UNCHARTED TERRITORY: LEGAL ISSUES AND CHALLENGES IN AERIAL TORTS

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ABSTRACT

The existing legal framework of aerial torts has undergone a transformation with the growing usage of unmanned aerial vehicles (UAVs), often known as drones, in civilian airspace. This abstract examines the difficult legal questions and problems brought up by incidents involving unmanned aerial vehicles.

Conventional tort law finds it difficult to adjust to a scenario in which there is no pilot at the controls since it is primarily dependent on the demonstration of human negligence. It becomes difficult to place the blame because the manufacturer, the software developer who created the flight control system, or the operator who set the flight path could all be at fault.

The absence of worldwide standardization in aviation liability frameworks and rules further complicates matters. In certain countries, a practice that is deemed permissible may be viewed as careless. For producers, operators, and possible victims, this discrepancy puts them in danger, particularly when it comes to cross-border accidents.

The abstract then looks at possible ways to get around this unfamiliar area. These include placing manufacturers under severe liability, creating internationally defined, unambiguous standards for UAV operation, and setting up reliable UAV insurance programs.

The need of cooperation between governments, manufacturers, and legal professionals is emphasized in the closing remarks. Together, we can create a transparent and equitable structure that will assign liability in the event of an aerial tort involving an unmanned aerial vehicle, making the environment safer and more predictable for all parties engaged in this fascinating but challenging field.

Keywords: Aerial Torts, autonomous aerial vehicles, Data Privacy, Space debris, Sustainable future.

INTRODUCTION

Birds and conventional manned airplanes are no longer the only creatures that fly in the skies above us. A new age in aviation has begun with the widespread use of unmanned aerial vehicles (UAVs), sometimes known as drones. Although unmanned aerial vehicles (UAVs) have many civilian uses, such as aerial photography and search and rescue, their growing use also brings with it a distinct set of difficulties, especially when it comes to legal accountability. This paper explores the unexplored field of aerial torts with respect to unmanned aerial vehicles.

Historically, recognized legal standards have controlled aerial torts. When an aircraft that is being piloted is involved in an accident, there is a defined process for allocating fault. But with the advent of UAVs, the whole thing gets thrown off balance. UAVs rely on intricate software algorithms and pre-programmed flight paths to function autonomously, in contrast to their manned counterparts. Because there is no human pilot at the controls, the conventional tort liability framework—which depends on demonstrating human actor negligence—is essentially upended.

There is even more complexity involved. The establishment of a thorough legal framework to address liability in the case of an accident has lagged behind the growing use of UAVs. The potential for mishaps increases with the continued evolution of UAV technology and the expansion of its applications. Imagine a situation in which an injured bystander is hit by a faulty delivery drone that crashes into a busy marketplace. Who is at fault here—the corporation running the delivery service, the software developer behind the flight control system, or the drone manufacturer? In a circumstance like this, determining who is to blame becomes a complex maze where each party may have some level of responsibility.

The uneven patchwork of laws controlling UAV operating in several nations further muddies the waters. What is considered appropriate behavior in one country may be considered irresponsible in another. For producers, operators, and possible victims, this absence of global standardization poses a risk, particularly when cross-border accidents take place. Establishing a consistent and unambiguous set of global laws is essential for guaranteeing safety and creating a predictable structure for determining culpability.

This essay will examine the complex legal problems and issues that arise from UAV-related aerial torts. We'll explore the shortcomings of conventional tort law in this novel setting and

look at possible ways to get around this unexplored area. We can work to create a more secure and predictable environment for all parties involved in the fascinating but complicated world of unmanned aerial vehicles (UAVs) by investigating options such as placing strict liability on manufacturers, creating internationally standardized regulations, and putting in place credible insurance mechanisms. In the end, developing cooperation amongst governments, producers, legal professionals, and the drone sector itself will be essential to creating an equitable and functional legal framework to handle aerial torts involving unmanned aerial vehicles.

Research Objectives

- Analyze how existing aviation regulations and international treaties address these different types of aerial torts.
- Identify the legal challenges posed by the emergence of new technologies like drones (e.g., difficulty assigning blame in accidents, privacy concerns).
- Identify any gaps or inconsistencies in the current legal framework for aerial torts.
- Develop potential solutions or recommendations for legal reform. This could involve proposing new legislation, revising existing regulations, or advocating for clearer judicial standards.
- Consider the potential impact of these proposed reforms on safety, innovation, and privacy rights within the airspace.

Research Questions

- What are the key categories of aerial torts (e.g., collisions, trespass, privacy violations)?
- How do existing aviation regulations and international treaties address aerial torts?
- What are the legal challenges posed by the emergence of new technologies like drones?
- Are there any inconsistencies or gaps in the current legal framework for aerial torts?
- How can the law be reformed to better address the legal issues and challenges in aerial torts?

Research Advance

The evolving nature of the aerial tort

The field of aerial torts, which addresses civil wrongs involving airplanes, is always evolving. The legal structures are unable to keep up with the technological advancements in the aviation industry. Unmanned aerial vehicles (UAVs) present a distinct difficulty. Liability issues arise when these unmanned vehicles are involved in accidents. For example, who has responsibility if a drone goes awry and crashes into a building, or if someone uses one to spy on someone privately? It is up to the courts to interpret the law's current tort principles and adapt them to these new circumstances.[1]

The situation is made more difficult by the increase in international aviation travel. When a transnational aviation accident happens, the legal issue becomes a complex dance to resolve. The focus shifts to international treaties and agreements, deciding which court has the jurisdiction to hear the matter and making sure that legal principles are applied uniformly in all relevant jurisdictions.[2]

Not even the relationship between travelers and airlines is stable. Airlines are required by law to treat their passengers with reasonable care. Nevertheless, what constitutes "reasonable care" is a dynamic concept. In light of continuously changing security risks, erratic passenger conduct, and the pandemonium of in-flight emergencies, courts are continually reassessing what this means. Passenger profiling and wrongful denial of boarding are two new types of aerial torts that emerged in the post-9/11 era. In this case, judges must balance the requirement for strong security measures with the passengers' fundamental rights.[3]

The digital era offers yet another level of intricacy. The risk of cyberattacks is growing as in-flight technology is used more and more. In the case that a cyberattack causes serious harm or

[1][Joshua turner, Sara Baxenberg, Wiley Rein, Kyle Gutierrez, Scott Bouboulis],[Torts of the Future:Drones],[instituteforlegalreform.com],[(Jan. 5, 2022)],[https://instituteforlegalreform.com/wp-content/uploads/2022/01/1323_ILR_Drones_Report_V7_Pages_Digital.pdf.]
[2][Aviation Cyber Security], [Aviation Cyber Security Guidance Material part 1:organization culture and posture],[go.updates.iata.org],[(February 2021)],[https://go.updates.iata.org/acys-guidance-material-part1-organization]
[3][LAWS5017: Private International Law A at USYD — StudentVIP],[studentvip.com.au],[https://studentvip.com.au/usyd/subjects/laws5017.]

interferes with a flight, who would be responsible? For the legal system, this is unknown area that requires creative solutions.[4]

Aerial torts will surely change in the future due to national and international rules pertaining to drone usage, cybersecurity, and data privacy. These rules will create a framework for resolving future conflicts resulting from these quickly developing technologies and offer much-needed clarity. Aerial tort law is an exciting field that constantly evolves to maintain a fair and safe environment for all parties engaged in air transport by balancing innovation and established legal precedents.[5]

Privacy v. Air space right

The conflict between privacy rights and airspace rights has resurfaced as the number of airplanes, drones, and other aerial vehicles takes to the skies. Landowners used to have a literal concept of domain that stretched "all the way to heaven". Above their land, they had authority over the airspace. But the 20th century saw the development of airplanes, which compelled a reassessment. Governments created public easements for high-altitude air traffic in order to facilitate air travel. This meant that while landowners still had ownership of their properties, they did not have total control over the airspace above them. As long as they stayed inside approved navigable airspace, airplanes may fly over private land without violating anyone's rights.[6]

Another wrench in the works is the proliferation of unmanned aerial vehicles (UAVs) and drones. UAVs can fly at far lower altitudes than airplanes, which makes them potentially intrusive in areas where many people believe they have a legitimate expectation of privacy—their own backyards. This is where worries about privacy arise:

Low-Altitude monitoring: Unwanted monitoring is a major concern, particularly in residential areas, given that drones can take close-range, high-resolution photos and movies. Imagine

[4] *ibid.*
[5] [Joshua turner, Sara Baxenberg, Wiley Rein, Kyle Gutierrez, Scott Bouboulis],[Torts of the Future:Drones],[instituteforlegalreform.com],[(Jan. 5, 2022)],[https://instituteforlegalreform.com/wp-content/uploads/2022/01/1323_ILR_Drones_Report_V7_Pages_Digital.pdf.]
[6] [Maria Villegas Bravo],[Overview of EPIC's Comments to DOJ and DHS on the use of facial recognition, other technologies using biometric information, and predictive algorithms.],[epic.org],[(March 8,2024)],[https://epic.org/overview-of-epics-comments-to-doj-and-dhs-on-the-use-of-facial-recognition-other-technologies-using-biometric-information-and-predictive-algorithms/.]

someone looking through your windows with a drone—a possibility that wasn't very concerning prior to UAVs.

Data collection: Without the subjects' knowledge or consent, drones fitted with sensors may be able to collect data about individuals and property. Your everyday activities and the design of your property could be among the many things that are gathered, leaving a digital trail that you might not be comfortable with.

In the era of unmanned aerial vehicles, striking a balance between two conflicting interests—airspace rights and privacy rights—is essential. Here are a few possible fixes:

Creating comprehensive and unambiguous laws is an essential first step in the operation of unmanned aerial vehicles (UAVs). Low-altitude aircraft over private land should be prohibited by these regulations, particularly in residential areas.

Privacy Protections: To shield people from unauthorised aerial observation and data collection, stricter legislation and enforcement procedures are required. This could entail limiting the amount of data that UAVs can collect and guaranteeing that people have the right to know if their data has been captured.[7]

Technological Safety Measures: Additional privacy protections may be provided by looking at technological solutions like geofencing, which prohibits drone operation in specific regions like neighborhoods or sensitive sites.

We are currently writing the rules for how we will fly and reconcile privacy issues with new technology. Governments, IT companies, and privacy activists will need to work together to create a framework that protects people's right to privacy while encouraging innovation in the UAV industry. This would enable us to enjoy the advantages of technology without compromising our feeling of privacy and security in our own houses.[8]

International law and its inconsistencies

Aerial torts are civil wrongs involving aircraft, and the worldwide legal landscape surrounding them is a patchwork quilt full with contradictions. International law, which was created to

[7] *ibid.*
[8] *ibid.*

guarantee seamless and secure international air travel, finds it difficult to keep up with the industry's rapid changes. When it comes to settling conflicts, this lack of uniformity can present serious obstacles, especially when incidents cross national borders. Let's investigate these discrepancies in more detail and consider possible fixes.

The jurisdictional maze that determines which court should hear a matter is one of the biggest obstacles.[9] A foundational piece of international aviation law, the Montreal Convention creates a framework for claims pertaining to passengers and cargo resulting from international air transportation. The Convention does not, however, offer conclusive solutions for every situation. Consider the scenario in which a drone piloted out of Germany collides with a structure located in France. In this case, the jurisdiction would not be clearly established by the Montreal Convention. This ambiguity can cause protracted legal disputes and delays in receiving compensation, leaving victims dissatisfied and unsure of where to turn for assistance.[10]

The relevant legislation may still be a source of disagreement even after jurisdiction has been established. National aviation regulations might vary greatly. For instance, there may be significant national differences in pilot training requirements and maintenance practices. This makes it possible for a behaviour that is regarded as negligent in one nation to be justified by the laws of another, such as poor pilot training that causes an accident. Depending on the area, this discrepancy may have a cascading effect that results in radically different legal outcomes for the same incident. Consider a pilot error-related plane crash. In contrast to a situation where the airline is from a country with stricter laws, victims may have more difficulty showing negligence if the airline is from a country with inadequate training standards.[11]

Another level of complication is brought about by the unmanned aerial vehicle (UAV) and drone industries' rapid development. In order to deal with these new technology, international law is still developing. Manufacturers, operators, and potential victims are left in the dark by unclear international regulations. How do we establish who is liable for a UAV accident? If a

[9][IATA],[A Universal Liability regime for International Carriage by Air - The Montreal Convention 1999 (MC99)], [Montreal Convention 1999],[www.iata.org],[(January 2019)],[https://www.iata.org/en/programs/passenger/mc99/.]
[10][IATA],[A Universal Liability regime for International Carriage by Air - The Montreal Convention 1999 (MC99)], [Montreal Convention 1999],[www.iata.org],[(January 2019)],[https://www.iata.org/en/programs/passenger/mc99/.]
[11]*ibid.*

rogue drone breaches someone's privacy, who is at fault? These are issues that international law is currently debating.

There is a glimmer of optimism, though. In order to foster international collaboration and create universal standards for the security and safety of air travel, international organizations such as the International Civil Aviation Organization (ICAO) are essential. This effort is demonstrated by the Montreal Convention, which aims to harmonize certain features of aerial torts among its member states. Future cooperation and international agreements are probably what will shape international tort law pertaining to aerial vehicles. A more uniform legal framework would be possible with improved collaboration between national aviation authorities, updated international treaties, and possible amendments to current agreements. Everyone participating in international air travel would benefit from more clarity and protection as a result of better channels for dispute resolution. However, development in this field is frequently sluggish and necessitates agreement from a wide range of nations with different agendas and legal frameworks. The aviation industry's dynamic nature adds to the complexity of the situation by necessitating ongoing modifications to international law in order to keep up with new developments and problems.[12]

Liability for autonomous aerial vehicles

Drones, or autonomous aerial vehicles, are becoming increasingly common in public airspace. This has created a complicated web of liability around aerial torts. AAVs function autonomously, as contrast to regular aircraft with human pilots, which begs the important question of who bears responsibility in the event of an accident. Blame-assignment becomes a complex problem that calls into question traditional tort law, which mostly relies on human negligence.[13]

A Web of Potential Culprits: The blame game expands when there is no pilot present. Who created the AAV—the manufacturer, the software engineer creating the complex flight control system, or the operator managing the flight path alone? Every player has an important part to

[12][PowerPoint Presentation - Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) Implementation],[icao.int],[(June 30, 2022)], [https://www.icao.int/APAC/Meetings/2022%20Implementation%20of%20CORSIA/CORSIA%20Implementation%20webinar%2030June2022_Section1-2-3_v1.pdf.]

[13][Dronedeploy],[Everything you need to know about the DJI Dock 2],[dronedeploy.com],[(Mar. 29, 2024)],[https://www.dronedeploy.com/blog/everything-you-need-to-know-about-the-dji-dock-2.]

play, and any mistake could result in an accident. In situations such as drone delivery, the situation becomes much more complex. If there was a delivery mishap, who would be at fault—the manufacturer, the software developer behind the flight plan, the delivery service handling the process, or perhaps the website that handled the order? Every entity within this ecosystem have the capacity to be culpable.[14]

Limitations of Current Frameworks: In this pilotless environment, current tort law doctrines frequently find it difficult to adjust. When you're working with lines of code and algorithms instead of a human pilot making judgments, proving negligence becomes a major challenge. The uneven patchwork of aviation laws and liability systems across many nations further complicates matters. In certain countries, a practice that is deemed permissible may be viewed as careless. Particularly in situations involving cross-border events, this lack of uniformity puts producers, operators, and possible victims in a risky situation.[15]

Choosing a Path for the Future: A number of viable strategies are beginning to emerge to get us through this unknown area. Strict liability for AAV manufacturers is one strategy. This would make them liable for any harm the drone did, regardless of whether they were careless. Manufacturers are therefore highly motivated to give safety features and thorough testing top priority before putting AAVs into the air.

Another critical stage is the development of worldwide standards and unambiguous norms for AAV operation. To ensure responsible use of these technologies, these rules should cover important issues such as operator licensure, thorough safety standards to reduce accidents, and data privacy concerns. Strong insurance programs for AAVs might also lessen victims' financial damages in the case of an accident. This might entail making insurance mandatory for manufacturers or operators.[16]

The legal environment pertaining to AAV responsibility is still developing. As technology develops and the use of AAV grows in popularity, further legal developments in this field are likely. To ensure that culpability in the event of an aerial tort involving an autonomous aerial

[14][Bruce Crumley],[Drone news and views covering DJI, Skydio, Parrot and more],[dronedj.com],[(May 24, 2024)],[https://dronedj.com/.]
[15][Federal Aviation Administration],[Drones for Good],[faa.gov],[(Nov. 20, 2020)],[https://www.faa.gov/podcasts/the-air-up-there/drones-good.]
[16][AUVSI News],[Weekend Roundup: May 15, 2020],[auvsi.org],[(May 15, 2020)],[https://www.auvsi.org/industry-news/weekend-roundup-may-15-2020.]

vehicle is obvious and equitable, governments, manufacturers, and legal experts must cooperate together. This will provide a more secure and consistent atmosphere for all those engaged in the fascinating yet intricate realm of unmanned aerial vehicles.

The issue of space debris

The sky above us isn't as empty as it appears. Space debris is growing more and more prevalent in Low Earth Orbit (LEO), the region where many operational spacecraft are located, and it is a dangerous presence. This ever-expanding collection of man-made objects is a serious threat to both current spacecraft operations and upcoming space research projects as they travel around Earth at frightening speeds.[17]

- *An Orbital Junk Cocktail:* The debris in space is not your typical rubbish heap. The assortment of debris is terrifying, ranging from tiny paint specks lost from spacecraft to enormous, defunct satellites and even spent rocket stages - remnants from previous flights. Let's examine the primary offenders in more detail:

- *Collision Shrapnel:* It is produced when debris or working spacecraft collide, setting off a disastrous chain reaction that scatters more trash into the already packed orbit.[18]

- *Satellite Graveyard Shift:* Despite their initial importance as technological wonders, satellites eventually have an expiration date. Sadly, a large number of these abandoned satellites are still in orbit, which exacerbates the issue.[19]

- *Remaining Rocket Components:* Satellite launchers' upper stages frequently lack the fuel and trajectory necessary to reenter Earth's atmosphere, forcing them to settle permanently in the debris cloud.[20]

The High-Velocity Threat: Space debris travels at an astonishing speed, which poses a significant threat. Reaching up to 17,500 miles per hour, even a small fragment has the ability

[17][Garber, Stephen J.],[Space Debris],[nasa.gov],[https://www.nasa.gov/headquarters/library/find/bibliographies/space-debris/.]
[18][KATHY JONES, KRISTA FUENTES, DAVID WRIGHT],[A Minefield in Earth Orbit: How Space Debris Is Spinning Out of Control (Interactive)],[scientificamerican.com],[February 1,2012],[https://www.scientificamerican.com/article/how-space-debris-spinning-out-of-control/.]
[19]*ibid.*
[20]*ibid.*

to cause severe harm or even take a functioning satellite out of action.[21] This might cause other problems:

Interruptions Rain Down: Satellites play a major role in our daily lives, providing everything from weather forecasts to GPS navigation and communication services. These vital services could be interfered with by space debris, leading to turmoil and financial losses.[22]

The Kessler Tragedy Is Coming: The Kessler Syndrome is a terrifying idea that describes a situation in which debris objects collide and cause a cascading impact. Every collision produces more debris, which builds up exponentially in orbit and may eventually make space travel too dangerous.[23]

The good news is that we are actively involved. A number of programs are in motion to counter the increasing hazard posed by space debris:

In order to effectively clean up the space junk, Active Debris Removal (ADR) systems are being developed to collect and de-orbit huge debris items or defunct satellites.

Avoiding Bullets Operational satellites can be deliberately guided via manoeuvres to avert possible collisions with tracked debris particles.[24]

In order to lower the likelihood that satellites would end up as permanent space junk, the "Design for Demise" idea promotes the creation of satellites that can burn up more easily in Earth's atmosphere when their lives are drawing to an end.

A Joint Venture for a Sustainable Future: International collaboration and ethical space exploration techniques are essential to reducing the threat posed by space debris. We can guarantee a sustainable future for space activities by putting into practice efficient ways for removing debris, designing spacecraft with divisibility in mind, and encouraging international

[21][Space Debris | The Aerospace Corporation],[aerospace.org],[(Apr. 9, 2024)],[https://aerospace.org/cords.]
[22]*ibid.*
[23][About space debris],[Space Debris],[esa.int],[https://www.esa.int/Space_Safety/Space_Debris/About_space_debris.]
[24][KATHY JONES, KRISTA FUENTES, DAVID WRIGHT],[A Minefield in Earth Orbit: How Space Debris Is Spinning Out of Control (Interactive)],[scientificamerican.com],[February1,2012],[https://www.scientificamerican.com/article/how-space-debris-spinning-out-of-control/.]

cooperation. By doing this, we can keep enjoying the advantages of space travel without endangering the fragile orbital environment.

CONCLUSION

Undoubtedly, the increasing utilisation of unmanned aerial vehicles (UAVs) has transformed numerous facets of our existence. But a new chapter in the intricate realm of aerial torts has emerged because to their growing presence in commercial airspace. The conventional system for determining fault in aviation mishaps, which mostly depends on demonstrating pilot negligence, finds it difficult to adjust to the unmanned character of unmanned aerial vehicles. Because of this uncertainty, there is a chain of possible guilt that might involve manufacturers, software developers, and operators, all of whom could be held partially or fully accountable in the event of an accident.

A multifaceted strategy is needed to navigate this unexplored region going forward. Creating precise, globally agreed rules for UAV operation is an essential first step. To ensure responsible use of this technology, these rules should cover important issues such as operator licensure, thorough safety standards to reduce accidents, and data privacy concerns. Furthermore, manufacturers might be encouraged to prioritise safety features and thorough testing prior to releasing UAVs into the air if stringent liability was imposed on them.

Moreover, creating strong insurance programs for UAVs is crucial to reducing victims' financial losses in the case of an incident. This might entail making insurance mandatory for manufacturers or operators. Ultimately, it is imperative that manufacturers, governments, legal professionals, and the drone industry itself continue to work together. Together, they can create a just and efficient legal system that allocates responsibility in an open and predictable way.

UAV technology has a bright future ahead of it, but to ensure that it is safe and responsible, legal issues must be resolved now. We can navigate this uncharted region and make sure that the skies remain a place for innovation and responsible technological growth by encouraging collaboration and adopting clear laws. As we proceed, maintaining public safety and privacy while highlighting the advantages of UAVs requires finding a balance. Then and only then will we be able to fully utilize this fascinating technology to its fullest.