International Journal of Aviation Research

Volume 17 | Issue 01 Peer-Reviewed Article

The Legal Implications of Drone Use by Minors

Jorge L. D. Albelo, Ph.D.
Purdue University Global

Tyler B. Spence, Ph.D.
Oklahoma State University

The growing availability and affordability of unmanned aircraft systems (UAS), also known as drones, have led to more minors using them for fun and commercial purposes. This study looks into the relationship between juvenile justice and aviation law. It focuses on the legal issues that arise from drone misuse by minors, such as violating airspace rules and posing risks to public safety. Using a doctrinal legal search methodology along with qualitative content analysis, the study investigates federal and state drone laws, legal cases, and examples from news articles and reports. A comparison of laws reveals differences in how various regions regulate drones operated by minors, with gaps in statutory clarity and enforcement mechanisms. The findings show that minors can be held responsible under both aviation and non-aviation laws, which include those related to public safety and property damage. This study highlights unclear areas in current legal systems, especially concerning minors' responsibilities and the role of parents in monitoring drone operations. Recommendations include unifying state and federal laws, clarifying the legal duties of minors and their parents, and promoting programs that educate users about safe drone practices. These steps aim to enhance oversight and mitigate risks associated with misuse, thereby creating a safer aviation environment. This research emphasizes the need for flexible legal structures to tackle the changing challenges of drone use by minors.

Keywords: Aviation, Drones, Juvenile Justice, Minors, Public Safety

Recommended Citation:

Albelo, J. L. D., & Spence, T. B. (2025). The legal implications of drone use by minors. *International Journal of Aviation Research, 17*(1), 1-32.

Introduction

The growing availability and lower cost of drones have led to their widespread use among different groups, including minors. Although these devices offer educational and entertainment opportunities, they also present significant legal and regulatory challenges. Concerns about privacy violations, trespassing, and public safety have emerged regarding the current laws on drone use by minors. As drones become a bigger part of daily life, developing a set of rules that maintains a balance between innovation, safety, and legal responsibility is essential. This paper examines the intersection of regulatory and risk theory with the legal implications of minors using drones. By framing drone-related risks through regulatory perspectives, this study aims to assess how the law mitigates potential harms while fostering responsible use.

Regarding terminology, juveniles and minors may have the same context. However, in legal doctrine, the terms can have distinct differences. A legal adult is defined by reaching the age of 18; a juvenile is any person under the legal adult age, and therefore under the age of 18 (Cornell Law School, n.d.). In this context, minors and juveniles can be interchangeable; however, anyone under an age that is allowed by law or regulation is also legally a minor (Grabel and Associates, 2025). In a common context, a person under the age of 21 being below the legal alcohol drinking age and is classified as a minor. We will employ the term 'minor' in this paper using the definition set by the Federal Aviation Administration (FAA), which establishes a regulatory age for certification of a remote pilot certificate at 16 (Federal Aviation Administration, 2024). A 16-year-old with a certificate may then be able to face typical certificate sanctions due to violations in the form of certificate suspension or revocation. This creates a dichotomy where non-certificated drone operators under the age of 18 would not have the opportunity for a certificate action and would be treated as minors under the legal adult age definition, while certificated pilots could be treated differently and held to different standards of accountability at the age of 16.

The regulatory landscape surrounding drone use is complex, involving federal aviation laws, state-level privacy and trespassing statutes, and juvenile justice policies. Despite increasing awareness of drone-related risks, regulations remain fragmented, and enforcement mechanisms often lack clarity, particularly when minors are involved. Moreover, regulatory theory suggests that risk assessment and legal intervention should be proportional to the likelihood and severity of harm. However, uncertainty in how these risks manifest in juvenile contexts complicates regulatory responses. Therefore, this study aims to contribute to the discourse on drone regulation by identifying legal gaps, evaluating enforcement challenges, and proposing a framework for addressing the risks associated with drone use by minors. By integrating perspectives from aviation law, juvenile justice, and regulatory theory, this research seeks to inform policymakers, legal practitioners, and educators about the evolving challenges in this domain.

Research Questions

The present research integrates perspectives from aviation law, juvenile justice, and regulatory theory to illuminate the complex interplay between emerging drone technologies and

youth accountability, offering actionable insights for policymakers, legal practitioners, and educators navigating these evolving challenges. By employing a qualitative investigation grounded in case studies, policy analyses, and stakeholder interviews, the study examines the mechanisms of oversight and enforcement in juvenile drone operations. It explores how age-specific regulations balance innovation with risk mitigation, while addressing gaps in current frameworks that may undermine public safety. Ultimately, the analysis aims to foster more effective, equitable policies that promote responsible drone use among minors without stifling technological education. Therefore, this study is guided by the following research questions (RQs):

RQ1: How are juveniles subject to oversight for responsible drone use?
RQ2: How do policy restrictions support enforcement to ensure public safety?

Theoretical Framework

Regulatory and risk theory offers a useful way to examine the legal issues surrounding drone use by minors. I t examines how legal systems manage risks while promoting technological progress and public safety (Drahos, 2017). This theory is especially important in aviation law, where regulations aim to reduce dangers related to air traffic, protect privacy, and ensure accountability in harm or damage cases. The growing availability of drones, especially for minors, raises new regulatory challenges. There needs to be a careful balance between encouraging technological engagement and mitigating risks associated with unregulated or unsafe use. According to Drahos (2017), risk is a common part of modern life. It shapes public awareness through exposure to threats like terrorism, environmental disasters, and new diseases. This constant presence of risk prompts a regulatory response, as societies try to manage uncertainties with scientific, technical, and economic assessments. The legal system, particularly in areas like aviation and drone regulation, reflects these efforts by aiming to balance technological innovation with safety and public welfare.

In the case of drones, especially when operated by minors, we can see how actuarial, sociocultural, and political risks overlap. Actuarial risk refers to measurable safety hazards (Drahos, 2017), such as midair collisions, property damage, and physical harm. Sociocultural risks include privacy issues and the potential for misuse (Drahos, 2017), such as unauthorized surveillance. Political risks involve inconsistent regulations and different enforcement practices in various areas (Drahos, 2017). Like broader risk management, drone regulations must confront uncertainty. They have to decide the right level of intervention needed to reduce potential harm while not hindering technological progress.

As Braithwaite (2017) and Grabosky (2017) note, regulation is often seen as a way to reduce risk. It influences behaviors and technologies to lower the chances of disaster. However, many critics view regulatory actions as a burden. They argue that too much oversight limits innovation and personal responsibility. This tension between protection and overregulation is central to drone laws (Clarke & Moses, 2014; Widerner, 2016), where the challenge lies in fostering responsible drone use among minors without imposing disproportionate restrictions. For instance, in the U.S., the Federal Aviation Administration's (FAA) part 107 regulations require commercial drone operators to meet rigorous certification requirements (Marshall, 2021),

but recreational drone use, including by minors, remains relatively unregulated. This regulatory gap highlights the complex discourse surrounding risk management. While proponents of stricter drone laws emphasize safety concerns (Calandrillo et al., 2020; Clarke & Moses, 2014), some critics argue that an overregulated environment could discourage youth engagement in STEM fields and limit the development of future aviation professionals (Butler, 2024).

Different jurisdictions apply distinct risk regulations based on their cultural and political risk sensitivities. The precautionary principle, dominant in the European Union, takes a risk-averse stance, often requiring proof of safety before permitting new technologies (Steele, 2006). In contrast, the U.S. regulatory model often follows an interactive feedback approach, allowing new technologies onto the market with evolving safety protocols (Anklam et al., 2022). Applying this distinction to drone safety training for minors and parental liability for any damages is important. A more engaging model could allow unrestricted drone use with evolving safety measures, such as mandatory drone registration or real-time geofencing to prevent unsafe operations. These different approaches show how regulatory ideas shape ways to manage risk. They influence whether drone-related incidents lead to strict new laws or stay within a system of personal responsibility.

A major challenge in regulatory responses is the uncertainty involved in risk assessment. While we can measure actuarial risks using crash statistics and technology failure rates, sociocultural and political risks are more subjective, shaped by public perception and media stories (Haines, 2017). Research shows that certain risks get more regulatory attention because they are more emotional (Ditto et al., 2006; Kahan, 2007). For instance, a highly publicized drone accident involving a minor could lead to quick regulatory changes, even if such incidents are rare. Additionally, political figures often shape risk assessments to fit their regulatory goals. This is known as policy-based evidence instead of evidence-based policy (Gunningham & Sinclair, 2017). As a result, regulations can be too cautious or overly lenient, depending on the current political and economic interests. For example, industry lobbying might oppose stricter drone laws to protect business interests, while privacy advocates could call for stricter rules on drone surveillance.

Literature Review

The fast growth of civilian drones has led to important research on their regulation and public safety. First, Tran and Nguyen (2022) looked into how drones fit into urban areas, focusing on Singapore's rules. Their approach includes a detailed case study that shows practical uses like flight corridors and real-time tracking systems. Tran and Nguyen (2022) also highlight specific challenges in cities, like crowded airspace, using simulation data to support their points. However, their findings are limited because they focus only on Singapore, missing out on different urban situations. The lack of engagement with stakeholders and a shallow look at privacy issues also limit its broader relevance.

Conversely, Bhat et al. (2024) provide a technical overview of drone components, levels of autonomy, and global regulations. They analyze UAV technologies, including communication protocols and path-planning algorithms. While Bhat et al. (2024) call for global standardization and discuss uses in agriculture and defense, their brief treatment of ethical issues and regulatory challenges weakens their impact on policy. In contrast, Clarke and Moses (2014)

employ a risk assessment framework to evaluate the dangers associated with drones, including crashes and hijacking. They apply regulatory theory, including the enforcement pyramid, and analyze technology-neutral laws, such as Australian tort law, providing a solid theoretical foundation. Overall, the literature emphasizes the need for consistent, enforceable regulations, stakeholder involvement, and real-world testing to mitigate risks such as crashes and injuries. Current research frameworks suggest practical urban solutions, technical standards, and legal changes to help shape global policies for safer drone integration.

Legal Frameworks Governing Recreational Drone Usage

The laws governing recreational drone operation are a mix of national and international rules aimed at reducing risks to aviation safety and public security. In the United States, the Federal Aviation Administration (FAA) has primary authority over drone activities, thanks to the FAA Modernization and Reform Act of 2012 and its updates. Recreational operators must follow the FAA's Part 107 regulations. These rules require registration for drones that weigh between 250 grams and 55 pounds. They also enforce airspace restrictions and operational limits, which include keeping a visual line of sight and avoiding flights over people or near airports. Although it is not required for hobbyists, the FAA's Remote Pilot Certification sets a standard for operational skill.

Across the globe, regulatory methods vary. The European Union's European Union Aviation Safety Agency (EASA) has introduced a risk-based system under Regulation (EU) 2019/947 (Council Regulation, 2019). This regulation sorts drone operations into "open," "specific," and "certified" categories, with most recreational use falling under the "open" category. This system imposes weight limits, altitude caps, and no-fly zones to protect critical infrastructure and sensitive sites. On the other hand, countries like Canada and Australia employ hybrid models that combine registration rules with educational requirements to promote responsible usage (Canadian Aviation Regulations [CAR], 2025; Civil Aviation Safety Authority [CASA], 2025).

These legal frameworks seek to balance public access to airspace with the need for safety and security. However, enforcement presents challenges. The anonymity and mobility of drones make it hard to pinpoint accountability. Cases of unauthorized drones entering restricted airspace, such as near airports or government buildings, highlight the weaknesses of current regulations and the need for technological solutions, including geofencing and remote identification systems.

Ethical Dilemmas in Recreational Drone Use

The ethical implications of using recreational drones are significant. They touch on privacy, safety, environmental impact, and social equity, each posing unique challenges for responsible use. The addition of high-resolution cameras and advanced sensors to consumer drones has raised serious concerns about privacy violations (Jiang et al., 2020; Uchidiuno et al., 2018). These devices can capture detailed images and audio from angles that violate traditional expectations of privacy, even in areas that appear to be public. Unlike ground-based surveillance, aerial monitoring often happens without the knowledge or permission of those

being observed, leading to ethical questions about personal freedom and the right to privacy (Jiang et al., 2020; Uchidiuno et al., 2018). The risk of drones being used for voyeuristic or intrusive purposes, whether intentionally or accidentally, highlights the need for ethical guidelines that prioritize informed consent and transparency.

Safety remains a critical ethical concern. Though typically lightweight, recreational drones pose tangible risks to human life and property. The possibility of collisions with manned aircraft, while statistically rare, carries catastrophic consequences, as evidenced by near-miss incidents reported near major airports (Gettinger & Michel, 2015; Pyrgies, 2019; Sun & Hubbard, 2025). Ground-level accidents, such as crashes in populated areas, can result in injury or property damage, particularly when operators lack adequate training or disregard safety protocols (Pyrgies, 2019). The ethical onus falls on operators to internalize a duty of care, yet the accessibility of drones to novices often fosters a cavalier attitude toward risk mitigation (Gettinger & Michel, 2015; Sun & Hubbard, 2025). This underscores the necessity for ethical education that emphasizes accountability and foresight.

Environmental considerations further complicate the ethical landscape. Drone operations can disrupt communities through noise pollution and physical intrusion (Ramos-Romero et al., 2022). Studies have documented behavioral changes in avian and mammalian species exposed to drone activity, raising concerns about biodiversity preservation (Afridi et al., 2025; Mo & Bonatakis, 2020). Additionally, the environmental footprint of drones (i.e., from resource-intensive manufacturing to the disposal of lithium-ion batteries) poses questions about sustainability (Kumar et al., 2025; Vedrtnam et al., 2025). Ethical drone use demands a commitment to minimizing ecological harm, yet recreational operators often lack awareness of these impacts (Ramos-Romero et al., 2022).

Trends in Juvenile Law Violations and Delinquency

Juvenile delinquency, encompassing acts by individuals under 18 that violate legal statutes, remains a pressing societal concern, particularly in the context of minor law violations such as truancy, curfew breaches, and petty theft. Recent trends indicate a complex landscape where declining overall delinquency rates coexist with persistent challenges, notably the lack of parental or adult supervision. Over the past two decades, juvenile delinquency rates in the United States have exhibited a marked decline. Data from the Office of Juvenile Justice and Delinquency Prevention (OJJDP, 2022) indicate an 81% reduction in violent crime cases handled by juvenile courts from 1994 to 2020, with specific decreases across weapons (85%), violations (81%), and simple assault (72%). Arrest rates for status offenses, such as truancy and curfew violations, have similarly dropped, partly due to the 1974 Juvenile Justice and Delinquency Prevention Act's deinstitutionalization mandate, which discourages secure detention for non-criminal acts (Coalition for Juvenile Justice [CJJ], 2012).

Despite this decline, minor law violations remain prevalent, often linked to unstructured and unsupervised settings (Lantz & Knapp, 2024). Status offenses, which include acts like underage drinking or skipping school, are particularly sensitive to supervision deficits. These offenses, while not criminal if committed by adults, constitute a significant portion of juvenile court caseloads, with simple assault and intimidation offenses dominating by the end of 2022

(Lantz & Knapp, 2024). The persistence of such violations underscores the role of environmental and social factors, particularly the absence of consistent adult oversight. Lack of supervision is a well-known risk factor for juvenile delinquency (Abhishek & Balamurugan, 2024). It increases opportunities for deviant behavior. Research shows that family dynamics play a significant role in supervision levels. Single-parent households, parental conflict, and economic stress can lead to less oversight. This creates situations where young people are more influenced by peers or engage in risky behaviors (Abhishek & Balamurugan, 2024). For example, children in single-parent families may have higher risks of delinquency due to financial pressures and less parental involvement. However, studies indicate that the quality of supervision is a stronger predictor than family structure alone.

The connection between a lack of supervision and minor law violations has a significant impact on juvenile justice policy. The drop in delinquency has led to reforms aimed at decreasing incarceration rates (Lantz & Knapp, 2024). Some states have banned confinement for misdemeanors and probation violations. Yet, the ongoing problem of status offenses highlights the need for preventive measures that focus on improving supervision (Abhishek & Balamurugan, 2024). In the U.S., there has been a cultural shift towards seeing unsupervised juvenile activities as neglect, influenced by broad child neglect reporting laws (Flynn et al., 2023). This view can result in over-intervention, where normal activities, such as walking home alone, are closely examined, which may push families away and divert resources from more serious cases. A balanced approach is necessary to differentiate between harmless independence and absolute neglect. This will ensure that interventions focus on situations where a lack of supervision clearly raises delinquency risks (Flynn et al., 2023).

Methods

This study used a doctrinal legal research method along with qualitative content analysis to investigate the laws that regulate drone use by minors. The doctrinal approach involved a detailed review of primary legal sources, including laws, regulations, and court cases, to understand the current legal landscape (Hutchinson & Duncan, 2012; Pradeep, 2019). The analysis looked at federal drone rules from the Federal Aviation Administration (FAA) and state-specific laws to find differences, similarities, and gaps in oversight. This was key in understanding how various jurisdictions handle drone violations, especially those involving minors.

Qualitative content analysis facilitated the integration of information from diverse sources, including news articles, case reports, and legal texts, organized into themes related to infractions (Creswell & Poth, 2018; Merriam & Tisdell, 2016). These themes included violations committed by individuals with drones, aviation infractions by people outside the aviation industry, and general law enforcement interactions with minors. A crime analysis framework, as outlined by Rollo et al. (2022), was also employed for analyzing news articles related to law enforcement arrests of minors when drones were involved. Both of these approaches facilitated the identification of recurring themes (Creswell & Poth, 2018; Merriam & Tisdell, 2016; Rollo et al., 2022), such as the interaction between drone misuse and non-aviation laws, as well as the unclear legal responsibilities of minors. For example, the study looked at how laws about property damage or public safety might apply to drone misuse outside aviation.

A comparative legal approach examined how different jurisdictions regulate drones operated by minors, focusing on differences in enforcement, penalties, and parental responsibility (Monateri, 2012). This included analyzing individual state drone laws in the United States and comparing them to federal rules to find discrepancies and vague areas in the law. For instance, some states have stricter rules for drone operators, while others depend mostly on federal guidelines, which may lead to inconsistencies in how minors are held accountable. The comparative analysis also reviewed legal cases about parental responsibility, especially as trends show parents being held liable for their children's actions in other situations (Monateri, 2012), such as school shootings. This viewpoint was important for assessing how parental oversight could be included in drone regulations to improve accountability.

Combining data from these sources (i.e., legal texts, case studies, and news reports) enabled a thorough assessment of the gaps in oversight for minors operating drones (Gibbs, 2018). By merging findings across three themes (drone infractions, aviation violations, and parental responsibility), the study pinpointed areas where minors might face legal consequences under current laws and where other laws might apply. For example, cases where drones interfered with manned aircraft or caused public harm showed the potential for broader civil or criminal liability. Based on this analysis, the study provides recommendations to address regulatory gaps, including clarifying the legal responsibilities of minors and their guardians, aligning state and federal regulations, and promoting educational initiatives to foster safe drone operation. These recommendations aim to enhance oversight and mitigate risks associated with improper drone use by minors, fostering a safer aviation environment.

Data Collection

The study analyzed qualitative data from a variety of sources across three different themes of legal contexts. The first search parameter involved drone-related infractions of individuals. The primary investigation was to uncover any drone infractions by minors. To draw future implications, it was also important to investigate other infractions involving law enforcement to categorize potential areas where minors could face punishment for misuse. In addition to looking for case reports of drone violations, the second area of investigation was concerning aviation-related infractions by non-aviation industry personnel. After that was thoroughly searched, the next step was to investigate general themes involving law enforcement infractions by minors. This would allow comparisons to be made between the existing drone regulations and the possibility of enforcement through other statutes outside of an aviation context. In the United States, a social parameter is the relationship between parents and guardians and their responsibilities over their children. In light of parents beginning to be held responsible for the actions of their children in school-shooting events, the final investigative component was to evaluate the relationship between the legal requirements of parental guidance and how that could apply to their need to be involved in overseeing drone operations. To get the necessary context across these themes, specific documents were collected from four different pillars of documents.

As outlined in Rollo et al. (2022), data collection of online news articles was completed using the crime analysis framework. This framework identified 8 steps: 1) data extraction

through “web scrapping”; 2) categorization of events; 3) identification of who, what, when, where, why and how; 4) identification of time of event; 5) named entity extraction to identify the persons involved; 6) linking identified persons to resources; 7) geographical localization of events; and 8) identification of duplicate storylines in news articles.

Common themes were synthesized from these sources as they apply to being able to understand how improper drone use could lead to legal implications for minors and the extent to which they may be held accountable for such violations. Archival search engines were used to find news articles and case reports of infractions involving drone use. These were collected and organized into categories of infractions.

Data Analysis

The investigation was largely qualitative, looking at the primary sources of legal text from different states and the associated drone regulations promulgated by the federal government. Comparisons were then assessed, and gaps were identified where ambiguity existed. In addition, case study reports from news sources were investigated to better understand situations of law enforcement engagement with minors in an aviation context, and comparing that to law enforcement engagement with individuals increasing the risk of harm to other parts of the aviation industry as well (i.e., aircraft and helicopters). Mass media reports were identified as an important component for analysis because “mass media reports provide the most readily accessible source of information on tort outcomes” (Bailis & MacCoun, 1996, p. 419). Having this approach allowed a detailed triangulation of not just the gaps in regulatory oversight for minors and associated statutory ambiguity, but also the specific intersection where non-drone laws could overlap in situations where drones were misused. Finally, based on the gaps and assessments, a detailed analysis was provided for understanding how minors could be treated from a legal standpoint when engaging in the improper use of drones. Recommendations could then be provided to fill gaps and better correlate the context of drone misuse to enhanced oversight for safe operations.

Ethical Considerations

Given that the research is grounded in publicly accessible legal documents and judicial decisions, it does not implicate ethical concerns related to human subjects, thereby obviating the need for institutional review board oversight. To maintain scholarly integrity, all legal interpretations were articulated with strict objectivity, ensuring an impartial and balanced analysis of regulatory frameworks. This approach mitigates potential biases, fostering a neutral discourse that respects the complexity of legal systems and promotes a rigorous examination of the subject matter without compromising ethical standards.

Limitations of the approach

Several limitations to this study must be acknowledged prior to analyzing the findings and discussing the results. While this study does engage in a specific legal topic, the scope is limited to the review of the use of drones by minors, with the application to the aerial component of the technology. Specific case law pertaining to the use of the technologies equipped on board

the drone is not examined in this particular study. In addition, the regulatory and legal underpinnings for drone use across all applications are still being developed, and best practices for legal enforcement may vary depending on the jurisdiction and law enforcement's understanding of the technology's use. The recent data may not be exhaustive of juvenile drone infractions for several reasons, including the age of the defendants, a focus on a classification of the case that does not involve drone use, or warnings or verbal notices given by law enforcement where no subsequent action was taken. While these limitations may prevent broad quantitative generalization of data, the qualitative nature of this study is focused on the synthesis of the specific cases that have been identified.

Findings

Known as the Federal Aviation Regulations (FARs), the rules governing flying a drone are regulated by the FAA and enacted under Title 14 of the Code of Federal Regulations (CFRs) in the interest of aviation safety. When it comes to specific applications to minors, the application of drone use regulations appears ambiguous. Table 1 lists the entirety of drone use regulations applicable to age limitations. When the FAA enforces its rules, there are two types of punitive actions it can take: certificate actions, such as suspension or revocation, and civil monetary fines. Simoneau et al. (2023) analyzed FAA drone enforcement cases and found that between 2011 and 2020, the FAA sanctioned 55 drone operators with civil penalties; however, none appeared to target operators under 18 years old, and the largest fines were levied against companies attempting to skirt the regulatory requirements.

Table 1

Regulations Governing Drone Use by Minors

Text	Meaning	Regulation
Be at least 16 years of age	A person receiving a remote pilot certificate to operate under the rules of Part 107 must be at least 16 years old.	14 CFR §107.61(a)*
A small unmanned aircraft must be registered by its owner using the legal name of its owner, unless the owner is less than 13 years of age.	Operators registering a drone should be at least 13 years old.	14 CFR §48.25(b)**
If the owner is less than 13 years of age, then the small, unmanned aircraft must be registered by a person who is at least 13 years of age.	Juveniles under the age of 13 may own a drone but cannot legally register it. If a drone requires registration, it must be registered by someone over the age of 13.	14 CFR §48.25(b)**

Note. Statute text retrieved from the electronic code of federal regulations at ecfr.gov. *see source citation (Code of Federal Regulations, 2025a). **see source citation (Code of Federal Regulations, 2025b).

FAA Age-Related Drone Regulations

Title 14 CFR 107 is the specific section concerning certification of pilots and operational parameters in the airspace for drones between .5lbs and 55 lbs when acting under the authority of an action where a remote pilot certificate is needed. However, only one specific regulation relates to age (14 CFR §107.61(a)), which requires a person to be at least 16 years old to obtain the certificate. So, anyone operating a drone under the age of 16 cannot have a certificate suspended or revoked, as there is no certificate allowed, leaving only potential civil monetary options. Still, to date, there appears to be no evidence of fines levied against operators of anyone under the age of 16.

Although anyone with a remote pilot certificate can conduct operations under Part 107 and be afforded the operational privileges, they are particularly utilized for commercial operations. There is a separate set of regulatory guidance for operators who fly drones recreationally for any drone of at least .5lbs. These are outlined in law passed by Congress and encoded in Title 49 of the United States Code (USC) section 44809 (49 USC §44809) and titled, "Exception for limited recreational operations of unmanned aircraft." These are similar in application to Part 107 except there are no age limitations directly specified in the operation, indicating that anyone of any age can operate under this law and operate without the requirements of a remote pilot certificate required for Part 107.

Regulatory Applications Beyond FAA

In aviation, the FAA is not the only government agency that can enforce oversight of operations. Laws passed by Congress allow instances where violations may be criminal in nature, and the U.S. Department of Justice can arrest individuals for violating criminal statutes related to aviation infractions. In many cases, state and local law enforcement agencies make the initial arrests based on state or local statutes as well. Table 2 details a sample list of aviation-related criminal arrests made by law enforcement agencies related to various aviation infractions.

The list in Table 2 highlights the potential of arrest under non-aviation-specific charges when involved in an aviation-related criminal incident. The specific purpose of the list is to demonstrate that, although the FAA is the primary regulator for aviation and does not have law enforcement powers, there are still other means of pursuing egregious and nefarious actions under applicable statutes. These actions can pertain to non-aviators engaging in illegal actions such as shooting down an aircraft, threatening or intimidating the lives of personnel on airport properties, or even operating an aircraft in a way that violates non-aviation statutes. The incidents in Table 2 show the associated aviation relationship, which includes incidents involving airplanes, helicopters, and drone operations. Should the FAA determine that specific FAA regulations were also violated, they could also choose to pursue administrative penalties in the form of certificate actions or civil fines. Under FAR 61.15, a pilot must report being arrested for driving while intoxicated, and failure to do so is grounds for certificate suspension or revocation (Code of Federal Regulations 2025c). Thus, it is possible to be arrested by a law

enforcement agency for criminal penalty and also face enforcement by administrative agencies, in this case, the FAA.

Table 2

Aviation Arrests by Law Enforcement Agencies

Date (mm/yyyy)	Description	State	Aircraft Type	Infraction	Source
02/2025	15 Year old Arrested for demanding access to general aviation plane at FBO	AR	Airplane	Attempted aggravated assault, attempted aggravated robbery and terroristic threatening	(Levien, 2025)
11/2024	72 year old shot drone	FL	Drone	Criminal mischief, ordered to pay $5,000	(Perkins, 2024)
10/2017	51 year old shot at small planes flying over property		Airplane	Attempted murder and assault	(Associated Press, 2017)
04/2024	13 year old arrested for pointing laser at sheriff helicopter	FL	Drone	Felony misuse of a laser lighting device	(Accettulla, 2024)
09/2023	12 year old arrested for shooting laser pointer at police helicopter	MI	Helicopter	Initially arrested and subsequently released to parents	(McIntyre, 2023)
12/2024	2 men arrested after flying drone near Boston Logan Airport	MA	Drone	Charged with trespassing	(McComack, 2024)

Importantly, Table 2 shows that criminal enforcement of aviation incidents is typically egregious and/or intentional, with a threat to public safety. In several cases, the harshest penalties are levied against individuals who are not minors. The case of the 15-year-old brandishing a weapon to attempt to obtain access to an aircraft is a notable exception. However, it was also discovered that local law enforcement engages in arrests of minors when aiming laser pointers at aircraft (particularly law enforcement helicopters). This is perhaps one example where ignorance of the threat to safety is not considered acceptable. Because the laser pointers were aimed at law enforcement helicopters, they were able to quickly pinpoint the location and

perpetrators, having caught them directly in the act. In the case of the 12-year-old, while initially being detained, it was reported that the individual was ultimately released back to their parents (McIntyre 2023). However, in the case of the 13-year-old, the individual was charged with violating a specific ordinance related to laser lighting devices, which is a criminal statute and not a regulatory FAR enforced by the FAA.

Juvenile Delinquency Violations with Drone Applications

Despite the lack of specific drone-related regulations governing the use of drones by minors, except for a few age-related regulations, there are ways in which juveniles can be held accountable through the legal system for their actions. Laws are often ambiguous enough that they can be applied to numerous situations and contexts, although the initial reason for the law may have been a specific event. The most common reasons minors are arrested are listed in Table 3.

Table 3

Common arrest reasons for minors

1	Drug abuse and alcohol offenses
2	Underage drinking
3	Tobacco offenses
4	Vandalism
5	Curfew violations and loitering
6	Disorderly conduct
7	Larceny theft
8	Motor vehicle theft
9	Robbery
10	Assault and battery
11	Sexual assault
12	Illegal possession of firearms

Note: Data retrieved from Cole Pashcall Law (2022).

While some of these offenses, such as underage drinking or motor vehicle theft, do not directly relate to the operation of a drone, many of these categories could apply to contexts while operating a drone and be used as an enforcement mechanism against minors. Drone technology could be used to assault or harass individuals, and the capabilities of drones to carry equipment could allow them to be altered to carry weapons. In 2015, an 18-year-old posted a video online showing a drone he created equipped with a semi-automatic handgun. In this case, federal authorities investigated the use and, at the time, determined no laws were broken (Good Morning America, 2015). While ultimately this video was shot in the woods where the risk of harm was

minimal, the capabilities demonstrate the potential, allowing for the possibility of misuse and harm, whether intentional or not.

As noted in Table 2, trespassing was used as the charge to arrest individuals flying their drones in an area not approved for flight within the boundaries of Boston Logan International Airport. This type of charge could be applied to minors in similar ways, regardless of the intentionality of the flight. However, the noted infractions of actual drone flight appear to be flown by adults and not minors. There is difficulty in assessing the true interactions with law enforcement, though, because the United States has precedent to treat minors differently from adults, regardless of the infraction, except in the most serious circumstances (i.e., murder). When dealing with minors, law enforcement usually applies age constructs to determine the most appropriate outcomes. Many offense outcomes include being released under a suspended sentence, put on probation, pay a fine, or placed in detention. In addition, even when federal authorities arrest a minor, they are often released to state authorities, and their crimes are not pursued in federal courts (Doyle, 2018). The deference to treat minors differently is largely related to their age. Historical precedent in Western Societies has treated individuals under the age of 13 as not capable of understanding the consequences of their actions, and therefore they need to learn behavior instead of being punished. Once a minor starts to approach adult age (i.e., 14 and above), the closer one gets to 18, the more serious the consequences become legally (Doyle, 2018). Some 16 or 17-year-olds can now be charged as adults for their crimes despite their age, but only in the most serious of crimes, such as murder (Doyle, 2018). While crimes like vandalism could be prosecuted fully if a drone were to be used in such a way, a young minor might only receive minimal punishment that reinforces learning behavior, such as cleaning up or repairing the damage. Despite there being some offenses where law enforcement authorities are very serious about the need for punishment and some minors approaching adult age receiving more sentences closer to that of adults, as Table 2 showed, while a 13-year-old was charged with felony misuse of a laser, the 12-year-old involved in the same type of behavior was released back to their parents.

Parent/Guardian Oversight of Minors Using Drones and Liabilities

In the United States, there is an expectation that the parents or guardians raising their children have a specific duty to teach them and be responsible for their actions. This can be seen in some of the specific state laws noted in Table 4. While minors may be the ones to commit certain offenses, when it comes to responsibility, the parents have a duty to ensure they are teaching their children societal expectations and responsibilities. Every state has at least some component of parental liability law when its children misbehave in certain circumstances. Importantly, as can be seen by comparing the laws noted between Arizona and Texas, Arizona makes a clear note that it does not matter if the parents could have anticipated the crime being committed by their child. In contrast, the Texas law clearly states that parents are only liable if there is clear negligence on their part and a reasonable expectation that they could have known their child might have committed the offense.

Table 4

Sample of Parental Liability Laws in US States

State	Statute	Text	Source
AL	§ 6-5-380: Liability of parents for destruction of property by minor	The parent or parents, guardian, or other person having care or control of any minor under the age of 18 years with whom the minor is living and who have custody of the minor shall be liable for the actual damages sustained, but not exceeding the sum of $1,000, plus the court costs of the action, to any person, firm, association, corporation and the State of Alabama and its political subdivision for all damages proximately caused by the injury to, or destruction of, any property, real, personal or mixed, by the intentional, willful, or malicious act or acts of the minor. Except, approved foster parents of the Department of Human Resources shall not be liable for damages caused by foster children.	(Onecle, 2021)
AZ	§ 12-661: Liabilities of parents or legal guardians for malicious or willful misconduct of minors	A. Any act of malicious or willful misconduct of a minor which results in any injury to the person or property of another, to include theft or shoplifting, shall be imputed to the parents or legal guardian having custody or control of the minor whether or not such parents or guardian could have anticipated the misconduct for all purposes of civil damages, and such parents or guardian having custody or control shall be jointly and severally liable with such minor for any actual damages resulting from such malicious or willful misconduct. B. The joint and several liability of one or both parents or legal guardian having custody or control of a minor under this section shall not exceed ten thousand dollars for each tort of the minor. The liability imposed by this section is in addition to any liability otherwise imposed by law.	(Arizona Legislation, n.d.)
CA	§ 1714.3: Discharge of Firearm Liabilities	Civil liability for any injury to the person or property of another proximately caused by the discharge of a firearm by a minor under the age of 18 years shall be imputed to a parent or guardian having custody and control of the minor for all purposes of civil damages, and such parent or guardian shall be jointly and severally liable with such minor for any damages resulting from such act, if such parent or guardian either permitted the minor to have the firearm or left the firearm in a place accessible to the minor. The liability imposed by this section is in addition to any liability otherwise imposed by law. However, no person, or group of persons collectively, shall incur liability under this section in any amount exceeding thirty thousand dollars ($30,000) for injury to or death of one person as a result of any one occurrence or, subject to the limit as to one person, exceeding sixty thousand dollars ($60,000) for injury to or death of all persons as a result of any one such occurrence.	(California Legislative Information, n.d.)

Table 4 Continued

State	Statute	Text	Source
FL	§ 741.24: Civil actions against parents; Willful destruction of theft of property by minor	(1) Any municipal corporation, county, school district, or department of Florida; any person, partnership, corporation, or association; or any religious organization, whether incorporated or unincorporated, shall be entitled to recover damages in an appropriate action at law, in a court of competent jurisdiction, from the parents of any minor under the age of 18 years, living with the parents, who maliciously or willfully destroys or steals property, real, personal, or mixed, belonging to such municipal corporation, county, school district, department of the state, person, partnership, corporation, association, or religious organization. (2) The recovery shall be limited to the actual damages in addition to taxable court costs.	(Justia, 2024a)
NJ	§ 2A:53A-16: Parental liability for certain acts of minor	1. The parents of any minor who shall maliciously or willfully injure any property of a railroad, street railway, traction railway or autobus public utility shall be liable for damages in the amount of the injury to a limit of $5,000, to be collected by the property owner in the Superior Court, together with costs of suit.	(LegalFix, 2019)
TN	§ 37-10-101 Liability of parent or guardian for acts of juveniles	Any municipal corporation, county, town, village, school district or department of this state, or any person, or any religious organization, whether incorporated or unincorporated, shall be entitled to recover damages in an action in assumpsit in an amount not to exceed ten thousand dollars ($10,000) in a court of competent jurisdiction from the parents or guardian of the person of any minor under eighteen (18) years of age, living with the parents or guardian of the person, who maliciously or willfully causes personal injury to such person or destroys property, real, personal or mixed, belonging to such municipal corporation, county, town, village, school district or department of this state or persons or religious organizations.	(Justia, 2024b)
TN	§ 37-10-103 Circumstances under which parent or guardian are liable	(a) A parent or guardian shall be liable for the tortious activities of a minor child that cause injuries to persons or property where the parent or guardian knows, or should know, of the child's tendency to commit wrongful acts that can be expected to cause injury to persons or property and where the parent or guardian has an opportunity to control the child but fails to exercise reasonable means to restrain the tortious conduct. (b) A parent or guardian shall be presumed to know of a child's tendency to commit wrongful acts, if the child has previously been charged and found responsible for such actions.	(Justia, 2024b)

Table 4 Continued

State	Statute	Text	Source
TX	§ 41.001: Liability of parents for conduct of child	A parent or other person who has the duty of control and reasonable discipline of a child is liable for any property damage proximately caused by: (1) the negligent conduct of the child if the conduct is reasonably attributable to the negligent failure of the parent or other person to exercise that duty; or (2) the wilful and malicious conduct of a child who is at least 10 years of age but under 18 years of age.	(Texas Statutes, n.d.)
TX	§ 41.002: Limit of damages	Recovery for damage caused by wilful and malicious conduct is limited to actual damages, not to exceed $25,000 per occurrence, plus court costs and reasonable attorney's fees.	(Texas Statutes, n.d.)
UT	§78-11-20 Property damage caused by a minor – liability of parent or legal guardian	(1) The parent or legal guardian having legal custody of the minor is liable for damages sustained to property not to exceed $2,000 when: (a) the minor intentionally damages, defaces, destroys, or takes the property of another; (b) the minor recklessly or willfully shoots or propels a missile, or other object at or against a motor vehicle, bus, airplane, boat, locomotive, train, railway car, or caboose, whether moving or standing; or (c) the minor intentionally and unlawfully tampers with the property of another and thereby recklessly endangers human life or recklessly causes or threatens a substantial interruption or impairment of any public utility service. (2) For purposes of this section, Subsection (1)(a) or (c) includes graffiti, as defined in Section 76-6-107. (3) A court may waive part or all of the liability for damages by the parent or legal guardian if the offender is adjudicated in the juvenile court under Section 78-3a-118 only: (a) upon a finding of good cause; or (b) if the parent or legal guardian: (i) made a reasonable effort to restrain the wrongful conduct; and (ii) reported it to the property owner involved or the law enforcement agency having primary jurisdiction after he knew of the minor's unlawful act. No report is required under this section from a parent or legal guardian if the minor was arrested or apprehended by a peace officer or by anyone acting on behalf of the property owner involved.	(Justia, 2006)

Table 4 highlights a sample of specific language from various state laws regarding parental liability for crimes committed by their children. Table 5 illustrates the prevalence of these laws nationwide.

Table 5

*Parental Liability for crimes by minors among US States****

Law in State	Minimum Fine	Max Fine	Average Fine
45	$800	25000*	$6,166
23	$800	$30,000*	$9,344
11	$250	$30,000*,**	$12,500
6	$200	25000*	$12,500
4	$2,500	$10,000	$6,127
3	$5,000	$20,000*	$8,700
3	$2,000	$5,000	$4,000
2	$5,000	$20,000	$5,625
2	$5,000	$15,000	$10,000
1	$30,000 (Injury)	$60,000 (Death)	$30,000/$60,000
1	No Min	No Limit*	$4,000
1	$5,000	$5,000	$5,000
1	$2,000	$2,000	$2,000
1	$5,000	$5,000	$5,000

Notes: *No limit from at least one state: property damage (*FL, HI, LA, NH), personal injury (HI, TN with parents prior knowledge of child propensity), theft (FL), desecration (HI), school damage (NJ), firearms (NH); **Only requirement is value maximum for theft plus a maximum of $300 exemplary addition (WI). ***Data adapted from Matthissen, Wickert, and Lehrer, 2022, https://www.mwl-law.com/wp-content/uploads/2018/02/PARENTAL-RESPONSIBILITY-LAWS-CHART.pdf.*

As can be seen from Table 5, nearly every state has a law regarding parental liability when their child commits a willful act that damages property. It reduces by about half if that extends to personal injury. However, the amount to which the parents are determined to be responsible varies quite a bit, and many states do not require a major financial burden for liability. If a minor were to fly a drone and crash it in such a way that it did damage to property or injured a person, there is an avenue that the parents would ultimately be expected to pay to fix the damage or pay for medical expenses of the person injured to at least some extent. Only 4 states- Florida, Hawaii, Louisiana, and New Hampshire- have no maximum limit on liability for property damage, with Hawaii also having no maximum limit for personal injury liability. In many cases, though, the statutory maximums range from about $2,000 to $10,000. Even with these statutory liability options, there is still a default that minors, particularly those under 14 or 15, should be focused on learning behavior, and that their cognitive development is not adequate enough to really punish them in accordance with maximums under the law.

Discussion

This research was conducted to explore two specific research questions: 1) how are juveniles subject to oversight for responsible drone use, and 2) how do policy restrictions support enforcement to ensure public safety? Advertisements and retail stores appear to make some drones indistinguishable from kids' toys, and popular magazines like Popular Mechanics provide opinions on their assessments of the technology in articles such as "the 6 best drones for kids in 2024," which adds to the perceptions of the technologies (Prices et al., 2024). However, in contrast, the FAA and aviation professionals approach the operation of a UAS as a serious operation with a need to fully understand the airspace system, regulatory requirements, and applicable aviation-related knowledge as an aviator in the system (Federal Aviation Administration, n.d.; Moore, 2017; Pilot Institute, 2025). With a technology where young kids are increasingly interacting with drones as operators, conflicting public and industry perceptions of operational needs and requirements, a relatively slow and complex process for regulation development, and continuous learning regarding the needed safety requirements for robust safety needs for a novel technology, the need to address the gap in awareness of how juveniles are and can be treated when not using the technology responsibly is important.

The two research questions posed within this study are related and approach two perspectives with combined outcomes. They reflect the objective to provide documentation regarding the landscape of the current rules, laws, and associated policies regarding the operational use of drones that pertain to the application of juvenile use. Additionally, an aim of this study was to examine the existing policies and highlight how they are typically applied in known situations of violations, as well as the impacts on public safety considerations and societal perceptions regarding juvenile learning opportunities when mistakes are made.

In general, there is a hesitancy for a government jurisdiction to charge criminal statute violations against minors when there are other avenues available for engaging in behavioral learning. When a case has civil implications (i.e., lawsuits), avenues for settlements are often encouraged over trial settings, although when harm has been done in some capacity, remedies can include monetary liability to the parents or guardians responsible for the juvenile. While this is often seen as a just approach for young people who are still physically developing their bodies and have not learned the consequences of all their behaviors, in the case of improper use of drones, these experiences can have tragic and deadly consequences.

Social Change Impact

The integration of drone technology into society is resulting in fundamental shifts in daily life activities. As with any new technology, some readily embrace the change, some hesitate initially but ultimately adopt the use, and some resist change. However, the use of drones requires responsible use within an accepted set of parameters because misuse, intentional or unintentional, can have serious safety consequences to unsuspecting bystanders. Direct safety violations could lead to collisions with occupied aircraft that result in injuries or fatalities;

indirect safety violations could lead to delayed emergency responses to wildfires when firefighters have to pause missions due to inadvertent flights into temporary flight restriction areas or improper use of recording equipment violating the privacy rights of those who did not intend to be recorded. The drone technologies are capable of carrying equipment that could turn the drone into a weapon or be used to harass or intimidate others. These potentials for harm are all indicative of why there are listed age limits for operation as a certificated remote pilot, or why anyone under 13 needs a consenting older individual to register the drone and accept the responsibilities of being the approved operator. However, these are exceptions to the rules because anyone can fly a drone regardless of age, and acquiring one is as simple as visiting a large store that typically sells electronic devices.

When a juvenile commits a violation of a law or regulation, the general default by precedent is to treat the individual as an uninformed learner, more as accidental due to mental or physical age limitations, than as one who requires rehabilitation in the same way a legal adult would be treated for the same offense. Suppose homes burn down during a delayed fire response. In that case, when people are injured or killed due to a crash or collision, or the potential for increased harm to bystanders is unnecessarily increased, there is no clear guidance on who is responsible and how young individuals should be treated, corresponding to the required responsibilities needed to operate in the complex airspace environments. As the technologies become even more sophisticated and capable, with increasing ease of use to accomplish tasks that only specialized individuals previously could accomplish, the necessity to be able to impart the proper use standards and responsibilities will only grow. As is often the case with other acts that increase the potential for harm to others, ignorance is not a valid excuse. Government oversight will need to continue to be directly involved in directing manufacturers to provide the necessary background knowledge or understanding of the roles a pilot of any qualification or age needs to have in order to safely operate the equipment in a responsible way.

There needs to be an increased focus from the FAA, Congress, and state legislatures to evaluate their regulations and laws regarding their ability to enforce drone misuse in the event a minor is involved. The FAA needs to determine a more comprehensive application of regulatory enforcement for individuals, including minors, who do not hold a remote pilot certificate, and fines are not the best remedy either. Congress can learn from the past and work to establish better statutory oversight of minors' use of drones and work with state and local governments to better delineate the law enforcement expectations. Although to date, there have been no significant infractions from minors, the proliferation of technology and the numerous possibilities of use that can pose risks in various situations cannot be ignored until something does happen.

Policy Implications and Applications

Technological developments also typically develop prior to the regulatory environment constraining the use of such technologies (Aspray & Doty, 2023). This holds true in aviation, especially because the FAA regulates safety, and there should be a demonstrated recognition that

a safety problem exists in the first place unless directed by Congress to specifically regulate a certain issue. In Flyers Rights Education Fund Inc. v. Federal Aviation Administration (2023), the D.C. Circuit Court of Appeals noted that in 2018, Congress passed a law authorizing the FAA to make regulations pertaining to aircraft seat dimension size, with two points- 1) Within 1 year of passage, the FAA "shall issue regulations that establish minimum dimensions for passenger seats on aircraft", and 2) "and that are necessary for the safety of passengers." (p. 3). The Court found that the conjunction "and*"* was necessary to fulfill the authority of the law and that, as long as there was no demonstrated safety relation, then there was no authority to regulate seat size. Within the context of the case, the Court found that, to the date of the case, there was no evidence determining "*any* seat-size regulations 'are necessary for the safety of passengers'" (Flyer Rights Inc v. Federal Aviation Administration, 2023, p. 4). Drone regulation has also been constrained by the language of Congress to allow for industry development. This was evident through the FAA's attempt to require a drone registration database in 2015 to be able to understand the growth of drones available for operation in the airspace (for those above .5 lbs). However, in 2012, Congress explicitly stated that no rule could be made to regulate model aircraft that were encompassed in the newly defined space of an unmanned aircraft system (UAS) or drone. Therefore, the D.C. Circuit Court of Appeals found that this registration database, despite the intentions of the FAA to better understand the growing implications for operations within the airspace, was not allowed under the laws of Congress (Taylor v. Huerta, 2017).

In the case of juveniles, the lack of connection between technological advancements and regulatory and/or legal authority has delayed or interfered with their prosecution for committing acts that would have otherwise been enforced. As the commercial jet age of the aviation industry was in its infancy in the 1960s, aircraft hijackings were a growing problem. In 1969, David Booth became the youngest person to attempt to hijack an aircraft at age 14. Despite threatening a passenger with a knife and claiming to have a bomb, claiming there were no facilities for a juvenile, the FBI and federal officials did not prosecute and let local officials handle the case (Associated Press, 2009; Lawrence Daily Journal-World, 1969). Ultimately, the local Juvenile Court judge determined Booth would not serve any detention time and was given a sentence of six months in the Bob Hope House (Associated Press, 2009). Seemingly in today's context, with the lack enforcement clarity for drone violations, the use of a drone for a comparatively egregious federal offense by an adult would likely render the involvement of numerous federal officials including possibly the FAA for determining civil fines regarding the inappropriate use of an aircraft while that would not necessarily translate to the same enforcement if the drone in question was used by a juvenile.

The issue of pre-emption, the relationship between federal and lower-level legal and regulatory authority, also adds complexity to determining where enforcement of issues may actually lie. The FAA Office of the Chief Counsel released a UAS fact sheet updating their expectation of compliance in areas where they determined the FAA has supreme regulatory oversight and describing the areas where they perceived lower levels of government (i.e., state and local) have purview to make their own regulatory constraints regarding UAS operations (Putnam & Nicholls, 2023). The document detailed three areas that are exclusive to federal

authority: 1) aviation safety, 2) established FAA regulations, and 3) commercial UAS (Putnam & Nicholls, 2023). Arguably, the second point is the most well-known in that lower-level governments cannot make regulations that interfere in any way with laws and regulations established by the Federal Government. However, the first point takes a strong stance, saying that state and local officials cannot make any laws or regulations aimed at anything regarding aviation safety. The line between what is aviation safety and not aviation safety is not clearly established, and something of concern to a local level of government may be safety-oriented, yet when it is related to a drone operation, it is now aviation safety. This ambiguity will undoubtedly make it more challenging for local-level enforcement of a local-level determination of an improper operational use of the technology. Regarding the third point, 16 year-olds can obtain a remote pilot certificate and operate drones in a commercial setting; however, the FAA has now determined that the entire space of commercial drone operations is only applicable to federal oversight, again highlighting a potential conflict between priorities at a federal level and what lower levels of government might consider a priority in law and/or regulation for handling issues of determined acceptable or unacceptable operational use of a drone. The FAA provides a few examples of areas where UAS regulation at a local level would not be preempted, including,

> zoning; harassment of individuals or groups; privacy; voyeurism; trespass on property; the exercise of other police powers; reckless endangerment; emergency medical services; search and rescue; law enforcement use of facial recognition; delivery of prison contraband; wildfire suppression;10 criminal mischief; transfer or delivery of controlled substances; taking photographs or videos with respect to particular facilities (e.g., water treatment facilities; prisons; oil refineries; chemical facilities; railroad facilities; amusement parks; energy production, transmission, and distribution facilities; and any system or asset described by title 42 of the United States Code, § 5195c(e)); requirements for police to obtain a warrant prior to using a UAS for surveillance; protection of wildlife; using UAS for hunting or fishing, or to interfere with or harass an individual who is hunting or fishing; and law enforcement operations (Putnam & Nicholls, 2023, p 6).

Many of these are already established laws and regulations that do not directly pertain to drone use and therefore do not require the context of the drone's operation. As highlighted in the findings, these are already areas that are available for use when considering the enforcement of juveniles, but the statutes likely do not have caveats for when those types of offenses are committed via a drone, compared with other means. These issues are enforceable regardless of the mode in which they are carried out. A significant limitation is that these supposed allowances by the Federal Government for areas where preemption is not applicable require court review to define the parameters that delineate the lines between federal and local oversight authority. The lower levels of government have to create the laws and regulations with the intent of enforcing them to create a disparity that can be challenged, which takes time and resources. As identified in the findings, the Federal Government does not have directly relevant laws and regulations that directly apply to the improper operational use of drones, and there is established

precedent clearly indicating a hesitancy to pursue juvenile issues where there is not an overtly egregious violation of laws that put the public in imminent harm.

Various drone technologies are being rapidly developed, advertised as not just work tools but also recreational toys themselves. Operational training is often self-sufficient, yet it comes with technologies that can easily be used in troubling ways and in ways where, without a full understanding of the context in which they are operating, they can be dangerous, illegal, or without a definitive barrier to cross prior to engaging in the activity. For example, video-recording cameras are routinely found on a variety of well-advertised drones, and by acting in 3-dimensional space, the ease with which such technologies are able to be deployed is something that previous generations of young users have never encountered. This means that the applications of laws and regulations were not designed with such use in mind because the possibilities of such use were not foreseen; however, the laws are often ambiguous enough to be interpreted to apply with consequences that users of any age may not realize or appreciate. At the same time, because of the rapid development of technologies and the rapid variability of use case possibilities, the laws and regulations also leave major gaps in enforcement applicability concerning such uses, and current enforcement can require unique interpretations of existing laws and regulations that have not previously been considered or tested for feasibility or legality. The gaps and inconsistencies, therefore, enable a conundrum of uncertainty for who can be held accountable and how they should be held accountable. In the case of juveniles, where for centuries the practice of deference toward learning behavior over punitive enforcement can create scenarios where they could find themselves in situations where someone of legal adult age could be harshly penalized for serious behavior that puts the safety of others at high risk, while juveniles doing the same action have little societal consequence.

Conclusion

The fast adoption of drone technology in society has brought significant challenges in creating effective oversight and guidance for drone use violations, especially when these violations involve legal minors under 18. The lack of clear legal and regulatory frameworks for young drone operators creates a complicated situation where accountability is unclear, and the risk of serious harm is often not adequately addressed. Generally, the approach to handling juvenile infractions focuses on education and rehabilitation rather than punishment. However, this method may not fully communicate the seriousness of drone-related violations, which can lead to severe issues like property damage, injuries, or even fatalities. As drone technology becomes more advanced and accessible, the need for strong and age-appropriate regulations and enforcement is increasingly urgent.

The FAA oversees drone activity in U.S. airspace and sets regulatory requirements to ensure safe operations. However, these regulations often assume that younger operators have a level of responsibility and understanding that they may not possess. Drones are widely marketed as recreational toys and are available for purchase at major retail outlets. Their ease of use allows individuals of all ages, including minors, to operate them without formal training or

certification. This accessibility, combined with drones' advanced features (i.e., high-resolution cameras, long-range flight, and payload delivery), introduces risks that current laws were not designed to address. For example, a minor accidentally flying a drone into restricted airspace, such as during wildfire response efforts, could interrupt crucial emergency operations, causing disastrous results. Similarly, unauthorized drone recordings could breach privacy laws, leading to legal issues that minors and their guardians may not fully understand.

The traditional legal system's approach to juvenile offenses emphasizes education over punishment, making accountability for drone misuse complicated. While this philosophy acknowledges that minors are still developing and may not fully grasp the consequences of their actions, drone-related violations can cause harm similar to that caused by adults. For instance, a collision between a drone and a manned aircraft could have catastrophic results. Yet, a young operator might face only minor consequences due to their age, while an adult could face significant penalties. This difference raises concerns about fairness and whether current frameworks can adequately handle the unique risks associated with drones.

State and local laws, which often address privacy violations, property damage, or public safety, complicate enforcement even further. These laws were usually not written with drone technology in mind, resulting in gaps in their applicability. For instance, a minor using a drone to record private property might violate state privacy laws, but the absence of specific drone-related laws can hinder prosecution. Moreover, the quick development of drone technology surpasses the creation of related regulations, resulting in a confusing mix of legal interpretations that differ by location. This inconsistency leaves law enforcement, regulators, and courts grappling with who should be held responsible and how.

To tackle these challenges, government oversight must be adjusted to ensure that drone manufacturers and retailers provide clear guidance on safe and legal operations for users of all ages. This could involve requiring educational materials at the point of sale or incorporating software restrictions that limit certain drone features for unregistered or underage users. Additionally, regulatory bodies such as the FAA should collaborate with state and local governments to establish consistent, enforceable standards that acknowledge the distinct risks associated with young operators. While the goal of treating minors as learners is well-intentioned, the potential for serious harm warrants a balanced approach that combines education with accountability. By establishing clearer guidelines and consequences, policymakers can help ensure that the benefits of drone technology are enjoyed without risking public safety or privacy.

Future Research and Recommendations

This study lays the groundwork for a discussion on defining who should be held accountable for the improper use of a drone by a minor. While this study highlights some relevant legal concepts and constructs, government policy at all levels will ultimately shape the enforcement structure and the social norms deemed acceptable for dealing with issues of misuse by minors. To be sure, more research is needed in the form of legal law review focusing on precedent and interpretation of likely enforceable laws, particularly those derived outside of

aviation-specific contexts, that may be used as common baselines for misuse enforcement. For example, voyeurism by minors may be handled in the legal system by precedent for the action of voyeurism, and the modality by which the video is attached becomes irrelevant. Yet, the operation of a drone may also be an avenue in which other enforcement mechanisms and agencies may be involved, and the extent to which those agencies pursue enforcement may not mirror the commonality across cases to which may be applied to the act of voyeurism by minors. It is impossible to address all the potential combinations and tangents to which laws may be applied for actions that can coincide with the use of drone and the physical operation of the drone to complete the act and future research will be needed across many avenues to ultimately build a complete picture of how enforcement of drone use by minors can, and ultimately should, be enforced for the best developmental outcomes of minors when using drone technology.

References

Abhishek, R., & Balamurugan, J. (2024). Impact of social factors responsible for juvenile delinquency: A literature review. *Journal of Education Health Promotion, 28*(13), 102. https://doi.org/10.4103/jehp.jehp_786_23

Accettulla, K. (2024). 13-year-old points flare gun with laser at pinellas sheriff's office helicopter 'because he was bored,' deputies say. *WFLA News*. https://www.wfla.com/news/pinellas-county/13-year-old-points-flare-gun-with-laser-at-pinellas-sheriffs-office-helicopter-because-he-was-bored-deputies-say/

Afridi, S., Laporte-Devylder, L., Maalouf, G., Kline, J. M., Penny, S. G., Hlebowicz, K., Cawthorne, D., & Lundquist, U. P. S. (2025). Impact of Drone Disturbances on Wildlife: A Review. *Drones, 9*(4), 1–26.https://doi.org/10.3390/drones9040311

Anklam, E., Bahl, M. I., Ball, R., Beger, R. D., Cohen, J., Fitzpatrick, S., … & Slikker Jr., W. (2022). Emerging technologies and their impact on regulatory science. *Experimental Biology and Medicine, 247*(1), 1–75. https://doi.org/10.1177/15353702211052280

Arizona Legislation. (n.d). *12-661: Liabilities of parents or legal guardians for malicious or wilful misconduct of minors*. https://www.azleg.gov/ars/12/00661.htm

Aspray, W., & Doty, P. (2023). Does technology really outpace policy, and does it matter A primer for technical experts and others. *Journal of the Association for Information Science and Technology, 74*(8), 885–904. https://doi.org/10.1002/asi.24762

Associated Press. (2009). Would-be hijacker's apology too late. *Fox 19*. https://www.fox19.com/story/10645680/would-be-hijackers-apology-too-late/

Associated Press. (2017). Polk county man accused of shooting at small plane. *WCCO News*. https://www.cbsnews.com/minnesota/news/man-shoots-at-plane/

Bailis, D.S., & MacCoun, R.J. (1996). Estimating liability risks with the media as your guide: A content analysis of media coverage of tort litigation. *Law and Human Behavior, 20*(4), 419-429. https://link.springer.com/article/10.1007/BF01498978

Bhat, G. R., Dudhedia, M.A., Pachal, R. A., Shirke, Y. S., Angane, N. R., Khonde, S. R., Khedkar, S. P., Pansare, J. R., Bere, S. S., Wahul, R. M., & Gawande, S. H. (2024). Autonomous drones and their influence on standardization of rules and regulations for operating: A brief overview. *Results in Control and Optimization, 14*, 1–12. https://doi.org/10.1016/j.rico.2024.100401

Braithwaite, J. (2017). Types of responsiveness. In P. Drahos (Ed.), *Regulatory Theory: Foundations and Applications* (pp. 117–132). Sage Publications. https://press-files.anu.edu.au/downloads/press/n2304/pdf/book.pdf

Butler, K. A. (2024). *The perceptions of pilots and support personnel in aviation/aerospace industry regarding future implementation of UAS.* [Master's Thesis, Arizona State University]. ASU Campus Repository. https://keep.lib.asu.edu/items/193526

Calandrillo, S. Oh, J., & Webb, A. (2020). Deadly drones: Why FAA regulations miss the mark on drone safety. *Stanford Technology Law Review, 23*(1), 182–251. https://digitalcommons.law.uw.edu/faculty-articles/593

California Legislative Information. *Civil Code 1714.3*. (n.d.). https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?lawCode=CIV&sectionNum=1714.3

Canadian Aviation Regulations (2025). Part IX – Remotely Piloted Aircraft Systems. https://laws-lois.justice.gc.ca/eng/regulations/SOR-96-433/FullText.html#s-900.01

Civil Aviation Safety Authority (2025). Drones rules. https://www.casa.gov.au/knowyourdrone/drone-rules

Clarke, R., & Moses, L. B. (2014). The regulation of civilian drones impacts on public safety. *Computer Law & Security Review, 30*(3), 263–285. https://doi.org/10.1016/j.clsr.2014.03.007

Coalition for Juvenile Justice. (2012). SOS Project: Standards of Care for Non-Delinquent Youth. https://www.juvjustice.org/sites/default/files/ckfinder/files/dso%20fact%20sheet.pdf

Code of Federal Regulations. *§ 107.61 Eligibility*. (2025a). https://www.ecfr.gov/current/title-14/section-107.61

Code of Federal Regulations. *§ 48.25 Applicants*. (2025b). https://www.ecfr.gov/current/title-14/section-48.25

Code of Federal Regulations. *§ 61.15.* (2025c). *Offenses Involving Alcohol or Drugs*. https://www.ecfr.gov/current/title-14/chapter-I/subchapter-D/part-61/subpart-A/section-61.15

Cole Pashcall Law. (2022). *What crimes are juveniles most often arrested for?* Cole Paschall Law. https://colepaschalllaw.com/what-crimes-are-juveniles-most-often-arrested-for/

Council Regulation. (2019). *Council regulation (EU) (2019/947): Rules and procedures for the operation of unmanned aircraft*. http://data.europa.eu/eli/reg_impl/2019/947/oj

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry & research design: Choosing among five approaches* (4th ed.). Sage.

Ditto, P. H., Pizarro, D. A., Epstein, E. B., Jacobson, J. A., & MacDonald, T. K. (2006). Visceral influences on risk-taking behavior. *Journal of Behavioral Decision Making, 19*(2), 99–113. https://doi.org/10.1002/bdm.520

Doyle, C. (2018). *Juvenile delinquents and federal criminal law: The federal juvenile delinquency act and related matters in short*. Congressional Research Service. https://sgp.fas.org/crs/misc/R45391.pdf

Drahos, P. (2017). Section 2: Theories and concepts of regulation. In P. Drahos (Ed.), *Regulatory Theory: Foundations and Applications* (pp. 115–116). Sage Publications. https://press-files.anu.edu.au/downloads/press/n2304/pdf/book.pdf

Federal Aviation Administration. (n.d.). Flying a drone for limited recreational purposes as permitted by 49 U.S.C. § 44809. *FAA Safety*. https://www.faasafety.gov/files/gslac/library/documents/2024/Dec/415545/Manf-insert-card-Rec-Flyer.pdf'

Putnam, J.E., & Nichols, M.A. (2023). Updated fact sheet (2023) on state and local regulation of unmanned aircraft systems (UAS).. *Federal Aviation Administration Office of the Chief Counsel and United States Department of Transportation Office of the General Counsel*. https://www.faa.gov/sites/faa.gov/files/State-Local-Regulation-of-Unmanned-Aircraft-Systems-Fact-Sheet.pdf

Flyers Rights Education Fund Inc. v. Federal Aviation Administration, NO. 22-1004 (D.C. Circuit 2023). https://law.justia.com/cases/federal/appellate-courts/cadc/22-1004/22-1004-2023-03-03.html

Flynn, R. M., Shaman, N. J., Redleaf, D. L. (2023). The unintended consequences of "lack of supervision" child neglect laws: How developmental science can inform policies about child independence and child protection. *Social Policy Report, 36*(1), 1–38. https://doi.org/10.1002/sop2.27

Gettinger, D., & Michel, A. H. (2015). Drone sightings and close encounters: An analysis. *Center for the Study of the Drone, Bard College, Annandale-on-Hudson*. 1–20. https://dronecenter.bard.edu/files/2015/12/12-10-Drone-Sightings-and-Close-Encounters.pdf

Gibbs, G. R. (2018). *Analyzing qualitative data* (2nd ed.). SAGE

Good Morning America. (2015). Gun-firing drone subject of federal investigation. *GMA*. https://www.goodmorningamerica.com/news/story/gun-firing-drone-subject-federal-investigation-32585072

Grabosky, P. (2017). Meta regulation. In P. Drahos (Ed.), *Regulatory Theory: Foundations and Applications* (pp. 149–161). Sage Publications. https://press-files.anu.edu.au/downloads/press/n2304/pdf/book.pdf

Haines, Fiona. (2017). Regulation and risk. In P. Drahos (Ed.), *Regulatory Theory: Foundations and Applications* (pp. 181–196). Sage Publications. https://press-files.anu.edu.au/downloads/press/n2304/pdf/book.pdf

Hutchinson, T., & Duncan, N. (2012). Defining and describing what we do: Doctrinal legal research. *Deaking Law Review*, *17*(1), 83–119. https://search.informit.org/doi/10.3316/agis_archive.20125043

Justia. (2024b). *2024 Tennessee Code Title 37 - JUVENILES (§§ 37-1-101 — 37-11-103) Chapter 10 - MISCELLANEOUS PROVISIONS (§§ 37-10-101 — 37-10-502) Part 1 - LIABILITY OF PARENT OR GUARDIAN FOR ACTS OF JUVENILES (§§ 37-10-101 — 37-10-103) Section 37-10-103 - Circumstances under which parent or guardian liable.* U.S. Law. https://law.justia.com/codes/tennessee/title-37/chapter-10/part-1/section-37-10-103/

Justia. (2006). *2006 Utah Code - 78-11-20 — Property damage caused by a minor -- Liability of parent or legal guardian.* U.S. Law. https://law.justia.com/codes/utah/2006/title78/78_0f021.html

Kahan, D. M. (2007). Two conceptions of emotion in risk regulation. *University of Pennsylvania Law Review*, *156*(3), 741–766. http://hdl.handle.net/20.500.13051/5411

Kumar, A., Prybutok, V., & Sangana, V. K. R. (2025). Environmental Implications of Drone-Based Delivery Systems: A Structured Literature Review. *Clean Technologies*, *7*(1), 1–26. https://doi.org/10.3390/cleantechnol7010024

Jiang, B., Yang, J., & Song, H. (2020). Protecting privacy from aerial photography: State of the art, opportunities, and challenges. *IEEE INFOCOM 2020-IEEE Conference on Computer Communications Workshops*, 799–804. https://doi.org/10.1109/INFOCOMWKSHPS50562.2020.9162649

Lantz, B., & Knapp, K. G. (2024). Trends in juvenile offending: What you need to know. *Council on Criminal Justice.* https://councilоncj.org/trends-in-juvenile-offending-what-you-need-to-know/

Lawrence Daily Journal-World. (1969, November 11). Hearing today for youth, 14 in hijack try. Lawrence Daily Journal-World. https://news.google.com/newspapers?nid=2199&dat=19691111&id=RixUAAAAIBAJ&pg=7070,1131490

Marshall, D. M. (2021). *UAS regulations, standards, and guidance*. CRC press.

McCormack, C. (2024, December 15). 2 men arrested after flying ‘hazardous drone operation’ near boston logan airport. *New York Post*. 2 men arrested after flying 'hazardous drone operation' near Boston's Logan Airport

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Mo, M., & Bonatakis, K. (2022). Approaching wildlife with drones: using scientific literature to identify factors to consider for minimising disturbance. *Australian Zoologist*, *42*(1), 1–29. https://doi.org/10.7882/AZ.2021.015

Monateri, P. G. (2012). *Methods of comparative law.* Edward Elgar Publishing

Moore, J. (2017). Report details drone risks. *AOPA*. https://www.aopa.org/news-and-media/all-news/2017/may/01/report-details-drone-risks

Office of Juvenile Justice and Delinquency Prevention (2022). OJJDP statistical briefing book. http://ojjdp.gov/ojstatbb/crime/qa05301.asp

Onecle. (2021). *Section 6-5-380 - Liability of parents for destruction of property by minor; exception.* https://law.onecle.com/alabama/title-6/6-5-380.html

Pradeep, M. D. (2019). Legal research- descriptive analysis on doctrinal methodology. *International Journal of Management, Technology, and Social Sciences*, *4*(2), 95–103. http://doi.org/10.5281/zenodo.3564954

Pilot Institute. (2025). *Part 107 or not? Risks for unlicensed drone flying*. https://pilotinstitute.com/risk-of-unlicensed-drone-flying/

Pyrgies, J. (2019). The UAVs threat to airport security: Risk analysis and mitigation. *Journal of Airline and Airport Management*, *9*(2), 63–96. https://doi.org/10.3926/jairm.127

Ramos-Romero, C., Green, N., Roberts, S., Clark, C., & Torija, A. J. (2022). Requirements for drone operations to minimise community noise impact. *International Journal of environmental research and public health*, *19*(15), 1–16. https://doi.org/10.3390/ijerph19159299

Rollo, F., Po, L., & Bonisoli, G. (2022). Online new event extraction for crime analysis. *Conference proceedings from the 30th Italian symposium on advanced database systems*. https://www.researchgate.net/profile/Laura-Po/publication/361439161_Online_News_Event_Extraction_for_Crime_Analysis/links/62b1970989e4f1160c8fde25/Online-News-Event-Extraction-for-Crime-Analysis.pdf

Steele, L. (2006). The precautionary principle: A new approach to public decision-making? *Law, Probability and Risk, 5*(1), 19–31. https://doi.org/10.1093/lpr/mgl010

Simoneau, T., Wallace, R.J., Spence, T.B., & Rupprecht, J. (2023). Ana analysis for federal aviation administration enforcement actions against sUAS operators. *International Journal of Aviation, Aeronautics, and Aerospace*, *10*(4), 1-28, https://doi.org/10.58940/2374-6793.1850

Sun, J., & Hubbard, S. (2025). An Examination of UAS Incidents: Characteristics and Safety Considerations. *Drones*, *9*(2), 112. https://10.3390/drones9020112

Taylor v. Heurta, No. 15-1495 (D.C. Circuit 2017). https://law.justia.com/cases/federal/appellate-courts/cadc/15-1495/15-1495-2017-05-19.html

Texas Statutes. (n.d.). *Family code title 2- child in relation to the family subtitle b- parental liability chapter 41- liability of parents for conduct of child*. https://statutes.capitol.texas.gov/Docs/FA/htm/FA.41.htm

Tran, T. H., & Nguyen, D. D. (2022). Management and regulation of drone operation in urban environment: A case study. *Social Sciences, 11*(10), 1–19. https://doi.org/10.3390/socsci11100474

Uchidiuno, J. O., Manweiler, J., & Weisz, J. D. (2018). Privacy and fear in the drone era: Preserving privacy expectations through technology. *CHI Conference on Human Factors in Computing Systems*, 1–6. https://doi.org/10.1145/3170427.3188457

Vedrtnam, A., Negi, H., & Kalauni, K. (2025). Materials and Energy-Centric Life Cycle Assessment for Drones: A Review. *Journal of Composites Science*, *9*(4), 1–43. https://doi.org/10.3390/jcs9040169

Widerner, M. N. (2016). Local regulating of drone activity in lower airspace. *Boston University Journal of Science and Technology Law*, *22*, 239–266. http://dx.doi.org/10.2139/ssrn.2732845