional, and professional) and total RPA hours. Both variables had a significant positive effect on how likely the participant was to have experienced violence and aggression while

flying an RPA. As the user type moves towards professional, there is greater likelihood of the user experiencing violence and aggression while flying an RPA. The higher the user's total flight hours, the greater the likelihood of experiencing violence and aggression. This is shown in Table 4.27 below.

Table 4.27
Experienced Violence and Aggression while flying an RPA

Variable	β	χ^2
Intercept	-1.604***	8.540
Surveying [1, 4]	0.117	0.157
Photography [1, 4]	-0.022	0.007
Asset Inspection [1, 4]	-0.434	0.733
Spraying / Washing and pest control [1, 4]	-0.670	1.773
Recreational (usual Flying) [1, 4]	0.196	0.353
Flight training / Testing / Research & Development [1, 4]	-0.560	1.572
Other (usual application) [1, 4]	-0.297	0.589
User type [2]	0.540*	5.418
Total RPA hours [3]	0.470*	3.995

*, **, ***, denote statistical significance at $\rho < 0.1$, 0.05 and 0.01, respectively

[1]. Categorical variable, where those within the category (i.e. response = 1) is the test variable
[2]. Ordinal Variable, where 1 = recreational, 2 = semi-professional, 3 = Professional
[3]. This was converted into a logarithmic scale to compensate for heteroscedasticity in the variable response variable.
[4]. Usual RPA application

4.5.2 Ordinal Logistic Regression

Level of Violence and Aggression

An ordinal logistic regression was carried out to assess if the dependent variable, *the level of the violence and aggression*, was influenced by the independent variables, *the RPA pilot's user type, the application the RPA was carrying out during the event, the location of the event, and the altitude which the RPA was flying at during the event*. These independent variables are listed in the formula below. The ordinal logistic regression was chosen because the dependent

variable was ordinal. This means that the regression will predict which ordinal value (in this case, between one and ten) that the participant will fall within (Pregibon, 1981).

H_0 (null hypothesis) = User and flight characteristics do not influence levels of violence and aggression against participants

H_A (alternative hypothesis) = User and flight characteristics do influence levels of violence and aggression against participants

The formula below shows the regression function.
Y = Level of violence and aggression (ordinal)
Y = δ (intercept) + c + e1 + e2 + e3 + e4 + f + g + h1 + h2 + h3 + h4 + log(i)

c = User Type (recreational / semi-professional / professional)
e1 = Surveying (application during event – most recent plus worst event)
e2 = Photography / Videography (application during event – most recent plus worst event)
e3 = Recreational (application during event – most recent plus worst event)
e4 = Other (Asset inspection / Spraying / Training / Emergency / Unclear / Surveillance / Fishing / Research) (application during event – most recent plus worst)
f = RPA mass (most recent plus worst event)
g = Where RPA was during the event (rural / semi-rural / urban / other)
h1 = Over private land (your private property or other private property with the owner/occupier's consent) (most recent plus worst)
h2 = Over public land that does not require consent (e.g., council parks that automatically allow RPA flights) (most recent plus worst event)
h3 = Over public land that requires consent from a local or central government agency, where consent had been obtained (most recent plus worst event)
h4 = Other (most recent plus worst event)
i = Altitude during the event AGL (continuous data / Logarithm)

Responses for “c” and “g” were ordinal. Responses for “e1” through to “e4” and “h1” through to “h4” were binary. Responses for “f” were continuous data. Responses for constant “i” were transformed using a logarithm to compensate for heteroscedasticity in the variable.

The omnibus test revealed that the regression function was statistically significant, χ^2 (12) = 25.841, p = 0.011. The full statistical results are shown in table 4.28 below. The results below show, as a group, the user characteristics have predictive power with regard to with the level of violence and aggression experienced during a threat, however, no individual user characteristics achieve statistically significance.

Table 4.28
Level of Violence and Aggression

Variable	β	χ2
Intercept 0	-4.114	6.722***
Intercept 1	0.098	0.005
Intercept 2	1.515	1.107
Intercept 3	1.876	1.687
Intercept 4	2.146	2.197
Intercept 5	2.349	2.622
Intercept 6	2.576	3.143*
Intercept 7	2.771	3.624*
Intercept 8	4.466	8.631***
Intercept 9	4.768	9.487***
User Type [1]	0.188	0.556
Surveying [2, 3]	0.269	0.222
Photography [2, 3]	-0.737	1.732
Recreational [2, 3]	-0.138	0.041
Other [2, 3] (applications)	-1.141	3.021
RPA mass [2]	0.253	1.321
Area type [2, 5]	0.060	0.100
Over private land [2, 3]	-0.519	1.163
Over public land that does not require consent [2, 3]	-0.680	2.038
Over public land that requires consent from a local or central government	0.367	0.509

agency, where consent had been obtained [2, 3]		
Other (Area) [2]	-0.631	2.110
Altitude (AGL) [2,4]	0.156	0.117

*, **, ***, denote statistical significance at ρ < 0.1, 0.05 and 0.01, respectively

[1]. Ordinal Variable, where 1 = recreational, 2 = semi-professional, 3 = Professional
[2]. During the event of violence and aggression
[3]. Categorical variable, where those within the category (i.e. response = 1) is the test variable
[4]. Logarithmic variables to compensate for heteroscedasticity in the variable response variable.
[5]. Ordinal Variable, where 1 = A rural area, 2 = A semi-rural area, 3 = An urban area (town / city).

4.6 Research Question 4

What impact, if any, does violence and aggression have upon RPA pilots and their ground crew?

Participants were asked questions around the effect the violence and aggression may have had from a financial and time perspective along with if they had made any changes to their operations since the most recent event. Table 4.29 below presents this.

Table 4.29
Financial loss from event of violence and aggression

Financial loss	No. of events
	***n* = 183**
Yes	11 (6.01%)
No	157 (85.79%)
Did not answer the question	14 (7.65%)

The majority of events, 157 (85.79%), did not incur a financial loss from the violence and aggression. Of those that indicated yes to a financial loss, the dollar amount ranged from $40 New Zealand dollars ($36 Australian dollars) to $11,001 New Zealand dollars (Australian $10,000). Some participants also stated loses in terms of time or employment opportunities lost.

Note. Dollar conversion amounts approximate. Converted using exchange rate on 31 March 2025 (Xe Corporation Inc, 2025).

Table 4.30 below displays changes to the time spent flying RPA after the participant's most recent event.

Table 4.30
Changes to time spent flying RPA

Time spent flying	Most recent event
	***n* = 155**
I fly more after this even occurred than prior to this event	16 (10.32%)
I fly less after this even occurred than prior to this even	15 (9.68%)

The time I spend flying RPA is unchanged	108 (69.68%)
I have stopped flying RPA after this event	1 (0.65%)
Did not answer this question	14 (9.03%)

Note. Question asked for most recent event only.

Participants were also asked after their most recent event if they had made other changes to their operation. There were 97 (62.58%) participants who indicated they hadn't made changes, 45 (29.03%) participants who indicated they had, and 13 (8.39%) participants did not answer the question. Those that answered "yes" had an additional qualitative question asking them about what they changed. A thematic analysis was carried out on the statements made describing the changes made by participants. The results of this thematic analysis are presented in Table 4.31.

Table 4.31
Changes made to Remotely Piloted Aircraft Operations

Theme	Sub-theme	No. of events	No. of statements	Examples
		***n* = 183**	***n* = 58**	
Hazard mitigation	Improving communications	16 (8.74%)	16 (27.59%)	"…undertaking more pre-flight engagement with parties that could notice flights.", "Working to ensure good communication of activity…", "Increased notification for neighbours."
	Location / flight time choice	13 (7.10%)	13 (22.41%)	"…change flying times", "…now conduct all test flights just before dusk, at the most remotest field in the area…", "…Choosing a location hidden from

			public, even if it's slightly less convenient…"
Identification	7 (3.83%)	7 (12.07%)	"Purchased signage to identify drone operations", "Being visible and wearing reflective vest at all times", "…carry a folder that provides information to the member of public that we are allowed to operate the UAV…"
Personal safety	6 (3.28%)	6 (10.34%)	"…general public nearby I will wait until I feel safe enough to fly…", "We always use security guards now when operating at night", "Stop flying when people close…"
Safety management systems	4 (2.19%)	4 (6.90%)	"Further in-depth job hazard analysis of the site…", "updated Risk register…"
Training	3 (1.64%)	3 (5.17%)	"…I write a whole section on how to avoid & manage aggro members of the public, for my drone workshops.", "…trained by my organisation in the 102 ground course specifying the privacy act to learn about."

	Scripted responses	2 (1.09%)	2 (3.45%)	"…I now have things to say prepared…", "…carry cue cards of my legal rights…"
Reduced flying (temporary or permanent)		7 (3.83%)	7 (12.07%)	"I no longer perform power line inspections in residential areas.", "Fly less", "Use my drone vastly less frequently at home than I do otherwise."
Did not answer this question		111 (60.66%)	Not Applicable	Not Applicable

Note. This question was asked for the most recent event only

4.7 Research Question 5

What pathways forward, if any, exist for RPA pilots and their ground crew to moderate this issue?

Participants were asked several questions around conflict resolution during the event and occurrence reporting after the event. To mitigate events of violence and aggression on RPA pilots and their ground crew both the RPA sector and the aviation regulator require data in order to develop a holistic overview about what is occurring in the sector. This section examines what data these organisations may currently have, in order to develop best practices and policies to reduce this from occurring. Table 4.32 presents a picture of what data the RPA sector, the police, and the aviation regulator may currently have on violence and aggression against RPA pilots and their ground crew.

Table 4.32
Conflict Resolution and Event Reporting

Variable	No. of events
	n **= 183**
Diffusing Situation[1]	
Yes, by compromise such as completing the flight at a later time	17 (9.29%)
Yes, by providing flight approvals	12 (6.56%)
Yes, by calm discussion	78 (42.62%)
No	58 (31.69%)
Other	5 (2.73%)
Did not answer the question	13 (7.10%)
Event Reporting – Aviation Regulator	
Yes	8 (4.37%)
No	164 (89.62%)
Did not answer question	11 (6.01%)
Event Reporting – Why Not Reported to Aviation Regulator[2,4]	
No particular reason	26 (14.21%)
The event was not serious enough	86 (46.99%)
I'm not legally required	27 (14.75%)
Other	33 (18.03%)
Did not answer the question	23 (12.57%)

Event Reporting - Police	
Yes, they responded at the time	9 (4.92%)
Yes, they responded at a later stage after the event	4 (2.19%)
Yes, they did not respond	3 (1.64%)
No, this event was not reported	152 (83.06%)
Did not answer this question	15 (8.20%)
Event Reporting – Elsewhere[3]	
Yes, this was reported through my company's internal reporting system	33 (18.03%)
Yes, this was reported to an industry organisation	2 (1.09%)
No, this was not reported elsewhere	118 (64.48%)
Other	13 (7.10%)
Did not answer this question	17 (9.29%)

[1] Some participants answered using other which was re-coded into the applicable best fit. Those that remained in *other* were predominately those that either were able to resolve the situation however it was not calm, or the RPA participant needed to call the police to resolve the situation.
[2] Reasons for not reporting the event was not mutually exclusive. Some participants may have been included in more than one reason; some participants chose to include further information by using the other option.
[3] *Other* included social media, the local city council, recreational groups, and reported to the client.
[4] This only includes the 164 participants who said they did not report the event in the previous survey question.

Results from these questions revealed 107 (58.47%) events where the situation was able to be diffused by compromise, by providing flight approvals, or by calm discussion. In 164 (89.62%) events, the occurrence of violence and aggression was not reported to the regulator. Participants who selected the New Zealand version were asked a further question around how the event was reported to the CAA which was an extra question for the CAA who were supporting this research. Three of the six participants who indicated they had reported the event to the regulator had selected the New Zealand version of the survey. They indicated they reported the event to the regulator via an aviation safety advisor or had used the CA005 incident reporting form available on the CAA website.

Participants who stated they did not report the event to the regulator were asked a further question around why. In 113 (61.75%) of the events the participant felt the event was not serious enough to report to the regulator or that they were not legally required to be reported to the regulator. However there were 33 (18.03%) events where participants reported other reasons.

Some examples of *other* comments are:

Participant 42: “This was a privacy concern”
Participant 162: “Not relevant to CASA – reported to my manager”
Participant 163: “Not sure of requirement or even how to report it”
Participant 172: “I didn’t want to [*sic*] offenders knowing my details”
Participant 214: “Little or no point reporting because nothing would be done or required to be done”.

Participants were also asked if the event had been reported to the police and elsewhere with 152 (83.06%) indicating no, this event was not reported to the police, and 118 (64.48%) reporting this event was not reported elsewhere. In 33 (18.03%) of the events, participants indicated that the event was reported through their company’s internal reporting system.

Chapter 5 Discussion

5.1 The Prevalence of Violence or Aggression Against Remotely Piloted Aircraft Users

This research found that 52% of participants have had an event of violence or aggression while flying RPA. Of those participants who had experienced an event, 18% had experienced an event previously, that was worse than their most recent event of violence and aggression (see Table 4.6). Although it is recognised that there may be some self-selection bias in this research, where participants who have experienced violence or aggression may have been somewhat more intrinsically motivated to select themselves for the study than those who had not. Nonetheless, such a high figure suggests that it is relatively common, even though the exact percentage of users who have experienced violence or aggression may be lower than what has been reported. Considering this, the following text discusses the results from this research and offers potential strategies to minimise events of violence and aggression from occurring within the RPA sector.

5.2 An Aviation Safety Concern

A considerable number of events of violence and aggression occurred while users were either alone or with one other person, and, most concerningly, while the RPA was still mid-flight and below 200ft (≈ 60m) AGL. This raise's concerns that RPA users are vulnerable without immediate support and may be interrupted mid-flight with little altitude available to avoid an accident. Most of the users were also flying multi-rotor RPA, which fall rather than glide, and supports the idea that this may be an issue for public safety as well. This research found a number of events of violence and aggression occurred in public spaces where innocent bystanders could be hurt in the event of loss of control or a flyaway as a result of distraction or confrontation for the RPA pilot (see Table 4.17 and Table 4.25 for more details).

The energy potential of an RPA is a function of its altitude, mass, and the speed it is travelling at, and, current literature shows severe injury is possible from an RPA, regardless of whether the RPA is falling vertically or has horizontal movement (Crahay et al., 2021; Koh et al., 2018; Moskowitz et al., 2018; Shelley, 2016). The concern around safety arises when the potential for injury from a falling RPA, is matched with the possibility of pilot distraction by a member of the public, and this can be likened to that of driver distraction on the road. There has been numerous research into the effects of distraction on drivers with some of the most distracting conditions for road users being conversing with others and driving when affected by emotion (Al-Rousan et al., 2021; Boboc et al., 2022). This research found anger and verbal aggression

was experienced in the majority of events of violence and aggression towards RPA users (see Table 4.9). It therefore stands to reason that an RPA pilot or ground crew may also find anger or verbal aggression distracting and could lead to a loss of control or flyaway event, posing potential risks to the general public and other airspace users.

The purpose of the New Zealand Civil Aviation Act (2023) is to protect people and promote safety in civil aviation. Under Part 9 of the Civil Aviation Act (2023), *Monitoring, investigation, and enforcement,* Subpart 4 – Seizure, etc, of aircraft without person onboard, the police have the authority to seize, hold or destroy an RPA. Although this subpart's intention may have been to do so should the RPA be operated dangerously by the RPA pilot, it could also be argued that a third person, in this case, the public member, could also contribute to the RPA being operated in a way "…that may endanger people or property…" (2023 § 316). The risk to people or property from a dangerous RPA user may include the risk from an angry member of the public distracting the RPA pilot away from operational tasks when the RPA is airborne, through arguably this would not cross into criminal behaviour towards the aircraft in the absence of intent.

The purpose of the New Zealand Aviation Crimes Act (1972) is to prevent unlawful interference with aircraft. The safety concern around a public member distracting an RPA pilot and/or crew could fall under the scope of Section 5 of the Aviation Crimes Act 1972 which states that anyone who commits a crime where the "…interference is likely to endanger the safety of the aircraft in flight…" may be liable to be convicted (§ 5). Although the public member's intent may not directly be towards interference of the aircraft, depending on the flight mode of the RPA, the repercussions from the event of violence or aggression may jeopardise the safety of the aircraft. That being said, one caveat to this, is this Act was written prior to widespread use of RPA therefore may legally be outside the scope of RPA operations.

Research in this area tends to either focus on public protection and prosecution from malicious RPA users rather than protection for the RPA user from malicious members of the public (Graham et al., 2021; Kurtpmar & Scott, 2024; Șcheau et al., 2023). Some of the participants in this research experienced threats and actual physical aggression such as driving aggressively towards the RPA user or shooting at the RPA, which may fit into criteria describing malicious

behaviour (see Table 4.18), and may also breach other Acts and regulations (e.g., road transport or firearms laws). Perhaps protection and prosecution due to malicious behaviour from the public could be a topic for further future investigation. As a side note, it is understandable that not all police will be well versed on aviation-specific legislation or regulations, however, it is hoped, if possible, should the RPA be seized by the police, that the aircraft is treated with care to avoid deliberate incidental damage. The RPA user may be fully compliant with all regulations and should not be punished for carrying out legal employment. Nonetheless, not all threats of violence and aggression will be serious enough to fall under malicious behaviour, therefore, other methods of dealing with these threats also need to be considered.

5.3 Company Legitimacy and Communication

In more than 60% of events, the participant believed the aggressor saw the RPA first before they saw the RPA crew. This seems logical as in 68% of events, the user reported the RPA as being in the air at the time of the event, meaning that the RPA would usually be more visible than someone at ground level. Additionally, many of the RPA applications during the event of violence and aggression (Table 4.24) were applications considered in the current literature (see Appendix A for detail) as being publicly acceptable applications for RPA. This implies the importance for an RPA user to show that they are legitimately following applicable regulations. This research found in 60% of events of violence and aggression, the RPA user had a method such as company branded clothing or signage for the public to identify them. These results bring up two key observations. The first is the need for RPA companies with valid and legal professional tasks to identify themselves as legitimate, and the second is to employ a mechanism for these organisations to communicate with the public when carrying out a legitimate task.

5.3.1 Legitimacy

Current methods of communicating legitimacy using company clothing or using signs and equipment may not be completely effective on their own which indicates further clarification on who the company is may help. Although there is a significant body of literature discussing acceptable and unacceptable applications, there appears to be no discussion on how a member of the public in reality could identify what an RPA is doing or recognise the company operating the RPA as legitimate. Sabino et al. (2022) found there may be more public support if each aircraft had a standardised colour which represented its purpose. This may be an option for

RPA used recreationally or in government organisations, however, this may not be possible for a commercial multi-purpose RPA, similar to that seen with helicopters (McMillan & Xu, 2024). For those operators which cannot do this, another method of identifying the company may be needed. In New Zealand the CAANZ publishes a list of companies who are approved under CAR Part 102 (Civil Aviation Authority of New Zealand, 2025a). In New Zealand CAR Part 102 is used when an RPA operator requires flight outside the standard CAR Part 101 rules. An example of this may be an electricity company needing to fly close to or over private property without the owner or occupier consent to carry out a safety powerline inspection. Unfortunately, the list of approved CAR Part 102 operators uses client names which do not necessarily match the company brand name and does not describe types of tasks each operator is approved to carry out (Civil Aviation Authority of New Zealand, 2025a). It is plausible that perhaps some of the current methods of identification that RPA users are utilising could be strengthened by this webpage including an approved operator's brand or trading name and some basic information on what the company tasks and approvals may be.

5.3.2 Communication

Open and clear communication during RPA operations may also be one method of mitigating violence and aggression within the RPA sector. Uchidiuno et al. (2018) found giving the public a means to query a nearby RPA's purpose could ease an individual's concerns. Participants in Tan et al. (2021) study felt uncomfortable around the lack of ability to identify the UA's purpose. Although New Zealand does not require RPA to have remote ID installed, internationally this form of identification has been used for some time. Current research on remote ID suggests in some countries, too much information is available giving personal information about the RPA user to those with malicious intentions which could put the RPA user in danger (Sciancalepore, 2024; Tedeschi et al., 2024). Some companies currently endeavour to communicate RPA operations to the public via publicly available websites, however, these require an individual know what to search online for to find this communication (Recon Advanced Spatial Solutions, 2023; Transpower, n.d.). Although further research would be needed, one method for mitigating of violence and aggression for commercial operators with approvals to operate may be with the sharing of information in one central location.

There are currently three New Zealand websites that RPA pilots use for planning and accessing information, which, if combined, could provide access to a single source of limited information

on the RPA for the public. These websites are Flight Advisor, Go PreFlight, and Airshare (Aeropath and Meteorological Service of New Zealand Limited, 2025; Airways Corporation of New Zealand Limited, 2025; Royal New Zealand Airforce, 2025). Flight Advisor, is aimed at avoiding mid-air collisions between RPA, low-level manned civilian aircraft (e.g., helicopters and agricultural aircraft), and low-level military aircraft (Royal New Zealand Airforce, 2025). The PreFlight website, which is a collaboration between Aeropath (Airways New Zealand) and the meteorological service of New Zealand Limited (MetService), offers Notices to Airmen (NOTAMs) and weather information for all New Zealand pilots (Aeropath and Meteorological Service of New Zealand Limited, 2025). The third website, AirShare, which is run by Airways Internation Limited, offers RPA pilots an opportunity to enter a flight request to operate in controlled airspace. AirShare also offers RPA the opportunity to share flight information with uncontrolled aerodromes (Airways Corporation of New Zealand Limited, 2025). Although some of the information on these websites currently provide too much detail for the information to be available for the general public, it is possible a webpage with reduced information such as a general vicinity of operations and appropriate approvals, may alleviate some of the public's privacy concerns.

5.4 Education – De-escalation techniques for Remotely Piloted Aircraft Users

Although there were many recreational RPA users who have experienced violence and aggression while flying an RPA, there were a sizeable number of commercial applications which also experienced violence and aggression. More professional users (as opposed to recreational) and those with higher flight hours have a higher likelihood of experiencing violence or aggression (Table 4.27). In other words, a professional RPA user with higher hours is more likely to experience violence and aggression than a recreational user with lower hours. This study also found in 58% of the events of violence and aggression, were able to diffuse the situation by either completing the flight at a later date, providing flight approvals, or by calm discussion. This implies that there may be validity in all RPA users, particularly professional organisations, learning de-escalation techniques similar to that suggested for flight crew in current literature on violence and aggression towards manned aviation (Coyle et al., 2021; Derrickson & Tripathi, 2022; McLinton et al., 2020).

5.5 Education – The Public

Although this research could not contact the aggressor in these events, there was some information from the victim identifying some of the aggressor's key traits. In over 70 % of events the aggressor was an individual (see Table 4.15) and in approximately 30% of events the aggressor was a neighbour or nearby property owner (see Table 4.14). In just under 30% of events the aggressor was a member of the general public. One noteworthy observation about the public from this research was the attitude-behaviour gap between those applications said to be acceptable by the public in current literature and applications accepted in this research. The attitude-behaviour gap refers to the gap between an individual's expressed view and their actual behaviour. This is often referred to, when discussing the difference between environmental attitudes, and behaviours towards protecting the environment (Farjam et al., 2019; Wyss et al., 2022). Section 2.8 in the literature review of this thesis discusses current literature on public acceptance and covers research involving over 28,000 participants. This thesis found regardless of the country of research, the general public viewed a number of applications such as emergency response, agricultural purposes, or infrastructure and building support, as acceptable uses for RPA (See Appendix A for detail). Many of these applications are included in the list of applications being carried out by participants in this research during the event of violence or aggression (see Table 4.16 and Table 4.24).

5.5.1 Education - Basic Remotely Piloted Aircraft Knowledge

Current literature indicates that the public tend to learn about RPA from social media, movies, television, and conventional news media platforms (Boucher, 2016; Oksman & Kulju, 2022; Reddy & DeLaurentis, 2016; Tan et al., 2021; Upadrasta & Leitner, 2023; Yunus & Techanamurthya, 2023). It has been found by increasing public knowledge, public acceptance of UA is increased as the public have the ability to identify risk and assess which applications which they support (Aydin, 2019; Upadrasta & Leitner, 2023; Za'im Sahul Hameed et al., 2023). Given that more than 50% of events occurred over public land, it appears there is a need for public education around unmanned aviation regulations and what RPA can be used for (Table 4.25). Perhaps providing these media platforms with accurate information around RPA may be one way to do this. The following paragraphs discuss what this information may include.

5.5.2 Education - The Danger of Distraction

One particularly concerning finding within this research was how distracting violence or aggression towards an RPA user may be. This research revealed that the level of violence or aggression towards the RPA user is predominantly with anger and verbal aggression (Table 4.9). However, concerningly there were also a number of more aggressive and violent events reported, some involving firearms. Huisingh et al. (2015) found that passengers who merely talked to a driver of a moving vehicle were distracting for the driver, therefore, it stands to reason that any of the levels of violence and aggression could also be distracting for RPA crew. Adding to this, many RPA were mid-flight during the event and at an altitude of 200ft or lower, meaning very little time for recovery should the user be distracted from flight duties (see Table 4.22 for details). It is therefore vital to consider the impact of anger and verbal aggression on the RPA user and include the dangers of distraction into public education. Campaigns from aviation regulators could address this with the key message being safety is the first priority over and above all other concerns. The findings reveal several reasons why the aggressor may have been triggered, one of which was privacy (Table 4.20). However, many of these concerns can be addressed after the fact, whereas safety of those on the ground, cannot be. Driver distraction when driving vehicles has been linked to accidents therefore it is reasonable to assume that distracting an RPA pilot during flight could also lead to accidents (Jazayeri et al., 2021; Liang & Yang, 2021).

5.5.3 Education - Public Privacy

Another area where education and public knowledge may help mitigate violence and aggression in the sector is in education around privacy. The applications which experienced the most violence and aggression were photography / videography, surveying, and recreational RPA flying (see Table 4.24). Although it is unknown exactly what the RPA was doing when recreational use was reported in this research, it is likely that many had a camera onboard. This suggests image capture and possibly privacy may be of particular concern for the public. Although there may be occurrences where the RPA may be hovering with untoward intentions (Graham et al., 2021), this research found RPA users strongly agree that RPA operators are generally compliant with Civil Aviation Rules applicable to their operation and that RPA operators respect people's privacy (Table 4.3), though that is only their perception. It is reasonable to infer that public education around privacy regulations, and what the public can do in the event of misconduct by an RPA user may also help mitigate violence and aggression

towards RPA users. Knowing what their rights are given the ubiquity of image capturing devices (e.g., CCTV) is also important so that RPA are not unfairly singled out.

One further suggestion with regards to privacy is one of inaudibility. Although some researchers have suggested noise may be a lessor concern for UA, there is support for making the UA less conspicuous either through noise decreasing technology or increased altitudes, which may divert attention away (Aydin, 2019; Boucher, 2016; Stolz et al., 2024). The use of other forms of surveillance designed to be discreet and blend into any environment is an area heavily discussed in the literature, however many sectors of society such as retail are currently utilising these (Doberstein et al., 2022; Webster, 2019). If the intent of the surveillance is acceptable to the public, for example police surveillance, the public may be more accepting once RPA use has become normalised. This can be likened, in most cases, to the general public no longer noticing CCTV in shopping centres or the use of personal cell phone camera's in public spaces (Burton, 2006; Roth, 2006).

5.6 Reporting

When it comes to reporting events of violence and aggression, very few seemingly get reported, with the majority of events not reported to the aviation regulator. In over 60% of events, the RPA user did not believe the event was not serious enough or deemed that it was not legally required. This research also found over 80% of events were not reported to police and over 60% of events were also not reported in any other location (see Table 4.32 for details on reporting). This may be the reason why research question one, *globally how widespread or prevalent is aggression or violence towards Remotely Piloted Aircraft (RPA) pilots and their ground crew,* cannot be answered by occurrence reporting alone. Occurrence reports are one method for aviation regulators to gather information and maintain an "overall picture" of what is happening in the sector in order to develop and evolve regulations (Civil Aviation Authority of New Zealand, 2022; Siddeshwar et al., 2024). Overall low occurrence reporting rates in all areas for RPA users has also been observed with 85% of reportable RPA safety concerns also going unreported (Walton & Henderson, 2023). This issue will require the support of aviation regulators to encourage RPA reporting. Some of the benefits of occurrence reporting regardless of seriousness is for the sharing of anonymised sector data and the allocation of government funding into safety programmes to benefit the sector (Civil Aviation Authority of New Zealand, 2025b; Dillon et al., 2024).

5.7 Remotely Piloted Aircraft User Perceptions

Importance also needs to be given to the views of those who are flying within the sector. Table 4.3 illustrates that the majority of RPA users believe that the public has a negative perception of RPA operations and does not understand the rules related to RPA operations or what commercial RPA operators do. Overwhelmingly, RPA users believe that public education around RPA operations would help mitigate violence and aggression towards RPA crew. Users also firmly believe that that RPA operators are generally compliant with the Civil Aviation Rules applicable with their operation and respect people's privacy. This suggests that users do not believe this violence and aggression is triggered by any intentional and devious acts towards the public by those that fly RPA; rather, this may revolve around the public's lack of understanding that an RPA is not only a toy for recreational use but can legitimately be used in commercial operations. Those that have experienced violence or aggression and those who conduct flight testing or research and development viewed social acceptance of RPA more negatively (see Table 4.4). Those who have experienced violence or aggression, had higher flight hours, and either conducted photography or flight testing and research and development as their normal application were more likely to see violence and aggression as a major issue for the sector (Table 4.5). Additionally, regardless of user characteristic there was overall support within the sector for public education around RPA (Table 4.3). These findings suggest that those with higher flight hours, or those that are involved in photography or flight testing and research and development as their normal application, may be supportive of educational programs directed towards both the sector and the public and may be able to provide further insight towards the content of these educational programmes.

Chapter 6 Conclusion

The primary objective of this thesis was to determine if violence and aggression towards RPA pilots and their ground crew was prevalent, and if so, what were the nature of threats against RPA pilots and their ground crew were. Key findings from this research were that violence and aggression is occurring in the sector, and the majority of these threats take the form of anger and verbal aggression. Most concerningly, a number of RPA users have experienced threats from the public to shoot the RPA down. Although current literature has questioned over 28,000 participants around public acceptance of uncrewed aircraft with numerous research papers focused on acceptable and unacceptable applications, there remains RPA users experiencing threats in spite of flying tasks which are reportedly acceptable RPA applications to the public. This paradox suggests that there may be an attitude-behaviour gap for the public in relation to RPA applications.

One alarming finding was the number of participants who had experienced threats from the public, while the RPA was mid-flight, 200 ft AGL or below, and when the RPA user was either alone or with one other person. Literature around the dangers of distraction and the danger to persons or property of an RPA in a vertical or horizontal fall illustrate how dangerous it could be to distract the RPA user. This supports the argument that this is a serious safety concern for the sector. This research recommends enforcement action for disruptive public members who endanger aviation safety during RPA flight, similar to penalties that may be imposed on a RPA pilot if they deliberately conduct a dangerous operation.

This research also found that RPA users believe the public does not understand what commercial RPA operators do, strongly agree that the public has a negative perception of RPA operators, and that public education around RPA operations would help mitigate threats towards RPA users. This is in line with suggestions from current literature that education would help with public acceptance of all uncrewed aircraft types. The benefit of this research with regards to public education is that it offers insight into a number of areas which could be triggering for the public and what areas of education may be useful. Some of these areas are providing general knowledge around what RPA are used for in commercial operations, the dangers of distracting an RPA pilot and ground crew, education around the privacy regulations, and how to raise an RPA-related concern with the correct regulator in their country. Current literature supports the idea that education of the public is needed, but it does not indicate what areas education needs to cover. One recommendation regarding education, would be for

government agencies which deal with public privacy to also engage in public education on how the public are protected and what they can do if they feel their privacy has been breached.

One unexpected finding and an area for sector improvement relates to event reporting. Particularly in New Zealand where these events are not legally required to be reported, an operator reporting events to the CAA benefits the sector in that data can be collected and released as statistics, as is done in manned aviation. This gives the sector information for training new RPA users to manage threats in addition to providing the regulator data to assess what is occurring in the sector. If rules need to be changed, the data is then available to provide to government, supporting information if a legislative or regulatory change is being contemplated. An additional recommendation is that regulators worldwide encourage RPA users to report threats of violence and aggression, especially while in flight, and for both the regulator and the sector to engage in public education programmes. Overall, it is hoped that this research will start dialogue between the RPA sector, aviation regulators, and the public on the importance of safety of the RPA user and how this improves public and aviation safety.

Chapter 7 Limitations and Future Research

The main aim of this research was to investigate how widespread or prevalent violence and aggression is towards remotely piloted aircraft (RPA) pilots and their ground crew and if identified as prevalent, what the nature of these threats are. This research asked the RPA crew (the victim) what the reality of their experiences were when flying RPA. Unfortunately, it was not possible to ask the public member (the aggressor) for a complete picture of the event, thus this research only presents the RPA users experiences. Although factors such as the RPA crew's ethnicity, age, gender may influence the level of aggression from the public after sighting the RPA, these were not explored in this research as this would involve a discussion including the member of public which was not possible. A further limitation of this research was self-selection bias where participants with experiences of violence and aggression while flying an RPA may have been drawn to this research to share their experiences. Future research in this area could examine public members who have experienced frustration and anger at an RPA pilot or ground crew.

This research had an intention of identifying if violence and aggression was occurring within the sector and what the nature of some for these threats were. New Zealand is a country that does not have remote identification (RID) of RPA and although there were users that participated in this research from counties with RID, the majority of the participants in this research were from within New Zealand making any observations as to the influence of RID to violence and aggression towards RPA pilots and their ground crew unachievable. This is also an area which could be examined in future research.

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Appendices

Appendix A

Acceptable and Unacceptable Uncrewed Aircraft Applications

Author(s)	Research perspective	Participant country	Acceptable unmanned aircraft applications	Less acceptable unmanned aircraft applications
Aydin (2019)	Knowledge, attitude and practice (KAP) model	United States of America	Search and rescue Monitoring wildlife Monitoring nuclear spills Disaster detection and relief Early detection of oil spills Delivering flotation equipment Firefighting Meteorology Emergency response Highway and bridge inspection Monitoring air pollution Surveying animal ecosystems Disease spread detection Monitoring crop health Construction surveying	Traffic patrol

			Tracking poaching Railway infrastructure monitoring Monitor ocean ecosystems Thermal monitoring for buildings Military applications Archaeological surveys Control drug trafficking Track criminals or terrorists Home security alarms Reforestation Treatment of agricultural fields Control illegal immigration Supplying connectivity Recording sports events Transport and deliver cargo	
Boucher (2016)	Semi-structured focus groups	Europe	Police applications (crime prevention) Military applications Applications with social benefit Border control Emergency response (for example bushfires, floods, tsunamis)	Parcel delivery Wedding photography Recreational use Use by children

			Applications where lives can be saved Applications where property or possessions of value are saved.	
EiBfeldt and Biella (2022); EiBfeldt et al. (2020)	Telephone interviews	Germany	Catastrophe response Science and research Life-saving and civil protection (for example police, fire brigades) Traffic surveillance and Infrastructure monitoring Medicine and transport samples Farming Pictures and videos (for example news)	Leisure time activities Parcel delivery Pictures and videos (advertisement)
Klauser and Pedrozo (2017)	Questionnaire	Switzerland	Unarmed military use Scientific research Police mandates Commercial aerial photography	Postal deliveries Recreational purposes
Markowitz et al. (2017)	Survey	United States of America	Firefighters Search and rescue Conservation	Real estate Business Hobbyist

			Farming	
Oksman and Kulju (2022)	Web-based questionnaire	Sweden and Finland	Agriculture and forestry use Transportation and delivery Private security companies Condition inspections of residential buildings Construction site planning, monitoring Condition inspections of industrial/critical areas Use with aid organisations For the use of first aid For police use Fire department use	Passenger transport Citizen journalism use Media use Private use
Reddy and DeLaurent (2016)	Survey	United States of America	Delivery Military Risk to human pilot Search and Rescue Crops Disaster response Land management (for example tending crops, forest fire tracking)	Spying Invasion of privacy Military Flights in residential areas Commercial operations

			Earth science (for example monitoring animals, weather tracking) Public service missions (for example tornado monitoring, search and rescue)	
Smith et al. (2022)	Questionnaire	England	Police monitoring borders / surveillance Emergency response Infrastructure management (for example building or bridge inspection)	Recreational flying (fun, photography, videography) Package delivery
Stokes et al. (2020)	Questionnaire	Australia	Shark surveillance	Not applicable
Stolz et al. (2023) Stolz et al. (2024)	Mixed methods – group task and discussion; Questionnaire	Germany	Research Civil protection Disaster management Agriculture Medical use Civil protection Monitoring of transport networks / energy supply	Photo and video (Parcel) delivery Air taxi Hobby

Tan et al. (2021)	Knowledge, Attitude and Practice (KAP) Model	Singapore	Government search and rescue Government firefighting Government disaster management Government environmental purposes Government security surveillance Government/commercial research Government/commercial infrastructure maintenance/inspection Commercial agricultural monitoring Commercial communication/broadcasting Commercial monitoring of atmospheric conditions Commercial entertainment/performances Commercial delivery and pickup	Commercial Air Taxi Private entertainment / performances Private Photography / videography Government issuing speeding ticket Government issuing parking tickets
Tepylo et al. (2023)	Survey	Canada	Search and rescue Firefighting and disaster response Wildlife monitoring / climate research Surveying infrastructure	Package delivery Surveillance/crime protection Newsgathering

			Geological surveying/mineral exploration Safety of life/tactical applications Crop spraying/agricultural forensic applications Border patrol/counterterrorism Filmmaking	
Upadrasta and Leitner (2023)	Online Survey	Europe	Emergencies and humanitarian aid Facilitate services to benefit society Industrial purposes Media (for example film, news)	Personal use by individuals and hobbyists Transport and mobility of commercial products Surveillance, observation and monitoring
Zhu (2019) Zhu et al. (2020)	Questionnaire / Interview	United States of America	Drone delivery (slightly positive)	Not applicable
Yunus and Techanamurthya (2023)	Knowledge, Attitude and Practice (KAP) Model	Malaysia	Search and rescue mission (SAR) Recording sports events Recording personal/family events Drone racing Military applications	Insurance claims

	Monitoring wildfire and forest fires
	Delivering floatation equipment
	Track suspected criminals or terrorists
	Disaster early detection and disaster relief
	Tracking poaching
	Photogrammetry
	Early detection of oil spills and pipeline damages or failures
	Highway and bridge inspection
	Monitoring the impacts of global warming
	Monitoring air pollution
	Construction surveying
	Monitoring nuclear plants for nuclear spills
	Control illegal immigration (border)
	Emergency response
	Food delivery
	Pesticide spraying
	Treatment of agricultural fields

	Surveying wild animal ecosystems
	Thermal monitoring for detecting poor insulation and air leakage
	Archaeological surveys
	Supplying connectivity via wireless signals
	Firefighting
	Railway infrastructure monitoring.

Note. Guidance from researchers was sought on what was deemed acceptable or unacceptable.
Note. Prior Research Table 2014 to 2024

Expanded demographic information

Appendix B

New Zealand Participants by Region

Region of New Zealand	No. of New Zealand participants
	***n* = 190**
North Island	
Northland	5 (2.63%)
Auckland	42 (22.11%)
Waikato	23 (12.11%)
Bay of Plenty	13 (6.84%)
Gisborne	0
Hawkes Bay	10 (5.26%)
Taranaki	5 (2.63%)
Manawatu -Whanganui	17 (8.95%)
Wellington	19 (10.00%)
South Island	
Tasman	2 (1.05%)
Nelson	3 (1.58%)
Marlborough	1 (0.53%)
West Coast	4 (2.11%)
Canterbury	30 (15.79%)
Otago	7 (3.68%)
Southland	7 (3.68%)
Did not answer question	2 (1.05%)

Appendix C

International Participants by Country

Country	No. of participants
	n **= 103**
United Kingdom of Great Britain and Northern Ireland (UK)	43 (41.75%)
United States of America (USA)	25 (24.27%)
Australia	20 (19.42%)
Canada	2 (1.94%)
Norway	2 (1.94%)
Uruguay	2 (1.94%)
Japan	1 (0.97%)
Germany	1 (0.97%)
Czech Republic	1 (0.97%)
Fiji	1 (0.97%)
Hong Kong (S.A.R)	1 (0.97%)
Bulgaria	1 (0.97%)
Russian Federation	1 (0.97%)
Vietnam	1 (0.97%)
Hungry	1 (0.97%)

Note. All international participants answered this question.

Appendix D

New Zealand/International - Violence and Aggression towards Remotely Piloted Aircraft Pilots and Ground Crew - Survey Flow

Block: Participant Information and consent Sheet (3 Questions)

Branch: New Branch
If
If Which version of the survey do you wish to complete? The New Zealand Version Is Selected

Standard: Demographic Questions (7 Questions)
Standard: Likert Scale Questions (1 Question)
Standard: Most recent event (29 Questions)
Standard: Worst event (26 Questions)

Branch: New Branch
If
If Which version of the survey do you wish to complete? The International Version Is Selected

Standard: Demographic Questions (intl) (6 Questions)
Standard: Likert Scale (intl) (1 Question)
Standard: Most recent (intl) (27 Questions)
Standard: Worst (intl) (24 Questions)

Page Break

Start of Block: Participant Information and consent Sheet

Q1 **Participant Information Sheet**

Violence and Aggression towards Remotely Piloted Aircraft Pilots and Ground Crew: An International Study

This is an invitation to all remotely piloted aircraft (RPA) pilots and ground crew to take part in a study to investigate the prevalence of violence and aggression towards their person, aircraft, and operations. We are seeking all RPA pilots and ground crew to undertake this study, even if they have had no instances that involved violence or aggression.

This study requires both participants who have experienced violence or aggression from the public either verbally, physically, or indirectly by the public's actions, along with those who have not experienced these actions. For those who have experienced violence or aggression from the public, this study will ask questions about the RPA user's most recent event and worst event.

Note that RPAs may also be known by other names such as drones, UAVs, UAS, RPAS, and model aircraft.

This study is being carried out by Ms Claire Walton, who is using the study as part of her Master of Aviation studies at Massey University. She is being supervised by Dr Isaac Henderson and Dr Thanh Ngo.

Why is the user perspective important?

There is significant research on public acceptance of uncrewed aircraft from the public’s perspective, however, what the experience of uncrewed aircraft users has been largely ignored. The user perspective needs to be investigated to provide RPA pilots and ground crew, their organisations, industry bodies, aviation regulators, and other government agencies with better information on the prevalence and nature of violence and aggression against RPA users. By better understanding the issues, this may help provide avenues for policy development and operational procedures to better manage this issue (if indeed it needs to be managed).

Who should take part?

All uncrewed aircraft pilots and ground crew, that meet the following criteria, are invited to take part in this research regardless of whether they have experienced violence or aggression:

Must be 16 years or older (or the age of consent in your local country). Either:

Currently fly RPA Have flown RPA before, but no longer do; or

Worked as ground crew of a remotely piloted aircraft operation.

Speak and understand English. **Participation in this study**

If you agree to take part in this study, you will be asked to confirm you have read and understood this information sheet.

Participation in this study is voluntary, and may be discontinued at any time while completing the survey. Data will be aggregated (not presented at the individual level), and anonymised (all identified information would be redacted before analysis).

If you received a link to participate via an industry body (e.g., UAVNZ) or regulator (e.g., Civil Aviation Authority), please note that data will only be shared with these organisations *after* it has been aggregated and anonymised. These organisations will have no knowledge or who did or did not participate and you will not be able to be identified by those organisations. This study is being carried out at Massey University under ethical requirements for studies involving human participants.

There is no financial reward or incentive to participate, however, better information on this issue will help to address the issue in the future, which is in the interest of the industry as a whole.

This questionnaire will take between 5 to 20 minutes to complete.

For further information contact:

Ms Claire Walton - c.walton@massey.ac.nz
Dr Isaac Henderson - i.l.henderson@massey.ac.nz
Dr Thanh Ngo - t.ngo@massey.ac.nz

Ethics Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Ohu Matatika 1, Application OM 23/52. If you have any concerns about the conduct of this research, please contact Professor Craig Johnson, Chair, Human Ethics Chairs' Committee and Director.
Telephone +64 6 951 6841, email humanethics@massey.ac.nz.

The researchers appreciate this may bring back uncomfortable experiences.

For resources on mental health, please see the World Health Organization's - Mental Health https://www.who.int/health-topics/mental-health#tab=tab_1

If you wish to speak to someone not involved in the study, please contact the following for support from a trained counsellor.

New Zealand

Lifeline – 0800 543 354 (0800 LIFELINE) or free text 4357 (HELP).
Samaritans – 0800 726 666
Suicide Crisis Helpline – 0508 828 865 (0508 TAUTOKO).
Healthline – 0800 611 116

United Kingdom

Mental Health Foundation https://www.mentalhealth.org.uk
Mental Health UK https://mentalhealth-uk.org
National Health Service (NHS) - Mental health https://www.nhs.uk/mental-health/

United States of America

Mental Health America (MHA) https://mhanational.org

Substance Abuse and Mental Health Services Administration (SAMHSA) https://www.samhsa.gov/mental-health/myths-and-facts

Canada

Government of Canada - Mental health support https://www.canada.ca/en/public-health/services/mental-health-services/mental-health-get-help.html#

Canadian Mental Health Association https://cmha.ca

The Centre for Addiction and Mental Health https://www.camh.ca

Singapore

Singapore Association for Mental Health (SAMH) https://www.samhealth.org.sg

Australia

Black Dog Institute https://www.blackdoginstitute.org.au/resources-support/support-groups/

Beyond Blue https://www.beyondblue.org.au/get-support/national-mental-health-helplines-support-groups

Head to Health https://www.headtohealth.gov.au

This Way Up https://thiswayup.org.au

Thank you for your time and participation in this study.

○ By continuing with this survey I confirm I have read and understand this information sheet and consent to take part in this study (1)

○ I do not wish to participate in this research (2)

Skip To: End of Survey If Q1 = I do <u>not</u> wish to participate in this research

Q2 Which version of the survey do you wish to complete?

- ○ The New Zealand Version (1)
- ○ The International Version (2)

Display This Question:

If Q2 = The International Version

Q3 In which country do you currently reside?

▼ Afghanistan (1) ... Zimbabwe (1357)

Q4 **What is your age?**

_____

Q5 **What is your gender?**

- ○ Male (1)
- ○ Female (2)
- ○ Other (please specify) (3)

_____

- ○ Prefer not to say (4)

Q6 **Which of the following best describes you? (select all that apply)**

- ○ Not a current remotely piloted aircraft user (1)
- ○ Recreational remotely piloted aircraft user (primarily for enjoyment). (2)
- ○ Semi-professional remotely piloted aircraft user (where less than 50% of your work time is spent on activities related to uncrewed aircraft operations). (3)
- ○ Professional remotely piloted aircraft user (where more than 50% of your work time is spent on activities related to uncrewed aircraft operations). (4)

Q7 **By your best estimates, roughly how many hours of recreational and commercial flying have you done on remotely piloted aircraft in the last 12 months?**

- ○ Recreational (1) _____
- ○ Commercial (2) _____

Q8 **What type of application do you usually operate a remotely piloted aircraft for? (*e.g., Recreational, Surveying, Photography, Agricultural Spraying, etc*.)**

_____

_____

Q9 **How did you find out about this survey?**

- ○ Referred by a friend (1)
- ○ Saw it on social media (3)
- ○ Sent a link from the Civil Aviation Authority of New Zealand (5)
- ○ Sent a link from UAVNZ / Aviation New Zealand (6)
- ○ Other (please specify below) (4)

_____

Q10 **Which region of New Zealand do you primarily fly remotely piloted aircraft in?**

- ○ Northland (4)
- ○ Auckland (5)
- ○ Waikato (6)
- ○ Bay of Plenty (12)
- ○ Gisborne (13)
- ○ Hawkes Bay (8)
- ○ Taranaki (9)
- ○ Manawatナォ-Whanganui (10)
- ○ Wellington (11)
- ○ Tasman (14)
- ○ Nelson (15)
- ○ Marlborough (16)
- ○ West Coast (17)
- ○ Canterbury (18)
- ○ Otago (19)

○ Southland (20)

Q11 Please indicate your level of agreement with the following statements:

	Strongly agree (1)	Agree (2)	Neither agree nor disagree (3)	Disagree (4)	Strongly disagree (5)
Violence and aggression towards RPA pilots and ground crew is a major issue for the industry (1)	○	○	○	○	○
Violence and aggression towards RPA pilots and ground crew is becoming more common (2)	○	○	○	○	○
The New Zealand public do not understand the rules related to RPA operations (3)	○	○	○	○	○
The New Zealand public has a negative perception of RPA operations (4)	○	○	○	○	○

The New Zealand public understand what commercial RPA operators do (5)	○	○	○	○	○
Public education around RPA operations would help mitigate violence and aggression towards RPA pilots and ground crew (6)	○	○	○	○	○
New Zealand RPA operators are generally compliant with all the Civil Aviation Rules applicable to their operation (7)	○	○	○	○	○
New Zealand RPA operators respect people's privacy (8)	○	○	○	○	○

Violence and aggression towards RPA operators is not a major issue in New Zealand (9)	○	○	○	○	○
The New Zealand public are generally respectful towards RPA pilots and their ground crew (10)	○	○	○	○	○

Q12 **Have you ever experienced aggression / intimidating behaviour / a negative reaction while flying (recreationally or commercially), or whilst operating as a ground crew for a remotely piloted aircraft operation?**

○ Yes (1)

○ No (2)

Skip To: End of Survey If Q12 = No

Q13 **Please briefly describe what happened in your <u>most recent occurrence</u> of being verbally or physically threatened. (note if you have had more than one, your worst occurrence will be asked for later in the questionnaire)**

_____

_____

Q14 **When this event occurred were you:**

○ The pilot (1)

○ A member of ground crew (e.g., visual observer or safety pilot) (2)

Q15 **Approximately how long ago did this event occur?**

○ Within the past month (1)

○ More than a month ago, but less than six months ago (2)

○ More than six months ago, but within the last year (3)

○ More than one year ago, but less than three years ago (4)

○ Over three years ago (5)

○ Q16 **What level of aggression do you think best describes this event?**

○ Anger (*expressing general annoyance or displeasure towards the pilot, the support crew, or the RPA*) (2)

○ Verbal Aggression (*language directed at the pilot, the support crew, or the RPA in a threatening or harmful manner, e.g., use of strong language, profanity or use of inappropriate gestures*) (3)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** *(threatening physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (4)

○ Threats of Physical Violence or Aggression towards the **RPA** *(threatening to damage or destroy the aircraft, e.g., kicking, hitting, using weapons other than a firearm)* (11)

○ Actual Physical Violence or Aggression **towards the pilot or the support crew** *(causing physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (5)

○ Actual Physical Violence or Aggression towards the **RPA** *(causing damage or destroying the aircraft, e.g., kicking, hitting, using weapons other than a firearm)* (9)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** using firearms *(e.g., threatening to shoot the pilot or ground crew)* (6)

○ Threats of Physical Violence or Aggression towards the **RPA** using firearms *(e.g., threatening to shoot the RPA down)* (12)

○ Actual Physical Violence or Aggression using firearms towards the **pilot or the support crew** (*e.g., shooting at the pilot or ground crew - may include shots that did not hit their target*) (7)

○ Actual Physical Violence or Aggression using firearms towards the **RPA** (*e.g. shooting at the uncrewed aircraft - may miss or hit the RPA)* (10)

○ Other (please specify) (8)
_____

Q17 **For this event, what do you believe the member(s) of the public discovered first?**

○ The remotely piloted aircraft (1)

○ The pilot or ground crew (2)

○ I am unsure (3)

Q18 **At what stage of flight were you when this event occurred?**

○ Pre-flight (1)

○ During flight (2)

○ Post flight (3)

Q19 **When this event occurred, what type of flight was the remotely piloted aircraft being operated for? (*e.g., Surveying, Photography, Recreational, Agricultural Spraying, etc*.)**

_____

_____

Q20 **When this event occurred, was the remotely piloted aircraft performing a commercial operation?**

○ Yes (1)

○ No (2)

Q21 **When this event occurred, which Civil Aviation Rule (CAR) Part was the remotely piloted aircraft operating under?**

- ○ CAR Part 101 (1)
- ○ CAR Part 102 (2)
- ○ CAR Part 141 (4)
- ○ Unsure (3)

Q22 **What was the approximate mass (weight) of the remotely piloted aircraft involved in this occurrence (at take-off)?**

- ○ Less than 250 grams (1)
- ○ More than 250 grams but not more than 2 kilograms (4.4 pounds) (2)
- ○ More than 2 kilograms (4.4 pounds) but not more than 15 kilograms (33 pounds) (3)
- ○ More than 15 kilograms (33 pounds) but not more than 25 kilograms (55 pounds) (4)
- ○ More than 25 kilograms (55 pounds) but not more than 150 kilograms (331 pounds) (5)
- ○ More than 150 kilograms (331 pounds) (6)

Q23 **What type of remotely piloted aircraft were you flying when this event occurred?**

- ○ A fixed-wing uncrewed aircraft (1)
- ○ A fixed-wing vertical takeoff and landing (VTOL) uncrewed aircraft (5)
- ○ A single-rotor uncrewed aircraft (i.e., uncrewed helicopter) (4)
- ○ A multi-rotor uncrewed aircraft (i.e., quadcopters, hexacopters, etc.) (2)
- ○ Other (please specify) (3)

_____

Q24 **Where was the remotely piloted aircraft operating during this event?**

- ○ A rural area (1)
- ○ A semi rural area (6)
- ○ An urban area (town / city) (2)
- ○ Other (please specify) (7)

_____

Q25 **Which of the following apply to the area that the remotely piloted aircraft was operating within during this event? (*Note that more than one may be selected*)**

- ☐ Over private land (your private property or other private property with the owner/occupier's consent) (1)
- ☐ Over public land that does not require consent (e.g., council parks that automatically allow RPA flights) (6)
- ☐ Over public land that requires consent from a local or central government agency, where consent had been obtained (12)
- ☐ Over a conservation area (e.g., forest, wildlife, beach, park, etc.) (2)
- ☐ Within the vicinity of a public event (8)
- ☐ Within 4km of a designated aerodrome (9)
- ☐ Low-level flying (i.e., at a height that will be closer to people and property occupiers) (11)
- ☐ Other (please specify) (7)

_____

Q26 In the next question, we will ask the approximate altitude that your RPA was flying at during the event. Would you prefer to answer this question in feet or metres?

- ○ Feet (above ground level) (1)
- ○ Metres (above ground level) (2)
- ○ I'm not sure what altitude the aircraft was flying at during the event (4)

Skip To: Q28 If Q26 = I'm not sure what altitude the aircraft was flying at during the event

Display This Question:
If Q26 = Feet (above ground level)
Or Q26 = Metres (above ground level)

Q27 **Approximately what altitude was the RPA flying?**

Display This Choice:
If Q26 = Feet (above ground level)

- ○ Feet (above ground level) (1)

_____

Display This Choice:
If Q26 = Metres (above ground level)

- ○ Metres (above ground level) (13)

_____

Q28 **Were you able to resolve (or diffuse) the situation through communication with the member(s) of the public?**

- ○ Yes, by compromise (such as completing the flight at a later time) (1)
- ○ Yes, by providing flight approvals (2)
- ○ Yes, by calm discussion (3)
- ○ No (4)
- ○ Other (please specify) (5)

_____

Q29 **Did you report this event to the Civil Aviation Authority of New Zealand?**

- ○ No (1)
- ○ Yes (2)

Display This Question:
If Q29 = Yes

Q30 **How did you report this to the CAA?**

- ☐ I used the CA005RPAS form (7)
- ☐ I filed an Aviation Related Concern (ARC) (8)
- ☐ I phoned CAA national office (9)
- ☐ I spoke to an RPAS inspector (via phone or face to face) (10)
- ☐ I spoke to an Aviation Safety Advisor (via phone or face to face) (11)
- ☐ Other (please specify below) (12)

_____

Display This Question:
If Q29 = No

Q31 Was there any particular reason why you did not report the event to the CAA?

- ☐ ⊗ No particular reason (1)
- ☐ The event was not serious enough (2)
- ☐ I'm not legally required to do so (3)
- ☐ Other (please specify) (4)

_____

Q32 **Were the police notified of this event?**

- ○ Yes, they responded at the time (1)
- ○ Yes, they responded at a later stage after the event (2)
- ○ Yes, they did not respond (3)
- ○ No, this event was not reported (4)

Q33 **Was the event reported anywhere else?**

- ○ Yes, this was reported through my company's internal reporting system (1)
- ○ Yes, this was reported to an industry organisation (2)
- ○ No, this was not reported elsewhere (3)
- ○ Other (please specify) (4)

_____

Q34 **How many other people were with you when this event occurred (*write 0 if you were alone*).**

_____

Q35 **As a consequence of this event, has the time you spend flying remotely piloted aircraft changed?**

- ○ I fly more after this event occurred than prior to this event (1)
- ○ I fly less after this event occurred that prior to this event (2)
- ○ The time I spend flying remotely piloted aircraft is unchanged (3)
- ○ I have stopped flying remotely piloted aircraft after this event (4)

Q36 **As a consequence of this event, did you incur financial loss? (*such as equipment loss, loss of clients, loss of work)***

- ○ Yes (please specify approximate amount below) (1)

_____

- ○ No (2)

Q37 **Following this event, have you changed your remotely piloted aircraft operations?**

- ○ Yes (1)
- ○ No (2)

Skip To: Q39 If Q37 = No

Display This Question:
If Q37 = Yes

Q38 **What did you change?**

_____

_____

Q39 **Did you have a system for the public to identify you as a legitimate remotely piloted aircraft operator (*e.g., banners, clothing, company vehicle, etc.*)?**

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Q39 = No

Display This Question:
If Q39 = Yes

Q40 **Please specify how the public might have been able to identify you as a legitimate operator.**

_____

_____

Q41 **Within the last 5 years, other than this occurrence, how often have you been verbally or physically threatened while flying or operating as a ground crew of a remotely piloted aircraft?**

- ○ Never, this was the only time (1)
- ○ 1-2 times (2)
- ○ 3-5 times (3)
- ○ 6-9 times (4)
- ○ 10-19 times (5)
- ○ 20 or more times (6)

Skip To: End of Survey If Q41 = Never, this was the only time

Q42 **Have you experienced aggression / intimidating behaviour / a negative reaction worse than your most recent occurrence?**

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Q42 = No

Q43 **Please briefly describe what happened in this event.**

_____

_____

_____

Q44 **Considering your worst event, were you:**

○ The remotely piloted aircraft pilot (1)

○ Part of the ground crew for a remotely piloted aircraft (2)

Q45 **Considering your worst event, what level of aggression do you think best describes this event?**

○ Anger (*expressing general annoyance or displeasure towards the pilot, the support crew, or the RPA*) (2)

○ Verbal Aggression (*language directed at the pilot, the support crew, or the RPA in a threatening or harmful manner, e.g., use of strong language, profanity, or use of inappropriate gestures*) (3)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** *(threatening physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (4)

○ Threats of Physical Violence or Aggression towards the **RPA** *(threatening to damage or destroy the aircraft, e.g., kicking, hitting, using weapons other than a firearm)* (11)

○ Actual Physical Violence or Aggression **towards the pilot or the support crew** *(causing physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (5)

○ Actual Physical Violence or Aggression towards the **RPA** *(causing damage or destroying the aircraft e.g., kicking, hitting, using weapons other than a firearm)* (9)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** using firearms *(e.g., threatening to shoot the pilot or ground crew)* (6)

○ Threats of Physical Violence or Aggression towards the **RPA** using firearms *(e.g., threatening to shoot the RPA down)* (12)

○ Actual Physical Violence or Aggression using firearms towards the **pilot or the support crew** (*e.g., shooting at the pilot or ground crew - this may include shot that missed their target*) (7)

○ Actual Physical Violence or Aggression using firearms towards the **RPA** (*e.g., shooting at the RPA - may miss or hit the RPA)* (10)

○ Other (please specify) (8)

_____

Q46 **<u>Considering your worst event</u>, what do you believe the member(s) of the public discovered first?**

- ○ The remotely piloted aircraft (1)
- ○ The pilot or ground crew (2)
- ○ I am unsure (3)

Q47 **<u>Considering your worst event</u>, at what stage of flight were you when this event occurred?**

- ○ Pre-flight (1)
- ○ During flight (2)
- ○ Post flight (3)

Q48 **<u>Considering your worst event</u>, what type of flight was the remotely piloted aircraft being operated for? (*e.g., Surveying, Photography, Recreational, Agricultural Spraying, etc.)***

_____

_____

Q49 **<u>Considering your worst event</u>, was the remotely piloted aircraft performing a commercial operation?**

- ○ Yes (1)
- ○ No (2)

Q50 **Considering your worst event, which Civil Aviation Rule (CAR) part was the remotely piloted aircraft operating under?**

- ○ CAR Part 101 (1)
- ○ CAR Part 102 (2)
- ○ CAR Part 141 (4)
- ○ Unsure (3)

Q51 **Considering your worst event, what was the approximate mass (weight) of the remotely piloted aircraft involved in this occurrence (at take-off)?**

- ○ Less than 250 grams (1)
- ○ More than 250 grams but not more than 2 kilograms (4.4 pounds) (2)
- ○ More than 2 kilograms (4.4 pounds) but not more than 15 kilograms (33 pounds) (3)
- ○ More than 15 kilograms (33 pounds) but not more than 25 kilograms (55 pounds) (4)
- ○ More than 25 kilograms (55 pounds) but not more than 150 kilograms (331 pounds) (5)
- ○ More than 150 kilograms (331 pounds) (6)

Q52 **Considering your worst event, what type of remotely piloted aircraft were you flying when this event occurred?**

- ○ A fixed-wing uncrewed aircraft (1)
- ○ A fixed-wing vertical takeoff and landing (VTOL) uncrewed aircraft (4)
- ○ A single-rotor uncrewed aircraft (i.e., uncrewed helicopter) (5)
- ○ A multi-rotor uncrewed aircraft (i.e., quadcopters, hexacopters, etc.) (2)
- ○ Other (please specify) (3)

_____

Q53 **<u>Considering your worst event</u>, where was the remotely piloted aircraft operating during this event?**

- ○ A rural area (1)
- ○ A semi rural area (4)
- ○ An urban area (town/city) (2)
- ○ Other (please specify) (7)

_____

Q54 **<u>Considering your worst event</u>, which of the following apply to the area that the remotely piloted aircraft was operating within during this event? (*Note that more than one may be selected*)**

- ☐ Over private land (your private property or other private property with the owner/occupier's consent) (1)
- ☐ Over public land that does not require consent (e.g., council parks that automatically allow RPA flights) (6)
- ☐ Over public land that requires consent from a local or central government agency, where consent had been obtained (12)
- ☐ Over a conservation area (e.g., forest, wildlife, beach, park, etc.) (2)
- ☐ Within the vicinity of a public event (8)
- ☐ Within 4km of a designated aerodrome (9)
- ☐ Low-level flying (i.e., at a height that will be closer to people and property occupiers) (11)
- ☐ Other (please specify) (7)

_____

Q55 In the next question, we will ask the approximate altitude that your RPA was flying at during your worst event. Would you prefer to answer this question in feet or metres?

- ○ Feet (above ground level) (1)
- ○ Metres (above ground level) (2)
- ○ I'm not sure what altitude the aircraft was flying at during the event (4)

Skip To: Q57 If Q55 = I'm not sure what altitude the aircraft was flying at during the event

Display This Question:
If Q55 = Feet (above ground level)
Or Q55 = Metres (above ground level)

Q56 **Approximately what altitude was the RPA flying during your worst event?**

Display This Choice:
If Q26 = Feet (above ground level)

- ○ Feet (above ground level) (1)

_____

Display This Choice:
If Q26 = Metres (above ground level)

- ○ Metres (above ground level) (13)

_____

Q57 **<u>Considering your worst event</u>, were you able to resolve (or diffuse) the situation through communication with the member(s) of the public?**

- ○ Yes, by compromise (such as completing the flight at a later time) (1)
- ○ Yes, by providing flight approvals (2)
- ○ Yes, by calm discussion (3)
- ○ No (4)
- ○ Other (please specify) (5)

_____

Q58 **Considering your worst event, did you report this event to the Civil Aviation Authority of New Zealand?**

- ○ No (1)
- ○ Yes (2)

Display This Question:
If Q58 = Yes

Q59 **How did you report your worst event to the CAA?**

- ☐ I used the CA005RPAS form (7)
- ☐ I filed an Aviation Related Concern (ARC) (8)
- ☐ I phoned CAA national office (9)
- ☐ I spoke to an RPAS inspector (via phone or face to face) (10)
- ☐ I spoke to an Aviation Safety Advisor (via phone or face to face) (11)
- ☐ Other (please specify below) (12)

_____

Display This Question:
If Q58 = No

Q60 Considering your worst event, was there any particular reason why you did not report the event to the CAA?

- [x] No particular reason (1)
- [ ] The event was not serious enough (2)
- [ ] I'm not legally required to do so (3)
- [ ] Other (please specify) (4) _____

Q61 **<u>Considering your worst event</u>, were the police notified of this event?**

- ○ Yes, they responded at the time (1)
- ○ Yes, they responded at a later stage after the event (2)
- ○ Yes, they did not respond (3)
- ○ No, this event was not reported (4)

Q62 **<u>Considering your worst event</u>, was the event reported anywhere else?**

- ○ Yes, this was reported through my company's internal reporting system (1)
- ○ Yes, this was reported to an industry organisation (2)
- ○ No, this was not reported elsewhere (3)
- ○ Other (please specify) (4) _____

Q63 **<u>Considering your worst event</u>, how many other people were with you when this event occurred (*write 0 if you were alone*)?**

_____

Q64 **(<u>Considering your worst event</u>) As a consequence of this event, did you incur financial loss? (*such as equipment loss, loss of clients, loss of work)***

- ○ Yes (please specify approximate amount below) (1)

_____

- ○ No (2)

Q65 **Considering your worst event, did you have a system for the public to identify you as a legitimate remotely piloted aircraft operator (*e.g., banners, clothing, company vehicle, etc.*)?**

- ○ Yes (1)
- ○ No (2)

Display This Question:
If Q65 = Yes

Q66 **Please specify how the public might have been able to identify you as a legitimate operator.**

_____

_____

Q67 **What is your age?**

_____

Q68 **What is your gender?**

- ○ Male (1)
- ○ Female (2)
- ○ Other (please specify) (3)

_____

- ○ Prefer not to say (4)

Q69 **Which of the following best describes you? (select all that apply)**

○ Not a current remotely piloted aircraft user (1)

○ Recreational remotely piloted aircraft user (primarily for enjoyment). (2)

○ Semi-professional remotely piloted aircraft user (where less than 50% of your work time is spent on activities related to uncrewed aircraft operations). (3)

○ Professional remotely piloted aircraft user (where more than 50% of your work time is spent on activities related to uncrewed aircraft operations). (4)

Q70 **By your best estimates, roughly how many hours of recreational and commercial flying have you done on remotely piloted aircraft in the last 12 months?**

○ Recreational (1) _____

○ Commercial (2) _____

Q71 **What type of application do you usually operate a remotely piloted aircraft for? (*e.g., Recreational, Surveying, Photography, Agricultural Spraying, etc*.)**

_____

_____

Q72 **How did you find out about this survey?**

- ○ Referred by a friend (1)
- ○ Saw it on social media (3)
- ○ Sent a link from an industry body (please specify which one) (6)
_____
- ○ Other (please specify below) (4)
_____

Q73 Please indicate your level of agreement with the following statements:

	Strongly agree (1)	Agree (2)	Neither agree nor disagree (3)	Disagree (4)	Strongly disagree (5)
Violence and aggression towards RPA pilots and ground crew is a major issue for the industry (1)	○	○	○	○	○
Violence and aggression towards RPA pilots and ground crew is becoming more common (2)	○	○	○	○	○
The public in my country do not understand the rules related to RPA operations (3)	○	○	○	○	○
The public has a negative perception of RPA operations (4)	○	○	○	○	○

The public understand what commercial RPA operators do (5)	○	○	○	○	○
Public education around RPA operations would help mitigate violence and aggression towards RPA pilots and ground crew (6)	○	○	○	○	○
RPA operators in my country are generally compliant with all the Civil Aviation Rules applicable to their operation (7)	○	○	○	○	○
RPA operators in my country respect people's privacy (8)	○	○	○	○	○

Violence and aggression towards RPA operators is not a major issue in my country (9)	○	○	○	○	○
The public in my country are generally respectful towards RPA pilots and their ground crew (10)	○	○	○	○	○

Q74 **Have you ever experienced aggression / intimidating behaviour / a negative reaction while flying (recreationally or commercially), or whilst operating as a ground crew for a remotely piloted aircraft operation?**

○ Yes (1)

○ No (2)

Skip To: End of Survey If Q74 = No

Q75 **Please briefly describe what happened in your <u>most recent occurrence</u> of being verbally or physically threatened. (note if you have had more than one, your worst occurrence will be asked for later in the questionnaire)**

_____

_____

Q76 **When this event occurred were you:**

- ○ The pilot (1)
- ○ A member of ground crew (e.g., visual observer or safety pilot) (2)

Q77 **Approximately how long ago did this event occur?**

- ○ Within the past month (1)
- ○ More than a month ago, but less than six months ago (2)
- ○ More than six months ago, but within the last year (3)
- ○ More than one year ago, but less than three years ago (4)
- ○ Over three years ago (5)

Q78 **What level of aggression do you think best describes this event?**

○ Anger (*expressing general annoyance or displeasure towards the pilot, the support crew, or the RPA*) (2)

○ Verbal Aggression (*language directed at the pilot, the support crew, or the RPA in a threatening or harmful manner, e.g., use of strong language, profanity or use of inappropriate gestures*) (3)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** *(threatening physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (4)

○ Threats of Physical Violence or Aggression towards the **RPA** *(threatening to damage or destroy the aircraft, e.g., kicking, hitting, using weapons other than a firearm)* (11)

○ Actual Physical Violence or Aggression **towards the pilot or the support crew** *(causing physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (5)

○ Actual Physical Violence or Aggression towards the **RPA** *(causing damage or destroying the aircraft, e.g., kicking, hitting, using weapons other than a firearm)* (9)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** using firearms *(e.g., threatening to shoot the pilot or ground crew)* (6)

○ Threats of Physical Violence or Aggression towards the **RPA** using firearms *(e.g., threatening to shoot the RPA down)* (12)

○ Actual Physical Violence or Aggression using firearms towards the **pilot or the support crew** (*e.g., shooting at the pilot or ground crew - may include shots that did not hit their target*) (7)

○ Actual Physical Violence or Aggression using firearms towards the **RPA** (*e.g. shooting at the uncrewed aircraft - may miss or hit the RPA)* (10)

○ Other (please specify) (8)

_____

Q79 **For this event, what do you believe the member(s) of the public discovered first?**

○ The remotely piloted aircraft (1)

○ The pilot or ground crew (2)

○ I am unsure (3)

Q80 **At what stage of flight were you when this event occurred?**

- ○ Pre-flight (1)
- ○ During flight (2)
- ○ Post flight (3)

Q81 **When this event occurred, what type of flight was the remotely piloted aircraft being operated for? (*e.g., Surveying, Photography, Recreational, Agricultural Spraying, etc*.)**

_____

_____

Q82 **When this event occurred, was the remotely piloted aircraft performing a commercial operation?**

- ○ Yes (1)
- ○ No (2)

Q83 **What was the approximate mass (weight) of the remotely piloted aircraft involved in this occurrence (at take-off)?**

- ○ Less than 250 grams (1)
- ○ More than 250 grams but not more than 2 kilograms (4.4 pounds) (2)
- ○ More than 2 kilograms (4.4 pounds) but not more than 15 kilograms (33 pounds) (3)
- ○ More than 15 kilograms (33 pounds) but not more than 25 kilograms (55 pounds) (4)
- ○ More than 25 kilograms (55 pounds) but not more than 150 kilograms (331 pounds) (5)
- ○ More than 150 kilograms (331 pounds) (6)

Q84 **What type of remotely piloted aircraft were you flying when this event occurred?**

- ○ A fixed-wing uncrewed aircraft (1)
- ○ A fixed-wing vertical takeoff and landing (VTOL) uncrewed aircraft (5)
- ○ A single-rotor uncrewed aircraft (i.e., uncrewed helicopter) (4)
- ○ A multi-rotor uncrewed aircraft (i.e., quadcopters, hexacopters, etc.) (2)
- ○ Other (please specify) (3)

_____

Q85 **Where was the remotely piloted aircraft operating during this event?**

- ○ A rural area (1)
- ○ A semi rural area (6)
- ○ An urban area (town / city) (2)
- ○ Other (please specify) (7)

_____

Q86 **Which of the following apply to the area that the remotely piloted aircraft was operating within during this event? (*Note that more than one may be selected*)**

- ☐ Over private land (your private property or other private property with the owner/occupier's consent, if required) (1)
- ☐ Over public land that does not require consent (e.g., council parks that automatically allow RPA flights) (6)
- ☐ Over public land that requires consent from a local or central government agency, where consent had been obtained (13)
- ☐ Over a conservation area (e.g., forest, wildlife, beach, park, etc.) (2)
- ☐ Within the vicinity of a public event (8)
- ☐ Within the vicinity of an aerodrome (9)
- ☐ Low-level flying (i.e., at a height that will be closer to people and property occupiers) (11)
- ☐ Other (please specify) (7)

_____

Q87 In the next question, we will ask the approximate altitude that your RPA was flying at during the event. Would you prefer to answer this question in feet or metres?

- ○ Feet (above ground level) (1)
- ○ Metres (above ground level) (2)
- ○ I'm not sure what altitude the aircraft was flying at during the event (4)

Skip To: Q89 If Q87 = I'm not sure what altitude the aircraft was flying at during the event

Display This Question:
If Q87 = Feet (above ground level)
Or Q87 = Metres (above ground level)

Q88 **Approximately what altitude was the RPA flying?**

Display This Choice:
If Q87 = Feet (above ground level)

- ○ Feet (above ground level) (1)

Display This Choice:
If Q87 = Metres (above ground level)

- ○ Metres (above ground level) (13)

Q89 **Were you able to resolve (or diffuse) the situation through communication with the member(s) of the public?**

- ○ Yes, by compromise (such as completing the flight at a later time) (1)
- ○ Yes, by providing flight approvals (2)
- ○ Yes, by calm discussion (3)
- ○ No (4)
- ○ Other (please specify) (5)

Q90 **Did you report this event to your local aviation authority (e.g., FAA, EASA, CAA, etc.)?**

- ○ No (1)
- ○ Yes (2)

Display This Question:
If Q90 = No

Q91 Was there any particular reason why you did not report the event to your local aviation authority?

- ☒ No particular reason (1)
- ☐ The event was not serious enough (2)
- ☐ I'm not legally required to do so (3)
- ☐ Other (please specify) (4) _____

Q92 **Were the police notified of this event?**

- ○ Yes, they responded at the time (1)
- ○ Yes, they responded at a later stage after the event (2)
- ○ Yes, they did not respond (3)
- ○ No, this event was not reported (4)

Q93 **Was the event reported anywhere else?**

- ○ Yes, this was reported through my company's internal reporting system (1)
- ○ Yes, this was reported to an industry organisation (2)
- ○ No, this was not reported elsewhere (3)
- ○ Other (please specify) (4) _____

Q94 **How many other people were with you when this event occurred (*write 0 if you were alone*).**

_____

Q95 **As a consequence of this event, has the time you spend flying remotely piloted aircraft changed?**

- ○ I fly more after this event occurred than prior to this event (1)
- ○ I fly less after this event occurred that prior to this event (2)
- ○ The time I spend flying remotely piloted aircraft is unchanged (3)
- ○ I have stopped flying remotely piloted aircraft after this event (4)

Q96 **As a consequence of this event, did you incur financial loss? (*such as equipment loss, loss of clients, loss of work)***

- ○ Yes (please specify an estimate amount with your currency, e.g., US$500, €300, £200) (1) _____
- ○ No (2)

Q97 **Following this event, have you changed your remotely piloted aircraft operations?**

- ○ Yes (1)
- ○ No (2)

Skip To: Q99 If Q97 = No

Display This Question:
If Q97 = Yes

Q98 **What did you change?**

_____

_____

_____

Q99 **Did you have a system for the public to identify you as a legitimate remotely piloted aircraft operator (*e.g., banners, clothing, company vehicle, etc.*)?**

- ○ Yes (1)
- ○ No (2)

Skip To: End of Block If Q99 = No

Display This Question:
If Q99 = Yes

Q100 **Please specify how the public might have been able to identify you as a legitimate operator.**

_____

_____

_____

Q101 **Within the last 5 years, <u>other than this occurrence</u>, how often have you been verbally or physically threatened while flying or operating as a ground crew of a remotely piloted aircraft?**

- ○ Never, this was the only time (1)
- ○ 1-2 times (2)
- ○ 3-5 times (3)
- ○ 6-9 times (4)
- ○ 10-19 times (5)
- ○ 20 or more times (6)

Skip To: End of Survey If Q101 = Never, this was the only time

Q102 **Have you experienced aggression / intimidating behaviour / a negative reaction <u>worse</u> than your most recent occurrence?**

- ○ Yes (1)
- ○ No (2)

Skip To: End of Survey If Q102 = No

Q103 **Please briefly describe what happened in this event.**

_____

_____

_____

Q104 **<u>Considering your worst event</u>, were you:**

- ○ The remotely piloted aircraft pilot (1)
- ○ Part of the ground crew for a remotely piloted aircraft (2)

Q105 **Considering your worst event, what level of aggression do you think best describes this event?**

○ Anger (*expressing general annoyance or displeasure towards the pilot, the support crew, or the RPA*) (2)

○ Verbal Aggression (*language directed at the pilot, the support crew, or the RPA in a threatening or harmful manner, e.g., use of strong language, profanity, or use of inappropriate gestures*) (3)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** *(threatening physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (4)

○ Threats of Physical Violence or Aggression towards the **RPA** *(threatening to damage or destroy the aircraft, e.g., kicking, hitting, using weapons other than a firearm)* (11)

○ Actual Physical Violence or Aggression **towards the pilot or the support crew** *(causing physical harm, e.g., kicking, hitting, using weapons other than a firearm)* (5)

○ Actual Physical Violence or Aggression towards the **RPA** *(causing damage or destroying the aircraft e.g., kicking, hitting, using weapons other than a firearm)* (9)

○ Threats of Physical Violence or Aggression **towards the pilot or the support crew** using firearms *(e.g., threatening to shoot the pilot or ground crew)* (6)

○ Threats of Physical Violence or Aggression towards the **RPA** using firearms *(e.g., threatening to shoot the RPA down)* (12)

○ Actual Physical Violence or Aggression using firearms towards the **pilot or the support crew** (*e.g., shooting at the pilot or ground crew - this may include shot that missed their target*) (7)

○ Actual Physical Violence or Aggression using firearms towards the **RPA** (*e.g., shooting at the RPA - may miss or hit the RPA)* (10)

○ Other (please specify) (8)

_____

Q106 **Considering your worst event, what do you believe the member(s) of the public discovered first?**

- ○ The remotely piloted aircraft (1)
- ○ The pilot or ground crew (2)
- ○ I am unsure (3)

Q107 **Considering your worst event, at what stage of flight were you when this event occurred?**

- ○ Pre-flight (1)
- ○ During flight (2)
- ○ Post flight (3)

Q108 **Considering your worst event, what type of flight was the remotely piloted aircraft being operated for? (*e.g., Surveying, Photography, Recreational, Agricultural Spraying, etc.)***

_____

_____

_____

Q109 **Considering your worst event, was the remotely piloted aircraft performing a commercial operation?**

- ○ Yes (1)
- ○ No (2)

Q110 **Considering your worst event, what was the approximate mass (weight) of the remotely piloted aircraft involved in this occurrence (at take-off)?**

- ○ Less than 250 grams (1)
- ○ More than 250 grams but not more than 2 kilograms (4.4 pounds) (2)
- ○ More than 2 kilograms (4.4 pounds) but not more than 15 kilograms (33 pounds) (3)
- ○ More than 15 kilograms (33 pounds) but not more than 25 kilograms (55 pounds) (4)
- ○ More than 25 kilograms (55 pounds) but not more than 150 kilograms (331 pounds) (5)
- ○ More than 150 kilograms (331 pounds) (6)

Q111 **Considering your worst event, what type of remotely piloted aircraft were you flying when this event occurred?**

- ○ A fixed-wing uncrewed aircraft (1)
- ○ A fixed-wing vertical takeoff and landing (VTOL) uncrewed aircraft (4)
- ○ A single-rotor uncrewed aircraft (i.e., uncrewed helicopter) (5)
- ○ A multi-rotor uncrewed aircraft (i.e., quadcopters, hexacopters, etc.) (2)
- ○ Other (please specify) (3)

_____

Q112 **Considering your worst event, where was the remotely piloted aircraft operating during this event?**

- ○ A rural area (1)
- ○ A semi rural area (4)
- ○ An urban area (town/city) (2)
- ○ Other (please specify) (7)

_____

Q113 **<u>Considering your worst event</u>, which of the following apply to the area that the remotely piloted aircraft was operating within during this event? (*Note that more than one may be selected*)**

- ☐ Over private land (your private property or other private property with the owner/occupier's consent, if required) (1)
- ☐ Over public land that does not require consent (e.g., council parks that automatically allow RPA flights) (6)
- ☐ Over public land that requires consent from a local or central government agency, where consent had been obtained (12)
- ☐ Over a conservation area (e.g., forest, wildlife, beach, park, etc.) (2)
- ☐ Within the vicinity of a public event (8)
- ☐ Within the vicinity of an airport (9)
- ☐ Low-level flying (i.e., at a height that will be closer to people and property occupiers) (11)
- ☐ Other (please specify) (7)

_____

Q114 In the next question, we will ask the approximate altitude that your RPA was flying at during your worst event. Would you prefer to answer this question in feet or metres?

- ○ Feet (above ground level) (1)
- ○ Metres (above ground level) (2)
- ○ I'm not sure what altitude the aircraft was flying at during the event (4)

Skip To: Q116 If Q114 = I'm not sure what altitude the aircraft was flying at during the event

Display This Question:

If Q114 = Feet (above ground level)

Or Q114 = Metres (above ground level)

Q115 **Approximately what altitude was the RPA flying during your worst event?**

Display This Choice:
If Q114 = Feet (above ground level)

- ○ Feet (above ground level) (1)

Display This Choice:
If Q114 = Metres (above ground level)

- ○ Metres (above ground level) (13)

Q116 **<u>Considering your worst event</u>, were you able to resolve (or diffuse) the situation through communication with the member(s) of the public?**

- ○ Yes, by compromise (such as completing the flight at a later time) (1)
- ○ Yes, by providing flight approvals (2)
- ○ Yes, by calm discussion (3)
- ○ No (4)
- ○ Other (please specify) (5)

Q117 **Considering your worst event, did you report this event to your local aviation authority (e.g., FAA, EASA, CAA, etc.)?**

- ○ No (1)
- ○ Yes (2)

Display This Question:
If Q117 = No

Q118 Considering your worst event, was there any particular reason why you did not report the event to the CAA?

- [x] No particular reason (1)
- [ ] The event was not serious enough (2)
- [ ] I'm not legally required to do so (3)
- [ ] Other (please specify) (4) _____

Q119 **<u>Considering your worst event</u>, were the police notified of this event?**

- ○ Yes, they responded at the time (1)
- ○ Yes, they responded at a later stage after the event (2)
- ○ Yes, they did not respond (3)
- ○ No, this event was not reported (4)

Q120 **<u>Considering your worst event</u>, was the event reported anywhere else?**

- ○ Yes, this was reported through my company's internal reporting system (1)
- ○ Yes, this was reported to an industry organisation (2)
- ○ No, this was not reported elsewhere (3)
- ○ Other (please specify) (4) _____

Q121 **<u>Considering your worst event</u>, how many other people were with you when this event occurred (*write 0 if you were alone*)?**

_____

Q122 **(<u>Considering your worst event</u>) As a consequence of this event, did you incur financial loss? (*such as equipment loss, loss of clients, loss of work)***

○ Yes (please specify an estimate amount with your currency, e.g., US$500, €300, £200) (1) _____

○ No (2)

Q123 **Considering your worst event, did you have a system for the public to identify you as a legitimate remotely piloted aircraft operator (*e.g., banners, clothing, company vehicle, etc.*)?**

○ Yes (1)

○ No (2)

Display This Question:
If Q123 = Yes

Q124 **Please specify how the public might have been able to identify you as a legitimate operator.**

_____

_____

_____