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Reassessing the Unit of Registration in Unmanned Aircraft Systems: Evidence from Ownership Characteristics in New Zealand

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Abstract

Registration of unmanned aircraft is widely adopted internationally and is a core component of the International Civil Aviation Organisation's framework of model rules for unmanned aircraft. This research analyzes the registration approaches introduced across advanced economies to uncover shared features and distinctions. New Zealand serves as the case study in this examination. At present, the country does not mandate registration for unmanned aircraft, yet its Ministry of Transport has suggested establishing such a system. Within this case study, ownership details from 919 New Zealand unmanned aircraft users were obtained via an online survey. Outcomes reveal that aircraft owned by individuals are generally operated solely by the owner, resulting in fewer users than aircraft. In contrast, aircraft owned by organisations have several users per aircraft, though these individuals are almost always staff members of that organisation. Such results imply that the optimal method for New Zealand to introduce a registration system would be to register users and organisations rather than each separate aircraft. Though focused on New Zealand, the outcomes also underscore the importance of additional global studies to assess how well registration systems align with actual ownership patterns.

Keywords Drone registration, Unmanned aircraft, Transport policy, New Zealand

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Introduction

Requiring registration for unmanned aircraft (commonly referred to as drones, model aircraft, uncrewed aircraft, and remotely piloted aircraft) has become a global standard. Over the last ten years, the United States, nations in the European Union, and other regions have implemented these systems. Although New Zealand's Ministry of Transport has raised the possibility of a registration scheme in a discussion paper [1], this has not become established government policy. The paper also sought opinions from interested parties on whether they favour the idea and how it could be structured. As detailed further in **Table 1**, nearly every advanced economy operates some form of registration. Yet, they vary in their focus: some register the aircraft directly, while others register the user and provide an operator ID suitable for use on several aircraft. New Zealand can choose to follow one of these models or skip registration entirely. Ownership information gathered directly from users can therefore play a valuable role in shaping upcoming policy decisions.

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Table 1. Comparison of unmanned aircraft registration schemes across advanced economies.

Jurisdiction	Registration scheme	Threshold	Cost	Duration	Age requirement	Exceptions
Australia	All aircraft used for commercial operations must be registered	None for commercial use; 250 g for recreational (from mid-2023)	AUD 40 (USD 26.72) per aircraft	1 year	16 years	Recreational operations (until mid-2023)
Austria	Each aircraft must display the Operator ID of the owner	250 g or equipped with a camera	EUR 32.40 (USD 34.43) per operator	3 years	18 years	-
Canada	All aircraft must be registered	250 g	CAD 5 (USD 3.68) per aircraft	Not specified	14 years	-
EASA Member States	Each aircraft must carry the Operator ID of the owner	250 g, or equipped with sensors capable of collecting personal data, or having kinetic energy exceeding 80 joules	Varies	Varies	Varies	Individual countries may apply different rules for model aircraft organisations
Finland	Each aircraft must display the Operator ID of the owner	250 g or equipped with a camera	EUR 30 (1 year), EUR 75 (3 years), or EUR 100 (5 years) per operator (USD 31.87, USD 79.67, USD 106.23)	Not specified	-	-
France	Each aircraft must be marked with the Operator ID of the owner	EASA requirements	Not specified	Not specified	Not specified	Model aircraft associations may have different rules, though registration is usually still required
Germany	Each aircraft must display the Operator ID of the owner	EASA requirements	Not specified	Not specified	Not specified	-
Hong Kong (SAR)	All aircraft must be registered	250 g	Free (until 1 June 2025)	Up to 5 years	18 years	-

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Iceland	All aircraft used commercially must be registered	250 g	Free	Not specified	Not specified	Recreational use permitted
ICAO Model Regulations	All aircraft must be registered	Not specified	Not specified	Not specified	Not specified	Different rules apply for approved aviation organisations
Ireland	Each aircraft must display the Operator ID of the owner	250 g or equipped with a camera	EUR 30 (USD 31.88) per operator	2 years	16 years	-
Japan	All aircraft must be registered	100 g	Online fee: ¥900 for the first aircraft and ¥890 for additional aircraft (USD 6.84 / 6.76)	3 years	Not specified	-
Luxembourg	Each aircraft must display the Operator ID of the owner	250 g, equipped with a camera, or capable of flying above 90 km/h	Not specified	1 year	Not specified	-
Macau (SAR)	No formal registration system; all drone activities require approval	-	-	-	-	-
Netherlands	Each aircraft must display the Operator ID of the owner	250 g or equipped with a camera	EUR 23 (USD 24.44) per operator	1 year	16 years	-
New Zealand	No registration system; Part 102 operators must record aircraft and unique identifiers in operational documentation	-	-	-	-	-
Singapore	All aircraft must be registered	250 g	SGD 15 (USD 11.10) per registration label	Not specified	16 years (3)	-
Slovenia	Each aircraft must display the Operator ID of the owner	EASA requirements	Not specified	Not specified	18 years (3)	-

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South Korea	All aircraft must be registered	2 kg for recreational use; all commercial use	Not specified	Not specified	Not specified	-
Sweden	Each aircraft must display the Operator ID of the owner	Not specified	130 SEK (USD 12.46), covering license and operator ID	5 years	Not specified	-
Switzerland	Each aircraft must display the Operator ID of the owner	250 g or equipped with a sensor capable of recording personal data	Not specified	Not specified	12 years	-
Taiwan	All aircraft must be registered	250 g	TWD 50 (USD 1.63)	Not specified	20 years (3)	-
United Kingdom	Each aircraft must display the Operator ID of the owner	250 g or equipped with a camera	£10 (USD 12.18) per person or organisation	1 year	18 years (3)	-
United States	All aircraft must be registered	250 g	USD 5 per aircraft	3 years	13 years	Recreational flyers are exempt if following FAA-recognised Community-Based Organisation rules

[1]Has other requirements that must be met when applying for registration, such as pilot competency, theory tests, training, airworthiness requirements, insurance requirements, or limiting the number of aircraft that can be registered.[2] EASA Member States include the 27 European Union Countries, as well as Iceland, Norway, Liechtenstein, and Switzerland. EASA Members are also included in the table separately, where information was accessible.[3] Younger persons can apply through their parents, guardians, or legal representatives. The table assumes the aircraft weighs less than 25 kg and will be operated outdoors. It simplifies requirements, allowing easy comparison of registration requirements. Readers should consult the relevant jurisdiction's rules for full details and to check for updates. Currency conversions were performed using rates as of 21 December 2022 [2-47].

Countries have cited numerous advantages and rationales for introducing registration systems. Primary motivations include:

• Establishing a framework that fosters accountability and responsible behaviour

• Helping unmanned aircraft users retrieve aircraft that have gone missing

• Increasing public confidence in unmanned aircraft technology through ways to trace owners

• Building a more secure and protected airspace environment

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• Supplying enhanced information to authorities for developing future regulations

• Providing a means for authorities to contact unmanned aircraft users directly

• Detecting operators who fail to comply and taking enforcement steps when necessary

• Supporting the merging of airspace so unmanned and manned aircraft can share the same areas

• Expanding the variety of permitted operations involving unmanned aircraft [1-7].

Scholarly sources express a range of opinions regarding unmanned aircraft registration. Clarke [8] makes the case for registration by comparing it to existing rules for motor vehicles. Still, he warns that the approaches rolled out in the United States during that period would deliver minimal advantages. He proposes stricter measures designed to motivate users to "join a club and bring themselves within an environment that makes information available, and brings with it both a sense of responsibility and insurance coverage" (pp. 154–155). Merkert *et al.* [9] conclude that Australian unmanned aircraft users' readiness to pay for registration hinges on the kinds of flying activities the registration permits. They advise against slowing industry expansion through yearly fees, noting that such modest amounts fall short of what users would actually pay and are unlikely to gain acceptance, as users may not recognise the corresponding value. Yao *et al.* [10] report that registering the owner gained the strongest backing from both pilots and observers in a United States sample as a way to ease privacy worries. Supporters valued its usefulness for identifying pilots, its similarity to practices in other fields, and its potential to reduce reckless behaviour (though the latter was mainly noted by observers). Still, both groups noted that it fails to provide direct privacy protection, and pilots worried it might violate their privacy.

Shelley [11] determined that the technology available at the time meant a registration scheme could not have stopped the Gatwick event, as those planning deliberate, harmful actions would evade any such rules or remote identification. On the other hand, Pentz and Tang [12] show that unmanned aircraft registration in the United States helped reduce incidents of unauthorised or negligent flying, based on events around 2017 when courts temporarily suspended registration and later restored it. In a similar vein, Pitcher [13] noted a sharp rise in unmanned aircraft reports to the Federal Aviation Administration (FAA) during 2018, followed by no further increase in 2019. With registration reinstated in December 2017, the authors attribute the 2019 stabilisation to the scheme's influence, as no major federal-level adjustments occurred in that interval. Additional studies have called for registration schemes [14-18], yet these rely on theoretical reasoning rather than hard data, drawing from fields such as law, society, and enforcement. Due to the scarce and conflicting findings in existing research on the value of registration schemes, this paper avoids taking sides in that discussion. Instead, it uses ownership patterns among New Zealand unmanned aircraft users to recommend the most fitting registration model if the country moves forward. New Zealand further gains from reviewing practices in other countries, an aspect this paper also addresses.

An international review of registration schemes for unmanned aircraft

In many respects, New Zealand's approach to regulating unmanned aircraft aligns with practices elsewhere, but it stands out for having no registration requirement [19, 20]. Even so, major variations exist worldwide in the design of these systems, particularly regarding whether registration applies to each aircraft individually or to each user (generally termed the operator), who receives a distinct identifier for placement on any number of aircraft. **Table 1** offers an overview of how registration rules differ among advanced economies. The selection of advanced economies follows the International Monetary Fund classification [21]. The review was restricted to jurisdictions where official government sources provided clear information without requiring the start of a registration process.

Table 1 demonstrates that only New Zealand and Macao's Special Administrative Region currently impose no registration obligation on either unmanned aircraft or their users. Large economies, including the United States, Canada, Australia, Japan, South Korea, Singapore, and Taiwan, have chosen to register aircraft individually. Meanwhile, countries within the European Union Aviation Safety Agency (EASA) and the United Kingdom have moved toward operator ID registration,

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allowing a single identifier to cover multiple aircraft. Most nations in this second group also enforce accompanying standards for training, skill verification, and insurance.

New Zealand's proposed registration scheme

During April 2021, New Zealand's Ministry of Transport issued the Enabling Drone Integration consultation paper. It outlined multiple updates to the existing rules covering unmanned aircraft nationwide. One key element was the suggested introduction of mandatory registration. The paper pinpoints the main challenges registration would target (quoting verbatim):

· Lack of compliance from drone pilots

· Inability to communicate directly with drone owners

· Inability to link a drone to a person, i.e., inability to identify who flies what, making complaints often unenforceable

· Limited ability to integrate drones into the civil aviation system.

· Difficulty in collecting accurate data and managing risks accordingly (p.41, [1]).

Under the plan, the aircraft owner would typically handle registration in most situations, even though the document notes that the pilot and owner are often the same person. Organisations, including firms, public agencies, and incorporated bodies, could also act as owners. Registration would become mandatory above a 250 g weight limit to align with the "majority of our aviation counterparts" (p. 42, [1]) and because prior studies have endorsed this cutoff [48]. Officials put forward a minimum age of 14, permitting those younger to proceed with a parent or guardian. This cutoff sits below levels in most entries from **Table 1**, yet follows New Zealand-specific reasoning: 14 marks the lowest age for receiving an infringement notice and for using identity authentication tools. Drawing parallels with United States exemptions for community groups, the paper recommends exempting unmanned aircraft flown inside Model Flying New Zealand (MFNZ) approved sites under direct MFNZ oversight. Even so, any flights outside those sites would trigger registration needs, potentially constraining many MFNZ members during flights above personal land or in open parks. Unlike the approaches in **Table 1**, registration would be permanent, as a one-time action tied to each aircraft. The paper provided no specific cost projections, yet emphasised that "any potential new fee should not become a barrier or disincentive to comply" (p. 48, [1]). It also stated that "we would need to consider whether to charge either per drone or per owner and whether this should be a one-off or annual fee" (p. 48, [1]). Being only a consultation document inviting feedback rather than a set policy, the final choice remains open, both the format and the potential existence of any scheme. Importantly, New Zealand could pursue registration by individual aircraft or shift to operator registration, in which a single unique code covers several aircraft. Leading jurisdictions employ both models, so evidence drawn from local unmanned aircraft users, particularly ownership details, should shape the decision. This research aims to provide practical guidance for steering New Zealand's final policy choice.

New Zealand's current unmanned aircraft regulations

Rules for unmanned aircraft activities are set out in Parts 101 and 102 of the Civil Aviation Rules (CARs). These were established under the Civil Aviation Act [49, 50]. CAR Part 101 serves as a collection of broad operational guidelines available to all users who adhere to its restrictions. Important restrictions encompass:

· Operations must take place during daylight, unless indoors or within a shielded area (below the height of the tallest object within 100 m of the aircraft).

· Operations must be conducted within visual line of sight, which may include the use of trained and competent visual observers.

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· Flights must not exceed 400 ft above ground level, unless a Notice to Airmen has been issued at least 24 h before the operation.

· Operations must not be flown over uninvolved persons, unless their consent has been obtained.

· Operations may only be flown over property with the consent of the owner or occupier of that property.

· The same airspace restrictions apply to unmanned aircraft as to manned aircraft, including the need to obtain permission from air traffic control to enter controlled airspace and the requirement to comply with special-use airspace rules. The only exception is Low Fly Zones, which cannot be entered under CAR Part 101.

· Operations can only take place within 4 km of a promulgated aerodrome if the operation is shielded and there is a physical barrier between the unmanned aircraft and the aerodrome, or if the pilot holds an approved qualification or is under the direct supervision of someone who does.

Aircraft between 15 kg and 25 kg can fly after inspection and approval by an authorised individual or body from the Civil Aviation Authority. Activities with aircraft heavier than 25 kg receive no allowance under CAR Part 101 [50].

Activities exceeding the listed limits demand a Part 102 Operator's Certificate. Entities submit an exposition document for evaluation to obtain this [37, 49]. The exposition must detail organisational governance, routine procedures, maintenance and airworthiness standards, crew preparation, and safety frameworks tailored to the scale and complexity of activities [51].

Materials and Methods

This research contributes to a larger investigation into unmanned aircraft users across New Zealand. A central component was conducting an online survey through Qualtrics, which ran from October 2020 to January 2021. The survey explored the use of unmanned aircraft, ownership levels, the effectiveness of safety initiatives, the suitability of current regulations, and other relevant topics. Recruitment was conducted by sharing the survey link on social media and by requesting assistance from Model Flying New Zealand, UAVNZ, and Aviation New Zealand to distribute it through their networks. During its active period, the survey received 946 submissions, though just 919 contained sufficient responses for inclusion in the analysis.

To secure a relevant sample, participants needed to satisfy these conditions:

· Live in New Zealand

· Have operated an unmanned aircraft previously

· Be at least 16 years old

The project underwent peer review and was classified as low risk with respect to ethical concerns. Consequently, it did not require submission to one of Massey University's Human Ethics Committees, but was logged as a low-risk project in the university's Human Ethics Database.

This analysis focuses on a selection of items from the broader survey. The complete survey dataset, encompassing all questions and answers, is openly accessible [52] at https://doi.org/10.6084/m9.figshare.16571558.v1 (accessed on 13 January 2023).

All 919 valid submissions were included in the analysis, as every participant responded to the ownership-related items. Nevertheless, 28 participants skipped the items concerning course attendance, OCA completion, membership in MFNZ or

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UAVNZ, or prior experience under a Part 102 Operator's Certificate (Q13–17).

Among the 919 respondents, 897 (97.61%) reported male gender, 17 (1.85%) female, 1 (0.11%) transgender, and 4 (0.44%) chose not to disclose gender. The average participant age was 57.05 (SD = 15.76), ranging from 16 to 88 years. Within the group, 38 (4.13%) were non-current users, 777 (84.55%) recreational users, 59 (6.42%) semi-professional users (under 50% of work time on unmanned aircraft tasks), and 45 (4.90%) professional users (over 50% of work time on unmanned aircraft tasks). From the 891 who addressed questions 13–17, 416 (46.69%) had joined a course on unmanned aircraft operations, 617 (69.25%) had succeeded in an OCA, 707 (79.35%) belonged to MFNZ, and 123 (13.80%) joined UAVNZ or Aviation New Zealand.

Owing to varying data formats, distinct statistical techniques were used for each type. Items 1 and 2 received no deeper examination because gender and age held no direct bearing on ownership matters. Items 3 and 13–17 served to sort participants by user traits. Items 4, 5, 8, and 9 consisted of yes/no ownership queries. Chi-squared tests of independence checked for meaningful links between affirmative answers and specific user categories, with Cramer's V [53] conveying effect size. Items 6, 7, and 10–12 generated numeric replies that deviated from the normal distribution. Thus, non-parametric approaches were applied. Kruskal–Wallis H tests [54] were used to assess variations in aircraft/user counts across user categories (non-current, recreational, semi-professional, or professional). Box plots enabled visual confirmation of comparable distributions. Dunn's procedure [55] used pairwise comparisons with the Bonferroni correction [56] for multiple tests. Mann–Whitney U tests [57] evaluated differences in aircraft/user counts linked to course attendance, OCA success, MFNZ or UAVNZ membership, or Part 102 experience. Visual checks confirmed similar distributions. Outcomes are reported as mean ranks and exact U sampling distributions [58].

Results and Discussion

Descriptive statistics on ownership and number of users for unmanned aircraft

Table 2 presents the absolute counts and percentages of users who have personally owned aircraft, currently or previously, and of those whose organisations have owned aircraft, currently or previously.

Table 2. Ownership rates for unmanned aircraft.

Ownership variable	Percentage	Participants (Number)
Personally owned an unmanned aircraft at some point in the past	95.65%	879
Currently owns an unmanned aircraft (1)	93.25%	857
The organisation has previously owned an unmanned aircraft (2)	30.25%	278
The organisation currently owns an unmanned aircraft (2)	24.16%	222

[1]Excludes 40 participants who indicated they had not owned an unmanned aircraft in the past. [2] Excludes 237 participants who answered "unsure" to organisational ownership, as well as the 5 participants who did not answer these questions.

Table 3 provides descriptive figures on the number of aircraft currently owned and the number of additional users of those aircraft over the prior 12 months. Positive skewness appeared in every variable; therefore, although the mean and standard deviation feature, the median and inter-quartile range likely prove more informative, displayed in the "Median (IQR)" column. The standalone number denotes the median (middle value), the initial bracketed number marks the lower quartile (25th percentile), and the following number marks the upper quartile (75th percentile). Range values further illustrate distribution extremes.

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Table 3. Descriptive statistics regarding the number of personally and organisationally owned aircraft, as well as the number of users of those in the last 12 months.

Ownership variable	Range	Median (IQR)	Mean (SD)	N
Number of personally owned aircraft per user	0–250	8 (3, 15)	11.26 (14.31)	919
Other users of personally owned aircraft	0–30	0 (0, 1)	1.08 (2.40)	856
Total users of personally owned aircraft	1–31	1 (1, 2)	2.08 (2.40)	856
Users per personally owned aircraft	0.01–11	0.2 (0.1, 0.5)	0.43 (0.79)	856
Number of organisationally owned aircraft	1–200	2 (1, 6)	8.83 (21.35)	218
Employee users of organisational aircraft	0–275	2 (1, 4)	6.48 (23.68)	214
Non-employee users of organisational aircraft	0–97	0 (0, 1)	2.24 (8.25)	214
Total users of organisational aircraft	0–275	3 (1, 6)	8.73 (24.66)	214
Users per organisationally owned aircraft	0–82.5	1 (0.41, 2)	2.33 (6.36)	214

^ The number of participants varies because some participants did not answer follow-up questions or were excluded due to earlier answers.

Differences between users

Table 4 displays the meaningful outcomes from Chi-squared tests of independence (assessing links between user categories and personal or organisational ownership), Kruskal–Wallis H tests (checking user type influence on owned aircraft counts and user numbers), and Mann–Whitney U tests (examining impacts from course attendance, OCA passage, MFNZ or UAVNZ membership, or Part 102 operation on owned aircraft counts and user numbers). Complete statistical details, covering non-significant findings. **Table 3** identifies user segments showing notable differences and uses a (+) marker for increased probability or higher count, or a (-) marker for reduced probability or lower count relative to the overall sample. Pairwise outcomes always employ the greater than symbol (>) to denote which segment held the superior mean rank.

Table 4. Statistically significant differences between user groupings for ownership variables.

Ownership variable	N	Observed differences
User personally owns an aircraft	919	Recreational (+) ***
	891	Non-current user (−) ***
		Passed an OCA (+) ***
		MFNZ Member (+) ***
		Part 102 Operator (−) *
Number of personally owned aircraft	889	Recreational user > Non-current user ***
		Recreational user > Semi-professional user ***
		Recreational user > Professional user ***
		Completed a Course (+) **

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		Passed an OCA (+) ***
		MFNZ Member (+) ***
Other users of personally owned aircraft	856	Recreational user > Non-current user *
		Professional user > Non-current user *
Total users of personally owned aircraft	856	Recreational user > Non-current user *
		Professional user > Non-current user *
Users per personally owned aircraft	856	Recreational user > Semi-professional user ***
	828	Recreational user > Professional user ***
		Completed a Course (−) *
		Passed an OCA (−) ***
		MFNZ Member (−) ***
The user's organisation owns an aircraft	676	Semi-professional user (+) ***
	659	Professional user (+) ***
		Completed a Course (+) ***
		Passed an OCA (+) ***
		MFNZ Member (−) ***
		UAVNZ Member (+) ***
		Part 102 Operator (+) ***
Number of organisationally owned aircraft	218	Professional > Recreational **
	212	Completed a Course (+) ***
		Part 102 Operator (+) **
Employee users of organisationally owned aircraft	212	UAVNZ Member (+) *
Non-employee users of organisationally owned aircraft	214	User type (pairwise comparisons insignificant) *
		Part 102 Operator (−) **
Total users of organisationally owned aircraft	212	UAVNZ Member (+) *
		Part 102 Operator (−) *
Users per organisationally owned aircraft	214	Recreational > Professional ***
	212	Completed a Course (−) ***
		Passed an OCA (−) *
		Part 102 Operator (−) ***

^ The number of participants varies because some participants did not answer follow-up questions or were excluded due to earlier answers. The results indicate statistical significance at the $P < 0.05$, 0.01, and 0.001 levels, respectively.

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Findings portray contrasting situations depending on whether unmanned aircraft are owned by individuals or organisations. Individually owned aircraft averaged 0.43 users per aircraft, with a median of 0.2. Thus, aircraft outnumber the people operating them. Organisationally owned aircraft show the reverse pattern, averaging 2.33 users per aircraft and a median of 1. In most instances, every user of organisational aircraft was an employee there, although exceptions existed—one respondent noted up to 97 non-employee users. Even at a basic descriptive level, these patterns point to New Zealand following models like those in EASA countries and the United Kingdom, registering operators rather than aircraft. Operators might be individuals or groups, each with a distinct identifier assigned to every aircraft. Study constraints leave uncertainty about the supervision of non-employee users on organisational aircraft. One remedy could involve distinguishing between flyer ID (the actual pilot) and operator ID (the owner, individual, or group), mirroring United Kingdom practice. This would also align with another idea from the Enabling Drone Integration paper: introducing a foundational pilot credential for operating unmanned aircraft weighing more than 250 g.

Among the notable differences in **Table 4**, several are policy-relevant. Recreational users possess the largest aircraft counts, surpassing other categories. MFNZ affiliates likewise own more aircraft than outsiders. This indicates that exempting MFNZ (as floated in the consultation paper) would spare members needless expenses when flying model aircraft inside approved zones under club guidelines. Such relief would matter chiefly if New Zealand mandated per-aircraft registration rather than per-operator. One MFNZ participant in the study personally held 250 aircraft. At an estimated NZD 10 (USD 6.29) annual fee per aircraft (based on global examples), full operations outside MFNZ zones would cost NZD 2500 (USD 1573.74) per year. Switching to per-operator charging with a single ID usable across all 250 aircraft would significantly ease this burden. The United Kingdom and most EASA nations require operator registration and operator IDs for model aircraft, just as for other unmanned aircraft types. MFNZ members proved less inclined to share aircraft with others, even though recreational users overall shared more than semi-professional or professional ones. This further supports either an exemption or operator-ID framework to ensure fairness for MFNZ participants.

As expected, semi-professional and professional users displayed elevated organisational ownership. Such ownership also rose among those who finished courses, cleared an OCA, joined UAVNZ, or worked under Part 102 certificates. Earlier studies link all these factors to greater and more diverse risk-reduction steps by users [59]. Organisations may adopt stronger caution due to financial and reputational risks if issues arise with their aircraft. They can also set internal rules for employee operation and conditions for non-employee access. Therefore, registering the organisation via an operator ID (instead of assigning unique IDs to each aircraft) better aligns with accountability structures.

In some cases, parallel concerns apply to MFNZ members regarding heavy ownership. One respondent indicated their organisation controlled 200 aircraft. A steeper organisational operator-ID fee would still undercut an annual per-aircraft total near NZD 2000 (USD 1258.99). It would further reduce administrative strain from repeated registrations during fleet updates or model changes, as a single operator ID could cover all aircraft. Organisations holding Part 102 certification have already incurred substantial Civil Aviation Authority charges and maintain individual aircraft identifiers. This research finds they operate with fewer users per aircraft yet more aircraft overall, so converting to operator IDs would curb extra expenses for this segment.

Conclusion

This research examined ownership features of unmanned aircraft drawn from a group of 919 New Zealand unmanned aircraft users. Insight into these features can inform upcoming decisions on unmanned aircraft registration policies. An international examination of approaches in advanced economies shows that the two primary methods involve either registering every unmanned aircraft individually or registering each operator and issuing an operator ID that must appear on every aircraft under their control or use. Outcomes from this research indicate that the second option—operator IDs (applied by EASA countries and the United Kingdom)—represents the strongest choice for New Zealand. Under this model, operators (whether individuals or entities) would register their distinct operator IDs and affix them to all aircraft they operate. Variations across user types imply that adopting per-aircraft registration would entail notable expenses for

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MFNZ members, given their larger aircraft holdings, and for organisations engaged in professional unmanned aircraft work, given their elevated ownership levels. Although the Ministry of Transport suggested an exemption for MFNZ members in the consultation paper that advocates individual aircraft registration above 250 g, this would cover only flights at MFNZ locations and would greatly reduce their existing operational flexibility. Consequently, this paper recommends that the most suitable registration approach for New Zealand would mandate that every unmanned aircraft user obtain an operator ID (typically the owner, barring unusual situations) and display it on every aircraft flown. MFNZ members could retain the proposed exemption for operations at MFNZ sites while remaining subject to registration rules for activities elsewhere. An operator ID framework is unlikely to impose heavy financial burdens on MFNZ members or organisations, unlike an aircraft-focused system would.

The actual value of registration systems remains uncertain, since numerous asserted advantages lack solid empirical backing. For this reason, New Zealand might decide to retain its existing stance of no registration requirement until stronger proof emerges. The final call on adopting a registration scheme rests with New Zealand's Cabinet, as elected representatives must weigh the broader public benefit. Although the information in this study cannot settle whether a registration scheme ought to proceed, it does offer clear direction on the preferred design of any such scheme if introduced.

Limitations and Future Research

A central constraint of this paper lies in its reliance on information collected solely from New Zealand users. While highly relevant for shaping local policy choices, the findings may not readily extend to other regions. Still, it demonstrates that gathering ownership details from both individual and group users can support the creation of fairer, more practical registration methods within any given area. Accordingly, comparable investigations in additional countries would enrich ongoing discussions. For developing nations with constrained administrative resources, such details could clarify the simplest path to system rollout and evaluate whether the effort justifies itself amid competing priorities for scarce resources. In parallel, existing scholarly literature provides scant evidence that registration systems enhance safety or deliver other benefits. This absence stands out sharply given the widespread adoption of such schemes by authorities globally. Where advantages cannot be quantified or verified, questions arise around validity and balance. The challenge of conveying tangible gains to users has appeared in prior writings [9], but efforts to demonstrate post-implementation results appear minimal. This represents a clear priority for upcoming studies, although progress may depend on authorities' readiness to release relevant data.

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None

Conflict of interest

Isaac Henderson is the Chair of UAVNZ, an industry and professional body representing commercial unmanned aircraft operators and other organisations involved in commercial unmanned aerospace. Isaac Henderson also provides consultancy services to unmanned aircraft operators, particularly in helping them achieve certification under Part 102 of the Civil Aviation Rules. However, none of this research's findings benefit him, directly or indirectly.

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