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FROM THE EDITOR

This first volume of the *Journal of Drone Law and Policy* had its genesis in 2019 when I attended the American Bar Association Air & Space Law Forum - Drone Law Conference at Jones Day in Washington, D.C. The panels at the Conference demonstrated that the field of air and space law has achieved another breakthrough in its evolution that calls for analysis from the legal community. The subject of this volume is legal application as applied to the policy and law of the integration of uncrewed aircraft into the national airspace. Note that throughout this issue, we have introduced "uncrewed" as a more inclusive term to the FAA's "unmanned," which are meant to be synonymous with each other.

This issue begins with two articles addressing important though divergent industry concerns: how the regulatory environment and public perception issues shape the ability of end-users to leverage drones across multiple industries; and public international law implications of non-state actor use of drones. The editorial staff offers a commentary addressing the ongoing COVID-19 pandemic and the focus it brings to the balance between privacy and public health and safety. We also offer a line-by-line commentary of 2020 Mississippi Senate Bill No. 2282 introduced by Senator Brice Wiggins of Pascagoula. This commentary is followed by two student articles highlighting legal issues related to: potential preemption challenges to state regulatory efforts; and urban air mobility. Finally, we offer reviews of two books on drone law and policy.

This issue would not have been possible without the assistance of editors Ariel Bailey, Laura Brady, Michael Bokeno, Kapule Gray, Christiana Paissios, Matthew Russ and Sam Thorpe. Further, without the guidance and motivation from Professor Hanlon, this volume would not have come to matriculation. With all of this in mind, the editorial team joins me in expressing gratitude to all of the authors for taking the leap of faith in working with us on this inaugural issue of the Journal of Drone Law and Policy and we look forward to future volumes. Although COVID may be on the forefront of all our minds, hopefully this tome offers comfort that the future of our nation is bright.

Nestor K. Delgado
Editor-In-Chief
Oxford, Mississippi – December 2020

A MULTI-INDUSTRY EXAMINATION OF DRONE USE: HOW THE REGULATORY ENVIRONMENT AND PUBLIC PERCEPTION ISSUES SHAPE THE ABILITY OF END USERS TO LEVERAGE UNCREWED AIRCRAFT SYSTEMS

Grant J. Guillot[*]

I. INTRODUCTION

Since the Federal Aviation Administration's Small Drone Rule of 2016 largely relaxed the restrictions prohibiting commercial drone use, industries operating across the United States (US) have been rapidly integrating drones into their respective operations. In 2019, the Federal Aviation Administration (FAA) predicted that by 2023, the fleet of commercial drone operators will nearly triple from 277,000 to 835,000.[1] In addition, while there were 42,000 registered commercial drones in the US in 2016, the FAA expects that number will increase tenfold by 2021.[2] A market research report published

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[1] U.S. GOV'T ACCOUNTABILITY OFF., GAO-20-136, UNMANNED AIRCRAFT SYSTEMS: FAA SHOULD IMPROVE DRONE-RELATED COST INFORMATION AND CONSIDER OPERATIONS TO RECOVER COSTS 1 (2019).

[2] Kelly McSweeny, *FAA Anticipates 1.6 Million Commercial Drones by 2021*, ZDNET (Mar. 23, 2017), https://www.zdnet.com/article/faa-anticipates-1-6-million-commercial-drones-by-2021/.

in 2019 noted the following: (1) for several years, the US has boasted the largest drone market in the world; (2) by 2024, the US commercial and private drone market is expected to be nearly three times larger than it was in 2018; (3) in 2024, there will be four times as many drones sold in the US as there were in 2018; and (4) no country in the world comes close to matching the US's investment in drones, which partially explains the visibility of commercial drone use in the US — more than half of all strategic partnerships in the worldwide commercial drone industry involve one or more US companies.[3] Furthermore, another report indicated that the value of drone activity in the US rose from USD $40 million in 2012 to about USD $1 billion in 2017, and the report estimated that commercial drones will have an annual impact of USD $31-$46 billion for US Gross Domestic Product in 2026.[4]

There are numerous reasons many sectors in the US have embraced drones (more formally known as uncrewed or unmanned aircraft systems or UAS). The benefits of incorporating drones into operations are numerous and significant. For starters, it is far less expensive to pay for and replace a drone than it is to risk the safety and life of a human employee in a high-risk scenario.[5] Aside from reduced costs, industries are also utilizing drones due to their versatility — they can perform an ever-growing list of tasks such as inspections, videography and photography, placement of devices, delivery of products and distribution of chemicals.[6] Furthermore, drones can reach places that humans and larger aircraft cannot reach and are able to collect a large assortment of data in significantly shorter periods of time as human error is mostly removed.[7]

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[3] RESEARCHANDMARKETS.COM, *US Drone Market Review & Outlook 2012-2024 by Segment, Industry and Application Method* (2019), https://www.globenewswire.com/news-release/2019/06/18/1870372/0/en/United-States-Drone-Market-Review-Outlook-2012-2024-by-Segment-Industry-and-Application-Method-Discusses-Leading-Market-Players-Future-Trends-and-Opportunities-to-Look-Out-For.html (last visited June 1, 2020).

[4] Pamela Cohn, Alastair Green, Meredith Langstaff, & Melanie Roller, *Commercial Drones Are Here: The Future of Unmanned Aerial Systems*, MCKINSEY & CO. (Dec. 2017), https://www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/commercial-drones-are-here-the-future-of-unmanned-aerial-systems.

[5] FED. AVIATION ADMIN., FAA Aerospace Forecast: Fiscal Years 2017-2037 (2017), https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/fy2017-37_faa_aerospace_forecast.pdf.

[6] *Id.*

[7] *Id.*

Government decision-makers and industry stakeholders are working together to encourage drone use in commercial operations and to foster the integration of drones into the nation's airspace.[8]

II. INDUSTRIES UTILIZING UNCREWED AIRCRAFT SYSTEMS

The following industries are just some of the sectors that are utilizing drones at an exponential rate:

A. Agriculture

In the agriculture industry, drones are used in various manners. Drones are capable of producing 3-D maps for soil and field analysis, which aid in the planning of seed planting patterns and management of irrigation and nitrogen levels.[9] Drones also allow farmers to utilize topographical, thermal and spectral mapping to gauge and evaluate crop health quicker with more precision and over a larger area of land.[10] In addition, drones are used to disperse seeds and nutrients into soil, to precisely monitor crop health and development and to identify dry areas of fields.[11] Drone use can result in more precise and efficient crop spraying.[12] In fact, experts estimate that crop spraying through the use of drones can be executed up to five times faster than spraying utilizing traditional methods.[13] Finally, drones have been utilized to pollinate flowers in the face of a declining bee population.[14]

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[8] *Id.*

[9] Michal Mazur, *Six Ways Drones Are Revolutionizing Agriculture*, MIT TECH. REV. (July 20, 2016), https://www.technologyreview.com/2016/07/20/158748/six-ways-drones-are-revolutionizing-agriculture/.

[10] Mahashreveta Choudhary, *What Are Popular Uses of Drones?*, GEOSPATIAL WORLD (July 31, 2019), https://www.geospatialworld.net/article/what-are-popular-uses-of-drones/.

[11] Mazur, *supra* note 9.

[12] *21 Popular Uses for Drones from Delivery to Ambulance that You Must See*, DRONES UAV REP. (Mar. 21, 2019), http://dronesuavreport.com/2019/03/21/21-ways-drones-are-shaping-our-future/.

[13] Mazur, *supra* note 9.

[14] *38 Ways Drones Will Impact Society: From Fighting War to Forecasting Weather, UAVs Change Everything*, CB INSIGHTS (Jan. 9, 2020), https://www.cbinsights.com/research/drone-impact-society-uav/.

B. Construction

End users in the construction industry utilize drones for many tasks, including surveying and plotting of sites, monitoring progress and materials, performing inspections, maintaining security and marketing for sale.[15] Drones can also be used to lift and stack materials, thus contributing to the development of physical infrastructure.[16] Drone use in the construction industry continues to skyrocket, with one study finding that drone use on construction sites rose by 239% from 2017 to 2018.[17] In addition, data suggests that drones will be used by more than 25% of the construction industry as soon as 2020.[18]

The increasing utilization of drones in the construction industry is not surprising as one survey found that using drones resulted in five to twenty times cost savings; 55% increased safety; 61% more accurate measurements; 65% improved communication and collaboration; and 52% reduced time to data insights.[19] Notably, within the past year, the construction industry has achieved significant advances in drone utilization, one example being Hensel Phelps's historic obtaining of a waiver from the FAA to fly small drones over people.[20]

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[15] *The Rise of Drones in Construction*, DRONEDEPLOY (June 6, 2018), https://www.dronedeploy.com/blog/rise-drones-construction-XNpCThIAACcA9X7G/.

[16] *38 Ways Drones Will Impact Society*, *supra* note 14.

[17] *The Rise of Drones in Construction*, *supra* note 15.

[18] Pae Natwilai, *The Benefits of Drones in Construction Industry*, DRONE NODES, http://dronenodes.com/drones-in-construction-industry/ (last visited June 1, 2020).

[19] DroneDeploy, *2018 Commercial Drone Industry Trends* (May 2018), https://dronedeploy-www.cdn.prismic.io/dronedeploy-www%2Fae535fda-dfc9-4bcf-9743-292df714e9fe_dd__2018_trends_report-f.pdf (last visited Sept. 21, 2020).

[20] Harry McNabb, D*rones in Construction: Inside the Approval of a Waiver for Flight Over Humans with Hensel Phelps and ParaZero*, DRONELIFE (Sept. 6, 2019), https://dronelife.com/2019/09/06/drones-in-construction-inside-the-waiver-approval-for-flight-over-humans-with-hansel-phelps-and-parazero. This waiver was historic because it was the first waiver for flight over people granted to a construction company in the United States which provides an opportunity for other construction companies to seek flight over people waivers from the FAA.

C. Energy/Oil and Gas/Utilities

Stakeholders in the energy industry are increasingly utilizing drones to achieve significant cost savings, enhanced safety and improved productivity. A number of the industry's subsectors (e.g., oil and gas, electric, nuclear, and renewables) are embracing UAS technology for a diverse range of functions, including collecting data and images for purposes of mapping, monitoring and site development construction; detecting oil and gas leaks; enhancing storm restoration measures; identifying and assessing damage to oil rigs and pipelines; inspecting power lines, solar panels, substations, transmission towers and wind turbines; and preventing damage and potential outages.[21]

End users in other utility sectors, such as the water and sewerage utility industries, can also use drones for many similar tasks, including leak detection, mapping, monitoring, pipeline inspection, and storm restoration.[22] Railway companies are also utilizing drones to increase safety in operations.[23]

D. Forestry

The forestry industry continues to find new ways to utilize drones to achieve maximum cost efficiency and streamlined operations. One of the most prevalent uses of drones in this sector is orthomosaic mapping, a process by which a drone captures overlapping images of a specific area that are then "stitched" into a single photograph, thus resulting in a much higher resolution and detailed image.[24] Aerial imagery provided by drones can allow end users to inspect areas that are difficult to reach; assess plant health

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[21] *38 Ways Drones Will Impact Society*, *supra* note 14; *The Case for Drones in Energy*, MEASURE, https://www.measure.com/the-case-for-drones-in-energy (last visited Sept. 21, 2020); Ruan Nelio, *16 Unique Ways of Using Quadcopters*, BUYBESTQUADCOPTER, https://buybestquadcopter.com/drone-uses/ (last visited Sept. 21, 2020).

[22] *25 Ways Drones Improve Efficiency & Risk for Utilities & Energy Companies*, SKYWARD (Jan. 2, 2018), https://skyward.io/25-ways-drones-improve-efficiency-risk-for-utilities-energy-companies/.

[23] Karl Schwab, *Drones for Railways: Real-World Benefits, Use Cases and ROI*, DARTDRONES, https://www.dartdrones.com/drones-for-railways/ (last visited June 1, 2020).

[24] *What Is An Orthomosaic?*, DRONEGENUITY, https://www.dronegenuity.com/orthomosaic-maps-explained/ (last visited Oct. 1, 2020). *See also What Is An Orthomosaic? Orthomosaic Maps & Orthophotos Explained*, DRONEGENUITY, https://www.youtube.com/watch?v=g8mapLUXyGI (last visited Oct. 1, 2020).

and damage issues; obtain more accurate tree counts; map harvest units; identify canopy gaps; monitor illegal quarrying; locate hotspots from fires; view 3D images of forests and 3D mapping for carbon storage; measure stockpiles; and identify the presence of wildlife through the use of thermal imaging.[25] In addition, drones are able to spread fertilizer over areas that were once deemed inaccessible, distribute seedlings in difficult-to-reach areas and provide early detection of forest fires, thereby preventing the rapid loss of thousands of acres of forest.[26]

E. Insurance

The insurance industry is relying increasingly on drones to identify and assess risks, as evidenced by the fact that insurance companies employ 17% of all commercial drones.[27] Drones allow insurers to more thoroughly and cost effectively inspect a property prior to issuing a new policy, as well as to inspect the property for maintenance purposes once a policy has been issued. [28] In addition, drones are more quickly and easily able to access insured properties immediately following a natural disaster, thus providing a significantly safer alternative to deploying an adjuster to inspect damaged property.[29] In fact, according to one study, drone utilization by claims adjusters is anticipated to result in an up to 50% increase workflow efficiency.[30] Furthermore, drones are able to capture high-resolution images of insured properties at safe distances, which can then be used to create catastrophe model components and inputs for analysis.[31] All of these benefits can facilitate shorter claim processing time and more precise risk management.

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[25] Choudhary, *supra* note 10; DRONEDEPLOY, *How Drone Data Is Advancing the Forestry Industry* (July 16, 2019), https://dronedeploy-https://www.dronedeploy.com/blog/drone-data-advancing-forestry-industry-XSz3YRIAACEAHLLs/.

[26] Choudhary, *supra* note 10.

[27] Zimlon, *How Drones Are Disrupting the Insurance Industry*; ROBOTICSTOMORROW (Aug. 6, 2019), https://www.roboticstomorrow.com/article/2019/07/how-drones-are-disrupting-the-insurance-industry/13938 (last visited Oct. 1, 2020).

[28] *Id.*

[29] *Id.*

[30] *The Future of Drone Ins. Is Here*, INS. LINE ONE, https://insurancelineone.com/news/the-future-of-drone-insurance-is-here/ (last visited Sept. 21, 2020).

[31] *Id.*

F. Maritime

Various participants in the maritime industry have begun using drones, including bathymetric surveyors, coast guards, container ports, cruise lines, shipyards, and shore-to-ship package couriers.[32] In the maritime sector, drones can be utilized for security and surveillance purposes; to deliver spare parts, documentation and medical equipment to ships; for search and rescue missions; and for ship and cargo inspections.[33]

Regarding inspections, drones can be used to inspect flare stacks, tops of cranes and confined spaces, as well as survey damage after incidents. In particular, drones allow end users to inspect remotely hull exterior or interior of tanks and other areas that are difficult for surveyors to reach.[34] Finally, drones can be used to monitor ships' emissions as they enter port.[35] All of these tasks can be performed by drones at a fraction of the time and cost of traditional means.

G. Mining and Aggregates

Another industry that is increasingly utilizing drones is the mining and aggregates sector. Mining requires continuous measurement and evaluation of physical materials, such as stockpiles of ore, rock or minerals.[36] The materials are difficult to measure;[37] however, drone photography enables industry operators to obtain volumetric data on stockpiles and assess operations from the air, thus reducing the risks associated with ground inspections.[38]

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[32] Jeremiah Karpowicz, *How Are Drones Being Used in Maritime and Offshore Services?*, WORKBOAT (July 8, 2019), https://www.workboat.com/brand-partner/how-are-dronesbeing-used-in-maritime-and-offshore-services/; Tracy Cozzens, *Are Drones the Future of Marine Surveying?*, GPS WORLD (Oct. 12, 2017), https://www.gpsworld.com/are-drones-the-future-of-marine-surveying/.

[33] Karpowicz, *supra* note 32; Cozzens, *supra* note 32.

[34] Cozzens, *supra* note 32.

[35] Alok Gupta, *Drones to Monitor Rising Emissions from Shipping Sector*, CGTN (Feb. 12, 2019).
https://news.cgtn.com/news/3d3d514e77516a4e32457a6333566d54/index.html.

[36] *38 Ways Drones Will Impact Society*, *supra* note 14.

[37] *Id.*

[38] *Id.*

H. Public Safety

Public safety officials and first responders utilize drones for a variety of reasons. For starters, in life and death situations, a drone can be deployed quickly and cover large areas of land in a fraction of the time it would take to use traditional methods.[39] Drones can also be used to provide first responders with a real-time assessment of an accident scene before they are deployed.[40] Drones with enhanced sensing capabilities can easily locate missing persons and facilitate successful rescue operations.[41] In addition, drones can perform high resolution inspections of dangerous areas from a safe distance without endangering the lives of individuals.[42] Drones utilizing thermal imaging and other advanced photography features can be used to track criminals.[43] Drones can also be used to gauge crowd levels at events and maintain infrastructure security.[44] Moreover, drones can be used to deliver vital medical supplies and organs in emergency situations.[45] The greatest example of drones saving lives was the successful drone delivery of a kidney to a transplant recipient in April 2019 at the University of Maryland Medical Center in Baltimore.[46] In that same vein, Zipline has utilized drones to delivery medical supplies in Rwanda and is now using drones to deliver pharmaceuticals off the coast of Massachusetts.[47]

Another area that is seeing a significant increase in drone use is firefighting. Drones equipped with thermal imaging cameras are utilized to monitor and combat forest fires by detecting abnormal temperatures.[48] In doing so, public safety officials are able to

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[39] *Law Enforcement Drones: Public Safety and First Responder Operations*, DRONE NODES, http://dronenodes.com/law-enforcement-drones/ (last visited Sept. 21, 2020).

[40] *Public Safety Drone Use Cases*, DRONESENSE, https://www.dronesense.com/use-case (last visited Sept. 21, 2020).

[41] *38 Ways Drones Will Impact Society*, *supra* note 14.

[42] Nelio, *supra* note 21.

[43] *21 Popular Uses for Drones*, *supra* note 12.

[44] Nelio, *supra* note 21.

[45] *Id*.

[46] *AiRXOS Participates in Historic Unmanned Aircraft Delivery of Organ for Successful Transplant in Maryland*, BUS. WIRE (Apr. 26, 2019), https://www.businesswire.com/news/home/20190426005493/en/AiRXOS-Participates-Historic-Unmanned-Aircraft-Delivery-Organ.

[47] Stephen Shankland, *Drones Will Swarm Our Skies When These 3 Things Happen*, CNET (Nov. 10, 2019), https://www.cnet.com/news/drones-will-swarm-our-skies-when-these-3-things-happen/.

[48] *38 Ways Drones Will Impact Society*, *supra* note 14.

determine areas that are most prone to forest fires or to identify fires in only three minutes from the time they begin.[49]

I. Real Estate

End users in the real estate industry use drones in various ways that increase efficiency and safety and reduce costs and risks. Through the use of LiDAR, a surveying method that uses light in the form of a pulsed laser to illuminate a target and measure the reflected light with a sensor, drones are able to capture 3D images of high-quality data for large land parcels, thus assisting developers with asset identification and inventory, transportation planning, traffic monitoring and assessments and utility mapping.[50] This type of imaging can also assist potential purchasers with evaluating matters concerning the structure of the land, such as the likelihood of flooding and other issues.[51] Moreover, advanced photography and videography drones are capable of providing potential buyers with the ability to participate in remote walk-throughs of the property and monitor the progress of a building's construction.[52] Finally, drones can provide property owners with analytics regarding the condition of a property before an issue, such as a roof leak, arises.[53]

J. Surveying and Mapping

In the surveying and mapping industry, drones capture topographic data up to five times faster than traditional methods with even less work hours.[54] Drones provide accurate and extensive data, as one drone flight is able to generate thousands of measurements which can be depicted in various formats.[55] Drones allow surveyors and mappers to reach areas that were previously

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[49] *Id.*

[50] Rhett N. Chiliberti, *How Drones and LiDAR Can Benefit Commercial Real Estate*, WOLF COM. REAL EST., https://wolfcre.com/drones-lidar-can-benefit-commercial-real-estate/ (last visited Oct. 1, 2020).

[51] *Id.*

[52] *38 Ways Drones Will Impact Society*, *supra* note 14.

[53] *Using Drones for Home and Rook Inspections: A Growing Trend*, HOMEVESTORS, https://homevestorsfranchise.com/blog/nationwide/2017/07/using-drones-home-roof-inspections-growing-real-estate-trend/ (last visited Oct. 1, 2020).

[54] *Surveying & GIS*, WINGTRA, https://wingtra.com/drone-mapping-applications/surveying-gis/ (last visited Sept. 21, 2020).

[55] *Id.*

inaccessible or not easily reachable, such as steep slopes, highways, harsh terrains, and train tracks.[56] Furthermore, because the collection of data by drones can be easily repeated without incurring significant costs, images can be captured at set intervals and overlaid on blueprints to monitor whether construction is proceeding according to specifications.[57] Orthomosaic imaging also allows surveyors and mappers to detect changes in the Earth's movement and velocity, thus assisting with the prediction of landslides and damage to bridges, railways and roads.[58]

K. Telecommunications

End users in the telecommunications industry are utilizing drones for tower inspections, network testing, aerial base stations and relay stations.[59] In regards to tower inspections, drones can do the following: identify biological or structural hazards and obstacles that degrade radio signals; access hard-to-reach areas while avoiding guy wires and electromagnetic fields; create 3D models; and perform inspections and make repairs significantly faster — and at a lesser cost — than human labor.[60] For example, immediately following Hurricane Harvey, AT&T and Verizon utilized drones in Houston, Texas, to inspect their towers, which would have been too time-consuming and dangerous had the inspections been conducted manually.[61] The drones were able to quickly and accurately assess storm damage, which allowed repair teams, in many cases, to restore service within hours as opposed to days.[62]

Regarding network testing, drones are able to more quickly and affordably test for connection speed, signal strength, latency and interference (including over large terrains) than human workers.[63] Finally, drones can serve as both aerial base stations and relay stations, providing residents in rural areas with Internet access

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[56] *Id.*

[57] *Id.*

[58] *Id.*

[59] *Drones in Telecommunications*, DRONERESEARCH (Mar. 22, 2016), https://www.slideshare.net/DroneResearch/drones-in-telecommunications.

[60] *Id. See A Drone Pilot's Guide to Surveying a Tower,* DRONE PILOT GROUND SCHOOL (Sept. 22, 2018), https://www.dronepilotgroundschool.com/tower-surveying/.

[61] *38 Ways Drones Will Impact Society*, *supra* note 14.

[62] *Id.*

[63] *Drones in Telecommunications*, *supra* note 59.

and establishing short-term solutions until permanent solutions are available.[64] After all, drones, which can essentially be "parked" in the air, can be deployed on demand, flown in any location, repositioned to boost coverage, spectral efficiency and user quality experience.[65]

L. Transportation and Logistics

Given the significant cost and time savings drone use generates, it is not surprising that the drone logistics and transportation market is estimated to be USD $11.20 billion in 2022 and is projected to reach USD $29.06 billion by 2027, at a compound annual growth rate ("CAGR") of 21.01% from 2022 to 2027.[66] In fact, the drone logistics and transportation market is anticipated to grow at the highest CAGR during the forecast period in the North America region.[67]

Drones can be used by transportation and logistics companies for several purposes. One area that is expected to see a significant increase in drone use is the delivery of goods from the store or warehouse to the end consumer.[68] For example, a consumer would place an order via a store's e-commerce portal and a drone would be utilized to achieve delivery within the same day (or, ideally, within the same hour).[69] Alternatively, the customer could place the order at an in-store location, and a drone would deliver it later that day.[70] Continuing technological advances and improvements to logistics

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[64] *Id*.

[65] *Id*.

[66] MARKETSANDMARKETS, *Drone Logistics and Transportation Market by Solution (Warehousing, Shipping, Infrastructure, Software), Sector (Commercial, Military), Drone (Freight Drones, Passenger Drones, Ambulance Drones), and Region – Global Forecast to 2027* (2018), https://www.marketsandmarkets.com/Market-Reports/drone-logistic-transportation-market-132496700.html (last visited Oct. 1, 2020).

[67] *Id*.

[68] Hector Sunol, *How Drones Will Affect the Logistics Industry in the Next 10 Years*, CYZERG (Aug. 25, 2015), https://articles.cyzerg.com/how-drones-will-affect-the-logistics-industry-in-the-next-10-years/.

[69] *Id*.

[70] *What Do Drones Mean For the Future of Warehouses?*, SYS. ID BARCODE SOLS. (July 5, 2016), http://www.systemid.com/learn/what-do-drones-mean-for-the-future-of-warehouses/.

measures will undoubtedly contribute to the eventual surge in drone delivery.[71]

UAS operators are working closely with government agencies to ensure safety in drone flights. In October 2019, the United Parcel Service obtained approval from the FAA to operate a nationwide fleet of drones, which will permit the company to perform drone deliveries on hospital campuses and bring it one step closer to providing all consumers with drone deliveries.[72] In addition, Amazon's drone delivery service, Amazon Prime Air, edges closer to achieving its goal of providing delivery to consumers within thirty minutes of ordering.[73] Furthermore, Wing, the drone delivery company owned by Google's parent company, Alphabet, announced in September 2019 that it would be participating in a government-sponsored pilot program whereby Wing, FedEx Express, Walgreens, and a local retailer would partner to make drone delivery of medical goods available to residents in Virginia.[74]

To understand the implications and benefits of enabling safe drone deliveries, one needs to look no further than the successful drone delivery of a kidney to a transplant recipient in April 2019.[75] The delivery, achieved through a partnership between AiRXOS (a part of GE Aviation) and the University of Maryland Medical Center in Baltimore, demonstrates that drone deliveries have the potential not just to be more convenient—they may also save lives.[76] In addition, drones are used to deliver blood, transplants and vaccines to individuals living in underdeveloped countries, such as Rwanda, Tanzania and Papua New Guinea.[77]

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[71] *Id.*

[72] Leslie Josephs, *UPS Wins First Broad FAA Approval for Drone Delivery*, CNBC (Oct. 1, 2019), https://www.cnbc.com/2019/10/01/ups-wins-faa-approval-for-drone-delivery-airline.html.

[73] Casey Coombs, *Amazon's Ambitious Drone Delivery Plans Take Shape*, THE DAILY BEAST (Sept. 3, 2019), https://www.thedailybeast.com/with-prime-air-amazon-wants-to-deliver-packages-in-30-minutes-or-less-via-drone?ref=scro
ll.

[74] Brittany Kruk, *The Skies No Longer the Limit*, WALGREENS BOOTS ALLIANCE (Aug. 4, 2020),
https://www.walgreensbootsalliance.com/news-media/our-stories/skys-no-longer-the-limit.

[75] *AiRXOS Participates in Historic Unmanned Aircraft Delivery*, *supra* note 46.

[76] *Id.*

[77] Nelio, *supra* note 21.

Consumers and, at times, retailers traditionally have experienced significant frustration with claims and returns processes. Drones could allow a customer to return a product without having to travel to a post office because a drone could be dispatched to the customer's home to retrieve the product.[78] In addition, a retailer could utilize a heavier duty drone to retrieve and return a damaged portion of a pallet of freight.[79] A streamlined claims and returns supply chain would allow a company to achieve cost savings, time savings, and increased customer satisfaction.

Vital organs, medical goods and consumer orders are not the only things that will increasingly be transported by drones in the future. Ride sharing is also poised to take to the skies, as companies like Airbus and Uber are hard at work making aerial electric ride-hailing a reality.[80]

M. Warehousing

Aside from deliveries, indoor drones are being used by companies to monitor and track inventory and heavy-duty drones can be used to transport packages between warehouses, thus allowing companies to meet local or regional demand without needing to rely on trucking.[81] In 2016 Walmart partnered with PINC to implement a pilot program which utilized drones carrying sensors, scanners, and cameras to monitor and track inventory at a greater rate than humans could; the results were promising.[82] Drones allow

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[78] *Companies Using Drones in Their Warehouses for Inventory Control & More*, DRONEVIDEOS.COM (Sept. 2, 2018), https://dronevideos.com/companies-using-drones-in-their-warehouses-for-inventory-control-more/.

[79] *Companies Using Drones In Their Warehouses For Inventory Control & More*, *supra* note 78; Schofield.

[80] Alan Boyle, *Uber Shows Off Its Latest Concept for Air Taxis; FAA Chief Hits Hard on Safety Issue*, GEEKWIRE (June 11, 2019), https://www.geekwire.com/2019/uber-shows-off-latest-concept-air-taxis-faa-chi
ef-hits-hard-safety-issue/; *Inside the race to develop the first flying, self-driving car*, CBS News (June 21, 2019), https://www.wcbi.com/making-the-jetsons-a-reality-the-first-flying-self-driving-car-are-coming/.

[81] Stefan Tasevski, *Drones in Warehouses – Adoption and Implementation*, DRONEBELOW (Jan. 22, 2019), https://dronebelow.com/2019/01/22/drones-in-warehouses-adoption-and-implementation/.

[82] *Companies Using Drones in Their Warehouses for Inventory Control & More*, *supra* note 78.

distributors to quickly identify and retrieve inventory, thereby cutting companies' inventory-carrying costs.[83]

III. REGULATORY FRAMEWORK

Although companies are eager to take advantage of the cost savings and time efficiency drone utilization promises to provide, several obstacles threaten the seamless integration of drones into various sectors. One of the greatest hurdles obstructing commercial drone use is the ever-evolving system of federal, state, and local regulations governing drone operations. While 49 USC. § 40103(a)(1) (2016) affords the US government with exclusive sovereignty over national air space, courts have consistently held that this law is not an express preemption clause, and thus, it does not expressly preclude the sovereign powers of states.[84] Therefore, drone users must comply with not only federal laws when operating drones but also a patchwork of state and local regulations applicable to the operator's specific case.

A. Federal Law

In 2012, Congress enacted the Federal Aviation Administration Modernization and Reform Act (FAAMRA) which directed the FAA to regulate the commercial operation of drones within the US.[85] Prior to August 29, 2016, businesses were required to obtain a special waiver called a Section 333 Exemption in order to use drones for commercial purposes.[86] However, the regulations have since been relaxed and, pursuant to 14 C.F.R. 107 ("Part 107"), businesses may now operate a drone for commercial purposes in many instances, though certain restrictions apply.[87] Among other

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[83] *Id.*

[84] *See, e.g.*, *Braniff Airways, Inc. v. Neb. State Bd. of Equalization & Assessment*, 347 US 590, 595 (1954).

[85] Pub. L. No. 112-95 (2012). *See* Nicholas Cody, *Flight and Federalism: Federal Preemption of State and Local Drone Laws*, 93 WASH. L. REV. 1495, 1496 (2018).

[86] Jonathan Rupprecht, *The Truth About Drone Delivery No One Is Talking About*, Section *Drone Delivery Problems,* RUPPRECHT L., https://jrupprechtlaw.com/amazon-drone-delivery-3-major-legal-problems-amazon-prime-air (last visited Oct. 21, 2020); *See also* Small Unmanned Aircraft Systems, 14 C.F.R. § 107 (2016).

[87] *See* Rupprecht, *supra* note 86.

regulations included in Part 107, in the absence of a Part 107 Waiver,[88] a drone in operation must (1) remain within the line of sight of the pilot in command;[89] (2) be operated by a live pilot;[90] (3) not be operated by a pilot who is simultaneously operating another drone;[91] (4) not be operated from a moving vehicle;[92] (5) not be operated during night;[93] and (6) not be operated over human beings, unless authorized by Part 107.[94] In addition, drones must be operated within certain airspace and generally must not be flown within five miles of an airport.[95]

Although securing a Part 107 Waiver is not as onerous as obtaining a Section 333 Exemption, companies often still find it time consuming and costly to be required to apply for these waivers in order to utilize drones for commercial operations.[96] In addition, the FAA closely scrutinizes each application, and each operator applying for a waiver must provide the FAA with extensive evidence of its ability to operate safely.[97] In fact, the FAA indicated that of the nearly 14,000 requests for waivers received as of December 2018, only 2,000 applications were approved.[98] As of August 2020, over 4,500 Part 107 Waivers had been approved by the FAA.[99] However, as discussed below, certain proposed rules and programs implemented by the FAA seek to encourage commercial drone utilization by scaling back several of these restrictions and by requiring further safety measures, such as remote identification. Should these efforts prove successful, commercial drone use will be given a significant nudge forward.

In addition, beyond-the-visual-line-of-sight (BVLOS) small UAS delivery operations must be approved by the FAA not under

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[88] *Part 107 Waivers,* FED. AVIATION ADMIN., https://www.faa.gov/uas/commercial_operators/part_107_waivers/ (last visited Aug. 6, 2020).

[89] 14 C.F.R. § 107.31.

[90] 14 C.F.R. § 107.19.

[91] 14 C.F.R. § 107.35.

[92] 14 C.F.R. § 107.25.

[93] 14 C.F.R. § 107.29.

[94] 14 C.F.R. § 107.39.

[95] 14 C.F.R. § 107.41.

[96] Rupprecht, *supra* note 86.

[97] Lisa Ellman, *Opinion: Drone Delivery Is Safe and Secure*, AVIATION WEEK INTEL. NETWORK (Nov. 26, 2019), https://www.commercialdronealliance.org/newsarchive/drone-delivery-is-safe-and-secure.

[98] US GOV'T ACCOUNTABILITY OFF., GAO-20-136, *supra* note 1.

[99] FED. AVIATION ADMIN., *supra* note 88.

Part 107, but under 14 C.F.R. 135 (Part 135).[100] These regulations are rigorous and were enacted with crewed aircraft in mind, and thus, in some instances their application to drones may be impractical.[101] For example, the requirement that an aircraft delivery operator carry an onboard flight manual is simply not feasible for a drone.[102] For this particular regulation, the FAA has provided an exemption for drones.[103] Nevertheless, the Part 135 certification process is arduous and consists of five phases.[104] Notably, the FAA has expressed that "Part 135 certification is the only path for small drones to carry the property of another for compensation beyond visual line of sight."[105]

In addition, on October 5, 2018, President Trump signed into law the FAA Reauthorization Act, which, among other things, requires the FAA to (1) adhere to deadlines for developing and implementing an uncrewed traffic management system; (2) implement a remote identification system; (3) improve the process for obtaining a Part 107 Waiver; and (4) enhance the pathway by which ubiquitous drone delivery operations may be safely enabled.[106] Nearly all of the parties involved unanimously agree that these initiatives must be accomplished in order for the commercial drone industry to flourish.[107]

B. State and Local Law

Despite the authority invested in the FAA to regulate commercial drone use, the federal government is surprisingly limited in its ability to govern many aspects of drone utilization.[108] On the other

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[100] Ellman, *supra* note 97.

[101] *Id.*

[102] *Id.*

[103] Operating Requirements: Commuter and On Demand Operations and Rules Governing Persons on Board Such Aircraft, 14 C.F.R. § 135.1 (1978). *See also* FED. AVIATION ADMIN., *Package Delivery by Drone (Part 135),* https://www.faa.gov/uas/advanced_operations/package_delivery_drone/ (last visited June 1, 2020).

[104] 14 C.F.R. § 135.1 (1978).

[105] *Package Delivery by Drone (Part 135), supra* note 103.

[106] Pub. L. No. 115-254; *See also* Isabella Lee, *The Top 20 Drone Stories of 2018 — Evolving Regulations, Alternative Power Sources, New DJI Drones, Public Safety Adoption, and BVLOS*, UAV COACH (Jan. 2, 2019), https://uavcoach.com/2018-top-stories/.

[107] *See* Lee, *supra* note 106.

[108] Laura Donohue, *A Tale of Two Sovereigns: Federal and State Use and Regulation of Unmanned Aircraft Systems*, *in* HANDBOOK OF UNMANNED AERIAL VEHICLES (Kimon

hand, states are governments of general jurisdiction and possess broad powers to regulate the issues raised by the commercial use of drones, especially insofar as they pertain to privacy, crime, and public safety.[109] As stated above, the FAA declined to exercise express preemption over all state and local drone laws, noting in a publication that it was "not persuaded that including a preemption provision in the final rule [was] warranted at [that time]" because the "preemption issues involving small [drones] necessitate a case-specific analysis that is not appropriate in a rule of general applicability."[110]

Even in matters that are not traditionally reserved for state and local regulation, such as restrictions on flight altitude, flight paths, operational bans, and regulation of the navigable airspace, the FAA has not called for express preemption but instead has recommended the state and local authorities consult with the FAA prior to enacting such restrictions.[111] Nevertheless, most state and local laws governing drone use relate to areas of law that have traditionally never been regulated by the federal government, such as land use, zoning, privacy, trespass, and law enforcement operations.[112] In addition, laws in at least ten states prohibit drone operations near or over critical infrastructure (electrical generation and transmission facilities, oil refineries, chemical facilities, etc.).[113] Furthermore, since 2013, at least 44 states have enacted drone-

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P. Valavanis & George J. Vachtsevanos eds., 2d ed. forthcoming), http://dx.doi.org/10.2139/ssrn.2943018 (last visited Sept. 21, 2020).

[109] FED. AVIATION ADMIN., State and Local Regulation of Unmanned Aircraft System (UAS) Fact Sheet, 3 (2015),
https://www.faa.gov/uas/resources/policy_library/media/UAS_Fact_Sheet_Final.pdf.

[110] FED. AVIATION ADMIN., OPERATION AND CERTIFICATION OF SMALL UNMANNED AIRCRAFT SYSTEMS, 81 FED. REG. 42,063,42,194 (June 28, 2016) (codified in various sections of 14 C.F.R). In 2017, one federal district court determined that an ordinance, which required city-level registration of all drones, prohibiting flight below 400 feet over private property, banning flights over public property, and requiring operations to remain within the line of sight of the operator, contradicted or defeated the purpose of the federal law, and thus, were preempted. *See* Singer v. City of Newton, No. 17-10071-WGY, 2017 WL 4176477 (D. Mass. Sept. 21, 2017).

[111] Cody, *supra* note 85, at 1509.

[112] *Id. at* 1508 *citing* FED. AVIATION ADMIN., *State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet*.

[113] Ann Kitch, *Eyes in the Sky: Two Experts Trade Views on Regulating Drones*, NAT'L CONF. OF ST. LEGS. (Mar. 14, 2019), http://www.ncsl.org/research/transportation/experts-trade-views-on-drone-regula
tions.aspx.

related laws or regulations,[114] while, as of March 2017, at least 135 municipalities in 31 states had enacted local drone laws.[115]

In a press release issued in 2018, the FAA reiterated that "[c]ities and municipalities are not permitted to have their own rules or regulations governing the operation of aircraft," but noted, that state and local authorities "may generally determine the location of aircraft landing sites through their land use powers."[116] Nevertheless, preventing a drone from landing or launching within a jurisdiction effectively prohibits drone utilization within that jurisdiction.[117] Perhaps no other industry would be as affected by such a regulation as would the transportation and logistics industry where commercial drone use would, above all else, depend on the ability of a drone to launch from one location and land in another.

IV. IMPEDIMENTS TO DRONE UTILIZATION

While the US has seen significant advancements in commercial drone use within the past few years, obstacles remain that prohibit the commercial drone industry from reaching its full potential. The federal regulatory environment, though becoming more drone-friendly in recent years, needs to continue to evolve before drone operations will be truly ubiquitous. Furthermore, public perception of drones, especially in areas of the country where commercial drone use has not gained sufficient exposure, needs to be modified so that the public will understand the numerous benefits drones can provide to various industries rather than viewing drones as voyeuristic devices that promote trespassing and invasions of privacy. To resolve these issues, state and local government decision-makers across the country will need to work with federal government

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[114] See *Current Unmanned Aircraft State Law Landscape,* NAT'L CONF. OF ST. LEGS., https://www.ncsl.org/research/transportation/current-unmanned-aircraft-state-law-landscape.aspx (last visited Apr. 1, 2020).

[115] Mark Dombroff, *FAA Efforts Aim to Reduce Drone Jurisdictional Disputes*, LAW360 (Nov. 19, 2019), https://www.foxrothschild.com/publications/faa-efforts-aim-to-reduce-drone-jurisdictional-disputes/.

[116] Press Release, Fed. Aviation Admin., Federal vs. Local Drone Authority (July 20, 2018), https://www.faa.gov/news/press_releases/news_story.cfm?newsId=22938.

[117] Miriam McNabb, *The FAA Stance on State Drone Regulation: Preemption is Still Preemption, But There's a Loophole*, DRONELIFE (July 24, 2018), https://dronelife.com/2018/07/24/faa-stance-on-state-drone-regulation-preemption-is-still-preemption.

leaders and industry stakeholders to facilitate commercial drone operations and remove barriers that threaten to curtail the progression of the industry.

A. Regulatory Hurdles

i. Federal Law

Among the FAA's regulations contained in Part 107 that present the greatest obstacles for commercial drone users are the requirements that a drone (1) not fly beyond the visual line of sight (BVLOS) of the pilot in command;[118] (2) not be operated during night;[119] (3) not be operated over human beings;[120] and (4) not be flown within five miles of an airport.[121] For example, only 1% of the applications for a waiver to operate over people are granted.[122] Furthermore, most customers live in or near cities. Given that most cities are located near an airport, the restriction generally prohibiting a drone from flying within five miles an airport severely inhibits the prospects for drone delivery.[123] However, the FAA in recent years has created certain programs and proposed rules with the aim of stimulating commercial drone utilization through the easing of these regulations.

One of these programs is the Low Altitude Authorization and Notification Capability Program (LAANC), implemented by the FAA in November 2017, which "provides access to controlled airspace near airports through near real-time processing of airspace authorizations below approved altitudes in controlled airspace."[124] LAANC, which is offered at nearly 400 air traffic facilities covering approximately 600 airports, automates the application and

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[118] 14 C.F.R. § 107.31.

[119] 14 C.F.R. § 107.29.

[120] 14 C.F.R. § 107.39.

[121] 14 C.F.R. § 107.41.

[122] Jonathan Rupprecht, *Feds Make Major Moves To Relax Restrictions On Use Of Drones*, FORBES (Jan. 14, 2019), https://www.forbes.com/sites/jonathanrupprecht/2019/01/14/proposed-drone-rules-allow-flying-over-people-and-at-night-without-waivers/#3262410a35a0.

[123] Rupprecht, *supra* note 86.

[124] FED. AVIATION ADMIN., *UAS Data Exchange (LAANC*) (last modified Sept. 20, 2020), https://www.faa.gov/uas/programs_partnerships/data_exchange/ (last visited June 4, 2020).

approval process for drone users seeking to operate near airports.[125] Because most consumers reside in cities, and thus, near an airport, the LAANC program especially holds great potential for retailers seeking to implement drone delivery as these companies will no longer be categorically prohibited from delivering goods within five miles of an airport.

In addition, on January 14, 2019, US Department of Transportation Secretary Elaine L. Chao, noting that "[d]rones . . . are well on their way to mainstream deployment," announced proposed regulations that would allow drone operators under certain conditions to fly over people and at night without the operator having to first obtain a waiver or exemption.[126] In the draft rules, the FAA proposes to categorize drone operations by weight, the potential for injuries in the event the drone crashes and other factors.[127] The goal of these proposed changes is to encourage technological innovation while mitigating safety risks.[128] While one cannot be certain if and when these proposed rules will be enacted, the implementation of these regulations would significantly boost the ability of companies to achieve profit maximization and cost efficiency through drone utilization as the companies would no longer need to expend resources obtaining waivers or exemptions.

ii. State and Local Law

State and local government decision-makers across the country have been encouraged to work with federal government leaders and industry stakeholders to facilitate commercial drone operations and remove barriers that threaten to curtail the progression of the industry. To that end, on October 25, 2017, President Trump signed a directive to commence the Unmanned Aircraft Systems (UAS) Integration Pilot Program, the goal of which is to "safely test and validate advanced operations for drones in partnership with state and

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[125] *Id*.

[126] U.S. DEPT. OF TRANSP., *Remarks Prepared for Delivery by U.S. Secretary of Transportation Elaine L. Chao, Transportation Research Board Annual Meeting, Washington, DC* (Jan. 14, 2019), https://www.transportation.gov/briefing-room/transportation-research-board-annual-meeting-washington-dc.

[127] David Koenig, *Feds to Ease Rules on Drone Flights over Crowds and at Night*, THE ASSOCIATED PRESS (Jan. 14, 2019), https://www.apnews.com/1c50bdd96d6244198df93d84c86bf156.

[128] U.S. DEPT. OF TRANSP., *Remarks Prepared for Delivery*, *supra* note 126.

local governments in select jurisdictions."[129] The program evaluates a variety of operation concepts, including night operations, flights over human beings, flights BVLOS of the pilot in command, package delivery and detect-and-avoid technologies.[130] On May 10, 2018, the US Department of Transportation announced ten state, local and tribal governments that had been selected to participate in the program.[131] Given that drone users must obtain relief from the restrictions set forth in Part 107 in order for commercial drone utilization to thrive, the implementation of the UAS Integration Pilot Program is a significant step in the direction of ubiquitous drone use among transportation and logistics companies.

However, the progress made through the collaboration of the federal government with state and local governments has been threatened by the efforts of property owners and special interest groups to curtail commercial drone use. Undoubtedly due at least in part to pressure by these groups, the Uniform Law Commission (ULC)[132] in 2018 proposed a law entitled the Uniform Tort Law Relating to Drones Act that drew an arbitrary 200-foot line in the sky under which no drones could operate without permission from private property owners.[133] Had the proposed law been implemented in its original form, it would have cut drone operators' accessible airspace in half in many areas given that in most cases drones are not allowed to fly above 400 feet.[134] In addition, in most states, the act of trespassing onto another's property gives rise to a presumption of injury and a right to sue.[135] Accordingly, the initial draft of the ULC's proposed law would have subjected a drone operator to

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[129] FED. AVIATION ADMIN., Press Release, *supra* note 116.

[130] *Id.*

[131] U.S. DEPT. OF TRANSP., *US Transportation Secretary Elaine L. Chao Announces Unmanned Aircraft Systems Integration Pilot Program Selectees* (May 9, 2018), https://www.transportation.gov/briefing-room/dot3419.

[132] Isabella Lee, *Backlash Against ULC Proposal to Ban Drones from Flying Below 200 Feet | Industry Leaders Including AUVSI and DJI Speak Up*, UAV COACH (Oct. 25, 2018), (https://uavcoach.com/ulc-drone-law/); The ULC is a highly-influential group of lawyers, judges, and legislators that propose model legislation to the states.

[133] *See* NAT'L CONF. OF COMM'RS ON UNIF. ST. LEGS., *Uniform Tort Law Relating to Drones Act* (May 30, 2019), https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=5bbdd6ae-9c3f-7a80-6a0f-6cdf54dbfe9e&forceDialog=0.

[134] Lee, *supra* note 106.

[135] Dombroff, s*upra* note 115.

civil liability every time the operator flew over another property at an altitude of 200 feet or below.[136]

When the ULC met for its annual meeting in Anchorage, Alaska, in July 2019, the attendees engaged in contentious disagreements over an amended version of the legislation.[137] While the property owners and special interest groups voted in favor of a version of the law that specifically enumerated the tort of aerial trespass by a drone, the UAS industry favored a version of the legislation that included a totality of the circumstances test that would require a landowner to demonstrate that the drone operator had substantially interfered with his use and enjoyment of his property.[138] The ULC was not able to agree on a final version of the legislation, and, as of the date of this Article, the fate of the proposed law is still undetermined.[139]

However, in October 2019, just two months following the ULC annual meeting, US Senator Mike Lee (R-Utah) proposed a bill that, if enacted, would give property owners ownership of the airspace up to 200 feet above their property.[140] The bill would also restrict the right of the federal government to regulate airspace below 200 feet, thereby vesting the state or tribal entity governing the land with all zoning and regulatory authority.[141] As of the date of this Article, Senator Lee's proposed bill has not yet been subjected to a Congressional vote.

The progress made among all the parties in the UAS Integration Pilot Program is also threatened by the efforts of cities and towns to regulate drones at the municipal level.[142] For example, drone operators in Chicago have complained about what they believe to be the local police's overly broad interpretation of the City's drone ordinance, which they allege results in a blanket prohibition

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136 *Id.*

137 *Id.*

138 *Id.*

139 *Id.*

140 S. 2607, 116th Cong. (2019-2020) https://www.congress.gov/116/bills/s2607/BILLS-116s2607is.pdf; Also see Miriam McNabb, *This New Drone Bill Would Make the Airspace Over People's Homes Private Property*, DRONELIFE (Oct. 15, 2019), https://dronelife.com/2019/10/15/breaking-news-this-new-drone-bill-would-make-the-airspace-over-peoples-homes-private-property/.

141 *Id.*

142 *Id.*

on drone use.[143] In addition, in New York City, real estate developers have contested a certain local statute that restricts aircraft takeoffs and landings to Port-Authority-designated airports or other facilities.[144] The developers, who wish to enable drone use, complain that the statute essentially bans commercial drone use within the city since the FAA generally prohibits drone flights at airports.[145] These anti-drone efforts undertaken by state and municipal government actors threaten to undermine the efforts of the FAA to work with all levels of government to enable ubiquitous commercial drone use.

B. Public Perception Issues

In addition to regulatory obstacles, public perception of drones, particularly as it relates to privacy and safety, also threatens to curtail to ubiquitous integration of drones into the US airspace. Because the FAA prohibits drones from flying more than 400 feet above the ground (or above the highest point of a structure), the public is far more likely to encounter drones on a regular basis than crewed aircraft, especially given that drones are being utilized at an exponential rate.[146] To put this fact in perspective, one must consider that in the span of only a few years, the number of registered drones has easily surpassed the number of registered airplanes and helicopters, which have been in existence for a far longer period of time.[147]

In regards to privacy, the same features of drones that would benefit end users in various industries also have the potential to raise privacy concerns. For example, a drone's small size, affordability and versatility makes it very useful for surveillance – whether lawful or unlawful. In addition, burgeoning cybersecurity issues also make privacy a critical issue when it comes to widespread drone use. Public perception of the safety of drones also bears on

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[143] *Id.*

[144] Tess Riski, *New York City Developers Lobby to Legalize Drones,* THE WALL ST. J. (Jul. 16, 2019), https://www.wsj.com/articles/new-york-city-developers-lobby-to-legalize-drones-11563274803.

[145] *Id.*

[146] Ben Husch, *States Would Gain Significant Authority in New Drone Bill*, THE NCSL Blog (Oct. 16, 2019), http://www.ncsl.org/blog/2019/10/16/states-would-gain-significant-authority-in-new-drone-bill.aspx.

[147] *Id.*

how seamlessly, and how quickly, drones will be widely incorporated into everyday life. Advances in uncrewed aircraft system traffic management services and remote identification technology have the potential to shift public perception of drones in favor of acceptance of commercial drone utilization.

i. Privacy

In 2016, the National Telecommunications and Information Administration (NITA) issued best practices in regards to drone related privacy concerns, which encourage drone users to (1) inform affected persons of UAS use and the collection of data; (2) take care in the collection and storage of information that identifies a particular person; (3) limit the use and sharing of such data; (4) secure data; and (5) monitor and comply with the law as it evolves.[148] In addition, the 2018 FAA Reauthorization Act requires the Government Accountability Office (GAO) and NTIA to review the privacy issues and concerns associated with drone operations.[149]

Also, in October 2019, the Cybersecurity and Infrastructure Security Agency (CISA), an operational component under Department of Homeland Security (DHS) oversight, issued *Cybersecurity Best Practices for Operating Commercial Unmanned Aircraft Systems* to help organizations utilizing drones identify some of the security and privacy risks and address them.[150] The guidance offered by CISA underscores that a drone must be treated in the same way a business treats any mobile device — a powerful storage and transmission vehicle that may be connected to the organization's enterprise network.[151] Similarly, the US Department of Justice in November 2019 updated its drone policy in an effort to minimize perceived cybersecurity threats or the unlawful use of drone

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[148] *Voluntary Best Practices for UAS Privacy, Transparency, and Accountability*, NTIA, https://www.ntia.doc.gov/files/ntia/publications/voluntary_best_practices_for_uas_privacy_transparency_and_accountability_0.pdf (last visited Oct. 1, 2020).

[149] Lee, *supra* note 106; *See also* Haye Kesteloo, *H.R. 302, The FAA Reauthorization Act of 2018 Passed by Senate Today*, DRONEDJ (Oct. 3, 2018), https://dronedj.com/2018/10/03/senate-faa-reauthorization-act-2018/.

[150] *Cybersecurity Best Practices for Operating Commercial Unmanned Aircraft Systems*, CISA, https://www.waterisac.org/system/files/articles/Cybersecurity%20Best%20Practices%20for%20Operating%20Commercial%20Unmanned%20Aircraft%20Systems%20Fact%20Sheet.pdf (last visited Oct. 1, 2020).

[151] *Id.*

technology.[152] Furthermore, as of 2019, twenty-seven states have enacted statutes or regulations aimed at alleviating the privacy concerns associated with drone use.[153] As one of the public's chief concerns regarding drone use is privacy implications, the aforementioned efforts by the federal and state governments to safeguard the privacy of US citizens may help facilitate public acceptance of drones.

ii. Safety

In October 2018, the FAA announced that it was partnering with the National Aeronautics and Space Administration (NASA) and the drone industry to develop the Unmanned Aircraft Systems Traffic (UTM) Management System Pilot Project, the goal of which is to "develop and demonstrate a traffic management system to safely integrate drone flights within the nation's airspace system."[154] The FAA noted that this system would be separate from, but complementary to, the traditional FAA air traffic management system, and it would create a shared information network and gather data for use in future rulemakings.[155] The FAA has awarded contracts to commercial service entities tasked with developing technology that would provide flight planning, communications and separation and weather services for drones.[156] The establishment of the UTM program, which facilitates the development of a streamlined and safe uncrewed traffic system, is just one more step in favor of commercial drone use across various industries.

However, in order for UTM to facilitate the safe integration of drones into the US airspace, the FAA has recognized that it must have some means of identifying the particular drones in operation at any given moment.[157] Accordingly, on December 31, 2019, the FAA published a Notice of Proposed Rulemaking on Remote

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[152] Miriam McNabb, *Department of Justice Updates Drone Policy*, DRONELIFE (Nov. 29, 2019), https://dronelife.com/2019/11/29/department-of-justice-updates-drone-policy/.

[153] Kitch, *supra* note 113.

[154] FED. AVIATION ADMIN., *DOT UAS Initiatives* (Apr. 3, 2019), https://www.faa.gov/uas/programs_partnerships/DOT_initiatives/ (last visited June 4, 2020).

[155] *Id.*

[156] *Id.*

[157] FED. AVIATION ADMIN., *UAS Remote Identification* (Mar. 5, 2020), https://www.faa.gov/uas/research_development/remote_id/.

Identification of UAS.[158] Remote Identification, or Remote ID, is essentially a digital license plate that enables authorities to identify and locate drones operating in US airspace.[159] The Remote ID proposed rule provides a framework for remote identification of all UAS operating in the airspace of the US.[160] It would facilitate the collection and storage of certain data such as identity, location, and altitude regarding an uncrewed aircraft and its control station.[161] Notably, the FAA has indicated that "remote identification… is a critical element for building unmanned traffic management capabilities," which, in turn, "will form the foundation for the development of other technologies that can enable expanded operations [such as operations over people or beyond visual line of sight]."[162]

V. CONCLUSION

In closing, the possibilities of how drones could improve daily life and commercial operations seem endless. The commercial utilization of drones is positioned to increase exponentially over the next few years as numerous industries discover innovative ways to cut costs, reduce risks, and increase efficiency using UAS technology. Furthermore, the public stands to benefit from the convenience of drone delivery as well as the life-saving public safety benefits drones are uniquely capable of providing. A complicated mosaic of federal, state, and local laws and proposed legislation threatens to stall the ubiquitous integration of UAS technology into commercial operations. In addition, public perception of drones will significantly contribute to the rate at which commercial drone use becomes commonplace. Public acceptance is intrinsically dependent upon the public's assurance that drones can be operated safely and without infringing upon privacy rights. Nevertheless, the FAA has implemented several measures to facilitate the realization of the benefits drones offer to prospective commercial operators. As drones are increasingly utilized in various industries, government

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[158] REMOTE IDENTIFICATION OF UNMANNED AIRCRAFT SYS., 84 FED. REG. 72438 (Dec. 31, 2019) (to be codified at 14 C.F.R. 1, 14 C.F.R. 47, 14 C.F.R. 48 14 C.F.R. 89, 14 C.F.R. 91, 14 C.F.R. 107) https://www.govinfo.gov/content/pkg/FR-2019-12-31/pdf/2019-28100.pdf.

[159] Shankland, *supra* note 47.

[160] FED. AVIATION ADMIN., *UAS Remote Identification*, *supra* note 157.

[161] *Id.*

[162] *Id.*

stakeholders, drone service providers, and end users must continue to work together to provide advocacy and education in order to unlock the maximum benefits provided by uncrewed aircraft systems.

AERIAL INSURGENCY: NON-STATE ACTOR USE OF UNCREWED AERIAL VEHICLES AND PUBLIC INTERNATIONAL AIR LAW IMPLICATIONS

Jeremy Grunert[*]

I. INTRODUCTION

On September 14, 2019, a series of projectiles rained down on two major oil facilities in the eastern Saudi Arabian regions of Abqaiq and Khurais, blasting holes in oil storage and production tanks, damaging equipment and starting extensive fires at both sites.[1] Early reports indicated that the strikes had involved uncrewed aerial vehicles (UAVs)—a fact that was confirmed when Yemen's Houthi rebels admitted responsibility for the attack, claiming they had undertaken the strikes using ten UAVs.[2] While the Abqaiq/Khurais attacks were hardly the first time the Houthis had targeted Saudi oil interests using weaponized UAVs,[3] the scale and precision of the September 2019 attacks, as well as their effect on Saudi and even global oil production, demonstrated the dramatic

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[1] Ben Hubbard, Palko Karasz & Stanley Reed, *Two Major Saudi Oil Installations Hit by Drone Strike, and U.S. Blames Iran*, THE N.Y. TIMES (Sept. 14, 2019, updated Sept. 15, 2019), https://www.nytimes.com/2019/09/14/world/middleeast/saudi-arabia-refineries-drone-attack.html; BBC, *Saudi oil attacks: Images show detail of damage*, BBC.COM (Sept. 16, 2019), https://www.bbc.com/news/world-middle-east-49718975.

[2] Nada Altaher, Jennifer Hauser & Ivana Kottasová, *Yemen's Houthi rebels claim a 'large-scale' drone attack on Saudi oil facilities*, CNN.COM (Sept. 14, 2019), https://www.cnn.com/2019/09/14/middleeast/yemen-houthi-rebels-drone-attacks-saudi-aramco-intl/index.html.

[3] *See* Vivian Yee, *Yemen's Houthi Rebels Attack Saudi Oil Facilities, Escalating Tensions in Gulf*, THE N.Y. TIMES (May 14, 2019), https://www.nytimes.com/2019/05/14/world/middleeast/saudi-oil-attack.html.

effect that a non-state actor's use of UAV technology can have on the global economy.[4] Indeed, as the use of UAVs by non-state actors—including terrorist groups, such as Hezbollah and the Islamic State; armed rebel factions, like the Houthis and the Free Syrian Army; or criminal organizations, including Central and South American drug cartels—continues to expand, it is increasingly apparent that UAV technology represents a significant force-multiplier for non-state entities that can threaten States' monopolies of force.

In this Article, I seek to examine the issue of armed and terrorist non-state actors' use of UAVs through the lens of public international air law and the legal regime for international aviation that has its origin in the post-World War II Chicago Convention on International Civil Aviation.[5] While States' response to non-state actor UAV use may ultimately fall more within the realm of the law of armed conflict or, in the case of UAV use by criminal organizations (which will not be examined in this Article), within States' domestic criminal laws, public international air law provides a framework for examining UAV use within the international regulatory context. Public international air law contains important rules with respect to pilotless aircraft, and may, through the international standards and policy-making of the International Civil Aviation Organization (ICAO), provide methods of regulating UAVs that would enhance States' abilities to address the threat that such aircraft pose. I will begin, in Part II of this Article, with a brief background on UAVs, their development since the early days of aviation, the distinctions between different types of UAVs, and the advancements in UAV technology and depreciation in UAV costs that have allowed UAV use by non-state actors to proliferate. Part III will examine the facets of the existing public international air law regime that are applicable to UAVs, including distinctions between State and non-State aircraft, provisions of the Chicago Convention that

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[4] The two oil facilities targeted in the September 14, 2019, attack together accounted for almost half of Saudi Arabia's oil production and approximately 5% of global oil production. It was later reported that Saudi Arabia had lost $2 billion worth of oil production as a result of the attacks. Anjli Raval, *Saudi Arabia loses $2bn of output after attack on oil infrastructure*, FIN. TIMES (Oct. 10, 2019), https://www.ft.com/content/514af7dc-eb59-11e9-a240-3b065ef5fc55.

[5] *See generally* Convention on International Civil Aviation, 15 U.N.T.S. 295 (Dec. 7, 1944) [hereinafter Chicago Convention].

directly address pilotless aircraft, and rules regulating States' military responses to civilian aircraft. In Part IV, I will analyze these areas of law and their application to States' response to non-state actor use of UAVs, particular with respect to limitations Article 3*bis* of the Chicago Convention may impose on States' responses to non-state actor UAV use (and even UAV use in general) within the context of the existing public international air law framework.[6] Finally, Part V will serve as a brief conclusion to this Article.

II. BACKGROUND

Prior to examining non-state actor drone use and applications of public international air law to this issue, it is important to first, define the terms that will be used throughout this Article to ensure the reader is familiar with such concepts as "non-state actors" and UAVs. It is also necessary to undertake a brief historical examination of UAV development and use, which plays a role in explaining both the current international air law provisions governing UAVs and the modern proliferation of UAV technology.

A. Definitions

For the purposes of this Article's examination of public international air law and non-state actor UAV use, I will partially utilize the definition of "non-state actors" provided by the US Naval War College and the *Dictionary of the Social Sciences*. This definition states:

> Non-state actors are entities that participate or act in international relations, with sufficient power to influence and cause change without any affiliation to established institutions of a state. These individuals or organizations have significant political, economic, or social influence without being allied to any particular country or state.[7]

This definition encompasses traditional non-state actors such as nongovernmental organizations, stateless terrorist groups (such

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[6] *See id.* at art. 3*bis*.

[7] U.S. NAVAL WAR COLL. LIBR., "De-escalation/ War Termination: Non-State Actors" (Oct. 3, 2019), https://usnwc.libguides.com/c.php?g=267716&p=2081785 (citing CRAIG J. CALHOUN, DICTIONARY OF THE SOCIAL SCIENCES (2002)).

as al-Qaeda), and criminal organizations that have sufficient power to influence their societies. However, this definition would likely *not* include terrorist organizations that successfully seize, control, and govern territory (such as the Islamic State or Hamas) or armed groups that are aligned to a particular State to such a degree that the "political wings" of such groups form a part of that State's government (Hezbollah would be the primary example of such an armed group). It is also unclear whether the US Naval War College/*Dictionary of Social Sciences* definition would encompass rebel groups seeking to displace a current State system (for instance, the Yemeni Houthis or any number of anti-Assad Syrian rebel groups). For the purposes of this Article, any terrorist, rebel or armed/paramilitary group not officially associated with the armed forces of a recognized State will also be considered a "non-state actor."

With respect to the definition of UAV, "ICAO has determined it to be a pilotless aircraft . . . which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous."[8] As ICAO makes clear, there are at least two types of UAVs encompassed within the scope of this definition: remotely-piloted aircraft (RPAs, which are also sometimes referred to as "remotely piloted aircraft systems" or RPAS, when discussing both the aircraft itself and its command-and-control system in conjunction with one another[9]) and truly unpiloted (in the sense of preprogrammed or "fully autonomous") aircraft. It should be noted that, while *all* UAVs are popularly referred to as "drones," only this second category of UAVs actually reflect the traditional understanding of a "drone" as a truly autonomous aircraft.[10] As non-state actors have utilized both types of systems, this Article will use the more all-encompassing term "UAV" rather than limit this examination to only RPAs or unpiloted drones.

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[8] ICAO, GLOB. AIR TRAFFIC MGMT. OPERATIONAL CONCEPT, DOC. 9854 AN/458 (2005) at B-6.

[9] *See* ICAO, REMOTELY PILOTED AIRCRAFT SYS. (RPAS) CONCEPT OF OPERATIONS (CONOPS) FOR INT'L IFR OPERATIONS (Oct. 19, 2017), https://www.icao.int/safety/UA/Documents/RPAS%20CONOPS.pdf#search=RPAS.

[10] *See* John Villasenor, *What Is a Drone, Anyway?*, SCI. AM. (Apr. 12, 2012), https://blogs.scientificamerican.com/guest-blog/what-is-a-drone-anyway/.

B. UAV History and Modern Non-State Actor Exploitation

Contrary to the public impression that UAVs represent a new, revolutionary technology and a uniquely 21st Century challenge, human beings have been using uncrewed kites, balloons and other aircraft for military purposes for hundreds, if not thousands, of years.[11] As Gregory K. James notes in *Unmanned Aerial Vehicles and Special Operations: Future Directions*, his thesis for the Naval Postgraduate School, "a Chinese warlord [reportedly] used large kites to carry explosives over a walled city and fortress nearly 2,000 years ago, allowing him to attack his adversaries while keeping his own troops out of range."[12] Uses of uncrewed balloons for explosive bombardment and balloons and kites for photographic aerial reconnaissance were developed and used during a number of 19th Century conflicts, including the First Italian War of Independence,[13] the American Civil War, and the Spanish-American War.[14]

With the Wright Brothers' invention of the heavier-than-air airplane in 1903 and subsequent improvements in airplane technology through the First World War, development of UAVs advanced significantly. During World War I, British engineer Archibald M. Low invented a remote-controlled aircraft known as the Ruston Proctor Aerial Target for use as a practice target in training anti-aircraft gunners,[15] while Americans Elmer Sperry, Peter Hewitt and Charles Kettering developed radio-controlled "flying bombs"—the precursors to modern cruise missiles.[16] World War II saw Nazi Germany advance UAV technology with the V-1 rocket, a

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[11] *See* Benjamyn I. Scott, *Overview*, in THE LAW OF UNMANNED AIRCRAFT SYSTEMS: AN INTRODUCTION TO THE CURRENT AND FUTURE REGULATION UNDER NATIONAL, REGIONGAL AND INTERNATIONAL LAW 3-5 (Benjamyn I. Scott, ed. 2016); DAVID HODGKINSON & REBECCA JOHNSTON, AVIATION L. AND DRONES: UNMANNED AIRCRAFT AND THE FUTURE OF AVIATION 3-13 (2018).

[12] Gregory K. James, Unmanned Aerial Vehicles and Special Operations: Future Directions, 5 (Dec. 2000)(Postgraduate Thesis, Naval Postgraduate School) https://apps.dtic.mil/dtic/tr/fulltext/u2/a386387.pdf.

[13] *See* HODGKINSON & JOHNSTON, *supra* note 11, at 4.

[14] Scott, *supra* note 11, at 3.

[15] Jason A. Yochim, The Vulnerabilities of Unmanned Aircraft System Common Data Links to Electronic Attack, 2 (2010)(Master's Thesis, U.S. Army Command and General Staff College), https://fas.org/irp/program/collect/uas-vuln.pdf.

[16] Bishane A. Whitmore, Evolution of Unmanned Aerial Warfare: A Historical Look at Remote Airpower—A Case Study in Innovation, 7-10 (2016)(Master's Thesis, U.S. Army Command and General Staff College), https://apps.dtic.mil/dtic/tr/fulltext/u2/1020384.pdf.

missile that was "pre-programmed to crash" and explode "after a set duration,"[17] as well as continued British and American development of remote-controlled target aircraft.[18] In the post-World War II era, UAVs began to be used during the Cold War for reconnaissance purposes, with American "Lightning Bug," D-21 and "Combat Dawn" spy UAVs flying missions over China, North Korea, Vietnam and the Soviet Union.[19] Eventually, in the 1990s, UAV technology grew sufficiently advanced to marry reconnaissance functions with the weaponization previously monopolized by armed combat aircraft—leading to the development of joint offense and reconnaissance UAVs, such as the MQ-1 "Predator" and MQ-9 "Reaper."[20] These military advancements occurred in conjunction with civilian applications of uncrewed flight technology, from early radio-controlled model airplanes, to commercial airline "autopilot" systems, to modern personal/commercial small UAVs.

While contrary to public perception, UAVs have a long history, there are several aspects of the modern UAV equation that represent revolutionary changes to the previous use and regulation calculus of UAVs. The first is the dramatic technological advance of UAVs and the significant expansion of their capabilities. Advanced military UAVs, such as the US remotely-piloted MQ-9 "Reaper," are capable of flying for fourteen hours or more "while carrying up to 3,000 pounds" of weaponry that can be launched at the touch of a button.[21] On the civilian side, the use of remote piloting technology to transport cargo or even passengers on commercial airliners or cargo planes modified into UAVs is becoming more and more viable.[22] The second major change is the radically reduced cost of UAV

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[17] Scott, *supra* note 11, at 4.

[18] *See* HODGKINSON & JOHNSTON, *supra* note 11, at 6-7.

[19] Thomas P. Ehrhard, Air Force UAVs: The Secret History, 8-13 (July 2010)(Mitchell Institute for Airpower Studies) https://apps.dtic.mil/dtic/tr/fulltext/u2/a525674.pdf.

[20] *Id.* at 49-53.

[21] DEP'T OF DEF., DEF. ACQUISITION MGMT. INFO. RETRIEVAL, *Selected Acquisition Report (SAR): MQ-9 Reaper Unmanned Aircraft System (MQ-9 Reaper)* 6 (Mar. 26, 2016), https://apps.dtic.mil/sti/pdfs/AD1019505.pdf.

[22] ICAO, UNMANNED AERIAL SYS. (UAS), CIR. 328 AN/190, 7 (2011), https://www.icao.int/Meetings/UAS/Documents/Circular%20328_en.pdf; Indeed, while recognizing that the technology for civilian passenger and cargo transport via UAVs should and will continue to "develop[] [and] mature," ICAO's chief concern with this practice is not technological viability but, rather, ensuring that such pilotless aircraft are "able to meet [the Organization's] defined standards and regulations."

technology—especially basic, "off the shelf" UAV systems. This factor is directly applicable to the proliferation of UAV use among non-state actors.

III. RELEVANT LAW

The legal basis of modern public international air law is the Chicago Convention on International Civil Aviation (the "Chicago Convention").[23] The international treaty, drafted in 1944 as the Second World War was drawing to a close, "recognized and codified certain principles of substantive international [aviation] law" and established ICAO.[24] While a full examination of the Chicago Convention's provisions is beyond the scope of this Article, a number of its Articles are either directly applicable to the topic of UAVs or provide the necessary legal underpinnings for addressing UAV-related issues. At the most basic level, the Chicago Convention establishes a State's "complete and exclusive sovereignty over the airspace above its territory,"[25] which is defined as "the land areas and territorial waters adjacent thereto under the sovereignty, suzerainty, protection or mandate of such State."[26] A State's right to sovereignty and control over its airspace provides the foundation from which a State may regulate its airspace, defend its airspace and territory from aerial threats, and limit types of aircraft, or aircraft from particular locations, from entering its airspace.

Article 3 of the Chicago Convention goes on to create a distinction between "state" and "civil" aircraft and specifies that the international regulatory regime established by the Chicago Convention will only apply to civil aircraft. In full, this Article states:

> a) This Convention shall be applicable only to civil aircraft, and shall not be applicable to state aircraft.
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> b) Aircraft used in military, customs and police services shall be deemed to be state aircraft.
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> c) No state aircraft of a contracting State shall fly over the territory of another State or land thereon without

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[23] *See generally* Chicago Convention, *supra* note 5.

[24] PAUL STEPHEN DEMPSEY, PUBLIC INTERNATIONAL AIR LAW 54 (2nd ed., 2017).

[25] Chicago Convention, *supra* note 5, at art. 1.

[26] *Id.* at art. 2.

> authorization by special agreement or otherwise, and in accordance with the terms thereof.
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> d) The contracting States undertake, when issuing regulations for their state aircraft, that they will have due regard for the safety of navigation of civil aircraft.[27]

As Jiri Hornik notes, when the Chicago Convention was adopted in 1944, there were two primary reasons for this distinction. First, "[i]t was believed . . . that there was a clear border between civil and military aviation and that there was no need to regulate the latter internationally due to its being a means for the exercise of sovereign state power."[28] Second, it was theorized that "state aviation [would] rarely [be] involved in international navigation"—a theory that has largely been disproven since 1944, as "international [air] navigation [now] constitutes a significant part of day-to-day state operations."[29]

Although Article 3 makes clear that the provisions of the Chicago Convention will not apply to "state" aircraft, the distinction between "state" and "civil" aircraft is one that has bedeviled States, practitioners of international aviation law, and even ICAO itself. While Article 3(b) stipulates that "military, customs, and police" aircraft shall be deemed state aircraft, no definition of either "state aircraft" or "civil aircraft" is provided in the Convention. The Convention text does not make clear whether the three examples of "state aircraft" it provides constitutes an exhaustive or unexhaustive list.[30] Fifty years after the drafting of the Chicago Convention, in 1994, ICAO's Legal Committee was still wrestling with the distinction, recommending that "all aircraft used in military, customs or police services, shall be considered as state aircraft" (with additional recommendation regarding how to determine whether an aircraft is used for these purposes), while "all other aircraft shall be considered to be civil aircraft."[31] While state vs. civil distinctions

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[27] *Id.* at art. 3

[28] Jiri Hornik, *Article 3 of the Chicago Convention*, 26 ANNALS AIR & SPACE L. 110, 114 (2001)

[29] *Id.* at 115.

[30] Chicago Convention, *supra* note 5, at art. 3. *See also* Hornik, *supra* note 28, at 117.

[31] LEGAL COMM., ICAO, *Secretariat Study on "Civil/State Aircraft,"* Working Paper Presented by the Secretariat, LC/29-WP/2-1, 29th Sess., 16 (July 15, 1994). In this same document, the Legal Committee also stipulated that "in determining whether an aircraft

sometimes remain in certain rare instances—particularly, as one 2015 ICAO Legal Committee working paper stated, for "aircraft used for unusual purposes"[32]—this definition has largely sufficed for distinguishing types of aircraft.

A key (and somewhat grim) reason that distinguishing between state and civil aircraft is important lies in Article 3*bis* of the Chicago Convention.[33] Article 3*bis*, one of the Convention's few actual amendments, was adopted in the wake of the Soviet Union's shooting down of a civilian airliner, Korean Airlines Flight 007, in September 1983.[34] The Article prohibits States' use of weapons against civil aircraft, stipulating that "every State must refrain from resorting to the use of weapons against civil aircraft in flight and that, in case of interception, the lives of persons on board and the safety of aircraft must not be endangered."[35] This prohibition, however, does not affect rights/obligations, such as the inherent right to self-defense, a State otherwise has under international law.[36] Additionally, Article 3*bis* stipulates that contracting States must take measures "to prohibit the deliberate use of any civil aircraft registered in that State or operated by an operator who has his principal place of business or permanent residence in that State for any purpose inconsistent with the aims of this Convention."[37]

It should be noted that the provisions of an amendment to the Chicago Convention only impose obligations on those States that have accepted and ratified the amendment—*unless* such an amendment simply codifies a legal principle already recognized as customary international law. The vast majority of signatories to the

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is used in military, customs and police services, the parties concerned should take into account all the surrounding circumstances," to include such factors as the aircraft's "operator," "the nature of the cargo" carried by the aircraft, whether the aircraft is State or privately owned, the type of "passengers or personnel carried" on the aircraft and the "nature of its crew," the "secrecy of the flight," the aircraft's "area of operation," and whether the aircraft is actually carrying the documentation required of civil aircraft by the Chicago Convention. *Id.* at 14, 16.

[32] LEGAL COMM., ICAO, *State/Civil Aircraft Definition and Its Impact on Aviation*, Working Paper Presented by Poland, et al., 1, LC/36-WP/2-6, 36th Sess. (Dec. 3, 2015).

[33] Chicago Convention, *supra* note 5, at art. 3*bis*.

[34] Sompong Sucharitkul, *Procedure for the Protection of Civil Aircraft in Flight*, 16 LOY. L.A. INT'L & COMP. L.J. 513, 515-16 (1994).

[35] Chicago Convention, *supra* note 5, at art. 3*bis*(a).

[36] *Id.* ("This provision shall not be interpreted as modifying in any way the rights and obligations of States set forth in the Charter of the United Nations.").

[37] *Id.* at art. 3*bis*(d).

Chicago Convention have ratified Article 3*bis*, including many of the States currently likely to be threatened by (and, perhaps, to sponsor) non-state actor UAV use, such as Iran, Iraq, Israel, the Russian Federation, Saudia Arabia, the Syrian Arab Republic and Yemen.[38] The US, however, has not. Practically, the non-ratification by the US may have little affect; as some commentators have pointed out, US "practices suggest that it nevertheless feels bound by the rules stipulated in article 3bis [sic]."[39] Further, the US may, indeed, view the prohibition on use of force against civil aircraft as a matter of customary international law. This seems to have been the position of the US delegate to the ICAO Assembly during the drafting debate for Article 3*bis*, who, commenting on US support for utilizing the word "recognize" in Article 3*bis*, paragraph (a), stated that the "purpose of [the] Assembly was to *codify existing principles of international law"* rather than create new ones.[40] Regardless of the US' true position on the use of force against civil aircraft, its non-ratification of Article 3*bis* makes it one of the few Chicago Convention member States to fail to agree to this amendment.

As we will see below, analyzing whether non-state actor UAVs qualify as "state" or "civil" aircraft under ICAO's quasi-definition and its associated factors elicits interesting, and somewhat conflicting, conclusions regarding the civil vs. state aircraft status of non-state actor UAVs. However, Article 8 of the Chicago Convention negates some of the practical effects of such an analysis by, essentially, *treating all UAVs in a manner similar to state aircraft*. Article 8 stipulates:

> No aircraft capable of being flown without a pilot shall be flown without a pilot over the territory of a contracting State without special authorization by that State and in accordance with the terms of such authorization. Each contracting State

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[38] *See* ICAO North American, Central American, & Caribbean Office, Fifth North American, Central American and Caribbean Directors of Civil Aviation Meeting (NACC/DCA/5), Working Paper, NACC/DCA/5—WP/09 (Apr. 8, 2014).

[39] Robin Geiß, *Civil Aircraft as Weapons of Large-Scale Destruction: Countermeasures, Article 3BIS of the Chicago Convention, and the Newly Adopted German "Luftsicherheitsgesetz,"* 27 MICH. J. OF INT'L L. 227, 228 (2005).

[40] ICAO ASSEMBLY 25TH SESSION (EXTRAORDINARY), *Executive Committee: Report, Minutes and Documents*, 44 ICAO Doc. 9438, A25-EX/4 (1984) https://www.icao.int/Meetings/a38/Documents/10024_en.pdf (emphasis added).

> undertakes to insure that the flight of such aircraft without a pilot in regions open to civil aircraft shall be so controlled as to obviate danger to civil aircraft.[41]

The language of Article 8 mirrors the language of Article 3(c), addressing overflight by State aircraft, with respect to the necessity of a "special authorization" for the overflight of UAVs (which, as we have seen above, constitute "pilotless aircraft" for the purposes of Article 8).

Given its language, was Article 8 meant to classify "pilotless aircraft" as "state aircraft"? This is a matter of some debate. Some authors have pointed to Article 8's comparative language to argue that the "drafters of the Chicago Convention recognised [sic] that 'pilotless aircraft' are not civil aircraft"[42] —i.e. if "aircraft without a pilot" must be "so controlled as to obviate danger to civil aircraft,"[43] does this imply a definitional distinction between "pilotless" and "civil" aircraft? Whether any such distinction was actually intended in the mid-1940s, it is clear that ICAO does not agree with such academic attempts to infer a non-civil aircraft status for UAVs. As UAV technology offers "new and improved civil/commercial applications," while also necessitating rules "ensuring the safety of . . . other airspace user[s] as well as the safety of persons and property on the ground,"[44] ICAO has been clear on its position that portions of the existing Chicago Convention regulatory framework are applicable to civil UAVs and that the Organization has both the right and the duty to create standards and recommended practices (SARPs) governing their use.[45]

IV. ANALYSIS

In analyzing the application of public international air law to the issue of non-state actor UAV use, it is necessary to determine, first, that non-state actor UAVs do, in fact, constitute civil aircraft

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[41] Chicago Convention, *supra* note 5, at art. 8.

[42] Fernando Fiallos, *"The Applicability of the Public International Air Law Regime to the Operation of UAS," in* THE LAW OF UNMANNED AIRCRAFT SYSTEMS: AN INTRODUCTION TO THE CURRENT AND FUTURE REGULATION UNDER NATIONAL REGIONAL AND INTERNATIONAL LAW 32 (Benjamyn I. Scott, ed. 2016).

[43] *Id.*

[44] ICAO, *supra* note 22, at iii and 4.

[45] *Id.* at 3-6, 11-14.

under the purview of the Chicago Convention and ICAO. This section will begin by examining this issue, before moving on to discuss the consequences of a civil aircraft classification for non-state actor UAVs under Article 3*bis* of the Chicago Convention. Possible lawful methods of responding/interdicting such UAVs will be discussed, and conclusions drawn.

A. Non-State Actor UAVs: State or Civil Aircraft?

As Part III noted, the vast majority of public international air law as elaborated in the Chicago Convention, as well as ICAO's ability to promulgate standards and regulations, only applies to civil aircraft and civil aviation.[46] This includes, Article 3*bis* of the Chicago Convention, prohibiting the use of weaponry against civil aircraft. For this reason, any discussion of State response to non-state actor UAV use must first address whether UAVs employed by non-state actors such as transnational terrorist groups are—or should be treated as—state or civil aircraft.

At first glance, the question seems to be a simple one. The very concept of a non-state actor entails a lack of ties or "affiliation[s] to [the] established institutions of a state." How, then, could an aircraft of any type utilized for any purpose by a non-state actor ever be considered a state aircraft? Would this not be a definitional impossibility—akin to describing something as a round square or an angled circle?

The analysis becomes a bit harder, however, when one considers ICAO's characterization that "all aircraft used in military, customs or police services, shall be considered as state aircraft" and the Organization's factors for analyzing whether an aircraft is, in fact, used in these areas. While most non-state actors cannot satisfy even the most basic of State attributes under international law,[47] many—and certainly the most dangerous, such as al-Qaeda, the Islamic State, and Hezbollah—can, and have, used aircraft for military purposes. As the terrorist attacks of September 11, 2001; the 2006 war in Lebanon between Israel and Hezbollah; and the rise of the Islamic State in Iraq and Syria between 2009 and 2017

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[46] *See* Chicago Convention, *supra* note 5, at art. 3.

[47] *See* Seth G. Jones, *Rolling Back the Islamic State,* RAND CORP. (2017), https://www.rand.org/content/dam/rand/pubs/research_reports/RR1900/RR1912/RAND_RR1912.pdf.

demonstrate, certain non-state actors can bring as much—or more—military force to bear than even some modern militaries. This includes militarized, and innovative, use of UAVs.

In an analysis of UAV use by groups such as Hezbollah and the Islamic State, the factors associated with ICAO's quasi-definition of state aircraft show that these UAVs appear to satisfy a significant number of the factors used to determine whether an aircraft is engaged in "military services."[48] Although such UAVs are owned and operated by "private" actors, they are engaged in traditionally military activities: surveillance, reconnaissance, and offensive air-to-ground attack. The Islamic State, for instance, utilized low-cost commercial drones for a wide range of military activities, including surveilling enemy defenses, guiding suicide bombers to their targets, and assisting with mortar targeting,[49] as well as kinetic attacks through both kamikaze[50] and bomb-release explosive methods.[51] As the Islamic State example shows, ICAO's "nature of the cargo" carried by the aircraft (which could also be logically expanded to "nature/use of the flight"), "secrecy of the flight," "aircraft registration and nationality markings," aircraft "area of operation" and "required documentation" factors all cut in favor of classifying an Islamic State UAV as a state aircraft. Similar analyses would apply for military-oriented UAV use by other terrorist organizations or non-state actors like Yemen's Houthis: such UAVs are used for traditional military purposes, will typically be flown secretly (for the purpose of catching enemies off-guard), may be flying in conflict zones or other areas that would otherwise be restricted for civil aircraft and will almost assuredly *not* be carrying the documentation required of civil aircraft. Based on even ICAO's factor-oriented analysis for determining "military service," then, it seems that UAVs used by terrorist or other armed non-state actors qualify as being "used in military service"—and, thus, would qualify as state

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[48] *See* LEGAL COMM., *supra* note 31, at 14.

[49] Don Rassler, *The Islamic State and Drones: Supply, Scale, and Future Threat,* COMBATING TERRORISM CTR., 3 (July 11, 2018), https://ctc.usma.edu/wp-content/uploads/2018/07/Islamic-State-and-Drones-Release-Version.pdf.

[50] David Grossman, *ISIS Using Kamikaze Drones in Iraq*, POPULAR MECH. (Oct. 12, 2016), https://www.popularmechanics.com/military/weapons/a23350/isis-using-kamikaze-drones-in-iraq/.

[51] Rassler, *supra* note 49, at 3.

aircraft were it not for the fact they are not being operated by traditionally-recognized States.

The analysis in the previous paragraph notwithstanding, when the Chicago Convention was drafted in 1944, the problem of powerful non-state actors with the ability to utilize aircraft for military purposes was largely non-existent. States at that time maintained a monopoly on the use and application of aerial force for "military, customs, and police services." Given that the Chicago Convention seems to pre-suppose an internationally-recognized State (one with all the rights and attributes of a State under international law) operating a "state aircraft," it seems unlikely that aircraft use (whether crewed or uncrewed) by a non-state actor, regardless of the purpose of that use and no matter how militarily damaging, could be interpreted as drawing such an aircraft into the realm of a state aircraft for the purposes of the Chicago Convention.

B. Article 3bis and Use of "Weapons" Against Non-State Actor UAVs

It is tempting to dismiss the analysis of whether a non-state actor UAV is a State or civil aircraft as a purely academic exercise. As we have seen, above, however, this distinction has a number of important consequences, and none are more significant than its practical effects under Article 3*bis* of the Chicago Convention. Indeed, should a State find itself in a position in which it must respond to a non-state actor UAV incursion or attack, the classification of that UAV as a civil aircraft will limit that State's ability to respond, and, potentially, to defend itself, without violating its treaty obligations. Article 3*bis*, as noted above, prohibits the use of weapons "against civil aircraft in flight" and requires that "in case of interception, the lives of persons on board and the safety of aircraft must not be endangered."[52] Thus, by the plain language of the Article, using anti-aircraft guns, small arms, air-to-air interceptors, or any other weapons to shoot down or destroy a non-state actor UAV is prohibited *if* such a UAV is classified as a civil aircraft.

What, then, can a State that has ratified Article 3*bis* do to defend itself against the threat of non-state actor UAV use? If destruction of a non-state UAV is prohibited, are other methods of

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[52] Chicago Convention, *supra* note 5, at art. 3*bis*(a).

countering a UAV threat permissible? The answer may lie in Article 3*bis* (a)'s second clause, regarding aircraft interception. If a crewed aircraft can be lawfully intercepted so long as the lives of its crew and passengers are protected and the safety of the aircraft itself is not endangered, it follows that a non-state actor UAV (which, will have neither crew nor passengers) may also be lawfully intercepted so long as the UAV itself is not damaged.

While a crewed aircraft can be directed by civilian or military air traffic controllers, or shepherded to an airport by military fighters, a UAV will not, itself, respond to such stimuli. Further, contacting or communicating with its operator (if the UAV is remotely piloted rather than autonomous) may be difficult or impossible. As one author notes, "a rogue [UAV] can be intercepted only . . . by blocking signals, hacking to assume control, or physically disabling it."[53] Excluding destructive methods of physically disabling a UAV, a number of creative solutions have been developed to counter or interdict UAVs. These solutions typically involve either some form of electronic interference with a hostile or unlawful UAV, or the application of physical restraint, such as the capture of such a UAV in a net.

Among the first category of counter-UAV methods is geo-fencing, or, as some organizations characterize it, "geo-limitation." The European Aviation Safety Agency (EASA) defines "geo-limitation" as "any limitation applied to a UAS [i.e. uncrewed aerial system] to constrain the uncrewed aircraft access to or exit from a defined zone or airspace volume."[54] These limitations are programmed into a UAV's operating software and use Global Positioning System (GPS) data to establish the defined zones (such as the airspace over military bases or certain prescribed radii around commercial airports) described by the EASA.[55] Should a UAV approach the perimeter of

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[53] Deepika Jeyakodi, *Cyber Security, in* THE LAW OF UNMANNED AIRCRAFT SYSTEMS: AN INTRODUCTION TO THE CURRENT AND FUTURE REGULATION UNDER NATIONAL, REGIONAL AND INTERNATIONAL LAW 75 (Benjamyn I. Scott, ed. 2016**).**

[54] EUR. AVIATION SAFETY AGENCY , EASA/NATIONAL AVIATION AGENCY TASK FORCE, REPORT: STUDY AND RECOMMENDATIONS REGARDING UNMANNED AIRCRAFT SYSTEMS GEO-LIMITATIONS (Sept. 2, 2016), at 55, https://www.easa.europa.eu/sites/default/files/dfu/GTF%20-%20Report_Issue2.pdf.

[55] *See* Drew Dixon, *Geofencing Stops Drones in Their Tracks,* GOV'TTECH.COM (Aug. 1, 2017), https://www.govtech.com/public-safety/Geofencing-Stops-Drones-in-Their-Tracks.html.

such a restricted area, signals can be sent to the UAV's piloting system to take evasive action and, should the UAV fail to change course, some geo-fencing or geo-limitation systems can send a "flight termination" signal to the UAV, "cutting off [its] mechanical operations" and forcing it to land.[56] Geo-fencing has been proposed both as a counter-UAV safety measure and, more generally, as a possible method of creating an over-arching "traffic management system" for commercial/civil UAVs.[57]

One significant problem with geo-fencing, however, is that it requires geographic limitation to be pre-programmed into the software of a given UAV.[58] Thus, UAVs that lack this programming or that have had their programming altered or overridden will not necessarily recognize or respond to geo-fencing limitation.[59] Several other forms of electronic interference can address this problem. First, assuming that a rogue or unlawful UAV could be detected prior to causing damage or completing its mission, a computer-savvy defender could exploit cyber vulnerabilities in the UAV's software. This could be done in a variety of ways, including by "jamming" the UAV, causing it to crash;[60] "spoofing" the GPS signal the

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[56] *Id.*

[57] *See* Parimal Kopardekar, NASA, *Safely Enabling Low-Altitude Airspace Operations: Unmanned Aerial System Traffic Management (UTM)*, ICAO Remotely Piloted Aircraft Systems Symposium Presentation (Mar. 24, 2015), https://www.icao.int/Meetings/RPAS/RPASSymposiumPresentation/Day%202%20Workshop%203%20ATM%20Integration%20Parimal%20Kopardekar.pdf.

[58] *See* Stefan A. Kaiser, *Small and Micro Unmanned Aircraft*, *in* THE LAW OF UNMANNED AIRCRAFT SYSTEMS: AN INTRODUCTION TO THE CURRENT AND FUTURE REGULATION UNDER NATIONAL, REGIONAL AND INTERNATIONAL LAW 23 (BENJAMYN I. SCOTT, ED. 2016); Dixon, *supra* note 55.

[59] Alexander Solodov, et al., *Analyzing the threat of unmanned aerial vehicles (UAV) to nuclear facilities*, U.S. DEP'T OF ENERGY, (Apr. 18, 2017), 9, https://www.osti.gov/pages/servlets/purl/1356834; In research sponsored by the United States Department of Energy's National Nuclear Security Administration, one of the authors' conclusions was that "geofencing technologies will more than likely only deter accidental intrusions and potential attacks by unsophisticated operators. Sophisticated operators capable of hardware assembly and firmware modifications will, more than likely, be able to overcome geofencing limitations."

[60] "Jamming" is "a type of intentional interference, involves overloading targeted radio frequencies with so much electronic noise communications cannot get through to their intended destination." Sarah M. Mountin, *The Legality and Implications of Intentional Interference with Commercial Communication Satellite Signals*, 90 INT'L L. STUD. 101, 104 (2014). Overloading a UAV's radio frequencies in this way can prevent it from maintaining connectivity with its operator, causing it to cease operation or enter a state of uncontrolled flight until it crash-lands. *See* Solodov, et al, *supra* note 59, at 9.

UAV is using to navigate;[61] or hacking the UAV's software in mid-flight to obtain control over the UAV. Of these methods, spoofing and hacking may allow a counter-UAV operator to cause a rogue UAV to land at a particular location for recovery and inspection, similar to the interception and interdiction of a crewed aircraft.

With respect to the Article 3*bis* analysis, would these methods—geo-fencing, jamming, spoofing, or hacking—against a UAV (used by a non-state actor or otherwise) constitute the use of "weapons" against civil aircraft? As we saw above, given the language regarding "the safety of [the] aircraft [] not be[ing] endangered," it seems the answer will depend on whether these methods harm or damage the UAV. Of the electronic methods addressed above, spoofing and hacking are the least likely to constitute the use of "weapons," as these methods allow a counter-UAV operator a measure of control over the landing and recovery of the UAV. Indeed, the very point of these methods will likely be twofold: to both counter the threat a UAV may pose by interdicting it mid-flight and, subsequently, to land and examine the UAV in order to determine the reason it was approaching a restricted or other unlawful area. A similar analysis would likely apply to geo-fencing, at least assuming a "flight termination" signal sent to an offending UAV causes a controlled, rather than crash, landing. Jamming and similar methods of electronic interference with UAVs that cause them to fly erratically until crashing very well might constitute "weapons," as these methods could cause damage to, or the complete destruction of, the aircraft.

C. Article 3bis and the Right to Self-Defense

In the context of Article 3*bis*, one possible rejoinder to the civil/state aircraft debate with respect to non-state actor UAVs is that, regardless of their status, a State may be able to take action against such UAVs pursuant to its inherent right of self-defense

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[61] "Spoofing" involves the emission of "a usable but false signal . . . that mimics the characteristics of a true signal so the user receives a fake (or spoofed) signal." Mountin, *supra* note 60, at 129-130. Spoofing, particularly of GPS signals, can affect even the most sophisticated operators; for instance, "Iran's capture of a U.S. military drone in 2011 is widely believed to have resulted from a spoofing attack where the drone pilot accidentally landed the plane in Iran, believing it was landing at its base in Afghanistan." Frank Oliveri, *The Pentagon's GPS Problem*, CONG. Q. (Feb. 9, 2013), http://public.cq.com/docs/weeklyreport/weeklyreport-000004218242.html.

under Article 51 of the United Nations Charter.[62] As the text of Article 3*bis* makes clear, "the rights and obligations of States set forth in the Charter of the United Nations" are not abrogated by Article 3*bis*.[63] It is certainly true that, if provided with sufficient time and opportunity, a State is likely to respond militarily to a threatening UAV incursion. Regardless of what State practice is likely to be, would a non-state actor's malicious use of a UAV constitute an "armed attack" triggering a State's right of self-defense?

Particularly in the aftermath of the September 11, 2001, terrorist attacks, the majority of legal commentators would likely support the idea that non-state actor behavior can trigger a State's right of self-defense. As the International Law Association notes, "Self-defence is a right triggered by an act, rather than the actor. The source of attack does not change the fact that the State must be able to stop it from causing harm."[64] State practice, more so than codified international law, offers extensive support for this proposition. The famous 1837 *Caroline* incident, in which the British attacked and destroyed a private vessel (which had been providing aid to Canadian separatists) in US territorial waters is a textbook example of State use of force against a non-state actor justified by self-defense.[65] The *Caroline* case's justification has served, and continues to serve, as a model for the self-defense-based use of force against non-state actors. Myriad examples provide evidence of the legality of forceful self-defense against non-state actors on the basis of State practice; however, international law, too, appears to support the proposition. Analyses of Article 51's application to self-defense against non-state actors range from the simplistic (for

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[62] U.N Charter art. 51. Pursuant to Article 51, "[n]othing in the present Charter shall impair the inherent right of individual or collective self-defence if an armed attack occurs against a Member of the United Nations, until the Security Council has taken measures necessary to maintain international peace and security. Measures taken by Members in the exercise of this right of self-defence shall be immediately reported to the Security Council and shall not in any way affect the authority and responsibility of the Security Council under the present Charter to take at any time such action as it deems necessary in order to maintain or restore international peace and security." *Id.*

[63] Chicago Convention, *supra* note 5, art. 3*bis*

[64] INT'L L. ASS'N**,** *Final Report on Aggression and the Use of Force*, Sydney Conference (2018) at 14, http://www.ila-hq.org/images/ILA/DraftReports/DraftReport_UseOfForce.pdf.

[65] *See* Jordan J. Paust, *Self-Defense Targetings of Non-State Actors and Permissibility of U.S. Use of Drones in Pakistan*, 19 J. TRANSNAT'L L. & POL'Y 237, 241-44 (Spring 2010).

instance, that "nothing in the language of Article 51 restricts the right to engage in self-defense actions to circumstances of armed attacks by a 'state'"[66]) to the cerebral (arguments that an interpretation of Article 51 excluding self-defense against non-state actors would be "unduly narrow in both a pragmatic and normative sense"[67]). Innumerable articles and books have been written on the topic of self-defense against non-state actors, and a full analysis of the issue would well exceed the scope of this Article. Suffice to say, that, in the words of the International Law Association, "there is growing recognition . . . that there are certain circumstances in which a State may have a right of self-defence against non-state actors operating extraterritorially and whose attacks cannot be attributed to the host State."[68]

That the actions of a non-state actor can trigger a State's right to self-defense is not, however, completely unquestioned. Such mass-casualty events as September 11th notwithstanding, a number of international judicial rulings indicate that there is no inherent right to self-defense against non-state actors under international law. The International Court of Justice has examined the issue in a number of cases, including the *Case Concerning Military and Paramilitary Activities In and Against Nicaragua* (1986) and the *Case Concerning Armed Activities on the Territory of the Congo* (2005). In the *Military and Paramilitary Activities* case, the Court elaborated its famous "effective control" test, in which it found that an attack by "armed bands, groups, irregular[] [forces], or mercenaries" will constitute an "armed attack" triggering Article 51 rights of self-defense only if (1) these irregular forces were "[sent] by or on behalf of a State" (i.e. were effectively controlled by a State party), and (2) the attack was of such magnitude or "gravity" that it would amount to an armed attack were it conducted by regular military forces.[69] In the *Armed Activities* case, the Court reiterated

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[66] *Id.* at 241.

[67] Norman G. Printer, Jr., *The Use of Force Against Non-State Actors Under International Law: An Analysis of the U.S. Predator Strike in Yemen*, 8 UCLA J. INT'L L. & FOR. AFF. 331, 351 (Fall/Winter 2003). For a discussion of the of Printer's analysis that Article 51 does, and should, apply to non-state actor terrorist groups, *see id.* at 344-352.

[68] INT'L L. ASS'N, *supra* note 64, at 15.

[69] Case Concerning Military and Paramilitary Activities Against Nicaragua (Nicar. v. U.S.), 1986 I.C.J. 14, 211 (June 27) at 103, https://www.icj-cij.org/files/case-related/70/070-19860627-JUD-01-00-EN.pdf.

the "effective control" test, finding that military action taken by Uganda against non-state armed groups in the territory of the Democratic Republic of the Congo (DRC) was *not* legitimate self-defense because these armed groups had not been "sent by the DRC," nor were "[acting] on behalf of the DRC."[70] The *Armed Activities* case is particularly significant for the current discussion of non-state actor UAV use, because—much like some of the UAV-using terrorist and rebel non-state actors discussed above—the non-state armed groups that were the subject of Uganda's military incursion effectively controlled much of the ostensibly DRC territory in which they operated.[71]

Summarizing the legal concept of an "armed attack" as an inherently State action, and the application of this result to Article 3*bis*, academic Michal Klenka writes:

> While the concept in customary law may undergo dynamic changes, it may be concluded that according to *lex lata*, an 'armed attack' within the meaning of Article 51 of the UN Charter does not cover non-State actors. Unless it could be established that the attacks were acts of or on behalf of a State, they could not be considered as armed attacks, which give rise to the right of self-defence. The sole exception provided by Article 3 bis is not applicable. Based on the conclusion that an armed attack must be an act of a State, one may further argue that when a civil aircraft is misused by non-State actors as a weapon of destruction, such an act is not the act of a State and does not turn the aircraft into a state aircraft.[72]

The implication of this analysis is that a State would be prohibited from the use of weaponry to destroy a civil aircraft—including a threatening non-state actor UAV—under any and all circumstances. While this position may be internally consistent with the interpretation of Article 51 as applicable only in the context of State-on-State relations, it has the unsatisfying, and practically

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[70] Armed Activities on the Territory of the Congo (Dem. Rep. Congo v. Uganda), 2005 I.C.J. 168 (Dec. 19) at 223, https://www.icj-cij.org/files/case-related/116/116-20051219-JUD-01-00-EN.pdf.

[71] *See* Stephanie A. Barbour & Zoe A. Salzman, *"The Tangled Web": The Right of Self-Defense Against Non-State Actors in the Armed Activities Case*, 40 N.Y.U. J. INT'L L. & POL. 53, 55-57 (Special Issue 2008).

[72] Michal Klenka, *Aviation Safety: Legal Obligations of States and Practice*, 10 J. TRANSP. SEC. 3, 127, 136 (Dec. 2017).

self-defeating, effect of emasculating State responses to aerial terrorism (or otherwise "military" aerial attack) by a non-state group. Does public international air law and the law of armed conflict really require a State to passively absorb an attack from a non-state actor's UAV and then, post-attack, seek a sufficient link between the non-state actor and the State from which the non-state actor's attack originated to justify self-defense-based retaliation against that State? How would the attacked State be legally allowed to respond to such an attack if sufficient links between the non-state actor and the State of the attack's origin did not exist, as in many failed or partially failed States? These problems illustrate the difficulties in navigating a response to non-state actor UAV use, and, indeed, *all* non-state actor military activity, if Article 51's concept of self-defense is not applicable against non-state actors. Such difficulties demonstrate the wisdom of accepting the majority viewpoint that non-state actors can, under certain circumstances, be the proper subject of State military action justified on the basis of self-defense.

V. CONCLUSION

The foregoing legal analysis of public international air law and its applicability to non-state actor UAVs (and UAVs in a more general sense) has resulted in a number of conclusions. Specifically, as non-state actors likely cannot be classified as state aircraft, they must be classified as civil aircraft, which are protected under Article 3*bis*'s prohibition of weapon-use against civil aircraft. This conclusion, in turn, may legally limit States' responses to threatening non-state actor UAVs—particularly depending on interpretations of justifiable self-defense under international law.

That Article 3*bis* applies to non-state actor UAVs, and, more generally, to all UAVs utilized by non-states (corporations, private individuals, etc.) for civil purposes, seems legally justifiable based its text and associated provisions of the Chicago Convention. But this legal result leads to a policy question: *should* Article 3*bis*'s protections of civil aircraft apply to UAVs at all? At its most basic level, Article 3*bis* was drafted and approved in order to protect human lives—the lives of civilian passengers and aircraft crew members flying on a civil aircraft that could possibly be targeted by

weapons.[73] At this time, the vast majority of UAVs, and certainly those UAVs utilized by non-state actors, are completely uncrewed, carrying neither crew nor passengers. Should the destruction of such a UAV really carry the same legal weight as the shooting down of a passenger-filled civilian airliner like Korean Airlines Flight 007?

Given the significant threat posed by non-state actor use of UAVs, such as the dramatic reduction in Saudi Arabian oil production cited at the beginning of this Article, it would be wise for ICAO and the signatory States of the Chicago Convention to consider ways in which public international air law may be able to address such threats. This could involve the establishment of a clearer way in which to classify different types of UAVs as civil vs. state aircraft, or, perhaps, building upon the provisions of Article 8 of the Chicago Convention (which treat UAVs in a manner similar to state aircraft) to re-classify UAVs as an effectively new category of aircraft, expanding the binary state/civil aircraft classification system. For the moment, however, Article 3*bis* seems to present the most significant legal hurdle toward a standard method of responding to threatening UAVs. While States have developed, and are continuing to develop, methods of counter-UAV technology that may satisfy the requirement of safe interdiction of UAVs under Article 3*bis*, the development of UAV-specific provisions within the international aviation law regime is necessary to provide clarity to States' responses to threatening UAVs.

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[73] While it can certainly be argued that Article 3*bis*'s reference to the "safety of aircraft" implies a secondary purpose of protecting private property, the linkage between the "lives of persons on board" and the "safety of the aircraft" demonstrates, again, that the primary purpose is the protection of human life.

COMMENTARY

DRONE UTILIZATION IN A PANDEMIC AND BEYOND: FINDING THE BALANCE BETWEEN PUBLIC SAFETY AND PRIVACY

Editorial Team

I. INTRODUCTION

On March 13, 2020, President Trump declared a national emergency in the midst of the COVID-19 outbreak.[1] Since then, life, as Americans previously knew it, seemed to come to a standstill. Following the national emergency declaration, the Governor of California, Gavin Newsom, announced a state-wide "stay-at-home" order, which led to a domino effect of other states announcing similar orders.[2] American professional sports leagues, including the National Basketball Association, Major League Soccer and National Hockey League, suspended seasons with no return date set.[3] Universities and colleges across the United States (US) suspended in-person classes, instead opting for online-format class instruction,[4] with an estimated return date as early as August 2020 and as late as January 2021.[5] Non-essential businesses, which estimates show

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[1] Erin Schumaker, *Timeline: How Coronavirus Got Started,* ABC NEWS (Apr. 23, 2020), https://abcnews.go.com/Health/timeline-coronavirus-started/story?id=69435165.

[2] Anagha Srikanth, *This is Where Your State Stands on Reopening During the Coronavirus Pandemic,* THE HILL (Apr. 26, 2020), https://thehill.com/changing-america/well-being/prevention-cures/491064-which-states-have-told-residents-to-stay-home.

[3] Stephen Cannella, *Into the Great Big Emptiness,* SPORTS ILLUSTRATED (Mar. 26, 2020), https://www.si.com/sports-illustrated/2020/03/25/coronavirus-cover-podcast-ed-letter.

[4] Anya Kamenetz, *A Growing Number of U.S. Colleges Cancel Classes Amid Coronavirus Fears,* NAT'L PUB. RADIO (Mar. 9, 2020), https://www.npr.org/2020/03/09/813750481/more-than-20-colleges-cancel-in-person-classes-in-response-to-coronavirus.

[5] Amanda Woods, *Some Colleges Consider Canceling In-Person Classes Until 2021 Over Coronavirus,* N.Y. POST (Apr. 15, 2020), https://nypost.com/2020/04/15/some-colleges-consider-canceling-in-person-classes-until-2021/.

comprise twenty-five percent of the US economy, shut down operations.[6]

Most Americans were allowed to venture from their homes only with adherence to certain guidelines, including rules about social distancing and mask-wearing.[7] Sidewalks and store aisles became regulated like traffic with one-way signs and arrows.[8] Even so, Americans scrambled to grocery stores like Walmart,[9] buying toilet paper, sanitary products and protective gear at alarming rates, leading to a nationwide shortage.[10] The national shortage of protective gear negatively affected hospitals nationwide,[11] leaving doctors to revisit the ethical concerns of triage plans, reserved for natural disasters or pandemics, to decide what COVID-19 patients would survive when ventilators ran out.[12] New Jersey Judge John E. Jones III described the pandemic as a global rampage "altering the landscape of everyday American life in ways previously

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[6] Josh Mitchell, *State Shutdowns Have Taken at Least a Quarter of U.S. Economy Offline,* WALL ST. J. (Apr. 5, 2020), https://www.wsj.com/articles/state-coronavirus-shutdowns-have-taken-29-of-u-s-economy-offline-11586079001.

[7] *See* Dartunorro Clark, *Trump Tells Governors He Is Setting New Coronavirus Social Distancing Guidelines,* NBC NEWS (Mar. 26, 2020), https://www.nbcnews.com/politics/white-house/trump-tells-governors-he-setting-new-coronavirus-Guidelines-n1169751; Sophis Ankel & Connor Perrett, *More than 20 US States are now requiring residents to wear face masks when in public,* BUS. INSIDER (Jul. 11, 2020), https://www.businessinsider.com/coronavirus-the-17-states-requiring-people-to-wear-masks-public-2020-6.

[8] Margaret Krauss, *One-Way Sidewalks and Parking Lot Dining Rooms: Is this the Future?,* NAT'L PUB. RADIO (May 8, 2020), https://www.npr.org/sections/coronavirus-live-updates/2020/05/08/852222980/one-way-sidewalks-and-parking-lot-dining-rooms-is-this-the-future.

[9] Sarah Nassaeur, *Walmart's Coronavirus Challenge is Just Staying Open,* WALL ST. J. (Apr. 18, 2020), https://www.wsj.com/articles/walmarts-coronavirus-challenge-is-just-staying-open-11587221657.

[10] Ana Swanson, *Global Trade Sputters, Leaving Too Much Here, Too Little There,* N.Y. TIMES (Apr. 10, 2020), https://www.nytimes.com/2020/04/10/business/economy/global-trade-shortages-coronavirus.html.

[11] Andrew Jacobs, Matt Richtel & Mike Baker, *'At War With No Ammo': Doctors Say Shortage of Protective Gear Is Dire*, N.Y. TIMES (Mar. 19, 2020), https://www.nytimes.com/2020/03/19/health/coronavirus-masks-shortage.html.

[12] Mike Baker & Sheri Fink, *At the Top of the Covid-19 Curve, How Do Hospitals Decide Who Gets Treatment?*, N.Y. TIMES (Mar. 31, 2020), https://www.nytimes.com/2020/03/31/us/coronavirus-covid-triage-rationing-ventilators.html.

unimaginable."[13] He acknowledged the forced economic and educational standstills implemented to combat a global pandemic including, among other things, government orders: demanding "non-essential" workers to stay at home; students to attend school remotely; and schools to shorten their academic calendar. All of which were deemed necessary to flatten the curve and save lives.[14]

Certainly, the COVID-19 crisis offers an opportunity for reflection regarding the intersection of community, personal freedom and public health and safety. As the public searches for an answer on how to return to normalcy – or what a new normal may look like – a number of emerging technologies provide opportunities for the public and private sectors to provide services in ways that adhere to social distancing guidelines and minimize the need for human contact. In particular, one emerging technology has been vital to completing tasks that ordinarily require face-to-face contact: drones.

The last few years have witnessed a growing understanding of the utility of drones. From property surveillance to emergency response to construction inspection,[15] drones can be deployed to places that would otherwise be difficult, or unsafe, for humans to tread. The COVID-19 crisis has exponentially increased potential uses as more and more companies and individuals are embracing drone delivery, both in vast and sparsely populated areas of Africa,[16] and suburban neighborhoods through the US.[17]

Yet as some drone activities have been welcomed, others have been feared. Drone deliveries require cameras. And cameras can be invasive. Even more troubling to some, drones can be fitted with all

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[13] Thakker v. Doll, 451 F. Supp 3d 358, 363 (M.D. Pa. 2020). Note that at the time this of writing COVID-19 infected 719,700 people worldwide and killed more than 33,673.

[14] *Id.*

[15] Aaron Pressman, *Drone Industry Flies Higher as COVID-19 Fuels Demand for Remote Services,* FORTUNE (July 13, 2020), https://fortune.com/2020/07/13/coronavirus-drones-dji-wing-flytrex-covid-19-pandemic/.

[16] Katie Prescott & Sarah Treanor, *Drones in Africa: How They Could Become Lifesavers,* BBC NEWS (Apr. 7, 2020), https://www.bbc.com/news/business-51837296#:~:text=Rwanda%2C%20the%20country%20of%20a,thousands%20of%20units%20of%20blood.

[17] Sean Captain, *Wing's Drone Delivery Services Are Booming Worldwide,* DRONE DJ (May 25, 2020), https://dronedj.com/2020/05/25/wings-drone-delivery-services-are-booming-worldwide/.

sorts of technology, including thermal imaging technology, which can, in some cases, determine from a distance if an individual has a fever.

The purpose of this Commentary is to support the continued innovation and use of drones. The authors believe that concerns about privacy could potentially create unnecessary roadblocks to the important evolution of technology that may be implemented by drones and seek to address those concerns without compromising Constitutionally protected expectations of privacy. Ultimately, the authors believe that industry and regulators must work together to increase public awareness and understanding so that drones may be responsibly integrated into the national air space and their full potential realized.

Part II of this Commentary takes a look at how drones are being used during the COVID-19 pandemic. Part III reviews the US Constitution's Fourth Amendment which encapsulates individual protection against government activity. Part IV reviews the intersection of health and privacy laws, and Part V synthesizes the discussion and provides insight as to how knee-jerk privacy pitfalls can be avoided, and how public health and safety can be properly balanced against privacy concerns.

II. DRONE TECHNOLOGY USES DURING COVID-19

Drones provide a unique advantage to the public and private sectors that was not widely understood prior to COVID-19: a method of providing services in a fast and reliable manner that requires zero human-to-human contact.[18] Drones have proven very effective and efficient when delivering vaccines, medical supplies and other biopharmaceutical samples to regions limited by geographical constraints.[19] In low-and-middle income countries, drones have been incorporated in immunization programs because they reduce labor costs, which slightly improve vaccine availability

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[18] Christopher Mims, *The Scramble for Delivery Robots Is On and Startups Can Barely Keep Up*, WALL ST. J. (Apr. 25, 2020), https://www.wsj.com/articles/the-scramble-for-delivery-robots-is-on-and-startups-can-barely-keep-up.

[19] *Drones,* UNICEF OFF. OF INNOVATION, https://www.unicef.org/innovation/drones (last visited Aug. 4, 2020).

to the targeted population.[20] For example, in April 2019, Gavi, the Vaccine Alliance announced that it would expand its medical drone network into Ghana with the help of Zipline drones.[21] The partnership would serve approximately twelve million people in Ghana (2,000 health facilities) making it the world's largest vaccine delivery network.[22] Similarly, in Rwanda, twelve hospitals located in the eastern part of the country receive over 5,500 units of blood, platelets and plasma by drone delivery.[23] Once a drone is within its preprogrammed destination, it notifies the doctor with a text and drops the package by parachute.[24] As a result, Rwanda has seen a decrease in "stored, wasted and spoiled blood."[25] In a drone-medical study conducted by John Hopkins pathologist, Dr. Amukele, researchers carried biological samples stored in a temperature-controlled chamber across 160 miles of Arizona desert (approximately three hours flight).[26] Analysis revealed that the flown-drone samples were comparable to the samples transported by vehicle (non-flown samples).[27] However, the non-flown samples did show a slight decrease in glucose and potassium levels, which Amukele attributed to a "lack of careful temperature control."[28] In China, drones are being utilized to broadcast updates to citizens, deliver critical supplies, disinfect spaces of public gathering and manage

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[20] John Hopkins Bloomberg School of Public Health, *Using Drone to Deliver Vaccines Could Save Money in Developing Countries*, ELSEVIER CONNECT (June 24, 2016), https://www.elsevier.com/connect/using-drones-to-deliver-vaccines-could-save-money-in-developing-countries; *See also* Leila A. Haidari et al., *The Economic and Operational Value of Using Drones to Transport Vaccines*, 34 VACCINE 4062-67 (Jul. 25, 2016), https://doi.org/10.1016/j.vaccine.2016.06.022.

[21] *Ghana Launches the World's Largest Vaccine Drone Delivery Network*, GAVI (Apr. 24, 2019), https://www.gavi.org/news/media-room/ghana-launches-worlds-largest-vaccine-drone-delivery-network.

[22] *Id.*

[23] Kelly Daly, *The Future is Here: How Drones are Modernizing the Healthcare Industry*, LEGAL ISSUES AFFECTING SUPPLY CHAIN, 8, 2 https://medicalalley.org/wp-content/uploads/2018/04/Medical-Alley-Article-08-Drones-by-Daly-FINAL2.pdf..

[24] *Id.*

[25] *Id.*

[26] Michael Rucker, *The Potential of Drones Providing Health Services*, Subheading *Can Drones Carry Sensitive Biological Samples?*, VERY WELL HEALTH (Mar. 17, 2020), https://www.verywellhealth.com/potential-of-drones-providing-health-services-4018989?print.

[27] *Id.*

[28] *Ghana Launches the World's Largest Vaccine Drone Delivery Network*, *supra* note 21.

temperature check points.[29] In Ghana, fixed-wing drones are being used to transport COVID-19 test kits and personal protective equipment across terrain with inadequate infrastructure and low broadband capabilities.[30] In Sweden, an emergency response-centric drone company, Everdrone, is deploying drones with defibrillators attached to scenes of cardiac arrest — which increases the likelihood of survival for a victim of cardiac arrest by 60%.[31] In the US, Consumer Value Store (CVS), in partnership with United Parcel Service (UPS), is delivering prescriptions to elderly patients at a retirement community in The Villages, Florida.[32] CVS was able to increase production outcomes and decrease the risk of COVID-19 exposure to existing consumers by incorporating drones into their existing business plan.

Further, the American private sector has begun to use drones as a resource to disinfect areas of property.[33] For example, EagleHawk, a New York based drone services company, adjusted its business model to offer disinfectant services to stadiums and convention center-like facilities using drones that were previously used to spray crops with pesticide.[34] Another breakthrough has been the Aertos 120-UVC, the first indoor drone that uses c-band ultraviolet lights to thoroughly disinfect smaller, high-risk areas such as an operating room at a hospital.[35] There are other ways that drones have been utilized in the private sector as well. The construction

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[29] *Innovating to Fight COVID-19: Four Ways Drones are Contributing,* DJI ENTER., https://enterprise.dji.com/news/detail/fight-covid-19-with-drones (last visited May 26, 2020).

[30] Aryn Baker, *Drones Are Delivering COVID-19 Tests in Ghana. Could the U.S. Be Next?,* TIME (Apr. 22, 2020), https://time.com/5824914/drones-coronavirus-tests-ghana-zipline/.

[31] Miriam McNabb, *Defibrillators and Drones: Everdrone Deploys Life-Saving Technology,* DRONELIFE (May 15, 2020), https://dronelife.com/2020/05/15/defibrillators-and-drones-everdrone-deploys-life-saving-technology/.

[32] Steven Melendez, *Prescription Delivery by UPS Drone? CVS Customers in This Florida Retirement Community Can Try It,* FAST CO. (Apr. 27, 2020), https://www.fastcompany.com/90497492/prescription-delivery-by-ups-drone-cvs-customers-in-this-florida-retirement-community-can-try-it.

[33] Jason Reagan, *EagleHawk Disinfects Drones to Sanitize Facilities,* DRONELIFE (May 5, 2020), https://dronelife.com/2020/05/05/disinfectant-drones-eaglehawk/.

[34] Ann Thompson, *How Drones Are Being Used to Stop the Spread of COVID-19,* WVXU (May 25, 2020), https://www.wvxu.org/post/how-drones-are-being-used-stop-spread-covid-19#stream/0.

[35] *Aertos 120 UVC Indoor Disinfection Drone,* DIGIT. AERTOS, https://digitalaerolus.com/aertos-120-uvc-disinfection-drone/ (last visited Aug. 4, 2020).

industry has begun using drones to perform inspections, scan and analyze, carry out certain laborer tasks on-site, and monitor work sites.[36] While challenges persist, independent auditors are beginning to see the benefits of drones. As American Institute of Certified Public Accountants' Chief Auditor Bob Dohrer stated, auditors can use drones that have cameras to do remote inventory observations.[37] In the insurance industry, calls are beginning to be made for insurers to approve the utilization of drones by agents across the US.[38] Amidst a decrease in travel demand, airports are beginning to focus efforts on security measures to detect drones that may be a threat to the safety of crewed aircraft.[39]

Uncrewed aircraft provide a rare opportunity for tremendous research and development for the public sector as well.[40] Municipalities and states are beginning to utilize uncrewed aircraft in operations that, would the COVID-19 crisis had never begun, they would have previously balked at. For example, a school district in Virginia partnered with Wing to deliver summer reading books to students by drone.[41] State agencies, such as the North Carolina Department of Transportation,[42] are beginning to incorporate drones into the delivery operations of personal protective equipment, medicine, and food to vulnerable populations. Further, local police departments across the US are starting to utilize drone technology in

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[36] *The Rise of Drones in Construction,* DRONEDEPLOY (June 6, 2018), https://www.dronedeploy.com/blog/rise-drones-construction/.

[37] *Remote Auditing During Pandemic: Zoom and Drones*, THOMSON REUTERS TAX & ACCT. (Apr. 29, 2020), https://tax.thomsonreuters.com/news/remote-auditing-during-pandemic-zoom-and-drones/.

[38] Zoe Sagalow, *Insurers Call for Federal Fund to Help Coronavirus-Impaired Businesses,* ROLL CALL (Mar. 31, 2020), https://www.rollcall.com/2020/03/31/insurers-call-for-federal-fund-to-help-coronavirus-impaired-businesses/.

[39] James Rundle, *Airports Use AI to Detect Drones,* WALL ST. J. (June 16, 2020), https://www.wsj.com/articles/airports-use-ai-to-detect-drones-11592299800?mod=searchresults&page=2&pos=7.

[40] Chaim Gartenberg, *Social-Distancing Detecting 'Pandemic Drones' Dumped Over Privacy Concerns,* THE VERGE (Apr. 23, 2020), https://www.theverge.com/2020/4/23/21232592/connecticut-suburb-westport-pandemic-drones-draganfly-social-distancing.

[41] Marie Fazio, *Kept Out of the Library, a School District Tries Summer Reading by Drone,* N.Y. TIMES (June 17, 2020), https://www.nytimes.com/2020/06/17/us/google-wing-drones-virginia-books.html?searchResultPosition=7.

[42] *NCDOT Helping in Effort to Use Drones in COVID-19 Relief Efforts,* N.C. DEP'T OF TRANSP. (Apr. 22, 2020), https://www.ncdot.gov/news/press-releases/Pages/2020/2020-04-22-ncdot-drones-covid-19.aspx.

daily operations in a number of ways: to survey crowd sizes, to enforce social distancing guidelines and to distribute COVID-19 updates.[43]

In spite of the benefits that drones provide to the public and private sector, there are concerns about potential privacy and real property violations.[44] In 2012, over 100 organizations and experts filed a petition over their concerns about the threat drones pose to private and civil liberties.[45] When the Petition was denied, the Electronic Privacy Information Center (EPIC) filed a lawsuit against the Federal Aviation Administration (FAA). EPIC argued that drones pose a risk for a loss of privacy and "impair freedom of travel due to fears of constant monitoring."[46] However, the case was dismissed for "lack of standing."[47] Currently, there are still no federal standards for privacy protection from drones. However, eighteen states require law enforcement to obtain a search warrant to use drones for surveillance or to conduct a search.[48] Additionally,

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[43] *See generally* Jed Pressgrove, *Drones Become Part of Local U.S. Responses to COVID-19,* GOV'T TECH. (Apr. 22, 2020), https://www.govtech.com/products/Drones-Become-Part-of-Local-US-Responses-to-COVID-19.html; Mary Meisenzahl, *'We Are Trying To Save Lives, Not Be Big Brother': US Police Are Facing Backlash For Using 'Dystopian' Drones To Ask People To Stay Home,* BUS. INSIDER (Apr. 23, 2020), https://www.businessinsider.com/us-police-drones-enforce-coronavirus-stay-at-home-orders-2020-4.

[44] *Westport Police Said They Will Not Test 'Pandemic Drone' That Can Sense Fevers, Coughing,* NBC CONN. (Apr. 24, 2020), https://www.nbcconnecticut.com/news/local/westport-police-said-they-will-not-test-pandemic-drone-that-can-sense-fevers-cou
hing/2260023/.

[45] *Epic v. FAA: Challenging the FAA's Failure to Establish Drone Privacy Rules*, ELEC. PRIV. INFO. CTR., https://epic.org/privacy/litigation/apa/faa/drones; Jennifer M. Bently, *Policing the Police: Balancing the Right to Privacy against the Beneficial Use of Drone Technology*, 70 HASTINGS L.J. 249, 265 (2018).

[46] Elec. Privacy Info. Ctr. v. Fed. Aviation Admin., 892 F.3d 1249, 1253 (D.C. Cir. 2018).

[47] *Id*. at 1256.

[48] *See* ARK. CODE ANN. § 5-60-103 (West 2020); CAL. CIV. CODE § 1708.8 (West 2020)); FLA. STAT. ANN. § 934.50 (West 2020); KAN. STAT. ANN. § 60-31A02 (West 2020); LA. STAT. ANN. § 14:337 (2020); MICH. COMP. LAWS. ANN. § 259.322 (West 2020); MISS. CODE. ANN. § 97-29-61 (West 2020); NEV. REV. STAT. ANN. § 493.103 (West 2020); N.C. GEN. STAT. ANN. § 15A-300.1 (2020); OR. REV. STAT. ANN. § 837.380 (West 2020); 18 PA. STAT. AND CONS. STAT. ANN. § 3505 (West 2020); S.D. CODIFIED LAWS § 22-21-1 (2020); TENN. CODE ANN. § 39-13-903 (West 2020); TEX. GOV'T CODE ANN. § 423.003 (West 2020); UTAH CODE ANN. § 76-6-206 (West 2020).

Illinois and North Dakota have legislation requiring all drone footage, not relevant to an investigation be destroyed.[49]

At the moment, the ultimate concerns that people seem to have are for drones that have thermal imaging [50] In a time where considerations of public health are paramount, supporters advocate that drones with thermal imaging capabilities are beneficial to the capabilities of law enforcement.[51] In the wake of the death of George Floyd, police departments were under attack for using drones to survey protests that were occurring across fifteen cities in the US.[52] The criticism came from private organizations including the American Civil Liberties Union, a liberal organization, and Americans for Prosperity, a conservative organization.[53] In response to the criticism, Seattle and Los Angeles were forced to get rid of their drone programs due to growing public concern,[54] and the New York City Council passed a bill that required the New York City Police Department to disclose its usage of drones for aerial surveillance and the data it collects within the city limits.[55]

In addition, there have been at least two police departments in Florida and Connecticut that integrated fever-detecting drones into their daily operations, only to discontinue the initiative after backlash from the Electronic Frontier Foundation (EFF) and the American Civil Liberties Union (ACLU).[56] The EFF's main contention

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[49] See Matt Reynolds, *All-Seeing Eye Do Police Drones Foster Trust or Threaten Civil Rights and Privacy?*, ABA J. 18, 19 (June/July 2020).

[50] Alex Williams, *The Drones Were Ready for this Moment,* N.Y. TIMES (May 23, 2020), https://www.nytimes.com/2020/05/23/style/drones-coronavirus.html.

[51] Matthew Guarigla, *Using Drones to Fight COVID-19 is the Slipperiest of all Slopes,* ELEC. FRONTIER FOUND. (May 5, 2020), https://www.eff.org/deeplinks/2020/05/using-drones-fight-covid-19-slipperiest-all-slopes.

[52] Zolan Kanno-Youngs, *U.S. Watched George Floyd Protests in 15 Cities Using Aerial Surveillance,* N.Y. TIMES (June 19, 2020), https://www.nytimes.com/2020/06/19/us/politics/george-floyd-protests-surveillance.html?searchResultPosition=9.

[53] John McKinnon & Michelle Hackman, *Drone Surveillance of Protests Comes Under Fire,* WALL ST. J. (June 10, 2020), https://www.wsj.com/articles/drone-surveillance-of-protests-comes-under-fire-11591789477?mod=searchresults&page=2&pos=11.

[54] *Id.*

[55] Alan Feuer, *Council Forces N.Y.P.D. to Disclose Use of Drones and Other Spy Tech*, N.Y. TIMES (June 18, 2020), https://www.nytimes.com/2020/06/18/nyregion/nypd-police-surveillance-technology-vote.html?searchResultPosition=6.

[56] Charles Rabin, *Fever-Reading Drones Just First of a Wave of Privacy Challenges, Civil Liberties Advocates Say*, MIAMI HERALD (May 4, 2020), https://www.miamiherald.com/news/state/florida/article242370226.html.

was that "the government has failed to show that such cameras are sufficient [to determine] whether a person has a fever remotely."[57]

Taking into consideration the over 2,600 satellites orbiting Earth,[58] GPS/tracking devices, and appliances in homes all across the globe that listen to every word we say,[59] it is clear that privacy is eroding. This is troubling to the large percentage of American citizens who value their privacy above all else. It's a concern that is certainly not alleviated by the increasing popularity of drones.

Before the COVID-19 outbreak, a group of researchers conducted a study to learn how Americans felt about the use of drones in various aspects of everyday life.[60] They found that Americans felt uneasy about drones being used by law enforcement.[61] The unease was especially prevalent in minority communities that felt that the use of drones would make it easier for law enforcement to target them.[62] Moreover, people were more uneasy about drones being used by law enforcement or the government, compared to a company using it for business, or someone operating a drone as a hobby.[63] On top of that, rumors about the government considering using drones to contact trace or scan a crowd of people for fevers have escalated privacy concerns.[64] It would be reasonable to suspect that these historic events will increase the uneasiness the public feels about using drones and other advanced forms of technology by the government and/or law enforcement in the present and in the future.

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[57] Elec. Privacy Info. Ctr. v. Fed. Aviation Admin., 892 F.3d 1249, 1253 (D.C. Cir. 2018).

[58] *UCS Satellite Database*, UNION OF CONCERNED SCIENTISTS (updated Apr. 1, 2020) https://www.ucsusa.org/resources/satellite-database#:~:text=UCS%20Satellite%20Database,purpose%2C%20and%20other%20operational%20details.

[59] Grant Clauser, *Amazon's Alex Never Stops Listening to You, Should You Worry?*, N.Y. TIMES (Aug. 8, 2019), https://www.nytimes.com/wirecutter/blog/amazons-alexa-never-stops-listening-to-you/

[60] Stephen Rice, *Eyes in the Sky: The Public Has Privacy Concerns About Drones*, FORBES (Feb. 4, 2019), https://www.forbes.com/sites/stephenrice1/2019/02/04/eyes-in-the-sky-the-public-has-privacy-concerns-about-drones/#2b79a2126984

[61] *Id.*

[62] *Id.*

[63] *Id.*

[64] *Coronavirus Detecting Drones Stir Privacy Concerns*, TODAY SHOW (Apr. 23, 2020), https://www.today.com/video/coronavirus-detecting-drones-stir-privacy-concerns-82439749894?playlist=mmlsnnd_todayarchivesthursday

Although the EFF's main contention and the concerns of Americans in general should not be understated, the known benefits of using available, affordable technology that adheres to social distancing guidelines far outweighs the potential of abuse by public officials.[65] Both: 1) the evolving jurisprudence regarding Amendment IV of the US Constitution (4th Amendment); and 2) a broader look at the intersection of health and privacy are instructive in understanding the legal bounds of Constitutional privacy protections and public concerns about privacy in the US.

III. FOURTH AMENDMENT CONSIDERATIONS

A. What is Privacy?

Before we can consider how the Constitution protects privacy, we have to consider what privacy actually means. Writing in 1968, Harvard law professor Charles Fried observed that:

> The more insidious intrusions of increasingly sophisticated scientific devices into previously untouched areas, and the burgeoning claims of public and private agencies to personal information, have created a new sense of urgency in defense of privacy.[66]

Professor Fried concluded that privacy is:

> . . . control over knowledge about oneself. But it is not simply control over the quantity of information abroad; there are modulations in the quality of the knowledge as well. We may not mind that a person knows a general fact about us, and yet feel our privacy invaded if he knows the details.[67]

Thus, privacy is a concept. And a very fluid one at that. There is no redline between what is private and what is not private. It can mean different things to different people but above all it is about power and control. Thinking about privacy in terms of control, it is

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[65] *Social Distancing,* CTR. FOR DISEASE CONTROL AND PREVENTION, https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/social-distancing.html (last visited May 26, 2020).

[66] Charles Fried, *Privacy,* 77 YALE L.J. 475, 475 (1968)

[67] *Id.* at 483.

not difficult to understand the knee-jerk reaction to tangible hardware that is viewed as taking away control.

Our right to privacy flows from common law. But even under the law the concept of privacy, the rights it affords, is flexible. It is redefined from time-to-time as a result of social change, and as a result of technological advancements.

It is important to point out here, that although drones have their own unique characteristics, the technology they employ is largely "an amalgamation of technology that the Supreme Court previously analyzed.[68] Drones are simply new platforms for technologies like photography, thermal imaging and even fever detection.[69] It is just that these technologies can be used more easily and flexibly on a drone. As such, the discussion about privacy rights and 4th Amendment protections must consider both where a drone travels and what it can do.

B. Early Cases

In the US, an individual's privacy from government surveillance and intervention is encapsulated in the 4th Amendment. At the time of this writing, the United States Supreme Court has not had the opportunity to rule on the Constitutionality of a drone-based search or seizure or other utilization of drones by government agents[70] which can include "photographing traffic crash scenes, monitoring correctional facilities, tracking prison escapees, crowd control, and monitoring dangerous situations, among others."[71] Nevertheless, 4th Amendment jurisprudence, and the concept of privacy it protection, has evolved considerably as a result of technological developments.

According to the 4th Amendment,

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[68] Rebecca L. Scharf, *Game of Drones: Rolling the Dice with Unmanned Aerial Vehicles and Privacy*, 2 UTAH L. REV. 457, 460 (2018).

[69] Id.

[70] *See* Dan Gettinger, *Drones at Home: Public Safety Drones 2,* CTR. FOR THE STUDY OF THE DRONE AT BARD COLL. (2017), https://dronecenter.bard.edu/files/2017/04/CSD-Public-Safety-Drones-Web.pdf.

[71] Amanda Essex, *Taking Off: State Unmanned Aircraft Systems Policies 20,* NAT'L CONF. OF STATE LEGS. (2016), https://www.ncsl.org/research/transportation/taking-off-state-unmanned-aircraft-systems-policies.aspx.

> [t]he right of the people to be secure in their person, houses, papers, and effects against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched the persons or things to be seized.[72]

In other words, people have certain rights in respect of their privacy, that cannot be violated unless the government has a search warrant.

Since the beginning of the 20th century, the US Supreme Court has struggled to determine exactly what privacy is protected face of burgeoning technological advancement.[73] In 1928, the Court was faced with a case wherein

> [s]mall wires were inserted along the ordinary telephone wires from the residences of four of the petitioners . . . The insertions were made without trespass upon any property of the defendants.[74]

The Court held this warrantless search did not violate the Constitution because the 4th Amendment only protects against the "the search of material things—the person, the house, his papers or his effects."[75] Here, since there was no invasion of the home or the person, there was no violation of the Constitution. However, in his dissent, Justice Brandeis presciently looked to the future of evidence-gathering when he warned:

> In the application of a Constitution, our contemplation cannot be only of what has been, but of what may be. The progress of science in furnishing the Government with means of espionage is not likely to stop with wire-tapping. Ways may someday be developed by which the Government, without removing papers from secret drawers, can reproduce them in court, and by

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[72] U.S. CONST. AMEND IV.

[73] Scharf, *supra* note 68 at 475.

[74] Olmstead v. U.S., 277 U.S. 438, 456-7 (1928) *overruled in part by* Berger v. State of N.Y., 388 U.S. 41 (1967), and *overruled in part by* Katz v. United States, 389 U.S. 347(1967).

[75] *Id.* at 464.

> which it will be enabled to expose to a jury the most intimate occurrences of the home.[76]

In 1967, the Supreme Court revisited the concept of privacy when a petitioner challenged the admissibility of information obtained from an eavesdropping device placed on the outside of a public phone booth.[77] The Court overruled its earlier opinion and confirmed that the 4th Amendment "protects people, not places . . . what [a person] seeks to preserve as private, even in an area accessible to the public, may be constitutionally protected."[78] In his concurring opinion Justice Harlan explained that in order for privacy to be protected in any given instance, the "rule that has emerged from prior decisions is that there is a twofold requirement, first that a person have exhibited an actual (subjective) expectation of privacy and, second, that the expectation be one that society is prepared to recognize as 'reasonable.'"[79]

C. Aerial Surveillance

The Supreme Court has found aerial surveillance to be "reasonable" as required by the 4th Amendment. In *California v. Ciraolo,* officers, unable to see over the defendant's fence, used a private plane to fly over Ciraolo's yard to see if he was growing marijuana.[80] The Court recognized the yard as part of Ciraolo's private property but stated that this did not "bar all police observation."[81] Using *Katz*, the Court determined that the defendant's expectation of privacy in his backyard was unreasonable because we cannot expect law enforcement officers to cover their eyes from observations made while on an airplane flying in public airways.[82]

Three years later, the Court held that helicopter surveillance was also not an illegal search under the 4th Amendment.[83] In *Florida v. Riley*, the officers used a helicopter to see inside the defendant's greenhouse, which was missing several roof panels, making it

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[76] *Id.* at 474 (*quotations omitted).*
[77] Katz v. United Sta*tes*, 389 U.S. 347, 348 (1967).
[78] *Id.* at 351.
[79] *Id.* at 361.
[80] California v. Ciraolo, 476 U.S. 207, 215 (1986).
[81] *Id.* at 213.
[82] *Id.*
[83] Fla. v. Riley, 488 U.S. 445, 449-51(1989).

possible for the officers to see inside from the air.[84] The missing panels made the defendant's expectation of privacy unreasonable.[85] The Court noted that their decision might have been different if the surveillance had included the "intimate details of the home or curtilage."[86]

One could conclude from these two cases that an uncrewed aircraft would be treated the same as a crewed. A separate case involving aerial surveillance touched on the technology being utilized. In 1986, Dow Chemical Company argued that aerial photography, using a specially enhanced camera, conducted by the Environmental Protection Agency was a warrantless, and thereby unconstitutional "search."[87] Applying the *Katz* test, the Supreme Court found that while "Dow plainly has a reasonable, legitimate, and objective expectation of privacy within the interior of its covered buildings….[t]he mere fact that human vision is enhanced somewhat, at least to the degree here, does not give rise to constitutional problems."[88] Interestingly, the Court also found that

> [a]n electronic device to penetrate walls or windows so as to hear and record confidential discussions of chemical formulae or other trade secrets would raise very different and far more serious questions; other protections such as trade secret laws are available to protect commercial activities from private surveillance by competitors.[89]

The Supreme Court continues to wrestle with the privacy-related consequences of improving technology. In 2001 it recognized that "it would be foolish to contend that the degree of privacy secured to citizens by the Fourth Amendment has been entirely unaffected by the advance of technology."[90] In *Kyllo v. United States*, the Court determined that despite the lack of a physical trespass, using an infrared scanner to detect heat signatures in a residence from outside of the defendant's residence is considered a search which requires a warrant because one has an expectation of privacy in his

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[84] *Id.* at 448.
[85] *Id.* at 450-51.
[86] *Id.* at 452.
[87] Dow Chem. Co. v. United States, 476 U.S. 227, 230 (1986).
[88] *Id.* at 236, 238.
[89] *Id.* at 239.
[90] Kyllo v. United States, 533 U.S. 27, 33–34 (2001).

or her own home.[91] *Kyllo* created the standard that law enforcement cannot use a technology that is not in public use to obtain information in the home if officers would not have otherwise discovered the information without entering the property.[92] Thus, while aerial surveillance, whether by uncrewed or crewed aircraft, is acceptable, the tools and technologies they host may not.

D. Beyond the Residence

Americans can take some solace in knowing that the 4th Amendment protects our privacy from the government in our home, albeit not from the air. However, we know that given new technologies, privacy intrusions can occur far from a residence.

In *United States v. Jones,* [93] the US government obtained a warrant to place a GPS tracking device on the bottom of a car owned by the defendant, Jones' wife.[94] The government tracked the vehicle's movements for twenty-eight days, obtaining more than 2,000 pages of data over that period.[95] The only evidence suppressed by the government was the information they obtained while the vehicle was parked on Jones' property.[96]

The Supreme Court held that there is no doubt that a car is considered an "effect" pursuant to the 4th Amendment.[97] Thereafter, the Court applied the reasonable expectation of privacy test.[98] Typically, people do not have a reasonable expectation of privacy on public roads.[99] The Supreme Court held that the current standard includes protection against trespass to property in order to obtain evidence. Since the government placed the GPS tracking device on the bottom of a car, they committed trespass to property; therefore, the 4th Amendment was violated.[100]

Justice Sotomayor agreed with the majority's holding in *Jones,* and, in a concurring opinion, suggested that the current 4th

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[91] *Id.*
[92] *Id.* at 40.
[93] United States v. Jones, 565 U.S. 400 (2012).
[94] *Id.* at 402-03.
[95] *Id.*
[96] *Id.*
[97] *Id.* at 404.
[98] United States v. Jones, 565 U.S. 400, 406 (2012).
[99] *Id.*
[100] *Id.* at 413.

Amendment privacy test will need future adjustment as technology enhances the government's monitoring capabilities.[101] Specifically, she stated that there are already a lot of forms of surveillance that do not require physical intrusions.[102] She worries that:

> Awareness that the Government may be watching chills associational and expressive freedoms. And the Government's unrestrained power to assemble data that reveal private aspects of identity is susceptible to abuse. The net result is that GPS monitoring—by making available at a relatively low cost such a substantial quantum of intimate information about any person whom the Government, in its unfettered discretion, chooses to track—may 'alter the relationship between citizen and government in a way that is inimical to democratic society.'[103]

Arguably, in respect of COVID measures, it is the very intent of the government to chill association.

It is important to recognize that in addition to the acceptance of unwarranted aerial surveillance with certain types of technology as reasonable, there are a number of exceptions to the warrant requirement that exist. For example, the requirement does not extend to open fields. In *Oliver v. United States*, the Supreme Court reasoned that while one may have an expectation of privacy in an enclosure in open fields, passing the first part of the *Katz* standard, the expectation of privacy is not one that society recognizes as reasonable because open fields are accessible to the public in a way a home is not.[104] Under this doctrine, the use of drones for surveillance over open fields would not require a warrant.

The courts have also determined that there are exceptions to the 4th Amendment warrant requirement if it can be established that there were "exigent circumstances."[105] In *United States v. Williams*, a Court of Appeals described such circumstances as "situations where 'real immediate and serious consequences' will 'certainly occur' if a police officer postpones action to obtain a

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[101] *Id.* at 413-18.
[102] *Id*. at 415.
[103] *Id*. at 416.
[104] Oliver v. United States, 466 U.S. 170, 173 (1984).
[105] Brigham City, Utah v. Stuart, 547 U.S. 398, 406 (2006).

warrant."[106] The courts have also considered law enforcement entering a "burning home to rescue occupants or extinguish a fire, to prevent a shooting or to bring emergency aid to an injured person" exigent circumstances.[107]

In all, 4th Amendment jurisprudence shows that the use of drones by law enforcement to enforce social distancing likely would not be considered an unconstitutional invasion of privacy because the surveillance would be conducted in a public space. However, a look into intersection of health and privacy suggests that adding thermal imaging capabilities to those drones may result in a different outcome.

IV. THE INTERSECTION OF HEALTH AND PRIVACY

Twenty years ago, it would have been difficult to imagine social media platforms and technology being as indispensable as they are today. Although these advancements offer innumerable benefits, they are accompanied by some seriously concerning problems. Among other things, it is easier than ever for companies, and the government, to collect and share health information data. In this time of COVID-19, many experts advocate for "widespread testing . . . combined with careful disease surveillance and contact tracing . . . to suppress transmission enough to allow some cautious semblance of normality until researchers are able to develop a vaccine" to counter the rapid emergence and devastating effects of the virus.[108] According to the Director of the National Institute of Allergy and Infectious Diseases, Anthony Fauci, "a COVID-19 vaccine could take twelve to eighteen months to develop, test and approve for public use."[109]

Around the world, government agencies are using digital surveillance techniques to suppress COVID-19 transmission while

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[106] United States v. Williams, 354 F.3d 497, 503 (6th Cir. 2003) (citing Ewolski v. City of Brunswick, 287 F.3d 492, 501 (6th Cir. 2002)).

[107] Wayne v. United States, 318 F.2d 205, 206 (D.C. Cir. 1963).

[108] Jay Stanley, *Temperature Screening and Civil Liberties During an Epidemic*, ACLU, 1 (May 19, 2020), https://www.aclu.org/sites/default/files/field_document/aclu_white_paper_-_temperature_checks.pdf.

[109] Nicoletta Lanese, *When Will a COVID-19 Vaccine be Ready?*, LIVESCI. (Apr. 16, 2020), https://www.livescience.com/coronavirus-covid-19-vaccine-timeline.html.

allowing their citizens to engage in normal activities.[110] For example, in South Korea, government authorities are using "surveillance-camera footage, smartphone location data and credit card purchase records to help trace coronavirus patients and establish virus transmission chains."[111] In Italy, officials are examining "location data transmitted by citizens' phones to determine how many [individuals] are obeying government lockdown order."[112] In China, "the government is requiring citizens to use software on their phones that automatically classifies each person with a color code — red, yellow or green — indicating contagion risk. The software determines which people should be quarantined or permitted to enter public places like subways."[113] In the US, the White House has relied on data-gathering from technology companies such as Google, Apple, and Facebook to reduce the number of COVID-19 cases by aggregating the location data captured by Americans' phones.[114] Many individuals are willing to share this information and endure intrusion when so many lives are at stake.[115]

Traditional contact-tracing is "a longstanding public health technique that works by identifying everyone whom a sick person may have exposed, and helping them identify their risks and take appropriate action."[116] Although effective, traditional contact-tracing is labor-intensive and slow when combating rapid-moving pathogens like COVID-19. A proposed solution seeks to use mobile phones' location and proximity detection to deliver alerts about potential exposures, also known as Technology-assisted Contact-tracing (TACT).[117] While this may feel like a rational response to COVID-19, it is perhaps a little extreme to demand mandatory tracing without giving individuals a choice. The American Civil Liberties Union (ACLU) suggests that "voluntary measures to combat

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[110] Natasha Singer & Choe Sang-Hung, *As Coronavirus Surveillance Escalates, Personal Privacy Plummets*, N.Y. TIMES (updated Apr. 17, 2020), https://www.nytimes.com/2020/03/23/technology/coronavirus-surveillance-tracking-privacy.html.

[111] *Id.*

[112] *Id.*

[113] *Id.*

[114] *Id.*

[115] Casey Ross, *After 9/11, We Gave Up Privacy for Security. Will We Make the Same Trade-off After COVID-19?*, STAT NEWS (Apr. 8, 2020), https://www.statnews.com/2020/04/08/coronavirus-will-we-give-up-privacy-for-security/.

[116] *Id.*

[117] *Id.*

disease tend to be more effective than mandatory ones because they leverage people's own incentives to report disease and receive help rather than creating an antagonistic relationship with the authorities that can spark resistance and evasion."[118] The ACLU's reasoning is that people will avoid participation in a privacy-sensitive scheme that seems compulsory and antagonistic and therefore untrustworthy.[119]

The ACLU examined involuntary disclosure of health-related information during public health emergencies and named effectiveness as an essential factor to determine the extent to which personal privacy should be violated in a public emergency.[120] Specifically, the ACLU examined temperature and fever checks/detections and stated such methods "should not be deployed unless public health experts say that it is a worthwhile measure notwithstanding the technology's problems. To the extent feasible, experts should gather data about the effectiveness of such checks to determine if the tradeoffs are worth it."[121]

The "principal health privacy law"[122] in the US is the Health Insurance Portability and Accountability Act[123] (HIPAA) Privacy Rule (Privacy Rule)."[124] HIPAA was enacted in 1996 to "ensure health insurance coverage after leaving an employer and also to provide standards for facilitating health-care-related electronic transactions."[125] Among other things, HIPAA directed the US Department of Health and Human Services "to issue regulations protecting the privacy of individually identifiable health information."[126] The resulting rules "strive[] to balance the interest of individuals in maintaining the confidentiality of their health

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[118] *Id.*

[119] *Id.*

[120] Stanley, *supra* note 108, at 7.

[121] *Id.*

[122] Mark A. Rothstein, *The End of the HIPAA Privacy Rule*, 44 J.L. MED & ETHICS 352, 352 (2016).

[123] Health Insurance Portability and Accountability Act of 1996, Pub. L. No. 104-191 (1996) 110 Stat. 1936 (codified in scattered sections of 26, 29 and 42 U.S.C.)

[124] 45 C.F.R §160-164 (2020).

[125] *HIPAA Privacy Rule and Public Health: Guidance from CDC and the U.S. Department. of Health and Human Services*, CTR. FOR DISEASE CONTROL AND PREVENTION, 1 (Apr. 11, 2003), https://www.cdc.gov/mmwr/preview/mmwrhtml/m2e411a1.htm.

[126] Stacey A. Tovino, *Teaching the HIPAA Privacy Rule,* 61 ST. LOUIS U. L. J. 469, 471-2 (2017).

information and the interest of society in obtaining, using, and disclosing health information to carry out a variety of public and private activities."[127]

Notably, the Privacy Rules apply only to "covered entities" in the "health care payment chain – health providers, health plans, health clearinghouses, and their business associates."[128] Essentially, they regulate how covered entities must act in respect of "the uses of, disclosures of, and requests for individually identifiable health information."[129] Pursuant to the Privacy Rules, covered entities may disclose what is termed Protected Health Information[130] (PHI), without individual authorization, "to a public health authority that is authorized by law to collect or receive such information

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[127] *Id.* at 475.

[128] Rothstein, *supra* note 122 at 325, *citing* 45 C.F.R. § 164.104 (2020).

[129] Tovino, *supra* note 126, at 475.

> Individually identifiable health information is information that is a subset of health information, including demographic information collected from an individual, and:
>
> (1) Is created or received by a health care provider, health plan, employer, or health care clearinghouse; and
>
> (2) Relates to the past, present, or future physical or mental health or condition of an individual; the provision of health care to an individual; or the past, present, or future payment for the provision of health care to an individual; and
>
> (i) That identifies the individual; or
>
> (ii) With respect to which there is a reasonable basis to believe the information can be used to identify the individual.

45 C.F.R. § 160.103 (2020).

[130] The Privacy Rules define Protected Health Information as:

> [I]individually identifiable health information:
>
> (1) Except as provided in paragraph (2) of this definition, that is:
>
> (i) Transmitted by electronic media;
>
> (ii) Maintained in electronic media; or
>
> (iii) Transmitted or maintained in any other form or medium.
>
> (2) Protected health information excludes individually identifiable health information:
>
> (i) In education records covered by the Family Educational Rights and Privacy Act, as amended, 20 U.S.C. 1232g;
>
> (ii) In records described at 20 U.S.C. 1232g(a)(4)(B)(iv);
>
> (iii) In employment records held by a covered entity in its role as employer; and
>
> (iv) Regarding a person who has been deceased for more than 50 years.

45 C.F.R. § 160.103 (2020)

for the purpose of preventing or controlling disease, injury, or disability, including, but not limited to, the reporting of disease, injury, vital events such as birth or death, and the conduct of public health surveillance, public health investigations, and public health interventions . . ."[131] Likewise, such information may be disclosed to a an individual who "may have been exposed to a communicable disease or may otherwise be at risk of contracting or spreading a disease or condition if the covered entity or public health authority is authorized by law to notify such person as necessary in the conduct of a public health intervention or investigation."[132] In short, the principal privacy rule protecting health information of individuals may be circumvented during a pandemic.

As noted previously, businesses have developed a variety of remote health detecting technology to reduce the rate of COVID-19 infections. While even the ACLU agrees that "a remote temperature check is not an enormous invasion of privacy, especially if individual records are not retained," advancing technologies are now capable of remote "detection of heart rate, breathing rate, and heart rate variability.[133] Critics argue that possessing tools that are capable of collecting intimate screenings of one's health are a significant privacy risk as they can reveal a "person's medical conditions, from detection of arrhythmias and cardiovascular disease, to asthma and respiratory failures, physiological abnormalities, psychiatric conditions, and even the stage of a woman's ovulation cycle."[134] Placing these tools on a drone platform exponentially increases the sense that a person does not have adequate control over knowledge of oneself. It feels like an aggressive assault on privacy.

However, the benefits of sharing this information could prevent mass infections, save lives and prevent future recurrences. While we have shown that remote health surveillance by drone would not likely violate the 4th Amendment or the Privacy Rule, the fact is that in order to build trust in the drone platform, and encourage its continued innovation and use, we must address privacy concerns.

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[131] 45 C.F.R. § 164.512(b)(1)(i) (2020).

[132] 45 C.F.R. § 164.512(b)(1)(iv) (2020).

[133] Jay Stanley, *Temperature Screening and Civil Liberties During an Epidemic*, 5 ACLU (May 19, 2020), https://www.aclu.org/sites/default/files/field_document/aclu_white_paper_-_temperature_checks.pdf.

[134] *Id.*

V. SYNTHESIZING A SOLUTION

Our analysis of 4th Amendment jurisprudence and HIPAA regulations shows that the utilization of drones by law enforcement is unlikely to be found by a court to be a violation of privacy, given the drone does not physically trespass, documents what is visible from public airspace using well-recognized technology and is collecting data that can legally be shared to promote public health. It is no secret that, much like any other enforcement mechanism, drone remote sensing capabilities, such as thermal imaging, have the potential to be taken advantage of by operators. However, drones provide many positive societal benefits and the potential for abuse should not deter the general public from supporting the integration of drones into the national airspace.

Thus far, multiple states have passed legislation that restricts or limits law enforcement's ability to utilize drones in their daily operations.[135] It has been argued that because of the patchwork of state laws that exist, Congress must mandate the FAA to develop regulations to address privacy concerns related to drones.[136] While the approaches of states to address privacy concerns of drones varies greatly,[137] there is reason to believe that states can adequately

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[135] Brittany Chiang, *FAA Best Practices, State Laws, Local Rules, and Police Efforts: A Multi-Faceted Approach to Regulating Police UAVs in the U.S.*, 38 U. LA VERNE L. REV. 201, 208-09 (2017).

> As of October 2016, thirty-two states have enacted laws and an additional five states have adopted resolutions to define UAVs, regulate law enforcement usage, and enumerate general public usage. Legislation addressing privacy concerns with UAVs has been passed in 22 states. Most states have focused on restricting law enforcement' use of UAVs.

Id.

[136] *See e.g.,* Sean M. Nolan, *"Big Brother" in the Private Sector Privacy Threats Under the FAA's New Civilian Drone Regulations*, 82 BROOK. L. REV. 1451, 1478 (2017) ("By developing comprehensive privacy protections at a federal level, the United States government can avoid stumbling out of the gate, and instead, embrace this impending wave of innovation.").

[137] *See* Toban Platt, *The Drone Wars: The Need for Federal Protection of Individual Privacy*, 13 WASH. J.L. TECH. & ARTS 27, 35–36 (2017).

> Florida was one of the first states to pass drone-specific legislation by prohibiting private individuals from using drones to record images of persons or property without prior consent. Oregon, Nevada and California have also passed restrictive drone laws which preserve privacy for individuals. In Oregon, the law grants a civil cause of action to a landowner against

and perhaps even uniformly legislate proper privacy protections given some guidance. Thus, the authors agree with those who suggest that states are best equipped to balance privacy and the preservation of drone usage in local communities.[138]

In order for states to adequately legislate this subject, there is a happy medium that must be met between the public sector and private citizens. Indeed it is irrefutable that "[t]he emergence of drones in domestic skies raises understandable privacy concerns that require careful and sometimes creative solutions."[139] A common sense solution that balances public health and the privacy concerns of the public is to introduce a model privacy law for state legislatures that would empower law enforcement agencies to utilize drones in a way that does not have the potential to violate the privacy of citizens and encourages the public sector to engage in an information campaign with private citizens.

Model language to implement this solution is offered below:

> a) Law enforcement agencies, or other applicable agencies, within this State may use drones to survey citizens in public spaces and enforce guidelines as prescribed by the laws of this State and applicable political subdivision of the State, so long as the collection, storage and dissemination of any individual's health information does not violate any of the provisions found in 45 C.F.R. § 160, 45 C.F.R. § 164.1 and 45 C.F.R. § 164.5.
>
> b) The Attorney General of this State is directed to develop a multi-media campaign that informs concerned citizens of the

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> anyone who flies a drone over their property. The Nevada law creates an action for trespass for anyone flying a drone less than 250 feet over another person's property without the owner's permission. Finally, California's legislature passed an "anti-paparazzi statute" prohibiting individuals from using a drone to capture an image or recording of a person engaging in a private, personal, or familial activity without permission.

Id.

138 *See e.g.,* Jennifer M. Bentley, *Policing the Police: Balancing the Right to Privacy Against the Beneficial Use of Drone Technology*, 70 HASTINGS L.J. 249, 288-89 (2018) ("Legislation regulating law enforcement's use of UAS should be enacted at the state level, as an exercise of the states' police power. Reliance on administrative policies to safeguard individual privacy or on law enforcement to police itself is an insufficient safeguard for Fourth Amendment freedoms.").

139 Gregory S. McNeal, *Drones and the Future of Aerial Surveillance*, 84 GEO. WASH. L. REV. 354, 415 (2016).

> State the new developments in the field of drone technology and the implementation of drones into law enforcement agencies across the State.

As public safety agencies in all fifty states have drones,[140] a messy patchwork of state-by-state laws regarding the privacy of citizens from contrivances used in airspace is inevitable.[141] However, section (a), as drafted, would provide law enforcement with the capability to conduct investigations of potentially criminal or civil activity that warrants the use of a drone in a public space. This capability would be subject to the existing laws and regulations of the state of origin where the legislation was introduced so the applicability of this legislation would vary by state.

Further, the legislation would set guidelines as to how public and private organizations are allowed to collect, retain and share the health information of citizens within the state in a manner that promotes the purpose of the Privacy Rule, which seeks to "strike a balance that permits important uses of information while protecting the privacy of people who seek health care."[142] Compliance with provisions of the HIPAA Privacy Rule is paramount to ensure that law enforcement can utilize drones while protecting an individual's health information.[143] In addition, while some may argue that drones should be subjected to a warrant requirement, helicopters and airplanes are already used by law enforcement for proactive surveillance; there is no reason that drones should be subjected to such a higher level of scrutiny than crewed aircraft.

Quite frankly, providing guidance to law enforcement agencies in the state is not enough to quell the negative public perception

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[140] Matt Reynolds, *All-Seeing Eye Do Police Drones Foster Trust or Threaten Civil Rights and Privacy?,* ABA J. (June 1, 2020), https://www.abajournal.com/magazine/article/do-police-drones-foster-trust-or-threaten-civil-rights-and-privacy ("Public safety agencies across all 50 states have drones, the Center for the Study of the Drone at Bard College says in a March 2020 paper, with 70% of disclosed public safety agencies working with drones in law enforcement.").

[141] See *State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet,* FED. AVIATION ADMIN. – OFF. OF THE CHIEF COUNSEL, 3 (Dec. 17, 2015), https://www.faa.gov/uas/resources/policy_library/media/UAS_Fact_Sheet_Final.pdf.

[142] *Summary of the HIPAA Privacy Rule,* HEALTH INFO. PRIV. – U.S. DEP'T OF HEALTH & HUM. SERVS. (July 26, 2013), https://www.hhs.gov/hipaa/for-professionals/privacy/laws-regulations/index.html.

[143] Reynolds, *supra* note 140.

regarding drone technology being utilized in their community,[144] and because of this, government officials need to have honest and frank discussions about the advantages of using drones during a public health crisis with the local community.

A case study provided on the evolution of Hawaii's approach to drone legislation shows that from 2011 to 2014, the state legislature went from passing supportive drone legislation to introducing restrictive measures.[145] Although an analysis was not provided on any sort of information campaign, one can infer from the drastic change of direction in legislative activity that citizens of Hawaii had lost trust in the drone platform. The case of Hawaii shows why a campaign informing citizens of the benefits of drone integration may quell some unnecessary fears. Section (b) of the proposed legislations ensures that the office of the Attorney General engages the community in an earnest and honest manner to educate the public on the developments of drone technology and how drones can be a benefit to a community in order to avoid the drastic change in legislative activity found in Hawaii in the early 2010s.

VI. CONCLUSION

As one scholar wrote in 2012, "[t]he actions that . . . state. . . legislatures take today will define the way unmanned aircraft are introduced to—and remain in—US civilian airspace."[146] This remains true in 2020 and as drone technology has advanced, the task of balancing public safety and a citizen's expectation of privacy in light of advancement is not an easy one, however this commentary shows that a delicate balance can be struck. The balance requires states to pass the model legislation provided in Part V and then engage the public in an honest, multi-media campaign to ensure

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[144] Stephen Rice, *Eyes in the Sky: The Public Has Privacy Concerns About Drones,* FORBES (Feb. 4, 2019), https://www.forbes.com/sites/stephenrice1/2019/02/04/eyes-in-the-sky-the-public-has-privacy-concerns-about-drones/#387fdf316984.

[145] Nate Vogel, *Drones at Home: The Debate over Unmanned Aircraft in State Legislatures*, 8 ALB. GOV'T L. REV. 204, 248 (2015) ("All of the proposals in 2011 offered support for unmanned aircraft in some way. . . . Support [was bipartisan]. . . . 2014 looked substantially different. There were still a couple of proposals supportive of the industry, but most of the thirteen bills introduced that session offered new restraints on unmanned aircraft operations.").

[146] Benjamin Kapnik, *Unmanned but Accelerating: Navigating the Regulatory and Privacy Challenges of Introducing Unmanned Aircraft into the National Airspace System*, 77 J. AIR L. & COM. 439, 465 (2012).

that citizens understand the bounds of how drones are to be utilized by law enforcement to ensure the public safety and privacy of the community.

It is also apparent that as other commentators have acknowledged, "emerging trends in state constitutional and statutory reform appear to enhance the privacy rights of individuals, where the US Constitution and tort remedies for privacy intrusions are weak or non-existent."[147] Many believe drones are a daunting innovation with the potential for abuse and abdication of one's expectation of privacy, however the reality of the matter is that drones provide the US with an opportunity to move into the twenty-first century by streamlining operations in an efficient, health-conscious manner.

Ultimately, what is there really to be afraid of? Restricting the usage of drones would consequently restrict innovation in the drone industry. Although some may object, we should sacrifice a glimmer of individual privacy for the public safety of the masses. As a society, we need to encourage the utilization of drones, not because of present technology available and the on-going COVID-19 pandemic, but because of what the future of drone technology holds for our communities.

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[147] Jennifer A. Brobst, *Enhanced Civil Rights in Home Rule Jurisdictions: Newly Emerging UAS/Drone Use Ordinances*, 122 W. VA. L. REV. 741, 768 (2020).

LINE-BY-LINE REVIEW OF MISSISSIPPI SENATE BILL NO. 2282 INTRODUCED BY MISSISSIPPI STATE SENATOR BRICE WIGGINS, REGULAR SESSION 2020

Editorial Team

The Mississippi Unmanned Aircraft Systems Act of 2020 (MUASA)[1] is a Mississippi state legislator's first substantive attempt to address the integration of uncrewed aircraft into the national airspace.

The stated purpose of the MUASA is

> to regulate unmanned aircraft systems; to provide definitions; to provide causes of action in tort for unlawful use of unmanned aircraft systems; to provide for criminal use of unmanned aircraft systems; to prohibit creation of prescriptive rights; to preempt local governments from regulating the operation of nonrecreational unmanned aircraft systems; to provide exceptions for law enforcement and public agency operations; to provide for emergency immunity for damages; to prohibit sabotage or destruction of public service unmanned aircraft systems; to amend section 97-3-107, Mississippi code of 1972, to include unmanned aircraft systems; to provide standards for the operation of unmanned aircraft systems by public agencies . . .[2]

The proposed bill starts with four definitions. "Commission" and "Department" are strictly for delegating the purposes of the bill to the Mississippi Transportation Commission and the Mississippi Department of Transportation, respectively.[3] MUASA defines an unmanned aircraft as

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[1] S.B. 2282, 135th Leg. Sess., Reg. Sess. (Miss. 2020) [hereinafter MUASA].

[2] *Id.* Compare MUASA *with* MISS. CODE. ANN. § 97-29-61 (West 2020) (The only statute currently in force in Mississippi that addresses drone use does not even mention drones by name, rather it is a "peeping Tom" statute, making any person who "peeps through a window or other building structure for the lewd, licentious and indecent purpose of spying . . . guilty of a felonius trespass.").

[3] MUASA, *supra* note 1, §§2(a) and (b).

> an aircraft that is constructed or operated without the possibility of direct human intervention from within or on the aircraft, including every object that is on board or otherwise attached to the aircraft, or carried or operated during flight, regardless of weight. For the purposes of this act, this term is synonymous with the term "drone.""[4]

This language reflects the definition of "unmanned aircraft" in Arizona,[5] California,[6] Georgia,[7] Kansas,[8] Kentucky,[9] Montana,[10] New Jersey,[11] North Carolina,[12] North Dakota,[13] Pennsylvania,[14] South Dakota,[15] Utah,[16] Wisconsin,[17] and West Virginia.[18] It is also important to note that the definition in MUASA reflects the definition of "unmanned aircraft" provided by the Federal Aviation Administration.[19] However, the definition of "unmanned aircraft" in MUASA differs from the definition of "unmanned aircraft" found in

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[4] *Id.* §2(c).
[5] ARIZ. REV. STAT. ANN. § 13-3729 (2020).
[6] CAL. GOV'T CODE § 853.5 (West 2020).
[7] GA. CODE ANN. § 6-1-4 (West 2020).
[8] KAN. STAT. ANN. § 60-31a02 (West 2020).
[9] KY. REV. STAT. ANN. § 183.011 (West 2020).
[10] MONT. CODE ANN. § 46-5-109 (West 2019).
[11] N.J. STAT. ANN. § 2C:40-27 (West 2020).
[12] N.C. GEN. STAT. ANN. § 63-1(3) (West 2020).
[13] N.D. CENT. CODE ANN. § 29-29.4-01 (West 2019).
[14] 18 PA. STAT. AND CONS. STAT. ANN. § 3505 (West 2020).
[15] S.D. CODIFIED LAWS § 50-1-1 (2020).
[16] UTAH CODE ANN. § 72-14-102(4) (West 2020).
[17] WIS. STAT. ANN. § 114.105 (West 2019).
[18] W. VA. CODE ANN. § 61-16-1(1) (West 2020).
[19] 14 C.F.R. § 107.3 (2020); *see also* FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, 126 Stat 11 (2012).

Florida,[20] Illinois,[21] Louisiana,[22] Maine,[23] Maryland,[24] Michigan,[25] Nevada,[26] New Hampshire,[27] Oklahoma,[28] Oregon,[29] Rhode

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[20] FLA. STAT. ANN. § 934.50 (West 2020) (Florida unnecessarily creates extra steps by defining a "drone" as a "powered, aerial vehicle that: does not carry a human operator; uses aerodynamic forces to provide vehicle lift; can fly autonomously or be piloted remotely; can be expendable or recoverable; and can carry a lethal or nonlethal payload.").

[21] 725 ILL. COMP. STAT. ANN. 167/5 (West 2020) (Illinois defines a "drone" as "any aerial vehicle that does not carry a human operator," which ultimately is insufficient, because it fails to account for situations where humans may be transported by drone in a commercial passenger or emergency response situation.").

[22] LA. STAT. ANN. § 3:41(2) (2020) (Louisiana defines a "aircraft" as an "unmanned aircraft operated as part of an unmanned aerial system," which is inadequate because it is fails to actually define "unmanned aircraft.").

[23] ME. REV. STAT. tit. 25, § 4501 (2019) (Maine defines an "unmanned aerial vehicle" as an "aircraft operated without a physical human presence within or on the aircraft that, in the manner in which the aircraft is used or in the manner in which it is equipped, is capable of performing audio or visual surveillance." Like Illinois, this definition is insufficient because it fails to account for situations where humans are transported by drone.).

[24] MD. CODE ANN. ECON. DEV. § 14-301 (West 2020) (Maryland defines an "unmanned aircraft" as "the flying portion of an unmanned aircraft system, flown by a pilot via a ground control system, or autonomously through use of an onboard computer, a communication link, and any additional equipment that is necessary for the unmanned aircraft to operate safely." This definition has a similar issue as to Louisiana, where the definition fails to stand on its own.).

[25] MICH. COMP. LAWS ANN. § 259.303(e) (West 2020) (Michigan defines an "unmanned aircraft" as an "aircraft flown by a remote pilot via a ground control system, or autonomously through use of an on-board computer, communication links, and any additional equipment that is necessary for the unmanned aircraft to operate safely.")

[26] NEV. REV. STAT. ANN. § 493.020 (West 2020) (Nevada defines an "unmanned aerial vehicle" as a "powered aircraft of any size without a human operator aboard the vehicle and that is operated remotely or autonomously." This definition has a similar issue to the definitions proscribed by Illinois and Maine.).

[27] N.H. REV. STAT. ANN. § 207:57(I-A) (2020) (New Hampshire defines an "unmanned aerial vehicle" as "any device capable of flying in the air which is remotely, automatically, or otherwise piloted without an occupant, including but not limited to, drones." The biggest issue with this definition is that the drafters should have used the term "autonomously" rather than "automatically." Further, it fails to account for drones that could carry passengers.").

[28] OKLA. STAT. ANN. tit. 3, § 322(3) (West 2020) (Oklahoma defines an "unmanned aircraft" as an "aircraft without occupants that is flown by a pilot via a ground control system or autonomously through use of an onboard computer and other additional equipment necessary to operate the aircraft and includes unmanned aircraft commonly called drones." The biggest issue with this definition is that it is rather redundant that the definition specifically states that it "includes unmanned aircraft commonly called drones.").

[29] OR. REV. STAT. ANN. § 836.005 (West 2020) (Oregon defines "aircraft" as "any contrivance used or designed for navigation of or flight in the air, but does not mean a one-person motorless glider that is launched from the earth's surface solely by the operator's

Island,[30] South Carolina,[31] Tennessee,[32] and Vermont.[33] The definitions provided by states that differed from MUASA ultimately either failed to account for drones that are capable of carrying passengers or had the reader imply that "aircraft" was a term synonymous with "drone" or "unmanned aircraft." Further, MUASA defines an uncrewed aircraft system as "an unmanned aircraft and all associated elements, including, but not limited to, communication links, sensing devices and components that control the unmanned aircraft."[34] Each of the states listed above has adopted a definitions of "unmanned aircraft system" that closely resembles the language employed by the MUASA.[35] Ultimately, Senator Wiggins was correct in deciding to define "unmanned aircraft" in accordance with the definition of "unmanned aircraft" as defined by the FAA. Although states should seek to pass legislation specific to the needs of the jurisdiction the legislation is presented in, foundational definitions such as "unmanned aircraft" should be uniform nationwide.

Section 3 of MUASA addresses torts and crimes generally by prescribing the following:

> "(1) This act applies to the operations of all unmanned aircraft systems and the acts of those who own, control or operate such systems, or are affected by such operations. (2) An unmanned aircraft system is an instrumentality by which a tort can be

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power." The greatest issue with Oregon's definition is that it fails to specifically address drones and has the reader imply in other statutes that "aircraft" is synonymous with "unmanned aircraft.").

[30] 1 R.I. GEN. LAWS ANN. § 1-4-2 (West 2020) (the definition provided by Rhode Island suffers from the same issue as Oregon, where it is to be implied that "unmanned aircraft" is synonymous with "aircraft," rather than specifically providing a definition for "unmanned aircraft").

[31] S.C. CODE ANN. § 55-1-5(2) (2020) (South Carolina's definition lacks specificity and, like Oregon and Rhode Island, leaves the reader to believe that "aircraft" and "unmanned aircraft" are synonymous terms).

[32] TENN. CODE ANN. § 39-13-901(2) (West 2020) (Tennessee defines an "unmanned aircraft" as "an airborne device that is operated without an individual in or on the device." Like Illinois, Maine and Nevada, this definition is insufficient because it fails to account for drones that can transport passenger, and the definition fails to define what an "airborne device" entails.).

[33] VT. STAT. ANN. tit. 20, § 4621(2) (West 2020) (Vermont defines a "drone" as a "powered aerial vehicle that does not carry a human operator and is able to fly autonomously or to be piloted remotely." Similar to other states, this definition fails to account for drones capable of transporting humans.).

[34] MUASA, *supra* note 1, § 2(d).

[35] *See supra,* notes 5 to 33.

> committed under the laws of this state. (3) An unmanned aircraft system is an instrumentality by which a crime can be committed under the laws of this state. (4) The criminal statutes of this state shall apply to any person who owns, controls or operates unmanned aircraft within this state, or to any other person liable under the criminal laws of this state."[36]

This provision of the bill serves as a catch-all for any criminal or tortious activity in the state of Mississippi that utilizes an uncrewed aircraft. Although other states have addressed specific criminal and tortious activities while using drones,[37] this provision appears to be the first that provides an umbrella approach to drone-supported criminal and tortious activity within a state.

Section 4 of MUASA addresses the prescriptive right of airspace over a real property owner's property. The provision states that "[r]epeated or continual operation of an unmanned aircraft over a landowner's or lessee's real property does not create a prescriptive right in the airspace."[38] Although prescriptive rights in the airspace do not generally exist for property owners,[39] "[c]ourts in several states now openly accept that such prescriptive rights to airspace can indeed be acquired" by political subdivisions.[40] To date, there is only one state statute that addresses the prescriptive right in the airspace generally. Oklahoma gives political subdivisions the authority to acquire, by purchase, grant, or condemnation, real property for public purposes, such as an air right or aviation

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[36] MUASA, *supra* note 1, § 3.

[37] *See* Toban Platt, *The Drone Wars: The Need for Federal Protection of Individual Privacy,* 13 WASH. J.L. TECH. & ARTS 27, 35 (2017) ("In 2016, thirty-eight states considered legislation related to drones . . . These statutes vary widely: some criminalize certain drone activities while others limit drones to specific uses, such as wildlife surveys."); Taly Matiteyahu, *Drone Regulations and Fourth Amendment Rights: The Interaction of State Drone Statutes and the Reasonable Expectation of Privacy*, 48 COLUM. J.L. & SOC. PROBS. 265, 284-85 (2015).

[38] MUASA, *supra* note 1, § 4.

[39] *See* Joshua B. Landis, Note, *Sunny and Share: Balancing Airspace Entitlement Rights Between Solar Energy Adopters and Their Neighbors*, 72 VAND. L. REV. 1075, 1089 (2019) ("Because no prescriptive right exists, neighboring property owners are free to develop their airspace to the extent permitted by law, regardless of whether doing so will effectively block sunlight from adjacent parcels.").

[40] David Casanova, Comment, *The Possibility and Consequences of the Recognition of Prescriptive Avigation Easements by State Courts*, 28 B.C. ENVTL. AFF. L. REV. 399, 407-08 (2001).

easement.[41] There has not been a documented case of an Oklahoma political subdivision exercising this expressed power, so time will tell whether or not an airport authority seeks to take advantage of this opportunity.

Section 5 of MUASA addresses county and municipal preemption of actions addressing the operation of uncrewed aircraft in the state of Mississippi. The section states:

> [e]xcept as expressly authorized by statute, a political subdivision shall not enact or enforce an ordinance, resolution, regulation or policy that regulates the ownership or operation of nonrecreational unmanned aircraft or otherwise engage in the regulation of the ownership or operation of nonrecreational unmanned aircraft systems. Any ordinance, resolution, regulation or policy of any county or municipality of this state regulating the ownership or operation of nonrecreational unmanned aircraft shall be deemed preempted and shall be null, void and of no force or effect.[42]

Some argue that additional measures would conflict with the regulations created by the Federal Aviation Administration.[43] A preemption provision would be a wise provision for state legislatures to include in introduced legislation to ensure there is only a second regulatory layer, rather than having a complex, onerous regulatory ecosystem addressing the operation of uncrewed aircraft in the United States.

Section 6 of MUASA addresses the operation of uncrewed aircraft in Mississippi by law enforcement and agents of public agencies. The section reads as follows:

> [n]othing in this act shall be deemed to prohibit the operation of an unmanned aircraft system by a law enforcement agency for any lawful purposes in this state. A public agency may operate an unmanned aircraft system only if the public agency

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[41] OKLA. STAT. ANN. tit. 3, § 113 (West 2020).

[42] MUASA, *supra* note 1, § 5.

[43] *See* Nate Vogel, *Drones at Home: The Debate over Unmanned Aircraft in State Legislatures*, 8 ALB. GOV'T L. REV. 204, 258 (2015) ("Unmanned aircraft operations are extensively regulated by the FAA, to the extent that currently every single unmanned aircraft operation must receive approval from the FAA. It could be argued that imposing additional requirements on federal law enforcement unmanned aircraft operations would conflict with the regulations Congress charged the FAA to create.").

> operates the unmanned aircraft system in accordance with the rules and regulations adopted by the Federal Aviation Administration.[44]

This language is rather broad for the discretion of law enforcement and other public agencies to operate uncrewed aircraft in the state of Mississippi. Although not uniform in nature, states such as Alaska,[45] Florida,[46] Idaho,[47] Illinois,[48] Indiana,[49] Iowa,[50]

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[44] MUASA, *supra* note 1, § 6.

[45] ALASKA STAT. ANN. § 18.65.900 (West 2020) (generally law enforcement agencies in Alaska are prohibited from operating uncrewed aircraft unless operations fall under prescribed exceptions).

[46] FLA. STAT. ANN. § 934.50 (West 2020) (In Florida, law enforcement agencies are prohibited from using a drone to gather evidence unless the agency obtains a search warrant or possesses "reasonable suspicion that, under particular circumstances, swift action is needed to prevent imminent danger to life or serious damage to property, to forestall the imminent escape of a suspect or the destruction of evidence, or to achieve purposes including, but not limited to, facilitating the search for a missing person.").

[47] IDAHO CODE ANN. § 21-213 (West 2020) (Law enforcement agencies in Idaho may use drones to assist with traffic accidents, traffic management, assess damage due to natural disaster or fire, assist in a search and rescue operation or following the issuance of a warrant.).

[48] *See* 725 ILL. COMP. STAT. ANN. 167/10 (West 2020); 725 ILL. COMP. STAT. ANN. 167/15 (West 2020); 725 ILL. COMP. STAT. ANN. 167/20 (West 2020); 725 ILL. COMP. STAT. ANN. 167/25 (West 2020); 725 ILL. COMP. STAT. ANN. 167/30 (West 2020); 725 ILL. COMP. STAT. ANN. 167/40 (West 2020) (There are a number of exceptions that law enforcement agencies in Illinois may utilize to use drones in their operations, however there are also a number of requirements as to the collection, retention and dissemination of the information that is collected by drone.).

[49] IND. CODE ANN. § 35-33-5-9 (West 2020) (In situations where a warrant for a search is required by Indiana law, a law enforcement agency must also receive a warrant to use a drone for a search of a similar nature.).

[50] IOWA CODE ANN. § 808.15 (West 2020) Iinformation obtained by law enforcement used by drone must have been pursuant to a search warrant to be admissible into evidence.).

Kentucky,[51] Nevada,[52], North Dakota,[53] Oregon,[54] Tennessee,[55] Utah,[56] Vermont,[57] Virginia[58] and Wisconsin prescribe the extent

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[51] KY. REV. STAT. ANN. § 500.130 (West 2020) (Kentucky law enforcement agencies may use drones for "legitimate government purposes" or as "authorized under the Fourth Amendment…and Section 10 of the Kentucky Constitution.").

[52] *See* NEV. REV. STAT. ANN. § 493.112 (West 2020); NEV. REV. STAT. ANN. § 493.115 (West 2020) (Absent probable cause or written consent by real property owner, a law enforcement agency in Nevada must obtain a warrant to use a drone for a search.).

[53] N.D. CENT. CODE ANN. § 29-29.4-02 (West 2019) (For information obtained by a drone operated by a law enforcement agency to be admissible into evidence, the information must be obtained by a search warrant or "in accordance with exceptions to the warrant requirement.").

[54] *See* OR. REV. STAT. ANN. § 837.310 (West 2020); OR. REV. STAT. ANN. § 837.320 (West 2020); OR. REV. STAT. ANN. § 837.330 (West 2020); OR. REV. STAT. ANN. § 837.335 (West 2020); OR. REV. STAT. ANN. § 837.340 (West 2020); OR. REV. STAT. ANN. § 837.345 (West 2020) (Oregon law enforcement agencies may use drones if they have obtained a search warrant, are provided consent by the real property owner, in an emergency situation, in crime or accident scene reconstruction or in training).

[55] *See* TENN. CODE ANN. § 39-13-609 (West 2020); TENN. CODE ANN. § 39-13-902 (West 2020); TENN. CODE ANN. § 39-13-905 (West 2020) (Generally, law enforcement agencies must receive a search warrant to use a drone to collect information, however there are a number of exceptions that law enforcement could utilize to use a drone without a search warrant.).

[56] UTAH CODE ANN. § 72-14-203 (West 2020) (So long as a search warrant is obtained, law enforcement agencies can use a drone to collect information. Law enforcement can also use third-party drone data if the data "appears to pertain to the commission of a crime; or the law enforcement agency or officer believes, in good faith, that: the data pertains to an imminent or ongoing emergency involving danger of death or serious bodily injury to an individual; and disclosing the data would assist in remedying the emergency.").

[57] VT. STAT. ANN. tit. 20, § 4622 (West 2020) (Law enforcement may use a drone for "observational, public safety purposes or pursuant to a warrant obtained under Rule 41 of the Vermont Rules of Criminal Procedure.").

[58] VA. CODE ANN. § 19.2-60.1 (West 2020). Generally, drone operation by law enforcement requires a search warrant, however a drone

> may be deployed without a warrant when an Amber Alert is activated pursuant to § 52-34.3; when a Senior Alert is activated pursuant to § 52-34.6; when a Blue Alert is activated pursuant to § 52-34.9; where use of an unmanned aircraft system is determined to be necessary to alleviate an immediate danger to any person; by a law-enforcement officer following an accident where a report is required pursuant to § 46.2-373, to survey the scene of such accident for the purpose of crash reconstruction and record the scene by photographic or video images; by the Department of Transportation when assisting a law-enforcement officer to prepare a report pursuant to § 46.2-373; for training exercises related to such uses; if a person with legal authority consents to the warrantless search; or by a law-enforcement officer to (a) aerially survey a primary residence of the subject of the arrest warrant to formulate a plan to execute an existing arrest

to which law enforcement and other public agencies are able to operate uncrewed aircraft in their jurisdiction.[59] On the other hand, states like Arizona,[60] Arkansas,[61] Delaware,[62] Louisiana,[63] Michigan,[64] New Hampshire,[65] New Jersey,[66] North Carolina[67] and Pennsylvania provide law enforcement and other public agencies with broad discretion to operate uncrewed aircraft like the language of this bill would have provided for agencies in the state of Mississippi.[68]

Section 7 of MUASA addresses the immunity of emergency responders from civil liability when operating uncrewed aircraft during the course of providing emergency services. The section states:

> (1) An emergency responder and his or her employer or employing agency shall be immune from civil liability for any damage caused by an unmanned aircraft or unmanned aircraft system if: (a) Such damage was caused while the emergency responder was engaged in providing emergency services; and (b) The emergency responder reasonably believed that the unmanned aircraft was interfering with the provision of such emergency services. (2) For the purposes of this section: (a) Emergency

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> warrant or capias for a felony offense or (b) locate a person sought for arrest when such person has fled from a law-enforcement officer and a law-enforcement officer remains in hot pursuit of such person.

Id.

[59] WIS. STAT. ANN. § 175.55 (West 2020) (A search warrant is required for law enforcement to operate a drone unless "in a public place or to assist in an active search and rescue operation, to locate an escaped prisoner, to surveil a place or location for the purpose of executing an arrest warrant, or if a law enforcement officer has reasonable suspicion to believe that the use of a drone is necessary to prevent imminent danger to an individual or to prevent imminent destruction of evidence.").

[60] ARIZ. REV. STAT. ANN. § 13-3729 (2020).

[61] ARK. CODE ANN. § 5-60-103 (West 2020).

[62] DEL. CODE ANN. tit. 11, § 1334 (West 2020).

[63] LA. STAT. ANN. § 14:337 (2020).

[64] MICH. COMP. LAWS ANN. § 259.307 (West 2020) (The statute provides limitations for surveillance, but the language provided in the statute shows that law enforcement can be exempt from the limitations.).

[65] N.H. REV. STAT. ANN. § 207:57 (2020).

[66] N.J. Stat. Ann. § 2C:40-30 (West 2020).

[67] *See* N.C. GEN. STAT. ANN. § 15A-300.1 (West 2020); N.C. GEN. STAT. ANN. § 63-95 (West 2020) (Like Michigan, regulations are prescribed for public agencies and law enforcement, however, law enforcement has a number of exemptions from the regulations.).

[68] 18 PA. STAT. AND CONS. STAT. ANN. § 3505 (West 2020).

> responder includes, but is not limited to, a law enforcement officer, a firefighter, an ambulance driver and emergency medical personnel. Emergency responder includes any full-time or part-time paid, volunteer or auxiliary employee of this state or another state, of any division of this state or another state, of the federal government, or of any agency or organization performing emergency management services in this state subject to the order or control of, or pursuant to a request of, a state, a division or the federal government; and (b) Emergency services includes, but is not limited to, firefighting services, police services, medical and health services, search and rescue services, emergency hazardous materials response, emergency evacuation of persons, emergency welfare services, emergency transportation services, restoration of public utility services, and other functions related to the protection of the public.[69]

This is an important provision to include because first responders should not have to worry about damage caused in the course of operation in the time of an emergency. So far, Arizona and California have provided emergency responders a similar form of immunity from civil liability.[70]

Section 8 of MUASA addresses the sabotage or destruction of uncrewed aircraft operated by emergency responders and penalties that accompany any sentencing guidelines. The section reads as follows:

> (1) It shall be unlawful for a person to purposefully or knowingly sabotage, damage or intend to sabotage or damage an unmanned aircraft system operated by a law enforcement, emergency service or fire department, or any other public agency, including an unmanned aircraft system operated on behalf of the agency. (2) Any person who violates subsection (1) of this section is guilty of a felony and shall be punished by confinement in the custody of the Department of Corrections for not less than three (3) years nor more than fifteen (15) years, a fine of not more than Twenty-five Thousand Dollars ($25,000.00), or both.[71]

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[69] MUASA, *supra* note 1, § 7.

[70] ARIZ. REV. STAT. ANN. § 26-314 (2020); CAL. GOV'T CODE § 853 (West 2020); CAL. CIV. CODE § 43.101 (West 2020).

[71] MUASA, *supra* note 1, § 8.

Although there have not been any states that address the sabotage or damage to an uncrewed aircraft operated by law enforcement or a public agency, many states have addressed uncrewed aircraft that unlawfully interfere with the operations of law enforcement and public agencies. Thus far, California,[72] Colorado,[73] Indiana,[74] Louisiana,[75] Michigan[76] and New Jersey have prohibited the operation of an uncrewed aircraft interfering with law enforcement or public agency operations generally.[77] In a similar vein, North Carolina,[78] Oregon[79] and West Virginia have prohibited the interference of a crewed aircraft using an unmanned aircraft,[80] while Montana specifically prohibits the use of an uncrewed aircraft that obstructs an aerial wildfire suppression effort by law enforcement or another public agency.[81] Senator Wiggins' efforts to prohibit the sabotage an uncrewed aircraft being operated by law enforcement or public agencies should serve as a model for other states who plan to introduce legislation addressing the unlawful operation of uncrewed aircraft. However, in the next draft of the bill, language should be drafted that addresses interference more generally as well as the interference of a crewed aircraft.

Section 9 of MUASA specifically addresses the crime of stalking and the application of operating an uncrewed aircraft in the commission of stalking someone. The section indicates that

> Any person, <u>including any person operating an unmanned aircraft system,</u> who purposefully engages in a course of conduct directed at a specific person, or who makes a credible threat, and who knows or should know that the conduct would cause a reasonable person to fear for his or her own safety, to fear for

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72 CAL. PENAL CODE § 402 (West 2020).

73 COLO. REV. STAT. ANN. § 18-8-104 (West 2020).

74 IND. CODE ANN. § 35-44.1-4-10 (West 2020).

75 LA. STAT. ANN. § 14:108 (2020).

76 MICH. COMP. LAWS ANN. § 750.45a (West 2020); MICH. COMP. LAWS ANN. § 259.321 (West 2020).

77 N.J. STAT. ANN. § 2C:40-28 (West 2020).

78 N.C. GEN. STAT. ANN. § 14-280.3 (West 2020).

79 OR. REV. STAT. ANN. § 837.374 (West 2020).

80 W. VA. CODE ANN. § 61-16-2 (West 2020).

81 MONT. CODE ANN. § 76-13-214 (West 2019).

> the safety of another person, or to fear damage or destruction of his or her property, is guilty of the crime of stalking.[82]

Despite Section 3 of this bill addressing tortious and criminal activity generally,[83] the author of the bill decided to address the use of an uncrewed aircraft system to commit the crime of stalking directly. While perhaps unnecessary, this seems to be a safeguard measure in case if a perpetrator attempts to argue that stalking is neither a criminal or tortious activity that Section 3 could apply to.

Section 10 of MUASA directs the Mississippi Transportation Commission to study the integration of uncrewed aircraft into the state airspace, in conjunction with the Department of Public Safety; the Department of Wildlife, Fisheries and Parks; the Department of Corrections; and the Department of Agriculture and Commerce. The section indicates that the Commission's duties include:

> (a) To provide advice to other departments and agencies of this state concerning the use of unmanned aircraft systems and related technology; (b) To provide advice to the public concerning the following: (i) Regulation of unmanned aircraft systems by the federal government and by this state; (ii) Safe operating principles for unmanned aircraft systems; (iii) Restrictions on the use of unmanned aircraft systems; and (iv) Any other matters within the scope of the commission's authority under this act; (c) To provide education and information to departments and agencies of this state, political subdivisions, and the general public about unmanned aircraft systems; (d) To receive and consider comments from persons in this state who are interested in or affected by the use of unmanned aircraft systems.[84]

The necessity of this study is paramount as the technology and prevalence of uncrewed aircraft is increasing. It is critical the state of Mississippi understands how to proactively address issues that may arise with uncrewed aircraft before they become burdensome. Other states such as Wyoming have established commissions to study uncrewed aircraft technology and regulations that would be

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[82] MUASA, *supra* note 1, § 9.
[83] *Id.* § 3.
[84] *Id.* § 10.

necessary to prepare the state for the full integration of uncrewed aircraft into the national airspace.[85]

A creative legislative alternative or addition might be to direct the commission to study the implementation of a Hospital Organ Donation UAS Corridor Network. A number of organs, such as the heart and lung, are viable for transplant only four to six hours after being extracted from a patient.[86] Industry leaders cite cumbersome transportation systems as a reason that annually only 30% of organ transplant patients receive the surgery they need and over 25% of viable organs for transplant are discarded because they cannot get into surgeons' hands in time.[87] However, the successful "custom-made drone" delivery of a kidney to a transplant patient at the University of Maryland School of Medicine in 2019 provides hope that if technology continues to advance and the proper regulatory measures are put into place, then organ delivery by drone can become routine for transplant patients.[88] In order for organ deliveries by drone to be successful state-wide, it would be critical for the state of Mississippi to develop a comprehensive network of unrestricted, uncrewed aircraft corridors between hospitals in the state.[89]

Section 11 of MUASA provides a provisional preemption savings clause that states: "[t]he provisions of this act shall apply unless preempted by applicable federal law or by regulations adopted by the Federal Aviation Administration."[90] The savings clause provided in this bill may seem minor, but the future implications are

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[85] WYO. STAT. ANN. § 10-3-201 (West 2020).

[86] *See Matching Donors and Recipients*, HEALTH RES. & SERVS. ADMIN., https://www.organdonor.gov/about/process/matching.html (last visited Dec. 22, 2020).

[87] *New Partnership in Drone Delivery System for Human Organs,* J. OF EMERGENCY MED. SERV., (Jan. 29, 2020), https://www.jems.com/2020/01/29/new-partnership-in-drone-delivery-system-for-human-organs/.

[88] Karen Zraick, *Like 'Uber for Organs': Drone Delivers Kidney to Maryland Woman*, N.Y. TIMES (Apr. 30, 2019), https://www.nytimes.com/2019/04/30/health/drone-delivers-kidney.html.

[89] *First Segment of NY 50-Mile UAS Corridor Receives BVLOS Authority,* NE. UAS AIRSPACE INTEGRATION RSCH. ALL. (Nov. 8, 2019), https://nuair.org/2019/11/08/first-segment-of-ny-50-mile-uas-corridor-receives-bvlos-authority/ (discusses the benefits that a drone corridor between Griffiss International Airport and the New York State Department of Homeland Security Emergency Services State Preparedness Training Center would provide for the state of New York as a whole).

[90] MUASA, *supra* note 1, § 11.

significant. As was seen in the holding of *Singer v. City of Newton*,[91] a section in this bill may be challenged by a resident of Mississippi and there must be a measure in place to protect the remaining language of the bill. The savings clause does just that.

This bill is a great starting point for legislative efforts in order to integrate drones into the national airspace. The authors encourage Senator Brice Wiggins to reintroduce the bill, with the amendments recommended above, in the next legislative session. It is also the authors' hope that legislators across the nation will review this bill and support similar legislation in their own state. Our final desire is that this bill can serve as a catalyst to support the life-saving innovations that drones provide our society and that this bill can lead the nation to establish special drone corridors for health-system networks nationwide.

[91] Singer v. City of Newton, 284 F. Supp. 3d 125, 128-33 (D. Mass. 2017) (the District Court held that a number of ordinances passed by the City of Newton addressing drone registration, flight altitude requirements and flights beyond the visual line of sight were conflict preempted by FAA regulations).

THE STATE OF DRONES: WHAT ROOM IS LEFT FOR STATES TO ESTABLISH AN UNCREWED AIRCRAFT REGULATORY SCHEME?

Nestor K. Delgado[*]

I. INTRODUCTION

A. Snapshot of Uncrewed Aircraft Industry

Between the rise of the Drone Racing League[1] and the utilization of small unmanned or uncrewed aircraft (alternately referred to herein as UAS) in the global fight against the spread of the coronavirus,[2] uncrewed aircraft have created many benefits for society. Similarly, multiple private sector industries have benefited from the utilization of uncrewed aircraft, including aerial photography,[3] aerial journalism[4] and agriculture[5] to name a few. In the public sector, the utilization of uncrewed aircraft has seen mixed results with

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[1] Dan Weil, *The Next Big Thing in Sports?,* WALL ST. J. (Mar. 11, 2020), https://www.wsj.com/articles/the-next-big-thing-in-sports-11583171352?mod=searchresults&page=1&pos=8.

[2] Timothy W. Martin & Liza Lin, *Fever-Detecting Goggles and Disinfectant Drones: Countries Turn to Tech to Fight Coronavirus,* WALL ST. J. (Mar. 10, 2020), https://www.wsj.com/articles/fever-detecting-goggles-and-disinfectant-drones-countries-turn-to-tech-to-fight-coronavirus-11583832616?mod=searchresults&page=1&pos=15.

[3] David A. Fischer, *Dron't Stop Me Now: Prioritizing Drone Journalism in Commercial Drone Regulation*, 43 COLUM. J.L. & ARTS 107, 109 (2019).

[4] Chuck Tobin et. al., *Will Federal Preemption Push Drone Journalism to New Heights? State, Municipal Regulations Suspect Following Singer v. City of Newton*, COMMC'N. LAW., 40 (Spring 2019).

[5] Allison I. Fultz, *Flying Ahead of the Pack: Drones in the Agriculture Industry*, 35 COMPUT. & INTERNET L., 4 (2018).

disaster relief efforts,[6] policing[7] and firefighting[8] but reports of rogue uncrewed aircraft interrupting first responders have increased.[9] Sectors that have significant potential for uncrewed aircraft include package delivery,[10] and inspection services for insurance companies.[11]

Some key distinctions about uncrewed aircraft and crewed aircraft are: the number of uncrewed aircraft that will need to be registered in 2035 are projected to surpass the number of airplanes that will need to be registered by 2035;[12] and uncrewed aircraft pilots are limited by the Federal Aviation Administration (FAA) to fly up to four hundred (400) feet,[13] compared to the sixty-thousand (60,000) foot ceiling that crewed aircraft are allowed to reach. These stark differences lead to a greater likelihood of tortious or criminal activity occurring with the use of uncrewed aircraft. Issues such as aerial trespass,[14] damage to uncrewed aircraft,[15] law enforcement's duty to public safety and United States (US) Constitutional protections against unreasonable search and seizure are of great concern

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[6] Nanci K. Carr, *Look! It's A Bird! It's A Plane! No, It's A Trespassing Drone*, 23 J. TECH. L. & POL'Y 147, 152 (2019).

[7] Jennifer M. Bentley, *Policing the Police: Balancing the Right to Privacy Against the Beneficial Use of Drone Technology*, 70 HASTINGS L.J. 249, 289 (2018).

[8] Brook C. Kolarich, *Playing with Fire: Drone Incursions into Wildfire Suppression Operations and the Regulatory Challenges to Reducing Their Risks*, 19 TEX. TECH. ADMIN. L.J. 301, 304 (2018).

[9] Colleen Shalby, *Illegal Drones Ground Water-dropping Helicopters at Critical Moment in Maria Fire Battle*, L.A. TIMES (Nov. 2, 2019), https://www.latimes.com/california/story/2019-11-01/maria-fire-drone-hinders-firefighting-efforts-as-blaze-doubles-in-size-overnight; Brittany Shammas, *Drones Are Swarming over Colorado and Nebraska at Night: Authorities Say They Have No Idea Why,* WASH. POST (Jan. 2, 2020), https://www.washingtonpost.com/transportation/2020/01/02/drones-are-swarming-over-colorado-nebraska-night-authorities-say-they-have-no-idea-why/.

[10] Carr, *supra* note 6.

[11] William Goodwin & Tyler Finn, *The Local Future of the Low-Altitude Airspace*, 31 AIR & SPACE L. 18, 21 (2018).

[12] Jonathan Vanian, *More Drones Are Now Registered With the Government Than Airplanes,* FORTUNE (Feb. 8, 2016) https://fortune.com/2016/02/08/more-registered-drones-than-airplanes/.

[13] 14 C.F.R. § 107.58(b). *See* Fed. Aviation Admin., *Fact Sheet – Small Unmanned Aircraft Systems (UAS) Regulations (Part 107)* (July 23, 2018), https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=22615.

[14] Kyle Joseph Farris, *Flying Inside America's Drone Dome and Landing in Aerial Trespass Limbo*, 53 VAL. U. L. REV. 247, 249 (2018).

[15] 5 B. E. Witkin, *Damage to Unmanned Aircraft or Unmanned Aircraft System* § 104 (11th ed. 2020).

to scholars addressing the integration of uncrewed aircraft into the national airspace.[16] To address these concerns, the FAA must keep the following needs in consideration when developing a regulatory scheme for uncrewed aircraft: identification of "see and avoid" technology to avoid unnecessary regulations, development of an uncrewed aircraft operation training scheme, and stipulation of appropriate procedures for when an uncrewed aircraft loses contact or is hacked from the operator.[17] Despite concerns of scholars and considerations of the FAA, states are in a great position to fill the gaps that exist in the regulatory scheme of uncrewed aircraft.

B. Uncrewed Aircraft in Mississippi

Mississippi in particular is uniquely positioned to be at the forefront of innovation in the uncrewed aircraft industry. The leading research university for the Alliance for System Safety of UAS through Research Excellence (ASSURE) is Mississippi State University, which provides the FAA with research to integrate uncrewed aircraft into domestic airspace and helps the industry transition into its billion-dollar potential by critiquing operations of uncrewed aircraft alongside crewed aircraft nationwide.[18] There are three companies (Aurora Flight Sciences, Northrop Grumman Unmanned Systems and Stark Aerospace) that manufacture uncrewed aircraft in the state.[19] There are also a number of community colleges across Mississippi that offer Associate degrees of Applied Science which prepare students for the FAA Part 107 Certification Exam and educate students on how to deconstruct and build their own uncrewed aircraft for a variety of industries.[20] The program

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[16] *See generally* Jamie Busby, *Drone Delivery: The Danger of Opening the Air As A Commercial Highway*, 18 LOY. MAR. L.J. 287, 301-303 (2019).

[17] Benjamin Kapnik, *Unmanned but Accelerating: Navigating the Regulatory and Privacy Challenges of Introducing Unmanned Aircraft into the National Airspace System*, 84 J. AIR L. & COM. 439, 448 (2019).

[18] *About Us,* ASSUREUAS.ORG http://www.assureuas.org/about.php (last visited Dec. 21, 2020).

[19] *Industries-Aerospace,* MISSISSIPPI.ORG, https://mississippi.org/industries/aerospace/ (last visited Dec. 21, 2020).

[20] *Mississippi: Business is Blossoming in the Magnolia State*, BUS. FACILITIES (Nov. 9, 2019), https://businessfacilities.com/2019/11/mississippi-business-is-blossoming-in-the-magnolia-state/; The programs can be found at https://www.hindscc.edu/programs-of-study/career-technical/unmanned-aerial-systems/ and http://www.prcc.edu/academics/plans/technology/uas

offered by community colleges will be introduced in high school vocational programs on the Mississippi Gulf Coast.[21]

Keeping in mind the influence that the uncrewed aircraft industry has on Mississippi, it is important to highlight legislation introduced in the Mississippi Legislature, by Senator Brice Wiggins of Pascagoula, during the 2020 legislative session.[22] The innovative legislative characteristics of Senator Wiggins' bill include the following: establishing uncrewed aircraft as an instrumentality of torts and crimes, establishing that continuous operation of an uncrewed aircraft over a landowner's real property does not create a prescriptive right in their airspace, establishing the fact that county and municipal governments are preempted from enacting ordinances regulating uncrewed aircraft, and creating a commission that serves as an advisory body for the advancement of uncrewed aircraft in the state of Mississippi.[23] Senator Wiggins' bill is a good starting point to safely and efficiently integrate uncrewed aircraft into the state's airspace. Creating a state registry of UAS would be able to provide additional benefits, as has been seen in other states.[24]

As will be demonstrated using the laws of several states as models, it is important to note that legislatively, when states establish an uncrewed aircraft registry, they must concurrently preempt counties and municipalities from being able to pass ordinances regulating uncrewed aircraft so that there is a uniform state operated and maintained registry. In addition, states must create a comprehensive uncrewed aircraft registry that can be operated in conjunction with the FAA's uncrewed aircraft registry.

As one commenter points out, "[w]ithout some agreement between legislatures, researchers and private companies, drone regulations will be extremely slow to develop, which could increase

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[21] Lindsay Mott, *Gautier High School First in State to Pilot New CTE Curriculum*, OURMSHOME.COM (Dec. 24, 2018), https://www.ourmshome.com/gautier-high-school-first-in-state-to-pilot-new-cte-curriculum/.

[22] S.B. 2282, 135th Leg. Sess., Reg. Sess. (Miss. 2020)

[23] *Id.*

[24] Arthur Holland Michel, *Drones AT Home Local and State Drone Laws,* CTR. FOR THE STUD. OF THE DRONE AT BARD COLLEGE (March 2017), https://dronecenter.bard.edu/files/2017/03/CSD-Local-and-State-Drone-Laws-1.pdf.

public fears around safety, privacy and surveillance."[25] The current state of affairs provides Mississippi an opportunity to be the leader in the mitigation of public fears of uncrewed aircraft by passing common-sense legislation that addresses the integration of uncrewed aircraft into intrastate airspace.

C. What to Expect

Echoing the sentiment of a Heritage Foundation legal fellow, Jonathan Zalewski, "the time is ripe to begin thinking about a new framework that incorporates state regulation of the NAS [national air space]."[26] That sentiment, coupled with statements from the Secretary of Transportation[27] and FAA Administrator,[28] give weight to the argument that states are in a position to create efficient uncrewed aircraft registries. In order to create the registry, state legislatures must pass legislation that does the following: preempts counties and municipalities from enacting ordinances regulating uncrewed aircraft, establishes a state operated and maintained uncrewed aircraft registry and distinguishes a state government's right to control navigable intrastate airspace from the FAA's right to control navigable interstate airspace.

Building on the background that was set out in Part I, Part II will introduce the concept of preemption under the Federal Aviation Act, Airline Deregulation Act and judicial decisions specific to

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[25] Zoe Manzanetti, *Legislators Face Tech-Heavy Agenda as They Confront the Future: Digital Issues to Watch,* GOVERNING.COM (Feb. 27, 2020), https://www.governing.com/next/Digital-Issues-to-Watch-in-2020.html.

[26] Jonathan M. Zalewski, *Sharing the Sky: Regulating Unmanned Aircraft in American Airspace Via Cooperative Federalism*, 42 U. DAYTON L. REV. 333, 348 (2017).

[27] Elaine L. Chao, *UAS Integration Pilot Program Selection Announcement*, U.S. DEP'T TRANSP. (May 9, 2018), https://www.transportation.gov/briefing-room/uas-integration-pilot-Program-selection-announcement ("Instead of a dictate from Washington, this program takes another approach. It allows interested communities to test drones in ways they are comfortable with.").

[28] Jeremiah Karpowicz, *Drone Integration and Regulatory Acceleration—An Interview with FAA Acting Administrator Dan Elwell*, COM. UAV NEWS (Sept. 4, 2018), https://www.expouav.com/news/latest/drone-integration-regulatory-acceleration-faa-dan-elwell/ ("Ultimately, what we want is some sort of standard or overarching rule(s) with broad applicability that can be tailored by the local community. To illustrate this further, let's look at other aviation contexts. Medivac helicopters operate under certain rules and regulations set forth by the FAA. However, the local jurisdictional authority provides additional guidance on where they can take off or land for routine operations. We envision the same dynamic for drone operations.").

uncrewed aircraft. Part III will highlight the necessity for states to act, in line with a proposal from the Real Estate Section of the American Bar Association (ABA). Part III will also demonstrate the legislative actions other states have taken so far on uncrewed aircraft. Finally, Part IV will demonstrate how cities and counties have contributed to the patchwork effect of uncrewed aircraft legislation. Further, Part IV will make the case as to why Senator Brice Wiggins' bill and the proposed legislation will provide a great foundation for states to follow. Part V will highlight on-going cases regarding the operation of uncrewed aircraft and offer concluding thoughts.

II. ZONE OF FEDERAL AUTHORITY IN AVIATION

A. Introduction to Preemption Generally

The 10th Amendment to the US Constitution states that "[t]he powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people."[29] In contrast,, Article VI of the Constitution, colloquially referred to as the Supremacy Clause, declares that

> [t]his Constitution, and the laws of the United States which shall be made in pursuance thereof; and all treaties made, or which shall be made, under the authority of the United States, shall be the supreme law of the land; and the judges in every state shall be bound thereby, anything in the Constitution or laws of any State to the contrary notwithstanding.[30]

Where questions arose as to whether federal law or state law controls a given situation, courts have engaged in an analysis as to whether the Supremacy clause requires that federal law preempts state law, or whether the 10th Amendment limits of the delegation to the federal government and preserves powers reserved to the states.

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[29] U.S. CONST. amend. X.

[30] U.S. CONST. art. VI cl. 2.

There are two types of preemption generally: express and implied.[31] Of implied preemption, there are two types: implied conflict preemption and implied field preemption.[32] Where a court is faced with express preemption, Congress' intent is often clearly demonstrated in the text of the preemption provision. However, when faced with the challenge of determining whether state law is impliedly preempted by an act of the US Congress or by federal regulations that flow therefrom, and in keeping with the 10th Amendment, Courts tend to begin a preemption analysis by invoking a presumption against preemption and looking for Congress' intent. For example, in *Rice v. Santa Fe Elevator Corp.*, a case that presents the roots of preemption jurisprudence and succinctly describes the various types of implied preemption, the US Supreme Court held that:

> Congress legislated here in [a] field which the States have traditionally occupied….So we start with the assumption that the historic police powers of the States were not to be superseded by the Federal Act unless that was the clear and manifest purpose of Congress….Such a purpose may be evidenced in several ways. The scheme of federal regulation may be so pervasive as to make reasonable the inference that Congress left no room for the States to supplement it.…Or the Act of Congress may touch a field in which the federal interest is so dominant that the federal system will be assumed to preclude enforcement of state laws on the same subject.…Likewise, the object sought to be obtained by the federal law and the character of obligations imposed by it may reveal the same purpose.…Or the state policy may produce a result inconsistent with the objective of the federal statute…..It is often a perplexing question whether Congress has precluded state action or by the choice of selective regulatory measures has left the police power of the States undisturbed except as the state and federal regulations collide.[33]

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[31] Justin W. Aimonetti & Christian Talley, *Game Changer: Why and How Congress Should Preempt State Student-Athlete Compensation Regimes*, 72 STAN. L. REV. ONLINE 28, 39 (2019), https://www.stanfordlawreview.org/online/game-changer/.

[32] *Id.*

[33] Rice v. Santa Fe Elevator Corp., 331 U.S. 218, 230-31 (1947).

Courts would subsequently identify the "assumption" described above as a "presumption against preemption."[34] As we consider the role of states in the regulation of drones and the types of preemption identified above, it is important to keep the presumption against preemption in mind, for the bedrock of the federalist system is subsidiarity, a concept embraced by the European Union where the federal government acts only when a state, county or municipal government is unable to.[35]

i. Express Preemption

Express preemption occurs where "Congress unambiguously states that preemption is to occur, there is no need to look beyond the specific language at issue because the results of the preemptive language are clear and unambiguous."[36] Express preemption analysis often takes place when a preemption provision provided in legislation is core to the question that a Court must answer.[37] In 1992, Justices Scalia and Thomas' concurrence in part in *Cipollone v. Liggett Group, Inc.*[38] pointed out that "[t]he existence of an express preemption provision tends to contradict any inference that Congress intended to occupy a field broader than the statute's express language defines."[39] Justices Scalia and Thomas are saying in *Cipollone* that where there is express preemption, Congress' intent is to preempt only that area described in the express language of the statute, and inferences that Congress intended to occupy a field broader than the express language are contradicted by the express language. So, if there is express preemption, there is no inference

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[34] *See, e.g.,* Sikkelee v. Precision Airmotive Corp., 822 F.3d 680, 683 (3d Cir. 2016) (Holding that federal law does not preempt state law product liability claims, because, "In light of principles of federalism and the presumption against preemption, Congress must express its clear and manifest intent to preempt an entire field of state law. Here none of the relevant statutes or regulations signals such an intent.")

[35] Johan Meeusen, *Comparing Interstate and European Conflict of Laws from A Constitutional Perspective: Can the United States Inspire the European Union?*, 67 AM. J. COMP. L. 637, 648 (2019).

[36] Laura K. Jortberg, *Who Should Bear the Burden of Experimental Medical Device Testing: The Preemptive Scope of the Medical Device Amendments Under Slater v. Optical Radiation Corp.*, 43 DEPAUL L. REV. 963, 990 (1994).

[37] Susan J. Stabile, *Preemption of State Law by Federal Law: A Task for Congress or the Courts?*, 40 VILL. L. REV. 1, 6 (1995).

[38] Cipollone v. Liggett Grp., Inc., 505 U.S. 504, 547 (1992).

[39] *Id.* at 547.

of a broader preemption, at least under that statute. Thus, where Congress has provided an express preemption clause, inferences of congressional intent to preempt a field broader than the express terms of the statute should not be entertained by courts.

ii. Implied Conflict Preemption

Implied conflict preemption "occurs when federal and state provisions directly conflict, preventing a party from complying with both regulations simultaneously."[40] O way this arises is when a state action conflicts with an issue of foreign relations. As Justice Souter wrote in *American Ins. Ass'n v. Garamendi,*[41] "an exercise of state power that touches on foreign relations must yield to the National Government's policy."[42]

A case of potential conflict preemption that arose just three years after *Garamendi*[43] was *Gonzales v. Oregon*[44] where the Supreme Court had to decide whether or not Congress, through the enactment of the Controlled Substances Act (CSA), preempted Oregon's Death with Dignity Act (DDA), which allowed physicians to practice physician-assisted suicide with controlled drugs for terminally ill patients.[45] For analysis later in this Article, it is important to point out that the Court stated that although "[s]tates traditionally have had great latitude under their police powers to legislate as to 'the protection of the lives, limbs, health, comfort, and quiet of all persons'. . .,[46] there is "no question that the federal government can set uniform national standards in these areas."[47] The Court ultimately decided that the CSA did not preempt the DDA by holding that "[t]he text and structure of the CSA show that Congress did not have this far-reaching intent to alter the federal-state balance and the congressional role in maintaining it."[48]

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[40] Jonathan V. O'Steen & Van O'Steen, *The FDA Defense: Vioxx(r) and the Argument Against Federal Preemption of State Claims for Injuries Resulting from Defective Drugs*, 48 ARIZ. L. REV. 67, 70 (2006).

[41] Am. Ins. Ass'n v. Garamendi, 539 U.S. 396 (2003).

[42] *Id.* at 413.

[43] *Id.*

[44] *See generally Gonzales* v. Oregon, 546 U.S. 243 (2006).

[45] *Id.* at 250.

[46] *Id.* at 270 (*quoting* Metro. Life Ins. Co. v. Massachusetts, 471 U.S. 724, 756 (1985)).

[47] *Gonzales* v. Oregon, 546 U.S. 243, 271 (2006).

[48] *Id.* at 275.

Just over a decade later, in *Arizona v. Inter Tribal Council of Arizona*[49] an issue came before the Supreme Court about whether an Arizona law requiring voters to provide a proof of citizenship to vote in federal elections was preempted by a federal regulation stating that citizens simply had to assert their citizenship under oath to vote in federal elections.[50] The majority in *Arizona* wrote that "when Congress legislates with respect to the 'Times, Places and Manner' of holding congressional elections, it necessarily displaces some element of a pre-existing legal regime erected by the States."[51] The displacement in this case was the "manner" of which the elections were held and the majority in *Arizona* held that the National Voter Registration Act

> precludes Arizona from requiring a Federal Form applicant to submit information beyond that required by the form itself. Arizona may, however, request anew that the EAC include such a requirement among the Federal Form's state-specific instructions, and may seek judicial review of the EAC's decision under the Administrative Procedure Act.[52]

The holding in *Arizona* led the states of Arizona and Kansas to create a two-tier voter registration system, requiring proof of citizenship in state elections but not federal elections.[53]

In 2016, Kansas' Secretary of State, Kris Kobach faced a series of court cases that contested the two-tier voter registration system. The first was *Fish v. Kobach*[54] where the court's majority ruled that "Secretary of State [Kobach] is directed to register for federal elections all otherwise eligible motor voter registration applicants that have been canceled or are in suspense due solely to their failure to provide [Documentary Proof of Citizenship]."[55] The second resulting case was *League of Women Voters of United States v. Newby*.[56] Like *Fish v. Kobach, a*t question here was the right of states to

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[49] Arizona v. Inter Tribal Council of Arizona, Inc., 570 U.S. 1 (2013).

[50] *Id.* at 4-7.

[51] *Id.* at 14.

[52] *Id.* at 20.

[53] Amanda Crawford, *Not All Voters Equal as States Move to Two-Tier Ballots*, BLOOMBERG (Oct. 9, 2013), https://www.bloomberg.com/news/articles/2013-10-10/not-all-voters-equal-as-states-move-to-two-tier-ballots.

[54] Fish v. Kobach, 189 F. Supp. 3d 1107 (D. Kan. 2016).

[55] *Id.* at 1152.

[56] League of Women Voters v. Newby, 838 F.3d 1 (D.C. Cir. 2016).

require "anybody who wishes to register to vote . . . provide documentary proof of United States citizenship." This requirement was appended to the "federally prescribed national mail voter registration form, often called 'the Federal Form.'"[57] The effect of this action was that the Federal Form led "registrants . . . to believe that they cannot be registered for federal elections unless they provide proof of citizenship.".[58] The court found that though Congress has the power to preempt state regulation, states have "exclusive authority to decide the eligibility for voters in federal elections,"[59] Nevertheless, here the court reasoned that the federal law as encapsulated in the Federal Form did not preclude a state from requiring additional information, but simply had to show that such information was "necessary."[60] The majority in *Newby* ultimately struck down the "state-specific instructions."[61]

Conflict preemption can occur across a variety of policy issues but its impact on the uncrewed aircraft industry is quite significant. The voter cases are persuasive for the argument that just because a federal regulation is in place, the regulation does not leave states unable to create a supplementary regulation for their residents to follow. Later in this Article, discussion will address a number of cases regarding how the integration of uncrewed aircraft into the national airspace has led to disputes between government entities and uncrewed aircraft operators who question the authority of the government entities passing regulations on the operation of uncrewed aircraft.

iii. Implied Field Preemption

According to Mr. Durst and Mrs. Shultz, an analysis of implied field preemption would be entertained by a Court when "authority intended to be wielded by," the federal government, is excluded from being exercised by the states.[62] In 1984, the Supreme Court in

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[57] *Id.* at 5.

[58] *Id.* at 4 (citations omitted).

[59] *Id.* at 11 (citations omitted).

[60] *Id.*

[61] *Id.* at 15.

[62] Daniel A. Durst & Karla M. Shultz, *Wielding and Yielding: Pennsylvania Judicial Procedural Rulemaking Authority and the Preemption Doctrine*, 26 WIDENER L.J. 45, 60 (2017).

Silkwood v. Kerr-McGee Corp.[63] determined that "[i]f Congress evidences an intent to occupy a given field, any state law falling within that field is preempted."[64] This principle is at work within a variety of fields, including alien registration and nuclear energy safety regulations.

The preempted field of alien registration is fairly straightforward. Whereas in 1941, the *Hines v. Davidowitz*[65] Court found that "[w]here the federal government has enacted a complete scheme for the regulation of aliens, and has therein provided a standard for their registration, a state cannot, inconsistently with the purpose of Congress, interfere with, curtail, or complement the federal law, or enforce additional or auxiliary regulations."[66] In 2012, the majority in *Arizona v. United States* stated that the "[g]overnment of United States has broad, undoubted power over the subject of immigration and status of aliens, resting, in part, on its constitutional power to 'establish a uniform Rule of Naturalization,' and its inherent power as sovereign to control and conduct relations with foreign nations."[67] Both holdings show the broad power that Congress possesses over states in matters of foreign affairs.

In nuclear energy, the line of precedent is not as straightforward. The Atomic Energy Act of 1954 (AEA) established a regulatory regime headed by the Atomic Energy Commission[68] that preempted the field of nuclear safety regulation. In 1983, a distinction was made in the holding of *Pacific Gas and Electric Company v. State Energy*[69] where the Court found that while "the Federal Government has occupied the entire field of nuclear safety concerns"[70] the "legal reality remains that Congress has left sufficient authority in the states to allow the development of nuclear power to be slowed or even stopped for economic reasons,"[71] which showed that state laws and regulations that were related to nuclear non-

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[63] Silkwood v. Kerr-McGee Corp., 464 U.S. 238 (1984).

[64] *Id.* at 248.

[65] Hines v. Davidowitz, 312 U.S. 52 (1941).

[66] *Id.* at 66.

[67] Arizona v. United States, 567 U.S. 387 (2012).

[68] 42 U.S.C. § 2011.

[69] Pacific Gas & Elec. Co. v. State Energy Res. Conservation & Dev. Comm'n, 461 U.S. 190, 223 (1983).

[70] *Id.* at 212.

[71] *Id.* at 223.

safety measures fell outside of the preempted field of the AEA. Furthermore, the holdings in *English v. General Electric*[72] and *Virginia Uranium, Inc. v. Warren*[73] showed that state law regulating nuclear safety would be preempted if it had "some direct and substantial effect on the decisions made by those who build or operate nuclear facilities concerning radiological safety levels"[74] and "comes close to trenching on core federal powers."[75]

iv. Conclusions on Preemption, Generally

The zones of federal authority and state authority regulating the aviation industry vary based upon the regulations that are the subject of discussion. The essence of express preemption lies in the provisions drafted by Congress. Consideration of the presence of implied conflict preemption is critical in a preemption analysis because courts must be careful to find whether or not a state provision directly contradicts a federal provision. Implied field preemption is important to a preemption discussion because states must be careful not to pass legislation that intervenes with the intent of the federal government.

In matters of aviation, the Federal Aviation Act often involves an analysis of implied field preemption as that Act carries no express preemption provision, whereas the Airline Deregulation Act requires an analysis of express preemption under 49 U.S.C. § 41713. These are addressed in the next section.

B. Aviation Preemption Challenges

i. Federal Aviation Act

The Federal Aviation Act of 1958,[76] which established "the FAA, was passed by Congress for the purpose of centralizing in a single authority the power to frame rules for the safe and efficient use of the nation's air space." [77] For the sake of this discussion, it is

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[72] English v. Gen. Elec. Co., 496 U.S. 72 (1990).

[73] Virginia Uranium, Inc. v. Warren, 139 S. Ct. 1894 (2019).

[74] *English v. Gen. Elec. Co.,* 496 U.S. at 85.

[75] Virginia Uranium, Inc. v. Warren, 139 S. Ct. at 1903.

[76] Fed. Aviation Act of 1958, § 601(A)(5, 6), (B); 49 U.S.C.A. § 1421(A)(5, 6), (B).

[77] Charles F. Krause & Kent C. Krause, *Preemption under the Federal Aviation Act,* 1 AVIATION TORT AND REGULATORY LAW § 5:3 (2020).

important to showcase the codified result of this Act, as it pertains to air safety, where the powers delegated to the FAA Administrator were to promote and oversee the safety of American airspace.[78] As Adam Miller pointed out, "49 U.S.C. 44701(a)(5) allows the FAA to prescribe regulations and minimum standards necessary for safety in air commerce and national security,"[79] and this allowance leaves "some room for state and local UAS laws, albeit recommending that state authorities first consult federal aviation authorities in such matters."[80]

Jurisprudence on the Federal Aviation Act shows that where there are pervasive regulations in an area, the Federal Aviation Act preempts all state claims in that area, particularly air safety.[81] In 1973, the US Supreme Court held in *City of Burbank v. Lockheed Air Terminal* that "[t]he Federal Aviation Act requires a delicate balance between safety and efficiency. . . . and the protection of persons on the ground . . . [t]he interdependence of these factors requires a uniform and exclusive system of federal regulation if the congressional objectives underlying the Federal Aviation Act are to be fulfilled."[82] In 1989, the 1st Circuit followed the guidance in *City of Burbank*[83] by holding that there was "an unmistakably clear intent to occupy the field of pilot regulation related to air safety, to the exclusion of state law."[84] A decade later, in *Abdullah v. American Airlines,* the 3rd Circuit found "Congress's intent to regulate interstate and international air safety to be unambiguous"[85] and held "state and territorial standards of care in aviation safety are federally preempted."[86] In 2004, the 5th Circuit held in *Witty v. Delta Airlines* that "federal regulatory requirements for passenger safety warnings and instructions are exclusive and preempt all state standards and requirements."[87] In 2005 and 2007, the 6th

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[78] 49 U.S.C.A. § 44701.

[79] Adam N. Miller, *Up in the Air: The Status & Future of Drone Regulation in Hawai'i*, 40 U. HAW. L. REV. 307, 331 (2017).

[80] Timothy M. Ravich, *Airports, Droneports, and the New Urban Airspace*, 44 FORDHAM URB. L.J. 587 (2017).

[81] Allen v. Spirit Airlines, Inc., 981 F. Supp. 2d 688, 692 (E.D. Mich. 2013).

[82] City of Burbank v. Lockheed Air Terminal Inc., 411 U.S. 624, 638–39 (1973).

[83] *Id.*

[84] French v. Pan Am Exp., Inc., 869 F.2d 1, 6 (1st Cir. 1989).

[85] Abdullah v. Am. Airlines, Inc., 181 F.3d 363, 376 (3d Cir. 1999).

[86] *Id.*

[87] Witty v. Delta Air Lines, Inc., 366 F.3d 380, 385 (5th Cir. 2004).

Circuit and 9th Circuit agreed with the 3rd Circuit's reasoning by holding respectively that "federal law establishes the standards of care in the field of aviation safety and thus preempts the field from state regulation"[88] and "federal law occupies the entire field of aviation safety."[89] On the basis of the Act's purpose to centralize air safety regulation and the resulting regulatory scheme, the 10th Circuit held in 2010 that "federal regulation occupies the field of aviation safety to the exclusion of state regulations."[90] Just a year later, the 2nd Circuit concluded that "Congress intended to occupy the field of air safety,"[91] but their discussion of the scope of Congress' intention to preempt the field of air safety is core to the essence of this paper. The 2nd Circuit highlights that "[i]n occupying the field of air safety, Congress did not intend to preempt the operation of state statutes and regulations like the ones at issue here"[92] and ultimately held that

> [a]lthough….Congress has indicated its intent to occupy the entire field of aviation safety, the generally applicable state laws and regulations imposing permit requirements on land use challenged here do not, on the facts before us, invade that preempted field.[93]

The holding in *Goodspeed Airport v. East Haddam Inland Wetlands and Watercourses Commission* shows that permit requirements on land use do not necessarily deal with aviation safety, and therefore might fall outside of the field of congressional preemption.[94] *Goodspeed* is important because it provides states with persuasive authority to make a case that there are powers available to them to oversee the regulations of uncrewed aircraft, notwithstanding implied preemption under the Federal Aviation Act.[95]

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[88] Greene v. B.F. Goodrich Avionics Sys., Inc., 409 F.3d 784, 795 (6th Cir. 2005).

[89] Montalvo v. Spirit Airlines, 508 F.3d 464, 473 (9th Cir. 2007).

[90] US Airways, Inc. v. O'Donnell, 627 F.3d 1318, 1326 (10th Cir. 2010).

[91] Goodspeed Airport LLC v. E. Haddam Inland Wetlands & Watercourses Comm'n, 634 F.3d 206, 210 (2d Cir. 2011).

[92] *Id.* at 212.

[93] *Id.*

[94] *Id.*

[95] *Id.*

ii. Airline Deregulation Act

In 1978, when Congress passed the Airline Deregulation Act (ADA), they "sought to ensure that its repeal of much of the federal regulatory program would not be undercut by new and invasive state regulation"[96] by including an express preemption provision.

When the ADA passed, the provision originally stated that

> no State or political subdivision thereof and no interstate agency or other political agency of two or more States shall enact or enforce any law, rule, regulation, standard, or other provision having the force and effect of law relating to rates, routes, or services of *any air carrier having authority under [title IV of this Act] to provide air transportation*.[97]

Following a recodification of title 49 of the U.S. Code in 1994,[98] the provision now states

> a State, political subdivision of a State, or political authority of at least 2 States may not enact or enforce a law, regulation, or other provision having the force and effect of law related to a price, route, or service of *an air carrier* that *may provide air transportation under this subpart* [(subpart II of part A of subtitle VII of title 49)].[99]

The linguistic difference of the provision was highlighted by two attorneys from the US Department of Transportation (DOT) who recently published an article stating that

> [i]nstead of slavishly abiding by the current text, courts must familiarize themselves with the pre-recodification law so as to correctly find the ADA applicable to intrastate operators, with

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[96] Jol A. Silversmith, *Federal Preemption over Air Carrier Prices, Routes, and Services: Recent Developments*, 24 No. 3 AIR & SPACE L. 4, 4 (2012); *see* Airline Deregulation Act of 1978, 49 U.S.C. § 41713.

[97] 49 U.S.C.A. § 1305(a)(1) (West 2020) (*emphasis added*).

[98] Revision of Title 49, U.S.C. Annotated, "Transp.", Pl 103–272, July 5, 1994, 108 Stat. 745.

[99] 49 U.S.C.A. § 41713 (West 2020) (*emphasis added*).

> economic authority constituting the appropriate predicate for such a finding.[100]

Scholars have also highlighted a number of Courts who have ruled on the effect of the ADA preemption provision that have established binding precedent for courts in the future.[101] Despite the Supreme Court's finding in *Northwest, Inc. v. Ginsberg,*[102] advising courts to rely upon pre-recodification language sets a dangerous precedent and backtracks the progress that has been made in the field over the past twenty years.

In 1992, utilizing precedent set by a previous holding on the effect of the preemption provision of the Employee Retirement Income Security Act of 1974,[103] the US Supreme Court held in *Morales v. Trans World Airlines* that "[s]tate enforcement actions having a connection with or reference to airline "rates, routes, or services" are pre-empted under 49 U.S.C.App. § 1305(a)(1)."[104] The *Morales*[105] holding, authored by Justice Scalia, was at the core of the discussion of *American Airlines v. Wolens* just three years later.[106] In *Wolens,* the majority held that "[t]he ADA's preemption clause. . . stops States from imposing their own substantive standards with respect to rates, routes, or services, but not from affording relief to a party who claims and proves that an airline dishonored a term the airline itself stipulated."[107] The majority is right in asserting that the application of express preemption upon state laws should be uniform. Those decisions should not be left to the mercy of the Supreme Court Justice authoring the opinion. As long as the

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[100] Alexander Simpson & Claire McKenna, *No Good Deed Goes Unpunished: The Recodification of the Airline Deregulation Act's Preemption Provision*, 31 AIR & SPACE L. 8, 11 (2018).

[101] *See generally,* Paul Stephen Dempsey, *Federal Preemption of State Regulation of Airline Pricing, Routes, and Services: The Airline Deregulation Act*, 10 FIU L. REV. 435 (2015).

[102] Northwest, Inc. v. Ginsberg, 572 U.S. 273, 282 (2014) ("While 'rule[s]' and 'standard[s]' are not mentioned in the current version of the statute, this omission is the result of a recodification that was not meant to affect the provision's meaning. Those additional terms were deleted as part of a wholesale recodification of Title 49 in 1994, but Congress made it clear that this recodification did not effect any 'substantive change.'").

[103] *See* Shaw v. Delta Air Lines, Inc., 463 U.S. 85, 85 (1983).

[104] Morales v. Trans World Airlines, Inc., 504 U.S. 374, 384 (1992).

[105] *Id.*

[106] *Id.*

[107] Am. Airlines, Inc. v. Wolens, 513 U.S. 219, 232–33 (1995).

landscape of the nation has not drastically changed between opinions, precedent should remain binding for purposes of delineating powers between states and the federal government.

The immediate response to *Wolens* and *Morales* took place in 1997,[108] when the 2nd Circuit held in *Abdu-Brisson v. Delta Airlines* that there was not an applicable bright line test to ADA express preemption provision challenges and that the provision should be approached by courts on a case-by-case basis.[109] Despite the court stating that there was not a definite bright line test, the 2nd Circuit acknowledged that

> [i]f state laws….are preempted merely because they can be said to broadly and generally "relate to prices or services" only in some tenuous, remote or peripheral way and thus preempted, then it is federal law which is unnecessarily interfering with legitimate state laws and policies. We do not believe that congressional intent should be so broadly interpreted without clear justification.[110]

In 2007, the 9th Circuit balanced three elements in *Montalvo v. Spirit Airlines* to determine whether the ADA's preemption provision expressly preempted Montalvo's claim.[111] First, the Court had to "ascertain and give effect to the plain meaning of the language used."[112] Then, the Court "look[ed] to the provisions of the whole law and to its object and policy."[113] Finally, the Court kept in mind that "Congress' intent is the ultimate touchstone of every preemption case."[114] Using *Witty*[115] as a basis for deciding this case, the 9th Circuit held that "[w]ithout more factual development, we cannot determine whether the preemptive reach of *Morales* extends as far as the seating configuration issue presented in this case" which resulted in the case being remanded to the District Court.[116]

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[108] *Id.; Morales v. Trans World Airlines, Inc.,* 504 U.S. at 384.

[109] Abdu-Brisson v. Delta Airlines, Inc., 128 F.3d 77, 85–86 (2d Cir. 1997).

[110] *Id.*

[111] Montalvo v. Spirit Airlines, 508 F.3d 464, 474 (9th Cir. 2007).

[112] *Id.* (quoting Hughes Air Corp. v. Public Util. Comm'n*,* 644 F.2d 1334, 1337 (9th Cir. 1981)).

[113] *Id.* (quoting Kelly v. Robinson*,* 479 U.S. 36, 43 (1986)).

[114] *Id.*

[115] *Witty v. Delta Air Lines, Inc.*, 366 F.3d at 85.

[116] *Montalvo v. Spirit Airlines*, 508 F.3d at 475.

Around the same time the 9th Circuit reached a decision in *Montalvo*,[117] a series of lengthy delays occurred on New York runways where passengers were not provided water or food.[118] This led the New York Legislature to pass measures ensuring passengers received fresh air, waste removal services and adequate food and water. The Air Transport Association contended this was preempted by the ADA.[119] The 2nd Circuit ultimately highlighted in 2008 that the "[p]urpose of the express preemption provision of the . . . ADA[] was to ensure that the states would not undo the federal deregulation with regulation of their own."[120] It held that the

> express preemption provision of ADA stated that a state law was preempted if it related to a price, route, or service of an air carrier, and the PBR requirements clearly related to services of an air carrier, as it substituted its requirements for competitive market forces, by mandating specific services"[121]

so it was therefore expressly preempted by the ADA.

Contrary to previous cases where actions by state legislatures and government agencies were core to the preemption discussion, in 2014, the Supreme Court encountered a case where it had to decide "whether the Airline Deregulation Act pre-empts a state-law claim for breach of the implied covenant of good faith and fair dealing."[122] In 2008, Northwest Airlines terminated Ginsberg's status with their frequent flyer program, WorldPerks Airline Partners Program, citing that he had "abused" their program; Ginsberg contended that Northwest terminated his status as a "cost-cutting measure."[123] The Supreme Court concluded that "the phrase 'other provision having the force and effect of law' includes common-law claims"[124] and held that "[b]ecause respondent's implied covenant of good faith and fair dealing claim seeks to enlarge his contractual agreement with petitioners. . . .49 U.S.C. § 41713(b)(1) pre-empts

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[117] *Id.*
[118] Air Transp. Ass'n of Am., Inc. v. Cuomo, 520 F.3d 218, 218 (2d Cir. 2008).
[119] *Id.*
[120] *Id.* at 222.
[121] *Id.*
[122] *Northwest, Inc. v. Ginsberg*, 572 U.S. at 276.
[123] *Id.* at 276, 277.
[124] *Id.* at 284.

the claim."[125] The portion of this decision that was particularly interesting was when the Court stated that "[w]hat is important, therefore, is the effect of a state law, regulation, or provision, not its form, and the ADA's deregulatory aim can be undermined just as surely by a state common-law rule as it can by a state statute or regulation."[126] The emphasis on the effect, not form, of a state statute is particularly interesting and a great way to approach the relationship that statutes share with preemption challenges. The emphasis also echoes Justices Scalia and Thomas' concurrence in *Cipollone,*[127] where the takeaway was that if there is express preemption, there is not field preemption based upon the same statute, which means that the preemptive effect is narrowed to mean only those things expressly stated by Congress are preempted.[128] The concurrence in *Cipollone*, as well as the jurisprudence described above indicates limitations on the preemptive effect of the ADA.

C. Uncrewed Aircraft and Preemption

i. The FAA's Power Grab

US Supreme Court jurisprudence shows that the FAA's authority is very broad, so the ultimate question is whether there are areas that would fall out of federal authority and within state authority. The FAA Modernization and Reform Act of 2012,[129] resulting FAA regulations,[130] *Taylor v. Huerta*[131] and *Singer v. City of Newton*[132] provide guidance on this question.

The origins of the FAA's registration rule for uncrewed aircraft began in 2012 when the FAA Modernization and Reform Act was passed and signed into law by President Obama. This act included the Special Rule for Model Aircraft[133] which stated that the FAA

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[125] *Id.* at 289.

[126] *Id.* at 283.

[127] *Cipollone v. Liggett Grp., Inc.*, 505 U.S. at 2633.

[128] *Id.*

[129] FAA Modernization and Reform Act Of 2012, Pl 112-95, Feb. 14, 2012, 126 Stat 11.

[130] 14 C.F.R. § 107.

[131] Taylor v. Huerta, 856 F.3d 1089 (D.C. Cir. 2017)

[132] Singer v. City of Newton, 284 F. Supp. 3d 125 (D. Mass. 2017).

[133] FAA Modernization and Reform Act Of 2012, Pl 112-95, Feb. 14, 2012, 126 Stat 11.

"may not promulgate any rule or regulation regarding a model aircraft."[134] During the Obama Administration, a directive was released stating

> [n]ot later than November 10, 2012, the Secretary of Transportation, in consultation with. . . the aviation industry, Federal agencies . . ., and the unmanned aircraft systems industry, shall develop a comprehensive plan to . . . (iii) establish standards and requirements for the operator and pilot of a civil unmanned aircraft system, including standards and requirements for registration and licensing.[135]

From this directive came a series of actions from the DOT and the FAA to create a regulatory framework addressing the registration of uncrewed aircraft.

In 2014, an administrative law judge with the National Transportation Safety Board (NTSB) upheld an FAA order designating uncrewed aircraft as definitionally the same as crewed aircraft, stating that "[w]e must look no further than the clear, unambiguous plain language of 49 U.S.C. § 40102(a)(6) and 14 C.F.R. § 1.1: an 'aircraft' is any 'device' 'used for flight in the air.' This definition includes any aircraft, crewed or uncrewed, large or small."[136] Two years later, the FAA published 14 C.F.R. Part 107, which introduced regulations including general provisions, operating rules, remote pilot certification requirements and waivers available to uncrewed aircraft pilots.[137] The NTSB administrative law judge's finding and 14 C.F.R. Part 107 were paramount to two cases that were decided three years later. *Taylor v Huerta*[138] and *Singer v City of Newton*,[139] addressed the FAA's authority over uncrewed aircraft and how state laws and local ordinances are affected by preemption of federal law.

In 2015, John Taylor was a model aircraft hobbyist in Washington DC who challenged an Advisory Circular which provided that model aircraft could not fly within Flight Restricted Zones, and a FAA-issued rule requiring owners of all small uncrewed aircraft

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134 49 U.S.C. § 40101.
135 49 U.S.C. § 44802.
136 Huerta v. Pirker, 2014 WL 8095629, at 5.
137 14 C.F.R. § 107.
138 *Taylor v. Huerta*, 856 F.3d 1089.
139 *Singer v. City of Newton,* 284 F. Supp. 3d at 125.

to register with the FAA.[140] The language of the Advisory Circular required that a person challenging the order must do so within 60 days of the order's issuance and although Taylor missed the deadline, he was still afforded the opportunity to file a late petition on "reasonable grounds."[141] Taylor listed two reasonable grounds in his petition: that the FAA did not provide adequate notice of the order's issuance and that the circular was "so confusing that it did not provide notice about the conduct it prohibited."[142] In May of 2017, the court held that "Taylor must point 'to more than simply ignorance of the order' as reasonable grounds for his delay. . . [h]is petition for review of Advisory Circular 91-57A is therefore untimely."[143]

In regards to the registration rule, the FAA argued that the rule was "authorized by pre-existing statutory provisions that are unaffected by the FAA Modernization and Reform Act"[144] and "consistent with one of the general directives of the FAA Modernization and Reform Act: to "improve aviation safety."[145] The *Taylor* Court held that the FAA

> lacked statutory authority to issue [a] rule requiring owners of small unmanned aircraft operated for recreational purposes to register with FAA, despite FAA's contention that rule was authorized by pre-existing statutory provisions that were unaffected by FAA Modernization and Reform Act's bar on rules and regulations regarding model aircraft, where [the] rule created new regulatory regime for model aircraft that included new registration process for online registration of model aircraft, imposed new requirements on people who previously had no obligation to engage with FAA, and imposed new penalties on model aircraft owners who did not comply.[146]

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[140] *Taylor v. Huerta,* 856 F.3d at 1090.

[141] *Id.* at 1094.

[142] *Id.*

[143] *Id. (citations omitted).*

[144] *Id.* at 1092.

[145] *Id.* at 1093.

[146] *Taylor v. Huerta*, 856 F.3d at137; PL 115-254; FAA Reauthorization Act Of 2018, Pl 115-254 (Oct. 5, 2018), 132 Stat 3186. See *FAA Reauthorization,* FED. AVIATION ADMIN. (June 21, 2019), https://www.faa.gov/about/reauthorization/.

In the same year as the holding of *Taylor*, the District Court of Massachusetts ruled on *Singer v. City of Newton*,[147] which also serves as an influential case in the realm of uncrewed aircraft law. In December of 2016, the city council of Newton, Massachusetts approved an ordinance regulating uncrewed aircraft "for the principal purpose of protecting the privacy interests of Newton's residents."[148] Michael Singer was a FAA-certified small uncrewed aircraft pilot who resided in Newton and did not operate or register his uncrewed aircraft as a hobbyist.

Singer brought suit against the city to challenge Ordinance sections[149] which "require[d] all owners of pilotless aircraft [to] register their pilotless aircraft with Newton, and also prohibit operation of pilotless aircraft out of the operator's line of sight or in certain areas without permit or express permission."[150] In the court's discussion of Newton Ordinances § 20–64(b),[151] it points out that the FAA

> indicated its intent to be the exclusive regulatory authority for registration of pilotless aircraft…[citing an FAA fact sheet that states] no state or local government may impose an additional registration requirement on the operation of UAS in navigable

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[147] *City of Newton,* 284 F. Supp. 3d 125.

[148] *Id.* at 127.

> The Ordinance states in part: "Purpose: The use of pilotless aircraft is an increasingly popular pastime as well as learning tool. It is important to allow beneficial uses of these devices while also protecting the privacy of residents throughout the City. In order to prevent nuisances and other disturbances of the enjoyment of both public and private space, regulation of pilotless aircraft is required. The following section is intended to promote the public safety and welfare of the City and its residents. In furtherance of its stated purpose, this section is intended to be read and interpreted in harmony with all relevant rules and regulations of the Federal Aviation Administration, and any other federal, state and local laws and regulations.

Id.

[149] *City of Newton,* 284 F. Supp. 3d at 131; ("The sections addressed in this case include NEWTON REV. ORDINANCES ch. 20, § 64(B), § 64(C)(1)(A), § 64(C)(1)(B) AND § 64(C)(1)(E).").

[150] *Singer v. City of Newton,* 284 F. Supp. 3d at127.

[151] NEWTON, MASS., REV. ORDINANCES ch. 20, § 64(B) ("Section (b) states: "Owners of all pilotless aircraft shall register their pilotless aircraft with the City Clerk's Office, either individually or as a member of a club . . .").

> airspace without first obtaining Federal Aviation Administration approval.[152]

It is important to note that the record reflects in this case that the city of Newton did not seek the approval of the FAA. The city of Newton argued that, because the FAA implemented mandatory registration for certain uncrewed aircraft, "this space creates a void in which the city may regulate drones."[153] The Court did not agree with the city's argument, holding that the

> [c]ity ordinance's registration requirements for pilotless aircraft conflicted with FAA's exclusive registration requirements and, thus, were subject to preemption; FAA explicitly indicated its intent to be exclusive regulatory authority for registration of pilotless aircraft, and city sought to register all pilotless aircraft without limit as to which altitude they operated, in clear derogation of FAA's intended authority.[154]

Although the Newton City Council passed the sections of this ordinance with the public safety and privacy of Newton residents in mind, Singer argued that "subsections (c)(1)(a) and (c)(1)(e) conflict with FAA-permitted flight."[155] The court's discussion of Newton Ordinances § 20–64(c)(1)(a)[156] and § 20–64(c)(1)(e)[157] highlighted that "Newton's choice to restrict any drone use below this altitude . . . thwarts not only the FAA's objectives, but also those of Congress for the FAA to integrate drones into the national airspace."[158] By establishing regulations in the city that regulate the use of uncrewed aircraft below the FAA-prescribed height of 400 feet, the court found that the city of Newton neglected to see how the FAA's consideration of co-regulation would "hardly permit an interpretation that essentially constitutes a wholesale ban on drone use in Newton."[159] Because of this, the court held that subsections (c)(1)(a) and (c)(1)(e) were preempted.

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[152] *City of Newton,* 284 F. Supp. 3d at 131.
[153] *Id.*
[154] *Id.* at 125
[155] *City of Newton,* 284 F. Supp. 3d at 131.
[156] NEWTON, MASS., REV. ORDINANCES ch. 20 § 64(C)(1)(A).
[157] *Id.* § 20–64(c)(1)(e).
[158] *City of Newton,* 284 F. Supp. 3d at 132.
[159] *Id.*

The final discussion in this case was regarding Newton Ordinance § 20–64(c)(1)(b),[160] where Singer argued that "subsection (c)(1)(b) conflicts with the FAA's visual observer rule and related waiver process, which only the FAA can modify."[161] The court highlighted the delegation of power from Congress to the FAA in their discussion of this subsection when the Court stated that "Congress [gave] the FAA the responsibility of regulating the use of airspace for aircraft navigation and to protect individuals and property on the ground . . ..and specifically directed the FAA to integrate drones into the national airspace system."[162] The Court then explained that the FAA used this power to require that a remote pilot command the flight of the uncrewed aircraft or a visual observer see the uncrewed aircraft through the duration of the flight and "allow waiver of the visual observer rule."[163] Because of this, the Court held that the subsection was preempted under the reasoning that "the Ordinance limits the methods of piloting a drone beyond which the FAA has already designated, while also reaching into navigable space . . . intervening in the FAA's careful regulation of aircraft safety cannot stand."[164]

ii. Subsequent Legislation and Congress' Reaction to Taylor

a. FAA Reauthorization Act Of 2018

In October of 2018, President Trump signed the FAA Reauthorization Act of 2018 into law.[165] This legislation addressed aircraft noise, the integration of uncrewed aircraft into national airspace, and the financing of airport capital projects. Furthermore, this legislation directed the FAA to appoint leadership in the field of supersonic aircraft. Finally, the legislation ensured safe lithium battery transportation.[166] In addition, as Mark. Connot and Jason Zummo pointed out, an interesting aspect of the FAA

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[160] NEWTON, MASS., REV. ORDINANCES ch. 20, § 64(C)(1)(B).

[161] *City of Newton,* 284 F. Supp. 3d at 132.

[162] *Id.*

[163] *Id.*

[164] *City of Newton,* 284 F. Supp. 3d at 133.

[165] FAA Reauthorization Act Of 2018, Pl 115-254 (Oct. 5, 2018), 132 Stat 3186; See *FAA Reauthorization,* FED. AVIATION ADMIN. (June 21, 2019), https://www.faa.gov/about/reauthorization/.

[166] *Id.*

Reauthorization Act of 2018 was that it codified the holdings from *Newton* and *Taylor v. Huerta.*[167] Inspired, although not altogether, from the 2016 version,[168] the FAA Reauthorization Act of 2018 provides strong evidence that Congress did not intend to preempt states entirely from regulating uncrewed aircraft in their airspace.

There are a number of things the 2016 version would have done. Part (a) states:

> [n]o State or political subdivision of a State may enact or enforce any law, regulation, or other provision having the force and effect of law relating to the design, manufacture, testing, licensing, registration, certification, operation, or maintenance of an unmanned aircraft system, including airspace, altitude, flight paths, equipment or technology requirements, purpose of operations, and pilot, operator, and observer qualifications, training, and certification. [169]

This, in essence, is a straight forward preemption clause related to the operation of uncrewed aircraft, among other things.

Part (b) codifies the holding in *Morales* – that a federal law might not preempt state laws that are general, affecting the general public, without significant adverse impact, and with a connection to the activity that is tenuous, remote or peripheral.[170]

Part (c) codifies something similar to *Abdullah v. American Airlines*, except that all causes of action under state law are permitted.[171] However, because the 2016 version never became law, there

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[167] Mark J. Connot & Jason J. Zummo, *Everybody Wants to Rule the World: Federal vs. State Power to Regulate Drones*, 29 AIR & SPACE L. 13, 16 (2016).

[168] FED. AVIATION ADMIN. REAUTHORIZATION ACT OF 2016, S. 2658, § 2142 (116TH CONG. 2016). .

[169] *Id.*

[170] *Id. (*"Nothing in this subtitle shall be construed to limit a State or local government's authority to enforce Federal, State, or local laws relating to nuisance, voyeurism, harassment, reckless endangerment, wrongful death, personal injury, property damage, or other illegal acts arising from the use of unmanned aircraft systems if such laws are not specifically related to the use of an unmanned aircraft system for those illegal acts.")

[171] *Id.*

> Nothing in this subtitle, nor any standard, rule, requirement, standard of performance, safety determination, or certification implemented pursuant to this subtitle, shall be construed to preempt, displace, or supplant any State or Federal common law rights or any State or Federal statute creating a remedy for civil relief, including those for civil damage, or a penalty for a criminal conduct. Notwithstanding any other provision of this

are only two situations in which preemption applies: whena municipal, county or state law conflicts with the ADA or the Federal Aviation Act. As noted, the ADA expressly preempts on "rates, routes and services" and the Federal Aviation Act impliedly preempts other areas, mostly for safety.

To date, two cases have addressed the FAA Reauthorization Act of 2018, as it relates to the ADA's preemption provision, since it became effective: *Air Evac EMS, Inc. v. Cheatham*[172] and *Scarlett v. Air Methods Corp.*[173] In December of 2018, the 4th Circuit heard a case regarding an air ambulance company, Air Evac EMS, and had to decide whether or not the ADA expressly preempted West Virginia's regulation of air ambulances.[174] The Court analyzed the language of the ADA's express preemption provision while addressing West Virginia's arguments that the air ambulance industry falls outside of the language and even if the air ambulance industry falls within the language, West Virginia's policies do not "run afoul of the ADA."[175] The 4th Circuit ultimately held that "the preemption clause reaches air ambulance companies like Air Evac" among other findings.[176]

Similarly, in *Scarlett,* using *Wolens* and *Ginsberg* as a foundation,[177] the 10th Circuit encountered a class action lawsuit where patients sued an air ambulance services provider to recover excess payments they made.[178] The plaintiffs argued before the court "that Defendants are not "air carriers" because they also provide

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> subtitle, nothing in this subtitle, nor any amendments made by this subtitle, shall preempt or preclude any cause of action for personal injury, wrongful death, property damage, or other injury based on negligence, strict liability, products liability, failure to warn, or any other legal theory of liability under any State law, maritime law, or Federal common law or statutory theory if such laws are not specifically related to the use of an unmanned aircraft system.

Id.

[172] Air Evac EMS, Inc. v. Cheatham, 910 F.3d 751 (4th Cir. 2018).

[173] Scarlett v. Air Methods Corp., 922 F.3d 1053 (10th Cir. 2019).

[174] *Cheatham*, 910 F.3d at 760.

[175] *Id.* at 762.

[176] *Id.* at 766.

[177] *Wolens*, 513 U.S. at 826; *Ginsberg*, 572 U.S. at 276.

[178] *Air Methods Corp.*, 922 F.3d at 1060.

intrastate flights,"[179] however, looking to the ADA's preemption provision, the Court held that

> [T]he definition of "air carrier" is expansive and encompasses companies that provide both intrastate and interstate flights. A company is an air carrier when it is "undertaking *by any means, directly or indirectly*, to provide air transportation." 49 U.S.C. § 40102(a)(2) (emphasis added). To "undertake" means "[t]o take on an obligation or task." *Undertake*, Black's Law Dictionary (10th ed. 2014). Defendants have obtained the necessary certifications to provide interstate flights and, in fact, do provide interstate flights. Under the plain meaning of § 40102(a)(2), Defendants have undertaken to provide air transportation.[180]

These holdings show that the ADA applies to air ambulances, and that was, according to the courts, Congress' intent. The question moving forward is whether or not courts will apply the same level of scrutiny to the uncrewed aircraft industry as the 4th Circuit and 10th Circuit did to the air ambulance industry in *Cheatham* and *Scarlett*.[181]

The contention between interstate and intrastate flight, core to the 3rd Circuit decision in *Ickes v. Federal Aviation Administration,* may provide guidance to this question.[182] The 3rd Circuit held that "because airplanes constitute instrumentalities of interstate commerce, any threat to them, such as the one posed by Ickes' flights of his Challenger II, is properly subjected to regulation even if the threat comes from a purely intrastate activity."[183] The fact that the Court's conclusion relied upon the Commerce Clause,[184] rather than the Supremacy Clause, further complicates the issue of how Courts will treat the activities of uncrewed aircraft in future.

b. FAA Registration and Remote ID Rules

In October of 2015, US DOT Secretary Anthony Foxx and FAA Administrator Michael Huerta announced the creation of a task

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[179] *Id.*
[180] *Id.* at 1061,
[181] *Cheatham*, 910 F.3d at 760; *Air Methods Corp.*, 922 F.3d at 1060.
[182] *Ickes v. Fed. Aviation Admin.*, 299 F.3d 260 (3d Cir. 2002).
[183] *Id.* at 263.
[184] U.S. CONST. art. 1, § 8, Clause 3.

force to create registration requirements for uncrewed aircraft systems stating that "[r]egistration will help make sure that operators know the rules and remain accountable to the public for flying their unmanned aircraft responsibly."[185] Two months later, in December of 2015, the DOT and FAA released a final rule which "provide[d] an alternative, streamlined and simple, web-based aircraft registration process for the registration of small unmanned aircraft, including small unmanned aircraft operated as model aircraft, to facilitate compliance with the statutory requirement that all aircraft register prior to operation."[186]

In 2017, the District of Columbia Circuit held in *Taylor v. Huerta* that the "Registration Rule is unlawful as applied to model aircraft."[187] However, a drone registration provision was included in the National Defense Authorization Act of 2017.[188] The resulting framework included 14 C.F.R. § 48.1[189] and 49 U.S.C.A. § 44103[190] which outlined the regulatory and statutory registration and marking requirements for small uncrewed aircraft in the US.[191] In February of 2019, the FAA and DOT released an interim final rule "requir[ing] small unmanned aircraft owners to display the unique identifier assigned by the FAA upon completion of the registration process (registration number) on an external surface of the aircraft."[192] This rule is important to the registration of small uncrewed aircraft because it would allow law enforcement to easily access the identifier rather than deconstructing the uncrewed aircraft to identify the operator.

In addition to registration requirements, remote identification has dominated the conversation on Capitol Hill as increased

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185 Press Release, Federal Aviation Admin., U.S. Transportation Secretary Anthony Foxx Announces Unmanned Aircraft Registration Requirement, (Oct. 19, 2015).

186 Registration and Marking Requirements for Small Unmanned Aircraft, 80 Fed. Reg. 78594, 78594 (Dec. 16, 2015) (to be codified at 14 C.F.R. pt. 1, 45, 47, 48, 91, and 375).

187 *Taylor v. Huerta,* 856 F.3d at 90.

188 National Defense Authorization Act of 2018, Pub. L. No. 115-91, § 143, 131 Stat 1283 (2017); *See also* Bryan V. Norton, *Drone 101: A Survey of the Overlapping Laws, Rules and Regulations in Idaho and the National Airspace*, 61 ADVOC. 31, 32 (2018).

189 14 C.F.R. § 48.1.

190 49 U.S.C.A. § 44103 (West).

191 14 C.F.R. § 1.1.

192 External Marking Requirement for Small Unmanned Aircraft, 84 Fed. Reg. 3669, 3669 (Feb. 13, 2019) (to be codified at 14 C.F.R. pt. 48)..

sightings of uncrewed aircraft have occurred, garnering the bipartisan support of Congress to implement measures sooner than later.[193] Remote identification is essential to the safe integration of uncrewed aircraft into national airspace and establishing guidelines for remote identification is key to creating a framework that will allow states and municipalities to have uncrewed aircraft fly with crewed aircraft in their respective airspaces.[194] On December 31, 2019, the FAA offered a notice of proposed rulemaking on the remote identification of uncrewed aircraft systems in the US,[195] which has been met with great criticism from top industry leaders such as Da Jieng Innovations [196] and the Experimental Aircraft Association.[197] Since then, the FAA has circulated a graphic simplifying their vision of remote identification in the US,[198] and obtained over 53,000 comments on the Federal Register regarding its proposal.[199] According to one legal practitioner, the proposal, if implemented as is,

> would amend current registration requirements for UAS operators, create operation and production requirements for UAS producers, and prohibit operators from registering multiple drones under a single registration number. Further, the rule

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[193] Michael Burke, *Senators urge FAA to allow remote tracking of drones*, THE HILL (Apr. 29, 2019), https://thehill.com/policy/transportation/441175-bipartisan-pair-of-senators-call-for-faa-to-publish-remote.

[194] *UAS Remote Identification,* FED. AVIATION ADMIN. (Mar. 5, 2020), https://www.faa.gov/uas/research_development/remote_id/.

[195] Remote Identification of Unmanned Aircraft Systems, 84 Fed. Reg. 72438, 72439 (Dec. 31, 2019) (to be codified at 14 C.F.R. pt. 1, 47, 48, 89, 91, and 107)..

[196] *US drone ban puts lives at risk, says DJI*, INSIDE IMAGING (Feb. 20, 2020), https://www.insideimaging.com.au/2020/us-drone-ban-puts-lives-at-risk-says-dji/.

[197] Gordon Gilbert, *EAA to FAA: Remote ID Rule Threatens Model Flying*, AIN ONLINE (Mar. 4, 2020), https://www.ainonline.com/aviation-news/business-aviation/2020-03-04/eaa-faa-remote-id-rule-threatens-model-flying.

[198] Jim Moore, *FAA Gets Early Earful on Drone ID Concerns About Privacy, Cost,* AOPA (Jan. 9, 2020), https://www.aopa.org/news-and-media/all-news/2020/january/09/faa-gets-early-earful-on-drone-id.

[199] Brian Garrett-Glacier, *UAS Service Suppliers Discuss 53,000 Comments on FAA's Remote ID Proposal,* AVIONICS INT'L (Mar. 19, 2020), https://www.aviationtoday.com/2020/03/19/uas-service-suppliers-discuss-53000-comments-faas-remote-id-proposal/.

> would require all registered UAS to have functional end-to-end communication throughout the duration of the flight.[200]

Until the FAA's proposal is released as a final rule, which is not expected until at least 2021,[201] states should continue to pass legislation regulating uncrewed aircraft in their borders to show the federal government that states are capable of doing what they always have done – exercising their police powers to make their citizens safe.[202]

D. Implications for State Regulation of Uncrewed Aircraft

Federal preemption only goes so far and leaves latitude for states to regulate some aspects of drones. Based upon the *Taylor* holding and subsequent legislation, states and political subdivisions would likely be unable to pass measures related to the recreational operation of uncrewed aircraft in their jurisdiction.[203] Furthermore, the *Newton* holding would likely preempt legislation regarding the registration of non-recreational uncrewed aircraft, changes to altitude limits or the FAA's visual-observer rule.[204]

State laws would be found to be expressly preempted from the ADA or impliedly preempted from the Federal Aviation Act because the 2016 version did not become law. In the case of legislation establishing a state-operated drone registry, the legislation would likely become an issue of implied preemption under the Federal Aviation Act, as amended by the 2018 legislation and the National Defense Authorization Act of 2017. The scope of implied preemption

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[200] Clifford Maine & Todd Dixon, *Proposed UAS Remote Identification Requirements To Impact Drone Users,* NAT'L L. REV. (Feb. 24, 2020), https://www.natlawreview.com/article/proposed-uas-remote-identification-requirements-to-impact-drone-users.

[201] Dave Lincoln, *The FAA's Proposed Remote ID Rule: What You Need to Know,* SKYWARD (Jan. 28, 2020), https://skyward.io/the-faas-proposed-remote-id-rule-what-you-need-to-know/. The FAA announced, on December 28, 2020 that "[i]t will be requiring Remote ID on Part 107 licensed drones." Jaron Schneider, *FAA Publishes Final Drone Rules: Remote ID Now Required,* PETAPIXEL (Dec. 28, 2020), https://petapixel.com/2020/12/28/faa-publishes-final-drone-rules-remote-id-now-required/. The rule is expected to the published in the Federal Register in January 2021. *Id*.

[202] Arthur Holland Michel, *Local and State Drone Laws,* CTR. FOR THE STUDY OF THE DRONE AT BARD COLLEGE (March 2017), https://dronecenter.bard.edu/files/2017/03/CSD-Local-and-State-Drone-Laws-1.pdf.

[203] *See Taylor v. Huerta,* 856 F.3d at 1093-94.

[204] *City of Newton,* 284 F. Supp. 3d at 132.

under the Federal Aviation Act, as it relates to the uncrewed aircraft industry, will depend upon whether a Court finds that uncrewed aircraft are instrumentalities of interstate commerce, following the holding from *Ickes*.[205] States must also be cognizant that legislation relating to the "rates, routes or services" would likely be preempted under the *Morales* holding.[206] Also, any legislation that establishes a standard of care within aviation safety will be found to be preempted under the *Abdullah* holding.[207]

Other areas of the law not previously addressed such as criminal activity, tortious activity, interests relating to the rights of real property owners, among other things should fall within the state's scope to regulate uncrewed aircraft operation. The scope may be narrow but powers do remain for states to regulate uncrewed aircraft that are not field preempted by the Federal Aviation Act and not expressly preempted by the Airline Deregulation Act.

III. ZONE OF STATE AUTHORITY

A. ABA Proposal on Aerial Trespass

In response to the increasing popularity of uncrewed aircraft and cases involving the preemption of uncrewed aircraft becoming more frequent,[208] the American Bar Association (ABA) Section of Real Property, Trust and Estate Law released a draft resolution and report in February of 2020 outlining recommendations to the federal government, state governments and other political subdivisions of the state.[209] The proposed resolution:

> urges federal, state, local, territorial, and tribal governments, and their respective agencies and departments, to protect real property interests, including common law trespass and privacy rights, with respect to any statute, ordinance, regulation, administrative rule, order, or guidance pertaining to the

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[205] *Ickes v. Fed. Aviation Admin.*, 299 F.3d 260, 299 (3d Cir. 2002).

[206] *Morales v. Trans World Airlines, Inc.*, 504 U.S. at 384.

[207] *Abdullah v. Am. Airlines, Inc.*, 181 F.3d. at 376.

[208] *See Taylor v. Huerta,* 856 F.3d; *City of Newton,* 284 F. Supp. 3d.

[209] Matt Reynolds, *ABA House of Delegates Passes Resolution on Drones; Delegate Calls it 'a Hot Topic,'* ABAJOURNAL.COM (Feb. 17, 2020), https://www.abajournal.com/news/article/resolution-111.

> development and usage of unmanned aircraft systems over private property.[210]

The report acknowledges both the potential for tortious and criminal activity over real property and benefits of uncrewed aircraft. Thus, a legal framework would be necessary to protect the interests of real property owners and occupants as "[e]merging technologies such as UAS do not fit squarely within existing trespass and privacy rights laws."[211] In order to protect these interests, the report advised government entities to consider existing frameworks of common law trespass and privacy rights as a foundation for governing uncrewed aircraft over real property but to keep in mind that "a 'one-size fits all' approach to rules governing the operation of drones is not appropriate.".[212]

The proposal highlights the necessity for states to act in the race against the federal government to regulate uncrewed aircraft. Furthermore, the ABA's report draws upon the seminal 1946 decision in *United States v. Causby—which allowed that while a landowner does not own all the airspace above his farm, there does exist some exclusivity in the "immediate reached of the enveloping atmosphere"*[213] —to demonstrate that traditional laws on real property are flexible and can evolve to handle emerging technologies.[214] The ABA's analysis would have been stronger had it also drawn upon the holdings in *Griggs v. Alleghany City*[215] and *Brown v. United States.*[216]

Granting *certiorari* from the Supreme Court of Pennsylvania, the US Supreme Court heard a case in 1962 that extended the holding in *Causby* to include takings by local governments.[217] After

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[210] AM. BAR ASSOC., Midyear Meeting 2020 – House of Delegates Resolution 111, https://www.americanbar.org/news/reporter_resources/midyear-meeting-2020/house-of-delegates-resolutions/111/ (last visited Dec. 30, 2020).

[211] *Id.* at 1. The Report can be found by following the "Proposed Resolution and Report" hyperlink.

[212] *Id.*

[213] *United States v. Causby*, 328 U.S. 256, 264, (1946).

[214] AM. BAR ASSOC., Midyear Meeting 2020, *supra* note 210, at 4-6.

[215] Griggs v. Allegheny Cty., Pa., 369 U.S. 84 (1962);

[216] *Brown v. United States*, 73 F.3d 1100, 1102 (Fed. Cir. 1996).

[217] *Allegheny Cty., Pa.*, 369 U.S. at 89.

analyzing Congress' re-definition of "navigable airspace,"[218] Justice Douglas held that

> respondent, which was the promoter, owner, and lessor of the airport, was in these circumstances the one who took the air easement in the constitutional sense.…[t]he Federal Government takes nothing; it is the local authority which decides to build an airport vel non, and where it is to be located.[219]

Over thirty years later, the Federal Circuit heard *Brown v. United States* laying out three factors:

> determining whether noise and other effects from overflights interfered with the property owner's rights in such a way as to constitute a taking of an avigation easement and hence require compensation: (i) the planes flew directly over the claimant's land; (ii) the flights were low and frequent, and (iii) the flights directly and immediately interfered with the claimant's enjoyment and use of the land.…caselaw following *Causby* has added a gloss on the third factor, requiring that the interference with enjoyment and use be "substantial."[220]

As Daniel Thompson correctly highlights, "[h]armonizing federal, state, and local airspace property laws will be one of the most frustrating obstacles for this integrated drone infrastructure above highways,"[221] because , "cases after *Causby* did not clarify the 'precise limits' of vertical property rights."[222] An interesting interpretation of *Causby*, as it relates to uncrewed aircraft, was presented by Robert Heverly. Heverly indicates that the holding in *Causby* would "allow states to step in and set navigable airspace for drones below that limit set by the FAA for other aircraft. . . [s]o long as the height set by a state meets the *Causby* overflight test, however, it is likely to be upheld."[223] If a state government chooses to set navigable airspace for drones below the limit, then a court, should

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[218] *Id*. at 88.

[219] *Id*. at 89.

[220] *Brown v. United States*, 73 F.3d at1102.

[221] Daniel Thompson, *Rethinking the Highway: Integrating Delivery Drones into Airspace Above Highways*, 95 IND. L.J. SUPPLEMENT 8, 10 (2020).

[222] Robert A. Hazel, *Privacy and Trade Secret Law Applied to Drones: An Economic Analysis*, 19 COLUM. SCI. & TECH. L. REV. 340, 348 (2018).

[223] Robert A. Heverly, *The State of Drones: State Authority to Regulate Drones*, 8 ALB. GOV'T L. REV. 29, 46 (2015).

remember that, in *Causby,* the federal government exercised its power in a way that infringed on the useful enjoyment of the land, in contravention of the state property law rights.[224] If a court rejects a state government's attempt to set the limits of navigable airspace, an alternative would be for the states to advocate for an auction of navigable airspace, where the federal government could auction geographic, exclusive assignments of airspace to the states.[225]

The ABA's proposal was a step in the right direction to harmonize airspace property laws, but the holding from *Griggs* and the three factors laid out by the Federal Circuit in *Brown* would have solidified the ABA's position and provided an updated analysis of the holding in *Causby*. That said, there are a number of municipalities, counties and states that have already put measures in place that regulate aspects of the operation of uncrewed aircraft.

B. State Preemption of Uncrewed Aircraft

Seventeen states have passed legislation that preempt municipal or county rules, regulations, codes or ordinances that seek to regulate aspects of the operation of uncrewed aircraft in their jurisdictions, including the registration of uncrewed aircraft. Arizona,[226] Connecticut,[227] Delaware,[228] Florida,[229] Louisiana,[230] Maryland,[231] Michigan,[232] New Jersey,[233] Oregon,[234] Pennsylvania,[235] Rhode Island,[236] and Virginia all passed express preemption provisions of uncrewed aircraft in their state with no exceptional circumstances.[237] An interesting note about Virginia is that a debate emerged in 2018 about whether or not county park authorities are able to regulate the use of uncrewed aircraft when there is a state

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224 *Causby*, 328 U.S. at 264.
225 Brent Skorup, *Auctioning Airspace*, 21 N.C. J. L. & TECH. 79, 93 (2019).
226 ARIZ. REV. STAT. ANN. § 13-3729 (2020).
227 CONN. GEN. STAT. ANN. § 7-149(B) (West 2020).
228 DEL. CODE. ANN. tit. 11, § 5.1334 (West 2020).
229 FLA. STAT. ANN. § 330.41 (West 2020).
230 LA. STAT. ANN. § 2:2 (2020).
231 MD. CODE ANN., ECON. DEV. § 14-301 (West 2020).
232 MICH. COMP. LAWS ANN. § 259.305 (West 2020).
233 N.J. STAT. ANN. § 2C:40-29 (West 2020).
234 OR. REV. STAT. ANN. § 837.385 (West 2020).
235 53 PA. STAT. AND CONS. STAT. ANN. § 305 (West 2020).
236 1 R.I. GEN. LAWS ANN. § 1-8-1 (West 2020).
237 VA. CODE ANN. § 15.2-926.3 (West 2020).

preemption provision in place.[238] The Attorney General of Virginia issued an opinion in March of 2018 stating "a public park authority may adopt rules or regulations concerning the operation of uncrewed aircraft systems, commonly known as drones, in its parks."[239]

Alaska specifically chose only to preempt municipalities in the state from passing ordinances permitting the release of images captured by uncrewed aircraft.[240] Georgia chose to pass an express preemption provision that allows existing ordinances to stay in place, municipalities to pass ordinances reinforcing FAA regulations and municipalities to pass ordinances regulating uncrewed aircraft on public property.[241] Illinois passed an express preemption provision that excluded Chicago from its requirements, which would allow the political subdivisions within Chicago's jurisdiction to implement measures regulating uncrewed aircraft.[242] Texas preempted political subdivisions from passing measures regulating uncrewed aircraft unless the measure is related to special events, public use of an uncrewed aircraft or use of an uncrewed aircraft near public property.[243] Finally, Utah preempted political subdivisions from passing measures regulating uncrewed aircraft unless the political subdivision is an airport operator.[244]

C. State Registration, Licensing and Permitting of Uncrewed Aircraft[245]

California, Louisiana, Minnesota, Nevada, North Carolina, Oregon and West Virginia have enacted legislation that establish a registry or licensing system of uncrewed aircraft operators. In

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[238] Courtney Wootton, Michael Bradley & Ray Neal, *Drones in Parks: It's All About Perspective,* NAT'L RECREATION. AND PARKS ASS'N (Dec. 7, 2018), https://www.nrpa.org/parks-recreation-magazine/2018/december/drones-in-parks-its-all-about-perspective/.

[239] The Honorable David L. Bulova, Op. Va. Att'y Gen. 17-047 (2018).

[240] ALASKA STAT. ANN. § 29.35.146 (West 2020).

[241] GA. CODE ANN. § 6-1-4 (West 2020).

[242] 620 ILL. COMP. STAT. ANN. 5/42.1 (West 2020).

[243] TEX. GOV'T CODE ANN. § 423.009 (West 2019).

[244] UTAH CODE ANN. § 72-14-103 (West 2020).

[245] *See generally* Arthur Holland Michel, *Local and State Drone Laws,* CTR. FOR THE STUDY OF THE DRONE AT BARD COLLEGE (March 2017), https://dronecenter.bard.edu/files/2017/03/CSD-Local-and-State-Drone-Laws-1.pdf; Jonathan Rupprecht, *US Drone Laws (2019) — Drone Laws by State,* RUPPRECHT LAW, P.A. (Jan. 2019), https://jrupprechtlaw.com/drone-laws-state/.

California, anyone wishing to operate an uncrewed aircraft for pest control must obtain a license from the state of California in addition to requirements from the FAA.[246] In Louisiana, "[e]ach person operating an unmanned aerial system in the course of an agricultural commercial operation shall obtain a license from the department" and "[e]ach unmanned aerial system operated in the course of an agricultural commercial operation shall be registered with the department."[247] The statute goes onto state that licenses will be issued after applicants submit a written application to the department and "complete an agricultural education and safety training course administered by the Louisiana Cooperative Extension Service or the Southern University Agricultural Research and Extension Center."[248] In Minnesota, commercial operators are required to register and license their uncrewed aircraft, implied as an aircraft in Minnesota law,[249] with the Minnesota Department of Transportation.[250] In addition, commercial operators are required to hold uncrewed aircraft insurance with the requirements outlined in the statute.[251] Nevada has codified that the Department of Public Safety shall create and maintain a registry of uncrewed aircraft operated by public agencies within the state of Nevada.[252] In 2015, a commercial uncrewed aircraft permitting system was created within the North Carolina Department of Transportation.[253] Recreational operators are not affected by the permitting scheme, however, any operator flying for commercial or governmental purposes has to pass a knowledge test and register with the department.[254] While this state statute is a permitting scheme, not a registry, it shows that field preemption is not as broad as some think and express preemption under the ADA might not apply to drone rates, routes, services.

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246 CA. FOOD AND AGRIC. CODE § 11901 (West 2020).
247 LA. STAT. ANN. § 3:43 (2020).
248 *Id.*
249 MINN. STAT. ANN. § 360.013 (West 2020).
250 MINN. STAT. ANN. § 360.60 (West 2020).
251 MINN. STAT. ANN. § 360.59(10)(A) (West 2020).
252 NEV. REV. STAT. ANN. § 493.118 (West 2020).
253 N.C. GEN. STAT. ANN. § 63-96 (West 2020).
254 *Id.*

In Oregon, a statute, codified in the Oregon Administrative Code,[255] directs the Oregon Department of Aviation to establish a registry of uncrewed aircraft systems operated by public bodies, other than educational institutions,[256] in the airspace of Oregon[257] where violators can be fined up to $10,000.[258] The implementation of this registry is highlighted in subsections (2)(a) and (2)(b) which state "[a] public body, other than an educational institution, may not operate an unmanned aircraft system in the airspace over this state without registering the unmanned aircraft system with the Oregon Department of Aviation"[259] but that

> [a]n educational institution may not operate an unmanned aircraft system in the airspace over this state without registering as a user of unmanned aircraft systems with the department. The department may not require an educational institution to register individual unmanned aircraft systems under this section.[260]

In West Virginia, "[p]ersons who intend to operate an unmanned aircraft system shall register at the area superintendent's office prior to engaging or participating in the operation of any unmanned aircraft system and specify where the activity will take place."[261] It is important to note that this registry is only in place for West Virginia uncrewed aircraft operators who wish to fly in the airspace of state parks, forests and rail trails. The way in which the language of the statute is written gives West Virginia state park superintendents broad discretion to "prohibit, issue directives, or implement time and place restrictions on unmanned aircraft system use"[262] in their jurisdiction.

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255 OR. ADMIN. R. 738-080-0045 (2020).
256 OR. REV. STAT. ANN. § 837.360 (West 2020).
257 *Id.*
258 *Id.*
259 OR. REV. STAT. ANN. § 837.360(2)(A) (West 2020).
260 OR. REV. STAT. ANN. § 837.360(2)(B) (West 2020).
261 W. VA. CODE ANN. § 20-5-2 (West 2020).
262 *Id.*

D. Municipal and County Registration of Uncrewed Aircraft[263]

Newton, Massachusetts is the only city known in the US which attempted to establish its own uncrewed aircraft registry and faced litigation.[264] However, there are other cities and counties that passed ordinances regulating uncrewed aircraft in similar ways to Newton. Oxford, Alabama passed an ordinance in November 2016 that states no person can operate an uncrewed aircraft without prior permission or designation by the chief of police.[265] Hermosa Beach, California passed an ordinance in 2016 requiring uncrewed aircraft operators to obtain a city-issued permit,[266] but other cities in California are refusing to follow suit, instead encouraging state officials to pass a uniform set of rules and regulations.[267] In Telluride, Colorado, people cannot operate uncrewed aircraft in the city without prior permission from the Town Manager or if they have physical or mental conditions impeding the operation of uncrewed aircraft.[268]

Citizens of Greenwich, Connecticut cannot operate uncrewed aircraft in any city park without the prior authorization of the Greenwich Director of Parks and Recreation.[269] Commercial operators of uncrewed aircraft in Defuniak Springs, Florida must register with and notify the local police department four hours in advance before conducting any commercial work with uncrewed aircraft in the city.[270] Operators of uncrewed aircraft in Miami, Florida are required to apply for permission with the City Manager for certain activities, which are not listed in the language of the ordinance.[271] In addition to FAA authorization, uncrewed aircraft operators in Augusta, Georgia must obtain permission from the Augusta, Georgia Commission to launch or operate uncrewed aircrafts within the

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[263] *See generally,* Michel, *supra* note 245.

[264] *See City of Newton,* 284 F. Supp. 3d.

[265] OXFORD, ALA., CODE art. 11, § 26-293 (2016).

[266] HERMOSA BEACH, CAL., CODE ch. 9, § 38.030 (2016).

[267] Tom Lindsey, *Response to 2015-2016 Orange County Grand Jury Report "Drones: Know Before You Fly,"* CITY OF YORBA LINDA (Aug. 23, 2016), http://www.ocgrandjury.org/pdfs/2015_2016_GJreport/2016-08-23_City_of_Yorba_Linda.pdf.

[268] TELLURIDE, COLO., CODE ch. 10, art. 11, § 30 (2017).

[269] GREENWICH, CONN., CODE ch. 7, art. 2, § 28(19) (1983).

[270] DEFUNIAK SPRINGS, FLA., CODE ch. 22, art. 4, § 52 (2016).

[271] MIAMI, FLA., CODE ch. 37, § 12(D)(1) (2020).

limits of Richmond County, Georgia.[272] Uncrewed aircraft operators in Fort Wayne, Indiana must notify and provide information to the city before flying anywhere above the Downtown Aerial District or within a five hundred yard radius of a public event.[273]

Operators in Anoka County, Minnesota must obtain a special permit from the parks and recreation department before flying their uncrewed aircraft over parks in the county.[274] Columbia, Missouri uncrewed aircraft operators are not allowed to fly their aircraft unless issued a special permit from the city prior to flight.[275] The Parks, Recreation and Historic Preservation Department of New York does not allow operators to fly uncrewed aircraft in department owned and operated land without a special permit from the department.[276]

E. Conclusion

It has been said that the *Singer* decision shows how "even if a municipality may regulate certain aspects of drone operations, it cannot do so in such a way that affects operation in the national airspace"[277] It has also been noted that "[a]llowing local governments to regulate the nature of drone use while leaving operational safety and licensing regulation to the exclusive control of the federal government would help to stave off the "patchwork" problem of inconsistent local regulation."[278] This a somewhat unfounded concern, as a patchwork already exists, yet the drone industry is moving forward. While there is a balance to be struck, states have shown they have the authority to regulate under their traditional police powers, yet the patchwork effect can still be mitigated by states preempting local authorities. State governments are best

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[272] AUGUSTA, GA., CODE art. 1, ch. 3, §44(B) (2016).

[273] FORT WAYNE, IND., CODE ch. 96, § 30(D) (2019).

[274] ANOKA COUNTY, MINN., REV. ORDINANCES ch. 4, § 5 (2018).

[275] COLUMBIA, MO., CODE art. 4, div. 8, §17-134 (2016).

[276] *Regulating Unmanned Aircraft Systems,* N.Y. PARKS, RECREATION AND HIST. PRES. (Jan. 6, 2015), https://parks.ny.gov/inside-our-agency/documents/Guidance Policies/RegulatingUnmannedAircraftSystemsDronesModelAirplanesQuadCopters.pdf.

[277] Chuck Tobin et al., *Will Federal Preemption Push Drone Journalism to New Heights? State, Municipal Regulations Suspect Following Singer v. City of Newton*, COMM. LAW., 10, 13 (Spring 2019).

[278] *Federalism-Preemption-Massachusetts District Court Finds Portion of Local Drone Ordinance Preempted by FAA Regulation.-Singer v. City of Newton, No. Cv 17-10071, 2017 Wl 4176477 (D. Mass. Sept. 21, 2017)*, 131 HARV. L. REV. 2057, 2063 (2018).

positioned to both protect citizens while creating a safe environment that will foster the drone industry. In order for a state-operated uncrewed aircraft registry to operate efficiently, state legislatures must assert their preemption power to stop political subdivisions from implementing measures regulating uncrewed aircraft.[279]

IV. FLYING FORWARD: THE NECESSITY FOR STATES TO ACT

A. Municipalities' and Counties' Missteps To-date

To date, there have been a number of troubling events in the field of uncrewed aircraft state policy and law. Texas and Virginia started a dangerous movement in 2013 when they became the first of many states and municipalities to pass legislation and ordinances that banned the use of uncrewed aircraft altogether.[280] Since then, there have been a number of instances where counties and municipalities are aimlessly enacting uncrewed aircraft regulations that have affected their residents in negative ways.

The first example is a resident of Carroll County, Maryland who wanted to become a full-time drone pilot but encountered a major issue: Carroll County required him to have a permit and a one million dollar flight insurance plan.[281] Law Professor Michael Greenberger argued that "whatever Carroll County is doing is inconsistent on a macro basis with the Maryland statute," while Carroll County Parks Director Jeff Degitz contended that the measure was to focus on "safety and making sure we don't have unintended consequences of that use [of uncrewed aircraft]."[282] The Attorney General of Maryland and Maryland State Senator Jim Rosapepe, the author of the bill preempting political subdivisions of Maryland from passing rules and regulations pertaining to the use of uncrewed aircraft, have yet to comment on the situation.[283] However, Maryland State Senator Haven Shoemaker recalled that the

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[279] *See Hunter v. City of Pittsburgh*, 207 U.S. 161, 178 (1907).

[280] Ray Carver, *State Drone Laws: A Legitimate Answer to State Concerns or A Violation of Federal Sovereignty*, 31 GA. ST. U. L. REV. 377, 382 (2015).

[281] Jon Kelvey, *Drone Pilots Also Navigating Conflicting State, Local Laws,* GOVERNING (Feb. 7, 2020) https://www.governing.com/now/Drone-Pilots-Also-Navigate-Conflicting-County-State-Laws.html.

[282] *Id.*

[283] *Id.*

discussion which led to the passage of the bill centered around the idea that there would be "some measure of statewide uniformity of the law relating to drones, instead of a county-by-county piecemeal approach."[284]

Secondly, a report from the Oregon State Bar Bulletin showed that there is significant tension between cities, such as Lake Oswego, and the state government of Oregon.[285] An expert on the forensic analysis of uncrewed aircraft argued that "[c]ities cannot control overflight . . .but they can control takeoffs and landings."[286] However, the city attorney of Lake Oswego countered that the city's ordinance prohibiting uncrewed aircraft flight without the park director's permission was "not an aviation regulation."[287] The conflicting statements of the forensic analysis expert and city attorney of Lake Oswego highlight that there is confusion over the question of what aspect of uncrewed aircraft operations states and municipalities are allowed to regulate.

Third, a number of cities and states have begun to release guidelines for uncrewed aircraft operators and other interested parties to follow for safe uncrewed aircraft operation. In 2019, the Virginia Department of Aviation released a guide for airports to follow regarding the current landscape of uncrewed aircraft and guidance on how to approach situations when uncrewed aircraft enter into an airport's airspace.[288] North Carolina,[289] Pennsylvania and Texas have released similar guidelines in their jurisdictions.[290] In addition, the municipal government of San Diego, California released a

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[284] *Id.*

[285] Cliff Collins, *Eyes in the Sky As Drone Use Grows, Regulations Are Scrambling to Catch Up*, 20, 23, OR. ST. B. BULL., (May 2019).

[286] *Id.* at 23.

[287] *Id.*

[288] Mark Flynn & Dr. Amber Wilson, *Unmanned Aircraft Systems 2019 Guide for Virginia Airports,* VA. DEP'T OF AVIATION (Jan. 2019), https://doav.virginia.gov/contentassets/3bdc791a908e4f2da75900faa141747c/suas_-guide-for-virginia-airports-2019.pdf.

[289] *Unmanned Aircraft Systems,* N.C. DEPT. OF TRANSP. (Dec. 6, 2019), https://www.ncdot.gov/divisions/aviation/uas/Pages/default.aspx.

[290] *Unmanned Aircraft Systems/Drones,* PA. DEPT. OF TRANSP. (2020), https://www.penndot.gov/Doing-Business/Aviation/Licensing%20and%20Safety/Pages/Unmanned-Aircraft-Systems-(Drone)-Information.aspx; *Unmanned Aircraft System (UAS) Standard Operating Procedure,* TEX. DEPT. OF PUB. SAFETY (Sept. 1, 2019), https://www.dps.texas.gov/docs/prCh4Anx11.pdf.

guide for uncrewed aircraft operators in the area.[291] The trend of state agencies providing guidelines for operators should continue to grow to show the FAA that states are capable of regulating uncrewed aircraft; however, municipal and county governments need to stop passing ordinances until state governments establish a framework.

B. The Case for Mississippi Regulation

i. Current Legislative Proposals

While one legal practitioner is concerned about a "power grab" by states to control their municipalities,[292] the buck must stop somewhere. In the case of the regulation of uncrewed aircraft, the buck must stop at the state-level. Phenomena in the battle between state and local authority are steadily increasing, especially in states with "sanctuary jurisdictions."[293] Lauren Phillips contends that "[s]tates are increasingly restricting the power of local governments, and, in doing so, impeding innovation and experimentation."[294] Just as states are petri dishes for innovation that guides federal choices, there is good reason to think that subunits within states can be petri dishes for innovation that guides state governments; however, uncrewed aircraft affect the state as a whole and innovation is best fostered by putting into place state-wide rules that encourage innovation whilst protecting real property owners and their property.

The case of uncrewed aircraft regulation poses an issue of subsidiarity on a state, rather than federal, level. Municipalities with millions of residents may have resources available to address policy issues that states traditionally would,[295] but in rural areas where

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[291] *What You've Always Wondered, But Didn't Know to Ask: A Drone Operator's Guide,* CITY OF SAN DIEGO (2020), https://www.sandiego.gov/sites/default/files/2019.03.05_drone_operator_guide.pdf.

[292] Emily S. P. Baxter, *Protecting Local Authority in State Constitutions and Challenging Intrastate Preemption*, 52 U. MICH. J.L. REFORM 947, 949 (2019).

[293] Toni M. Massaro & Shefali Milczarek-Desai, *Constitutional Cities: Sanctuary Jurisdictions, Local Voice, and Individual Liberty*, 50 COLUM. HUM. RTS. L. REV. 1, 18 (2018).

[294] Lauren E. Phillips, *Impeding Innovation: State Preemption of Progressive Local Regulations*, 117 COLUM. L. REV. 2225, 2262 (2017).

[295] *See* 620 ILL. COMP. STAT. ANN. 5/42.1 (West 2020).

political subdivisions may be ill-equipped to handle policy issues such as the regulation of uncrewed aircraft, the intervention of the state government is warranted. The bill that Mississippi Senator Brice Wiggins introduced in the legislature in Spring 2020 is a great example of warranted regulation of uncrewed aircraft.[296] The legislation expressly labels an uncrewed aircraft as an instrumentality of criminal and tortious activity, protects real property owners by not allowing uncrewed aircraft operators to claim a prescriptive right in their airspace, expressly preempts municipal and county action regarding the operation of uncrewed aircraft, establishes a commission to inform agencies and the public about the integration of uncrewed aircraft into Mississippi's airspace, as well as definitions among other things.[297] The bottom line is that the bill is a wonderful example of legislative action by a state government that falls within the scope of a state's authority to regulate uncrewed aircraft and should be followed as model legislation for other states.

ii. The Case for Advisory Nonpreemption and Legislation

Echoing the sentiment of Stephen Migala, "[w]hen the correct authorities are analyzed in concert with their legislative intent and historical context, it becomes evident that states are not preempted from restricting UASs in their low-lying non navigable airspace."[298] Given the holding in *Singer* and the FAA's updated Registration Rule,[299] it is reasonable to question how the existing state statutes, county rules and municipal ordinances have not been preempted as the Newton, Massachusetts ordinance had.[300] Following the release of the FAA's State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet (FAA Fact Sheet) in 2015,[301] "it is not at all clear what level of restriction would rise to a level of conflict with

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[296] S.B. 2282, 135th Leg. Sess., Reg. Sess. (Miss. 2020)

[297] *Id*.

[298] Stephen J. Migala, *UAS: Understanding the Airspace of States*, 82 J. AIR L. & COM. 3, 12 (2017).

[299] 49 U.S.C. § 40101; *City of Newton,* 284 F. Supp. 3d at 127.

[300] Michel, *supra* note 245.

[301] Fed. Aviation Admin, State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet (Dec. 17, 2015) [hereinafter Fact Sheet].

Congress's intent sufficient to render them preempted – all that is clear is that the Newton Ordinance did."[302]

The FAA Fact Sheet provides examples of state and local laws for which consultation with the FAA is recommended and that are within the state and local government police power; it does not elaborate upon examples of state and local laws that are preempted by the federal framework.[303] Further, the FAA Fact Sheet invites states, counties and municipalities to consult with the FAA's Office of the Chief Counsel before implementing measures regulating aspects of the usage and operations of uncrewed aircraft.[304] Also, it is important to note that the FAA stated in the FAA Fact Sheet that "[b]ecause Federal registration is the exclusive means for registering UAS for purposes of operating an aircraft in navigable airspace, no state or local government may impose an additional registration requirement on the operation of UAS in navigable airspace without first obtaining FAA approval."[305] However, that has not stopped municipalities, counties and states from passing measures that establish a registry or registry-like system of uncrewed aircraft in place, operated by the political division that passed the measure without consultation from the FAA.

Sarah E. Light commented that "cooperative federalism" and "advisory nonpreemption" are alternatives to traditional preemption that could serve as a reasonable solution to the issue of whether or not states can regulate uncrewed aircraft in their navigable airspace.[306] She goes on to highlight that "[h]ow the FAA interprets what constitutes "navigable airspace" may likewise have significant implications for whether there remains a role for states in regulating the safety of technological innovations like drones."[307] This leaves significant room for "cooperative federalism" and "advisory nonpreemption" to have a significant impact on how courts interpret "navigable airspace" for states to regulate.[308]

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[302] Nicholas Cody, *Flight and Federalism: Federal Preemption of State and Local Drone Laws*, 93 WASH. L. REV. 1495, 1512–13 (2018).

[303] *Id.*

[304] *Id.*

[305] *Id.*

[306] Sarah E. Light, *Advisory Nonpreemption*, 95 WASH. U.L. REV. 327, 347 (2017).

[307] *Id.* at 345.

[308] *Id.*

The US Supreme Court found in *Hodel v. Virginia Surface Min. and Reclamation Ass'n Inc.* that cooperative federalism "allows the States, within limits established by federal minimum standards, to enact and administer their own regulatory programs, structured to meet their own particular needs."[309] Andrew Ayers highlights two Acts that promote "cooperative federalism without forcing decisions into state legislatures:" the Clean Water Act and the Occupational Health and Safety Act of 1970.[310] He goes onto state that the Clean Water Act

> gives states the power to avoid federal preemption by developing their own programs for issuing permits to polluters...the Act requires that the state's attorney general certify that state law provides adequate authority for the program...states can promulgate water-quality standards under the Act if they submit a certification from "the State Attorney General or other appropriate legal authority within the State that the water quality standards were duly adopted pursuant to State law." Thus, the federal government remains neutral as to which entity within the state government promulgates the standards...Each of these provisions, in short, leaves it to the state to decide which entity takes the action that avoids federal preemption.[311]

In addition, "[t]he Occupational Health and Safety Act of 1970 (OSHA) allows states to avoid federal preemption by submitting a state plan for the development of occupational health and safety standards."[312] The elements of cooperative federalism found in the Clean Water Act and OSHA would provide a sound foundation for future legislation introduced by Congress. Furthermore, Gluck points out a key element of cooperative federalism, where "each federal program that gives…. implementation authority to the states

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[309] Hodel v. Virginia Surface Min. & Reclamation Ass'n, Inc., 452 U.S. 264, 289, (1981).

[310] Andrew B. Ayers, *Federalism and the Right to Decide Who Decides*, 63 VILL. L. REV. 567, 581-582 (2018).

[311] *Id.* at 581 ("Nothing in this section shall restrict any right which any person (or class of persons) may have under any statute or common law to seek enforcement of any effluent standard or limitation or to seek any other relief....").

[312] *Id.* at 582.

makes those states….partners with the federal government."[313] The partnership created by cooperative federalism allows state legislatures to exercise their autonomy while satisfying the intent of the FAA to have a uniform system in place, where states work in unison to integrate uncrewed aircraft into the national airspace.

Advisory nonpreemption is an abstract legal concept created by Light, where she writes that it is

> a federal agency's informal, advisory statement in policy guidance (rather than notice-and-comment rulemaking) that it has authority to regulate in a particular area. But the statement *does not actually preempt* states from regulating—at least temporarily (hence the moniker "nonpreemption"). And the agency sets a timetable to revisit the issue.[314]

Light goes on to write in future authorship that advisory nonpreemption acts as a necessary condition, some action on the part of the federal government to place either some or all of a regulatory program into a secondary institution, to create a regulatory horcrux, which requires both a necessary condition and sufficient condition, acceptance by the secondary institution.[315] Advisory nonpreemption is a great solution to the confusion that has been created by the mix of the FAA fact sheet, FAA directives, the *Taylor* and *Singer* decisions, and patchwork of municipal, county and state regulations.[316] As the capabilities and usage of uncrewed aircraft exponentially increase, it would be unwise for the FAA to continue to preempt state actions when situations, such as the COVID-19 pandemic, have led to more frequent and relaxed usage of uncrewed aircraft in the national airspace.[317]

By passing legislation that gives state governments the opportunity to develop a plan to oversee the operation of uncrewed aircraft in their jurisdiction and allowing the FAA to pass a

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[313] Abbe R. Gluck, *Intrastatutory Federalism and Statutory Interpretation: State Implementation of Federal Law in Health Reform and Beyond*, 121 YALE L.J. 534, 552 (2011).

[314] Light, *supra* note 306 at 333.

[315] Sarah E. Light, *Regulatory Horcruxes*, 67 DUKE L.J. 1647, 1659–60 (2018).

[316] 49 U.S.C. § 40101; *Taylor v. Huerta,* 856 F.3d at 1090; *City of Newton,* 284 F. Supp. 3d at 127; Michel, *supra* note 242; Fact Sheet, *supra* note 298.

[317] Jed Pressgrove, *Drones Become Part of Local U.S. Responses to COVID-19,* GOV'T TECH. (Apr. 22, 2020), https://www.govtech.com/products/Drones-Become-Part-of-Local-US-Responses-to-COVID-19.html.

complimentary statement of policy guidance for states' plans, "cooperative federalism" and "advisory nonpreemption" are pieces that would benefit an argument that states' have the right to regulate aspects of uncrewed aircraft activity and operation. "Cooperative federalism" and "advisory nonpreemption" alone would not suffice; a uniform piece of legislation drafted and passed by all fifty state governments is necessary to distinguish a state's right to regulate their own intrastate navigable airspace from the FAA's right to regulate the US' interstate navigable airspace.

Sarah E. Light is right, states should not be left to the mercy of the FAA to regulate activities of uncrewed aircraft that are not expressly prescribed to the states; which until now, the FAA has been slow to address these activities.[318] States have traditional police powers that guide them in prescribing rules and regulations that can oversee the activities of uncrewed aircraft in their airspace.[319]

Further, uncrewed aircraft are a cause of concern for states, as opposed to larger airplanes, because most uncrewed aircraft activity affects commerce locally, like small businesses, and the FAA needs to take this into consideration.[320] In the past, the discussion of the FAA's exclusive authority over American "navigable airspace" has revolved around the notion that traditional activities taking place in the American "navigable airspace" occur in an interstate context.[321] Scholars neglect to discuss the fact that the activities of uncrewed aircraft provide the first series of cases in the field of aviation law where the majority of activities occur in an intrastate context.[322]

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[318] Henry H. Perritt, Jr. & Albert J. Plawinski, *One Centimeter over My Back Yard: Where Does Federal Preemption of State Drone Regulation Start?*, 17 N.C. J. L. & TECH. 307, 389 (2015).

[319] Fact Sheet*, supra* note 301, at 3.

[320] Migala, *supra* note 298.

[321] *See* generally Lindsey P. Gustafson, *Arkansas Airspace Ownership and the Challenge of Drones*, 39 U. ARK. LITTLE ROCK L. REV. 245, 277 (2017); Michael Kamprath, *A Legal and Practical Overview of How Local Governments Can Help Protect the Safety of Manned Flight in the Vicinity of Airports*, 49 URB. LAW. 563, 576 (2017); Timothy T. Takahashi, Ph.D., *Drones in the National Airspace*, 77 J. AIR L. & COM. 489, 519 (2012); Jeffrey A. Berger, *Phoenix Grounded: The Impact of the Supreme Court's Changing Preemption Doctrine on State and Local Impediments to Airport Expansion*, 97 NW. U. L. REV. 941, 965 (2003).

[322] *Taylor v. Huerta,* 856 F.3d at 1090; *City of Newton,* 284 F. Supp. 3d at 127.

The fundamental reason to register commercial and recreational airplanes with the federal government is that oftentimes the activities of commercial and recreational airplanes require them to cross state and even international borders.[323] Uncrewed aircraft are tasked with activities that qualify as interstate commerce, however, one report shows that "most commercial drone activity takes place at limited altitudes close to the ground and within short horizontal ranges—typically no more than one mile."[324] A compelling point is that the public is far more likely to encounter a FedEx uncrewed aircraft delivering a package in their neighborhood than a FedEx airplane delivering their package to another state or country. For example, while a FedEx airplane would not deliver a package within the borders of Memphis, Tennessee, a FedEx uncrewed aircraft may deliver a package from Memphis International Airport to the FedExForum in Downtown Memphis. This daily encounter is evidence enough that state governments, charged with the responsibility to oversee municipalities and townships within their borders,[325] should be provided the authority to regulate the operations of uncrewed aircraft that are operating in their navigable intrastate airspace.

V. CONCLUSIONS

A. What the Future Holds

There are two court cases that the legal community should look forward to in the world of uncrewed aircraft: *National Press Photographers Assn. v. McCraw*, an on-going Federal court case in Texas, and *Michigan Coalition of Drone Operators v. Genesee County,* a pending State court case in Michigan. An on-going District Court case in Texas also has the potential to be a force in the case-law of uncrewed aircraft.[326] *National Press Photographers*

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[323] *Air Traffic by the Numbers,* FED. AVIATION ADMIN. (June 2019), https://www.faa.gov/air_traffic/by_the_numbers/media/Air_Traffic_by_the_Numbers_2019.pdf.

[324] Connot, *supra* note 167, at 3.

[325] *Cities 101—Delegation of Power,* NAT'L LEAGUE OF CITIES (Dec. 13, 2016), https://www.nlc.org/resource/cities-101-delegation-of-power.

[326] *See* generally Plaintiffs' Complaint for Declaratory and Injunctive Relief, Nat'l Press Photographers Association v. McCraw, No. 1:19-cv-00946 (W.D. Tex. Sept. 26, 2019), 2019 WL 4689362.

Assn. v. McCraw showcases what has been portrayed as a civil rights battle regarding privacy concerns between news associations and the Texas Privacy Act of 2013, which established rules and regulations pertaining to the operation of uncrewed aircraft in the state of Texas.[327] Despite the media portrayal of this case as a matter of civil rights, the complaint, filed in September of 2019, stated that the "[p]laintiffs seek a judgment….declaring that the No-Fly Provisions violate the Supremacy Clause."[328] The complaint went on to state that

> state drone regulations promulgated to protect aviation safety impermissibly infringe upon a field of exclusive federal regulation….[b]y banning drone use within the airspace around critical infrastructure and other facilities, Texas is attempting to regulate aviation safety through its No-Fly Provisions. The No-Fly Provisions are thus preempted by the federal government's exclusive authority to regulate aviation safety.[329]

In response, the defendants filed a Motion to Dismiss in November of 2019, which stated that the plaintiffs "seek nothing less than unrestricted information gathering on any private citizen, anywhere, at any time, by anyone."[330] The plaintiffs contended in December 2019 that "[t]he No-Fly Provisions are preempted by federal aviation law both because Congress has preempted state aviation safety regulations and because they directly flout and impede the objectives of federal aviation safety law."[331] Time will tell how this case unfolds but Judge Pitman's holding has the potential to establish further precedent in the 5th Circuit as uncrewed aircraft continue to be integrated into the national airspace.

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[327] *See* Christopher Collins, *It's Illegal to Take Drone Photos of Cattle Feedlots in Texas. Press Groups Say That Violates the First Amendment.,* DALLAS OBSERVER (Feb. 13 2020), https://www.texasobserver.org/drone-cattle-feedlots-first-amendment-panhandle/; *Federal Lawsuit Challenges Texas Drone Law That Unconstitutionally Restricts Visual Journalists,* NAT'L PRESS PHOTOGRAPHERS ASS'N (Sept. 26, 2019), https://nppa.org/news/nppa-files-lawsuit-austin-federal-court-challenging-texas-drone-law.

[328] *McCraw,* 2019 WL 4689362, at 3.

[329] *McCraw,* 2019 WL 4689362, at 29-30.

[330] Defendants' Motion to Dismiss at 18, Nat'l Press Photographers Association v. McCraw, No. 1:19-cv-00946-RP (W.D. Tex. Nov. 5, 2019), 2019 WL 8883956.

[331] Plaintiffs' Response in Opposition to Defendants' Motion to Dismiss at 26, Nat'l Press Photographers Association v. McCraw, No. 1:19-cv-00946-RP (W.D. Tex. Dec. 3, 2019), 2019 WL 2019 WL 8329485.

A Michigan state court case filed in the 7th Circuit has the potential to gain traction for the state preemption of the usage of uncrewed aircraft.[332] In *Michigan Coalition of Drone Operators v. Genesee County*, an uncrewed aircraft was confiscated and the operator, Jason Harrison, was handcuffed and detained by police, claiming that flying the uncrewed aircraft in parks was illegal.[333] Although this was found out not to be true, the Genesee County Board of Supervisors passed a regulation banning the operation of uncrewed aircraft in the parks.[334] In response, Jason Harrison formed the Michigan Coalition of Drone Operators and sued the Board of Supervisors in state court.[335] Circuit Judge Joseph Farah held in favor of the Coalition, concluding that "this Court prohibits the enforcement of any ban on possession, use or operation….by the Genesee County Parks Commission….that is inconsistent with the dictates of state and federal law."[336] Only time will tell how this case proceeds. Regardless, this is a case to keep an eye for the time being.

B. Final Thoughts

With the future of uncrewed aircraft regulation unknown, the industry needs a ranger to oversee the rules and regulations in the field to induce economic growth and serve as a check on centralized power.[337] Let it be clear, the ranger must stem from the power of the state government only. This article showed the Federal Aviation Act impliedly preempts the field of aviation safety;[338] while the

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[332] *Michigan Coalition of Drone Operators v. Genesee County,* 19-113058-CZ (Mich. Cir. Ct. 2020); *See* Kara Murphy, *US Judge Rules Against County Seeking to Ban Drone Flights in Their Parks,* DIGIT. PHOTOGRAPHY REV. (Feb. 17, 2020) https://www.dpreview.com/news/1042631835/judge-rules-against-county-seeking-to-ban-drone-flights-in-their-parks#:~:text=On%20February%2010th%2C%20the%20Honorable,battle%20was%20ignited%20after%20R.

[333] Jason Reagan, *Judge Strikes Down Michigan County's Drone Ban,* DRONE LIFE (Feb. 17, 2020) https://dronelife.com/2020/02/17/judge-strikes-down-michigan-countys-drone-ban/.

[334] *Id.*

[335] *Id.*

[336] *Id.*

[337] Richard C. Schragger, *Federalism, Metropolitanism, and the Problem of States*, 105 VA. L. REV. 1537, 1586 (2019).

[338] 49 U.S.C. § 1421.

ADA expressly preempts aviation routes, rates and services.[339] It is important to note that those might overlap, because we are dealing with two different statutes and two different sources of preemption. In addition, despite the directive from the FAA to consult with them before enacting a registration system of uncrewed aircraft, a number of states, counties and municipalities have established registry-like systems in place that have yet to be disputed.[340]

The *Singer* holding and Congressional response to the *Taylor* holding highlight that the patchwork of uncrewed aircraft statutes and regulations that exist in the US needs to be revisited.[341] In the past, there has been a degree of caution exercised by the FAA in addressing what state and local laws would be preempted.[342] The first two sections of the FAA Fact Sheet, "Why the Federal Framework" and "Regulating UAS Operations," are rather persuasive and expressly demonstrate that states have some latitude in this area.[343] The greatest issue that remains is the National Defense Authorization Act language that resulted from and overruled Taylor.[344] Ultimately, it is a field preemption issue, unless a compelling argument can be made that a registry is a 'service' under the ADA, but that is unlikely. Some cases on the ADA found no preemption because the thing at issue was not a 'service.' Some cases on the Federal Aviation Act found no preemption because the thing at issue was outside of the preempted field. It would be useful for the FAA to clarify what those boundaries are and whether the National Defense Authorization Act overrule of Taylor and the FAA's subsequent registry preempts a state registry.

From this point on, the FAA must be clear and concise in its determination of what aspects of the operation of uncrewed aircraft are federally preempted. States can play a role in regulation of drones, but a registry, unless narrowly tailored for a specific purpose other than just cataloging or identifying drones, as it currently stands, seems to likely be preempted. There is a large scope for states to regulate uncrewed aircraft, particularly given real

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339 Silversmith, *supra* note 96.
340 Fact Sheet, *supra* note 301.
341 49 U.S.C. § 40101; *City of Newton,* 284 F. Supp. 3d at 127.
342 Fact Sheet, *supra* note 301, at 1-3.
343 *Id.*
344 National Defense Authorization Act § 143.

property interests that have always fallen under the traditional police powers of a state.

However, states must retain a degree of flexibility to regulate emerging technologies that are affecting their own navigable airspace. A model piece of legislation that states should pass that would likely pass judicial muster should be drafted as follows:

> **Definitions.** In this act, (a) An "unmanned aircraft" means an aircraft that is constructed or operated without the possibility of direct human intervention from within or on the aircraft, including every object that is on board or otherwise attached to the aircraft, or carried or operated during flight, regardless of weight. For the purposes of this act, this term is synonymous with the term "drone." (b) An "unmanned aircraft system" means an unmanned aircraft and all associated elements, including, but not limited to, communication links, sensing devices and components that control the unmanned aircraft. (c) "Intrastate airspace" means an airspace of defined dimensions wholly within this State.
>
> **County and municipal preemption.** Except as expressly authorized by statute, a political subdivision shall not enact or enforce an ordinance, resolution, regulation or policy that regulates the ownership or operation of non-recreation or recreational unmanned aircraft or otherwise engage in the regulation of the ownership or operation of non-recreation or recreational unmanned aircraft systems. Any ordinance, resolution, regulation or policy of any county or municipality of this state regulating the ownership or operation of non-recreation or recreational unmanned aircraft shall be deemed preempted and shall be null, void and of no force or effect.
>
> **Right to govern intrastate airspace.** (a) An unmanned aircraft is an instrumentality that operates in intrastate airspace. (b) An unmanned aircraft system is an instrumentality that operates in intrastate airspace. (c) Where the Federal Aviation Administration has the right to control navigable interstate airspace, this State has the right to establish legislation, rules and regulations governing the instrumentalities that operate in navigable intrastate airspace. (d) Where the Federal Aviation Administration has the right to control navigable interstate airspace, this State has the right to establish legislation,

> rules and regulations governing the activities that occur in navigable intrastate airspace.
>
> **Torts and crimes generally.** (a) This act applies to the operations of all unmanned aircraft systems and the acts of those who own, control or operate such systems, or are affected by such operations. (b) An unmanned aircraft system is an instrumentality by which a tort can be committed under the laws of this state. (c) An unmanned aircraft system is an instrumentality by which a crime can be committed under the laws of this state. (d) The criminal statutes of this state shall apply to any person who owns, controls or operates unmanned aircraft within this state, or to any other person liable under the criminal laws of this state.
>
> **Prescriptive right.** Repeated or continual operation of an unmanned aircraft over a landowner's or lessee's real property does not create a prescriptive right in the airspace.

The bottom line is that a complete integration of uncrewed aircraft into Mississippi's airspace can only be completed if the state exercises their traditional police powers appropriately. The findings from this article show that while the creation of a Mississippi state registry would be ideal, such a measure would likely found to be preempted by the FAA, so instead the state should look to regulating aspects of uncrewed aircraft operation while showing their intentions to the FAA are clear: political subdivisions in the state are preempted from regulating uncrewed aircraft, a state's right to govern their navigable intrastate airspace is distinguished from the federal government's right to govern navigable interstate airspace, tortious and criminal activity committed with an uncrewed aircraft is actionable under state law and repeated operation of an uncrewed aircraft over someone's property does not create a prescriptive right to the real property owner's airspace.

"APPENDIX A"

[ ]LEGISLATURE REGULAR SESSION 2021

To: House Highways and Transportation; Senate Highways and Transportation

SENATE/HOUSE BILL No. [ ]

AN ACT TO REGULATE UNMANNED AERIAL SYSTEMS; TO PROVIDE DEFINITIONS; TO ENACT EXCEPTIONS; TO PROVIDE PENALTIES FOR VIOLATIONS OF THIS ACT; AND FOR RELATED PURPOSES.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF _____:

SECTION 1. Short Title. This act may be cited as the "Secure Uncrewed _____ Act of 2021."

SECTION 2. Definitions. In this act,

(a) An "uncrewed aircraft" means an aircraft that is constructed or operated without the possibility of direct human intervention from within or on the aircraft, including every object that is on board or otherwise attached to the aircraft, or carried or operated during flight, regardless of weight. For the purposes of this act, this term is synonymous with the term "drone."

(b) An "uncrewed aircraft system" means an uncrewed aircraft and all associated elements, including, but not limited to, communication links, sensing devices and components that control the unmanned aircraft.

(c) "Intrastate airspace" means an airspace of defined dimensions wholly within this State.

SECTION 3. County and municipal preemption. Except as expressly authorized by statute, a political subdivision shall not enact or enforce an ordinance, resolution, regulation or policy that regulates the ownership or operation of non recreation or recreational uncrewed aircraft or otherwise engage in the regulation of the ownership or operation of non recreation or recreational uncrewed aircraft systems. Any ordinance, resolution, regulation or

policy of any county or municipality of this state regulating the ownership or operation of non recreation or recreational unmanned aircraft shall be deemed preempted and shall be null, void and of no force or effect.

SECTION 4. Right to govern intrastate airspace. (a) An uncrewed aircraft is an instrumentality that operates in intrastate airspace.

(b) An uncrewed aircraft system is an instrumentality that operates in intrastate airspace.

(c) Where the Federal Aviation Administration has the right to control navigable interstate airspace, this State has the right to establish legislation, rules and regulations governing the instrumentalities that operate in navigable intrastate airspace.

(d) Where the Federal Aviation Administration has the right to control navigable interstate airspace, this State has the right to establish legislation, rules and regulations governing the activities that occur in navigable intrastate airspace.

SECTION 5. Torts and crimes generally. (a) This act applies to the operations of all ucrewed aircraft systems and the acts of those who own, control or operate such systems, or are affected by such operations.

(b) An uncrewed aircraft system is an instrumentality by which a tort can be committed under the laws of this state.

(c) An uncrewed aircraft system is an instrumentality by which a crime can be committed under the laws of this state.

(d) The criminal statutes of this state shall apply to any person who owns, controls or operates uncrewed aircraft within this state, or to any other person liable under the criminal laws of this state.

SECTION 6. Prescriptive right. Repeated or continual operation of an uncrewed aircraft over a landowner's or lessee's real property does not create a prescriptive right in the airspace.

IDENTIFYING CYBERSECURITY VULNERABILITIES IN THE REALM OF URBAN AIR MOBILITY

Charles Matranga[*]

I. INTRODUCTION

Achieving personalized flight is one of humanity's oldest dreams, with accounts from Ancient Greek myths and legends,[1] to Leonardo da Vinci's notes and drawings,[2] to the Wright Brother's Flyer.[3] In modern times, illustration of what future civilization might look like often includes depictions of flying cars whizzing about the sky over a sleek urban skyline. Even a series of paintings created between 1899 and 1910, titled "France in the Year 2000," depicted personalized flying machines being habitually utilized by cab drivers, mail men, police officers and firefighters.[4]

Despite attempts throughout history, we are still a long way from the personal aero-car utopia left imprinted onto our imaginations by books, television and films. However, recent technological advancements and infrastructure planning have shifted the framework of urban air mobility away from the regulatory nightmare of personal aero-cars and towards the concept of public air transportation. According to a NASA urban air mobility market study conducted by McKinsey and Company, the global market for urban air

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[1] *Icarus: Greek Mythology*, ENCYC. BRITANNICA (last visited Dec. 21, 2020) https://www.britannica.com/topic/Icarus-Greek-mythology.

[2] Peter Jakab, *Leonardo Da Vinci and Flight,* NAT'L AIR AND SPACE MUSEUM (Aug. 22, 2013) https://airandspace.si.edu/stories/editorial/leonardo-da-vinci-and-flight.

[3] Tom D. Crouch, *Wright Flyer of 1903,* ENCYC. BRITANNICA (last visited Dec. 21, 2020) https://www.britannica.com/topic/Wright-flyer-of-1903.

[4] Ana Swanson, *What People in 1900 Thought the Year 2000 Would Look Like*, WASH. POST (Oct. 4, 2015), https://www.washingtonpost.com/news/wonk/wp/2015/10/04/what-people-in-1900-thought-the-year-2000-would-look-like/.

mobility is predicted to reach over 1.9 billion dollars by 2040;[5] there may be a viable market for air metro transportation by 2028.[6] Air taxi services have the potential for localized profit among wealthier individuals in densely populated markets by 2030,[7] but the market would require dense vertistop infrastructure to create true "door-to-door" service like other on-demand transportation alternatives. The best estimate for air taxi cost per trip poses a significant barrier as compared to air metro services, which also is assumed to carry more passengers per trip.[8]

The attainment of commercial flight in the 1930's helped create a global community and revolutionized nearly every aspect of our daily lives to a degree rivaled only by the conception of the Internet. While commercial and recreational flight may be considered as a completed steppingstone on humanity's march toward the stars, we are far from realizing its true potential. Ubiquitous and affordable urban air mobility options present several benefits to the current transportation landscape. Traffic decongestion alone warrants national support for this burgeoning industry. According to a 2019 urban mobility report, commuters spend an average of 54 extra hours per year in traffic from speed limits caused by congestion.[9] However, no benefits are accompanied without risks. Urban air mobility faces a wide array of drawbacks and hurdles ranging from infrastructure, cost, certification and pollution (noise and emissions). Each of these concerns warrants their own individual analysis, but they are not the sole concern of this article. Rather, the most pressing concern pertains to the cybersecurity vulnerabilities of both crewed and uncrewed aircraft that are likely to be in use for urban air transport by 2030.

Technology has become increasingly intertwined in nearly every facet of our daily lives. The computing power and connectivity of today's cell phones alone are more powerful than any state-of-

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[5] NAT'L AEORONAUTICS AND SPACE ADMIN., URBAN AIR MOBILITY (UAM) MARKET STUDY, 20 (2018) https://www.nasa.gov/sites/default/files/atoms/files/uam-market-study-executive-summary-v2.pdf [hereinafter NASA UAM STUDY].

[6] *Id*.

[7] *See id*.

[8] *Id*. at 23.

[9] DAVID SCHRANK ET AL. 2019 URBAN MOBILITY REPORT, 1 (2019), https://static.tti.tamu.edu/tti.tamu.edu/documents/mobility-report-2019.pdf.

the-art computer system of the 20th Century.[10] Data breaches and computer viruses appear to be inevitable occurrences in the digital age.[11] While cancelling a credit card or wiping a hard drive are certainly an inconvenience, the stakes are much higher at 5,000 feet. For instance, what happens when a malicious actor seizes control of the autopilot functions of an uncrewed air taxi that is filled with passengers in a population dense urban environment? This paper will explore the cybersecurity vulnerabilities of urban air transport, identify ways in which malicious individual and group actors may attempt to expose those vulnerabilities, and finally offer guidance on how cybersecurity should be approached to ensure personal safety above and on the ground.

Part I of this paper will discuss the history of Urban Air Mobility (UAM) and identify the current companies leading the way in achieving safe and efficient UAM. Part II will discuss the benefits and obstacles associated with UAM in general. Part III will explore the cybersecurity threats and obstacles uncrewed and crewed aircraft will face in terms of air metro urban air transport. Part IV will look to the automotive transportation industry for guidance on how to better protect their systems, and therefore their passengers, from outside actors. Part V will offer suggestions on what measures should be taken to help ensure stable cybersecurity for urban air transport. Part VI will conclude this paper.

II. BACKGROUND

A. History of Flying Cars

Inventors have been chasing the dream of flying cars for over a century. In 1911, Glenn Curtiss unveiled the Curtiss Autoplane,

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[10] *Your Device has More Computing Power,* NAT'L AERONAUTICS AND SPACE ADMIN. https://www.nasa.gov/mission_pages/voyager/multimedia/vgrmemory.html#.XpIzHtNKhbU (last visited Sept. 21, 2020) ("Voyager 1 and Voyager 2 have 69.63 kilobytes of memory each. For comparison, an iPhone 5 with 16 gigabytes of memory has about 240,000 times the memory of a Voyager spacecraft.").

[11] *See generally* Davey Winder, *Data Breaches Expose 4.1 Billion Records in First Six Months Of 2019,* FORBES (Aug. 20, 2019), https://www.forbes.com/sites/daveywinder/2019/08/20/data-breaches-expose-41-billion-records-in-first-six-months-of-2019/#3c0d7afebd54.

a three seat Autoplane that featured "removable wings and tail, an aluminum body, and a cabin heater," as well as a rear propeller and steerable front wheels.[12] The design never produced a sustained flight and ultimately failed due to a lack of financial backers.

Another notable creation in pursuit of flying cars came from Robert Fulton's Airphibian in 1946. Taking an alternate approach, "[i]nstead of adapting a car for flying, Fulton adapted a plane for the road."[13] Much like the design of the Curtiss Autoplane, Fulton's Airphibian utilized detachable features that allowed a transformation time of "only five minutes to convert the plane into a car."[14] However, unlike the Curtiss Autoplane and other aspiring contemporaries, Fulton's Airphibian was the first roadable aircraft to receive a type certification from the Civil Aviation Administration in 1950.[15] Despite its operational success, the Airphibian failed due to financial restraints.

The last breakthrough in roadable aircraft came in 1949 with the Taylor Aerocar. Designed by Molten Taylor and inspired by Fulton's Airphibian, the Aerocar replaced the Airphibian's removable wings with "folding mechanisms" that allowed for seamless transformation from flight to road use.[16] Despite being one of the most successful attempts at achieving a flying car, a limited amount were produced and the few that remain exist only as a unique relic of innovation in the mid 20th century. Andrew Glass, author of *Flying Cars: The True Story*, offered insight on why these machines, despite their success, ultimately failed in the long run:

> The biggest challenge according to engineers in creating a flying car, is to create a machine that is robust, rugged, and

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[12] Stuart F. Brown, *Pie-in-the-Sky Flying Cars From the Past*, N.Y. TIMES (Aug. 22, 2014), https://www.nytimes.com/2014/08/24/automobiles/pie-in-the-sky-flying-cars-from-the-past.html.

[13] Kevin Bonsor, *How Flying Cars Will Work*, HOWSTUFFWORKS.COM https://auto.howstuffworks.com/flying-carhtm (last visited Dec. 21, 2020),

[14] *Id*.

[15] *Fulton Airphibian FA-3-101,* SMITHSONIAN NAT'L AIR AND SPACE MUSEUM, https://airandspace.si.edu/collection-objects/fulton-airphibian-fa-3-101/nasm_A19600127000 (last visited Dec. 21, 2020); *Original Design Approval Process,* FED. AVIATION ADMIN., , https://www.faa.gov/aircraft/air_cert/design_approvals/orig_des_approv_proc/ (last visited Dec. 21, 2020)
(A type certification is applied for and received under the regulations provided in 14 CFR §21.).

[16] Brown, *supra* note 12.

> probably heavy enough to withstand the rigors of the road, the bumps and the occasional fender benders, and at the same time a machine that is light enough and aerodynamic enough to be safe in the air. Most engineers claim that although it was an interesting problem, it was not a solvable one. The balance would always be wrong, or the weight would be wrong, and you could never do better than creating an inferior car that would also be an inferior airplane, and that you were much better off making an airplane and making a car and keeping them separate.[17]

Notwithstanding this candid assessment of the infeasibility of personal flying automobiles, many individuals and companies remain undeterred. The United States Patent and Trademark Office database yielded 170 results for the keywords: "flying cars" searched between the years 2001-2020.[18] Today, new emerging technologies and a recent surplus of willing benefactors have helped eliminate the financial and operational problems that plagued their predecessors, and UAM is finally appearing to become a reality.

B. Current UAM leaders and companies

The National Air and Space Administration (NASA) is one of the federal agencies facilitating the research and development of UAM. NASA has a history of increasing the "capacity and improv[ing] the efficiency, safety, and environmental compatibility of the air transportation system."[19] NASA's goal with the urban air mobility industry is the same as it has been for the aviation industry as a whole, which is setting the "long term vision for aviation and undertaking research and development that falls outside the

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[17] *The Future of Commuting May Be By Air, But Probably Not in Your Personal Flying Car,* CNBC (Mar. 8, 2020), https://www.cnbc.com/video/2020/03/06/why-dont-we-have-flying-cars-yet.html.

[18] US Patent & Trademark Office, http://appft.uspto.gov/netahtml/PTO/search-bool.html.

[19] *Urban Air Mobility – Are Flying Cars Ready for Take-Off?*, *Hearing Before the Comm. on Science, Space, and Technology*, 115 Cong. 14, 19 (2018) (Statement of Dr. Jaiwon Shin, Assoc. Adm'r Aeronautics Research Mission Directorate), https://www.govinfo.gov/content/pkg/CHRG-115hhrg30881/pdf/CHRG-115hhrg30881.pdf [hereinafter Shin Testimony].

scale, risk, and payback criteria that govern commercial investments."[20]

Three primary goals are among the elements included in NASA's holistic research and development strategy. The first is to provide market and technology analysis to determine the scope of the challenges, as well as their necessary solutions.[21] An example of this element in action can be found in a 2018 Urban Air Mobility Market Study sponsored by NASA and published in partnership with several consulting firms. The report provides insight on UAM through market analysis, public acceptance, the regulatory environment, potential barriers, as well as how to move forward.[22] Second, NASA plans to lead technology development in essential areas of UAM, such as noise reduction, air traffic management, autonomous flight systems, and partial or full electronic propulsion systems for vertical take-off and landing vehicles (eVTOL).[23] And lastly, NASA recently implemented a grand challenge to allow individuals and companies to "gauge their individual readiness and the overall system state-of-the-art."[24] NASA has currently signed Space Act Agreements with seventeen companies that have agreed to take part of the grand challenge.[25] The companies have been divided into three categories of participation: (1) developmental flight testing; (2) developmental airspace simulation; and (3) vehicle provider information exchange.[26]

Joby Aviation, a company founded in 2009 based out of Santa Cruz, California is the only company slated to participate in the first category, in which it will showcase its aircraft in the Grand Challenge Developmental Testing (GC-DT) and "demonstrate key integrated operational UAM scenarios as designed by NASA's UAM Grand Challenge team."[27] These scenarios will likely include communications, navigations, surveillance contingencies and air to air

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[20] *Id*.

[21] *Id*. at 20.

[22] NASA UAM STUDY, *supra* note 5, at 2.

[23] Shin Testimony, *supra* note 19, at 20.

[24] *Id*.

[25] *NASA's Urban Air Mobility Grand Challenge Advances with Agreement Signings,* NASA.GOV (Mar. 3, 2020), https://www.nasa.gov/press-release/nasa-s-urban-air-mobility-grand-challenge-advances-with-agreement-signings/.

[26] *Id*.

[27] *Grand Challenge Developmental Testing Partners,* NASA.GOV (Mar. 3, 2020), https://www.nasa.gov/aeroresearch/grand-challenge-developmental-testing.

conflict management.[28] Their proprietary craft is a piloted eVTOL capable of flying 200 miles per hour at a total range of over 150 miles on a single charge.[29] It is also touted as being 100 times more quiet than conventional aircraft and produces zero carbon emissions.[30] This impressive start-up not only warranted receiving the only slot for the first category, but it also recently received a $394 million investment from Toyota Motor Company.[31] Joby Aviation recently partnered with the Uber Elevate program for a "multi-year commercial partnership" with the ultimate goal of deploying air taxi services by 2023.[32]

In addition to their recent partnership with Joby Aviation, prominent transportation company Uber Technologies is a leading member of the second category, developmental airspace simulation, and will test its "UAM traffic management services in robust NASA-designed airspace simulations in the GC-DT and demonstrate key integrated operational UAM scenarios."[33] Uber is among the leaders in UAM and offers an extensive analysis of the market barriers in a ninety-eight page white paper, such as cost and affordability, safety and noise and carbon emissions.[34]

Bell Textron and Boeing are significant members of the third category, vehicle provider information exchange. They will "exchange information with the intent to prepare that partner for possible flight activities during the first Grand Challenge at a NASA-provided or other approved test range in 2022."[35] Both companies

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[28] *Id*.

[29] JOBY AVIATION https://www.jobyaviation.com/ (last visited Dec. 21, 2020).

[30] *Id*.

[31] Grant Martin, *Toyota Invests $394 Million in Electric Air Taxi Company Joby Aviation*, FORBES (Jan. 18, 2020), https://www.forbes.com/sites/grantmartin/2020/01/18/toyota-invests-590-million-in-electric-air-taxi-company-joby-aviation/#6429e4b88ea0.

[32] *Joby S4,* ELEC. VTOL NEWS https://evtol.news/joby-s4/ (last visited Dec. 21, 2020).

[33] *Grand Challenge Developmental Testing Partners, supra,* note 27.

[34] Uber Elevate, *Fast-Forwarding to a Future of On-Demand Urban Air Transportation,* UBER ELEVATE, 4-6 (Oct. 27, 2016), https://www.uber.com/elevate.pdf [hereinafter Uber Elevate White Paper]

[35] *Grand Challenge Developmental Testing Partners, supra,* note 27; *Flight Path for the Future of Mobility*, BOEING, http://www.boeing.com/NeXt/common/docs/Boeing_Future_of_Mobility_White%20Paper.pdf, 2 ("With increasing urbanization, a growing global population, aging infrastructure and the explosion of ecommerce, there is a need for new, sustainable and accessible modes of transportation. Urban air mobility (UAM) presents an opportunity to provide seamless, safe and rapid transportation to mitigate existing and future challenges faced by urban areas.").

have made great strides in achieving successful piloted, and even autonomous, urban air flight operations. Boeing's urban air mobility development department, Boeing NeXt, completed a controlled take-off, hover and landing with their autonomous passenger air vehicle (PAV) last year[36] and Bell Nexus recently unveiled a "four-passenger air taxi for the E-VTOL (electric vertical-takeoff-and-landing) market that's predicted to appear in the next five years . . . [and] looks like an all-black cross between a V-22 Osprey (also a Bell product) and a giant drone."[37]

The private sector is the largest force pursuing the realization of urban air mobility in the twenty-first century. While the public sector is necessary to explore and define the limits of the risks and rewards, it is the private sector that will likely bear the direct costs of trial and error. Executive Vice President of Technology and Innovation at Bell, Michael Thacker, celebrated this public and private union:

> Many of America's greatest accomplishments—from the Manhattan Project to the space program to the internet—were only possible through effective public-private partnerships. The promise of another great American accomplishment, true Urban Mobility in the vertical dimension, now lies before us, and along with it the promise of carrying on America's long legacy of leadership and innovation in aviation.[38]

One last prominent leader of urban air mobility is Kitty Hawk Corporation, which in 2017 announced the creation of the "Kitty Hawk Flyer."[39] The Flyer is "an amphibious, 10-rotor multicopter configuration that avoids many regulatory issues by operating as

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[36] *Boeing Autonomous Passenger Air Vehicle Completes First Flight,* BOEING (Jan. 23, 2019), http://www.boeing.com/features/2019/01/pav-first-flight-01-19.page.

[37] Michael Goldstein, *Bell Nexus VTOL Air Taxi Makes a Splash at 2019 Consumer Electronics Show,* FORBES (Jan. 14, 2019), https://www.forbes.com/sites/michaelgoldstein/2019/01/14/bell-nexus-vtol-air-taxi-makes-a-splash-at-2019-consumer-electronics-show/#5432d8712e31.

[38] *Urban Air Mobility – Are Flying Cars Ready for Take-Off?*, *Hearing Before the Comm. on Science, Space, and Technology*, 115 Cong. 54, 64(2018) (Statement of Michael Thacker), https://www.govinfo.gov/content/pkg/CHRG-115hhrg30881/pdf/CHRG-115hhrg30881.pdf.

[39] Kenneth H. Goodrich, *Dozens of Urban Air Mobility Projects Underway*, AEROSPACE AM. (last visited Sept. Dec 21, 2020), https://aerospaceamerica.aiaa.org/year-in-review/dozens-of-urban-air-mobility-projects-underway/.

an ultralight aircraft in the U.S."[40] Ultralight vehicles are single occupant vehicles used exclusively for sport and recreation and must conform to specific statutory requirements by meeting certain weight, fuel and seating limits.[41] The distinction between ultralight vehicles and traditional aircraft is extremely important as

> vehicles that meet the definition of an ultralight presently are not required to be registered or to bear markings of any type, are not required to meet airworthiness certification standards, and their operators are not required to meet any aeronautical knowledge, age, or experience requirements or to have airman or medical certificates.[42]

As previously mentioned, this paper is primarily concerned with VTOL aircraft to be used for air metro purposes, which due to their weight and passenger specifications will not be subject to the lax regulatory guidelines of ultralight vehicles. While there may be a concern regarding the potential for crowded and chaotic airspaces in urban environments between VTOL's and ultralight users, ultralight regulations mandate that "[n]o person may operate an ultralight vehicle over any congested area of a city, town, or settlement, or over any open air assembly of persons."[43] It will be important to maintain this regulation moving forward and to ensure the separation of air metro aircraft carrying passengers in urban environments and recreational ultralight users.

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[40] *Id*.

[41] 14 C.F.R. § 103.1 (2020).

[42] Ickes v. Fed. Aviation Admin., 299 F.3d 260, 264 (3d Cir. 2002) (citing 14 C.F.R. § 103.7). Petitioner in this case appealed the classification of his vehicle, Challenger II, as an aircraft rather than ultralight vehicle. Upon review the Third Circuit held that:

> [i]t is undisputed that the Challenger II has two seats, and that fact alone removes it from the ultralight category because it is not "used or intended to be used for manned operation in the air by a single occupant." 14 C.F.R. § 103.1(a). Furthermore, Ickes does not dispute the FAA's finding (nor did he ever appeal or petition for review of the findings in the earlier FAA proceedings) that his plane has an empty weight of 300 pounds, a fuel capacity in excess of 5 gallons, and a potential cruise speed of approximately 56–69 knots. See 14 C.F.R. § 103.1(e). Thus, based on its physical characteristics, Ickes' Challenger II is not an ultralight.

Id.

[43] 14 C.F.R. 103.15 (2020).

C. Intended benefits of UAM

All of the leaders and companies listed previously recognized one issue specifically to be a driving force in the pursuit of safe and affordable urban air mobility technology and infrastructure: traffic congestion.[44] According to a report by the United Nations Department of Economic and Social Affairs, 60.4 percent of the world's population will live in an urban environment by 2030, with estimates of up to 81. 4 percent of the population in more developed regions living in an urban environment by 2030 as well.[45] Necessity is indeed the mother of invention, and traffic and population congestion are reaching a critical stage far beyond mere inconvenience. Carbon emissions, lost productivity due to travel times, and general health concerns related to stress are important issues that the developing urban air mobility market are seeking to address.[46] Eric Allison, Head of Aviation Programs at Uber Technologies, Inc.

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[44] *See e.g., Joby Aviation*, SALINAS CHAMBER OF COM., https://business.salinas-chamber.com/member-directory/Details/joby-aviation-1195905 (last visited Dec. 26, 2020) (Increased congestion, longer commute times, and rising emissions compelled us to pioneer a new class of electric aircraft that quietly soars above gridlock—getting you to where you are going up to five times faster than driving."); BELL NEXUS, https://www.bellflight.com/products/bell-nexus (last visited Dec. 26, 2020)("Turn a 45-minute drive into a 10-minute flight. The safe, convenient Air Taxi is designed to let you make the most of your commute. Its sleek cabin offers a comfortable space for you to relax. Or work. Or socialize. All while saving your most precious resource: time."); Uber Elevate White Paper, *supra* note 34, at 2 (Uber Elevate: "Every day, millions of hours are wasted on the road worldwide. . . .Last year, the average San Francisco resident spent 230 hours commuting between work and home—that's half a million hours of productivity lost every single day. . . ., that's less time with family, less time at work growing our economies, more money spent on fuel—and a marked increase in our stress levels. . ." (citations omitted)); BOEING, http://www.boeing.com/NeXt/index.html?TB_iframe=true&width=370.8&height=658.8 (last visited Dec. 26, 2020)("With increasing urbanization, a growing global population, aging infrastructure and the explosion of ecommerce, there is a need for new, sustainable and accessible modes of transportation. Urban air mobility (UAM) presents an opportunity to provide seamless, safe and rapid transportation to mitigate existing and future challenges faced by urban areas.").

[45] *World Urbanization Prospects: The 2018 Revision*, U.N., DEP'T OF ECON. AND SOC. AFFAIRS, POPULATION DIV., 21 (2019) https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf.

[46] Uber Elevate White Paper, *supra* note 34 at 2; *See also Long Commutes May Be Hazardous to Health,* U.N., DEP'T OF ECON. AND SOC. AFFAIRS, POPULATION DIV. (May 8, 2012) https://www.ajpmonline.org/pb/assets/raw/Health%20Advance/journals/amepre/AJPM%20Jun2012%20Hoehner%20Commuting%20Distance%20FINAL%20_2_.pdf .

succinctly described the dilemma UAM is attempting to solve: "[M]oments stuck on the road represent less time with family, fewer hours growing our economies, and more money spent polluting our world."[47]

Texas A&M Transportation Institute's *2019 Urban Mobility Report* offers several more troubling statistics that properly reframes the severe issue of traffic congestion.[48] In 2017 alone, congestion caused traveling Americans to spend an additional 8.8 billion hours on the road and also purchase an extra 3.3 billion gallons for a total congestion cost of $179 billion.[49] To put this into perspective for the individual, the "average auto commuter spends 54 hours in congestion and wastes 21 gallons of fuel due to congestion at a cost of $1,080 in wasted time and fuel."[50] Traveling during alternative times of the day has also proven unsuccessful, as around 33 percent of delays occur in midday or overnight (i.e. non-peak time periods).[51] Unfortunately, all trends indicate that this problem will only worsen over the next five years, as estimated delay times and fuel costs are expected to grow to 10 billion hours and 3.6 billion gallons in 2025.[52]

These problems have not been completely ignored, as conventional and alternative means of transportation reform have been introduced. In 2007, New York City Mayor Michael Bloomberg outlined the city's plan for addressing travel congestion issues.[53] In the report, he outlined several conventional reforms, such as promoting car-sharing; expanding and improving the ferry service; ensuring bicyclist safety and convenience; improving safe access for

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[47] *Urban Air Mobility – Are Flying Cars Ready for Take-Off?*, *Hearing Before the Comm. on Science, Space, and Technology*, 115 Cong. 34, 34(2018) (Statement of Eric Allison), https://www.govinfo.gov/content/pkg/CHRG-115hhrg30881/pdf/CHRG-115hhrg30881.pdf..

[48] SCHRANK ET AL., *supra* note 9, at 1.

[49] *Id*.

[50] *Id*.

[51] *Id*. at 5.

[52] *Id*. at 12 (Additionally, the average commuter will spend up to 8 vacation days in traffic in 2025.).

[53] *See New York City Drivers Will Soon Have to Pay for the Privilege of Sitting in Traffic*, A.P. (Apr. 3, 2019), https://www.usatoday.com/story/news/nation/2019/04/03/congestion-pricing-new-york-city-drivers-soon-face-new-toll/3350401002/ ("New York City is set to become the first American metropolis that seeks to ease traffic congestion, cut pollution and boost mass transit by charging motorists a hefty toll for the privilege of driving into its most crammed areas.").

pedestrian walkways; implementing priced-based systems to reduce traffic congestion; and repairing damaged infrastructure (e.g. roads, bridges, subways, and bicycle and pedestrian paths).[54] These idealistic goals were not merely political rhetoric. In 2018, New York City Mayor Bill de Blasio released a progress report on his office's OneNYC initiative, highlighting massive improvements that have been successfully implemented to facilitate alternative forms of transportation throughout the city.[55]

Achieving a pervasive UAM infrastructure is not an instant cure for the ails of modern transportation. However, creating a safe, fast, efficient, accessible and quiet urban air transport vehicle that produces zero carbon emissions through electronic propulsion technology clearly possesses sizeable benefits for the nation's rapidly growing urban environments. While the industry is full of innovative companies and individuals willing to dedicate their time, expertise, and money to this revolutionary endeavor, the industry still faces its fair share of obstacles as well.

D. Obstacles in UAM

Cost and affordability regarding the production and accessibility of urban air transport is a key factor when assessing the feasibility of ubiquitous urban air mobility any time in the near future. Currently, the closest operational equivalent to eVTOL urban transport are helicopters, which are "energy-inefficient and very expensive to maintain, and their high level of noise strongly limits use in urban areas."[56] This is not to say that on-demand helicopter services are fruitless endeavors. Airbus recently ended Voom, an on-demand helicopter operation initiated in 2016 with air taxi companies in Mexico City, San Paolo, and San Francisco. The service recorded over 150,000 active app users, over 15,000 passengers, a 45%

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[54] CITY OF NEW YORK, *PLANYC, A GREENER, GREATER NEW YORK* 91 (2011), http://www.nyc.gov/html/planyc/downloads/pdf/publications/planyc_2011_planyc_full_report.pdf.

[55] CITY OF NEW YORK, ONENYC PROGRESS REPORT 2018, 32-33 (2018), https://onenyc.cityofnewyork.us/wp-content/uploads/2018/04/OneNYC_Progress_2018-2.pdf (Among other things, the report applauded the city's 2017 NYC Ferry system that carried three million riders in its inaugural year, the creation of eight additional select bus service routes to over 178,000 riders, and the addition of over 219.9 additional biking lane miles since 2015.).

[56] Uber Elevate White Paper, *supra* note 34 at 6.

customer return rate, and an "[a]verage ticket price equivalent to 2x the cost of a private ground taxi service for 1/10th of the time."[57] More importantly, it provided Airbus with a "wealth of valuable behavioural and operational data about urban air mobility (i.e. mission requirements and constraints, customer preferences, etc.) to inform a future vehicle design."[58]

Ultimately, on-demand helicopter ridesharing is unlikely to become a legitimate and widespread transportation alternative in the United States, as Uber's eight-minute, one-way helicopter taxi ride from downtown Manhattan to John F. Kennedy International Airport currently has a luxurious user cost of $200-$225.[59] UAM will therefore depend on the affordability of new eVTOL aircraft and infrastructure. The cost structure can be divided into three main categories: infrastructure, original equipment manufacturing (OEM) and operator costs.[60]

In terms of infrastructure, this will include several distinct levels of development including, but not limited to: air traffic management; service centers; distribution hubs; vertiports; and refueling/charging stations.[61] According to the white paper published by Uber Elevate, the estimated infrastructure costs necessary to accommodate 1,000 VTOLs across three to four cities would be approximately $121 million of initial costs alone.[62] The yearly costs of these vertiports would run an additional $86 million with expenses such as leases, maintenance, employee personnel, and security services.[63]

OEM costs include the total costs of individual aspects of urban air mobility such as costs relating to sensing systems, batteries, autonomous systems, certification costs.[64] Developing and

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[57] *Voom: An On-Demand Helicopter Booking Platform,* AIRBUS, https://www.airbus.com/innovation/urban-air-mobility/voom.html#key (last visited Sept. 21, 2020).

[58] *Id*.

[59] Stella Soon, *Uber's $200 Helicopter Taxi: Manhattan to JFK Airport in 8 Minutes Flat,* CNBC (Nov. 3, 2019), ; https://www.cnbc.com/2019/11/04/uber-copter-8-minute-helicopter-taxi-to-new-yorks-jfk-airport.html

[60] NASA UAM STUDY, *supra* note 5, at 14.

[61] *Id*.

[62] Uber Elevate White Paper, *supra* note 34, at 93 (Initial costs include the cost of retrofitting existing urban environments i.e. parking garages and heliports for use as heliports. This also includes the implementation of eVTOL charging capabilities).

[63] *Id*.

[64] NASA UAM STUDY, *supra* note 5, at 14.

manufacturing all of these intricate systems directly contribute to the total vehicle costs for individual eVTOL systems. Using the Uber Elevate initiative's estimations, the best case eVTOL costs with near-term manufacturing capabilities of 500 vehicles per year is a total of approximately $700,000 per vehicle.[65] The optimistic long-term cost scenario involves producing 5,000 vehicles per year for a total of around $275,000 per vehicle.[66] To put this ambitious manufacturing goal into perspective, "[i]n 2015 the Robinson R-44 piston engine helicopter ($473,000 price) was produced at *the highest rate of any helicopter that year with 196 units manufactured*, while a base model Bell 206 turboshaft helicopter had only 12 units produced ($900,000+ price)."[67] The cost estimates given by Uber Elevate are rough estimates based primarily on quantity of production and therefore they should not be taken as exact figures.[68] However, these estimates serve to illustrate the manufacturing requirements that will likely be necessary to provide ubiquitous and affordable urban air mobility transportation in a number of cities across the nation.

Lastly, operator costs pertain to any costs relating to the administrative or operational functions of urban air mobility.[69] This area is also referred to as indirect operating costs and is even more uncertain than the rough estimates pertaining to direct operating costs.[70] These costs may include operator certification,[71] corporate costs, energy costs, insurance, digital services (apps and websites) and payment systems.[72] Payment systems can refer to

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[65] Uber Elevate White Paper, *supra* note 34, at 87 (This total includes estimated piloting costs by professional helicopter pilot of $75,000/year, a vehicle unit cost of $600,000, and a battery cost of $28,000.).

[66] *Id*. (This total includes estimated autonomous piloting costs of $60,000/year, a vehicle unit cost of $200,000, and a battery cost of $14,000.).

[67] *Id*. at 91 (emphasis added).

[68] *Id*. at 62.

[69] NASA UAM STUDY, *supra* note 5, at 14.

[70] Uber Elevate White Paper, *supra* note 34, at 94.

[71] *Id*. at 17 ("VTOLs will be manufactured, flown, and maintained to meet the more stringent levels of control and FAA supervision covered under [14 CFR] Part 135. Additionally, VTOL operations, at least until autonomous operations become commonplace, will require commercial pilots who must have a higher level of training, experience, flight review, and medical certification than is the case for private pilots. Even if aircraft had equivalent failure rates, the control inherent in Part 135 operations will result in VTOL accident rates at least as low as operations within this section generally.").

[72] NASA, UAM STUDY *supra* note 5, at 14.

miscellaneous fees associated with credit card processing fees or other forms of monetary transactions.[73] In terms of current commercial aviation, "[m]uch of commercial aviation cost also resides in indirect taxes linked to fuel use, landing fees, and other airspace operation overhead [however, in] the case of VTOLs, the indirects are assumed to be relatively low due to the use of private infrastructure."[74]

III. FUTURE VULNERABILITIES

A. UAM Cybersecurity

Each of the elements and obstacles listed in the previous section do not exist in a vacuum, rather, they intersect and interact in conjunction with one another, especially in the arena of cybersecurity.[75] Ensuring secure cybersecurity systems for urban air transport is either directly related to, or dependent upon, the safety of passengers, costs of production and operation, and infrastructure. It is for these reasons that exploring urban air mobility's cybersecurity vulnerabilities and protections is the primary focus of this paper.

Additionally, because the air metro market appears to be more viable in the near future, as opposed to air taxis, due to lower costs and higher passenger quantities per trip, it is important to address the security concerns of individual VTOLs that will carry multiple passengers per trip over several trips over dense urban environments.

eVTOL's and the future of UAM are more prone to cyber threats due to their expanded and necessary interconnectivity and cyber computer systems. The OEM technology listed in the previous section detailing costs of production outlined the necessary system software of VTOL aircraft. An interview with Raytheon executive

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[73] Uber Elevate White Paper, *supra* note 34, at 87.

[74] *Id*.

[75] Anna L. Buczak & Erhan Guven, *A Survey of Data Mining and Machine Learning Methods for Cyber Security Intrusion Detection*, 18 IEE COMMS. SURVS. & TUTORIALS 1153, 1153 (2016) (The authors succinctly define cybersecurity as "the set of technologies and processes designed to protect computers, networks, programs, and data from attack, unauthorized access, change, or destruction.").

Todd Probert offers insight on how these systems have re-shaped the framework for metro transportation.[76] Probert notes that

> [t]here are a number of particular elements in the eVTOL domain that make it a unique cyber target . . . Many planned air taxis are set to be unmanned . . . meaning there is a degree of autonomy and a corresponding coordination with ground infrastructure in terms of air traffic management. However, air traffic management takes on a new meaning in this domain, as the vast majority of the systems are meant to fly in the relatively small, confined spaces of cities. This in turn means they demand sense and avoid systems to ensure air taxis avoid colliding with buildings or with other vehicles . . .. Such systems will need "some sort of cyber overlay" . . . .[77]

The long-term future of UAM certainly appears to be moving towards a fully autonomous "network of flying computers in the sky."[78] Boeing and SparkCognition company, Skygrid, envision an urban environment utilizing "blockchain technology, AI-enabled dynamic traffic routing, data analytics and cybersecurity features . . . enabling broad integration of autonomous air vehicles in the global airspace."[79]

While the pursuit of fully autonomous and interconnected flight systems would intuitively raise concerns of cyber threats, others view autonomous integration as an opportunity to minimize cyber intrusion. Airbus executive, Travis Mason, postulated that "increasingly automated systems in UAM also present new opportunities to minimize cybersecurity threats . . . because autonomous vehicles rely on fewer external resources and data."[80] However, as will be discussed in the next section, even current, non-automated forms of transportation with limited connectivity are still vulnerable to cyber-attacks.

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[76] Gerrard Cowan, *Protecting eVTOLs Against Cyber Threats,* EVTOL.COM, (Aug. 10, 2019), https://evtol.com/features/protecting-evtols-against-cyber-threats/.

[77] *Id.*.

[78] Amir Husain, *Urban Air Mobility in 2020: Four Trends to Watch*, FORBES (Dec. 13, 2019), https://www.forbes.com/sites/amirhusain/2019/12/13/urban-air-mobility-in-2020-four-trends-to-watch/#a74822c47110.

[79] *Flight Path for the Future of Mobility*, BOEING, *supra* note 35, at7.

[80] Husain, *supra* note 78.

To better understand the types of actions that may threaten the integrity of eVTOL cybersecurity we can look to industries that have anticipated, or have even already experienced, compromised operational abilities due to malicious cyber-attacks. The most analogous industry in terms of semi and fully autonomous research in public transportation are traditional and autonomous automobiles.

B. Cybersecurity in the Automotive Industry

The research and development of autonomous (self-driving) automobiles experienced a similar path as UAM over the last 40 years. The industry performed foundational research from the 1980's-2003, the "U.S. Defense Advanced Research Projects Agency (DARPA) held three 'Grand Challenges' that markedly accelerated advancements in AV technology and reignited the public's imagination," and there now has been an increase in collaboration in the commercial sector between manufacturers and researchers.[81]

Software and hardware advancements are now one of the numerous security challenges presented to autonomous vehicles (AV).[82] The necessity for consistent software updates in modern technology has created the potential for cybersecurity risks from unknown sources.[83] "Whether the entry point into the vehicle is the Internet, aftermarket devices, USB ports, or mobile phones, these new portals bring new challenges" as vehicle interconnectivity continues to grow.[84]

Prominent and concerning examples of compromised cybersecurity have already arisen due to software vulnerabilities of non-autonomous vehicles.[85] In 2015, 1.4 million vehicles were impacted

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[81] JAMES M. ANDERSON, AUTONOMOUS VEHICLE TECH.: A GUIDE FOR POLICYMAKERS, 56-57 (2014).

[82] *Id*. at 70.

[83] *Id*. ("Software upgrades, for example, will likely require connection to the Internet, which creates the possibility of vehicles being attacked by computer viruses that corrupt the system; for example, a virus could enter the system by masquerading as a legitimate software upgrade.").

[84] *Id*. (*quoting* former head of the National Highway Traffic Safety Administration, David Strickland).

[85] Roland L. Trope & Thomas J. Smedinghoff, *Why Smart Car Safety Depends on Cybersecurity*, 14 SCITECH LAW. 8, 10 (2018), https://www.americanbar.org/groups/science_technology/publications/scitech_lawyer/2018/summer/why-smart-car-safety-depends-cybersecurity/. (The article references two additional incidents not discussed in this paper, such as software patches issued to 2.2 million BMW's after the car's

by "the first and only (at this time) cybersecurity-related recall"[86] after two hackers exposed the vulnerability of Chrysler's UConnect system.[87] The hackers were able to access and control a variety of functions, including the air-conditioning, radio, windshield wipers, and eventually even the transmission, causing a test driver to slowly come to a halt on a busy interstate.[88] This incident led to a class action suit against Chrysler, in which the Plaintiffs asserted that the UConnect system was "exceedingly hackable" and that there was no way to "quickly, automatically, safely, securely, and effectively download software patches that are critical for protecting vehicles from the types of attacks described."[89] The case ultimately dismissed due to a lack of standing.[90]

There are two additional issues in the arena of autonomous automobiles, each issue fostering disagreement within the industry, that are worth mentioning in relation to UAM. First is the debate between manufacturers regarding whether the automotive industry should pursue full-autonomy or semi-autonomy in its vehicles.[91] Second, is the National Highway Traffic Safety Administration's (NHTSA) hands-off regulatory approach of exclusively relying

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ConnectedDrive software displayed vulnerabilities allowing the car to be remotely unlocked. The second incident refers to software patches distributed to all Tesla Model S vehicles after it was revealed that if a driver accessed a malicious web page, a variety of systems could be affected by an outside actor.).

[86] *Vehicle Cybersecurity,* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN.,, https://www.nhtsa.gov/technology-innovation/vehicle-cybersecurity . (last visited Dec. 22, 2020)

[87] Andy Greenberg, *Hackers Remotely Kill a Jeep on the Highway – With Me in It*, WIRED (Jul. 21, 2015), https://www.wired.com/2015/07/hackers-remotely-kill-jeep-highway/.

[88] *Id.*

[89] Flynn v. FCA U.S. LLC., No. 15-cv-855-SMY, U.S. Dist. LEXIS 53491, at *3 (S. D. Ill. 2020).

[90] *Id.* at *12 ("Moreover, Courts faced with similar standing challenges have found that a future risk of hacking is too speculative and that allegations of economic loss stemming from speculative risk of future harm cannot establish standing.").

[91] Arthur D. Spratlin, *The Autonomous Vehicle Revolution Expands to Trucks*, FOR THE DEFENSE (Dec. 2017), https://3epjwm3sm3iv250i67219jho-wpengine.netdna-ssl.com/wp-content/uploads/2018/01/The-Autonomous-Vehicle-Revolution-Expands-to-Trucks-Spratlin.pdf.

on its recall authority rather than issuing explicit Federal Motor Vehicle Safety Standards (FMVSS) regarding cybersecurity.[92]

The first issue is an important consideration for any future plans for autonomous eVTOLs. Semi-autonomous systems are systems that require the driver to be a backup in case of an emergency situation; therefore, the driver must still be attentive and available during the course of travel.[93] Semi-autonomous systems can already be found to some extent in cars that can park, "steer, accelerate, decelerate and change lanes without human intervention."[94] These features are becoming increasingly prominent in many companies, such as Mercedes, Volvo, and Nissan.[95] This level of autonomy seems to be combining the best of both worlds: the precision and security of automated systems for monotonous tasks with the option of human intervention in the possible event of system failure or malfunction. Unfortunately, this is likely not the case, as a "car with any level of autonomy that relies upon a human to save the day in an emergency poses almost insurmountable engineering, design, and safety challenges, simply because humans are for the most part horrible backups. They are inattentive, easily distracted, and slow to respond."[96] This has led other companies to take the approach of directly pursuing fully autonomous systems, such as Google's driverless car company, Waymo LLC.[97]

Despite concerns regarding semi-autonomous systems, UAM companies such as Uber Elevate are still pursuing "optionally piloted vehicles," in which "pilot control is unnecessary except for

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[92] Jeanne C. Suchodolski, *Cybersecurity of Autonomous Systems in The Transportation Sector: An Examination Of Regulatory And Private Law Approaches With Recommendations For Needed Reforms*, 20 N.C. J. L. & TECH. 121, 177-78 (2018).

[93] *Automated Driving Systems 2.0: A Vision For Safety 1*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., 4 (2017), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069aads2.0_090617_v9a_tag.pdf (This level of automation may also be referred to as "partial automation" or "conditional automation.").

[94] Will Kitson, *Driverless Cars with a Human Touch,* V1.CO (Feb. 7 2019) https://www.v1.co/story/driverless-cars-with-a-human-touch.

[95] Doug Demuro, *7 Best Semi-Autonomous Systems Available Right Now,* Autotrader (Jan. 4, 2018), https://www.autotrader.com/best-cars/7-best-semi-autonomous-systems-available-right-now-271865.

[96] Alex Davies, *The Very Human Problem Blocking the Path to Self-Driving Cars*, WIRED (Jan. 1, 2017), https://www.wired.com/2017/01/human-problem-blocking-path-self-driving-cars/.

[97] WAYMO, https://waymo.com/ (last visited Dec 22, 2020).

visual avoidance of obstacles and other aircraft."[98] Ultimately, in the event of a cyber-attack in which key functions are totally compromised, it is understandable for VTOL companies, and passengers, to wish to retain the option of human intervention either within the aircraft or perhaps remotely. The UAM industry should nevertheless take into the consideration the potential safety hazards of semi-autonomous vehicles.

The second issue pertains to the regulatory steps taken, or rather *not taken*, by the NHTSA regarding standard setting for autonomous vehicles. Regulatory oversight for the NHTSA is provided by two mechanisms: (1) auto manufacturers self-compliance with the FMVSS and (2) by the recall of vehicles deemed unsafe.[99] In essence, manufacturers "self-certify that they comply with the FMVSS before placing an automobile into public use. The NHTSA then randomly tests deployed vehicles to verify compliance with the FMVSS."[100] If the test deems the vehicle non-compliant or unsafe, the agency has authority to initiate a recall.[101] The use of self-compliance and post-production recalls is not an unusual form of compliance oversight, as the FAA utilizes a similar regulatory approach.[102]

However, in terms of standard setting, there currently are no mandatory FMVSS compliance standards regarding manufacturer's duties involving cybersecurity. Instead, manufacturers are encouraged to "follow a robust product development process based

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[98] Uber Elevate White Paper, *supra* note 34, at 18.

[99] Suchodolski, *supra* note 92, at 176-77.

[100] *Id*.

[101] *Id*.

[102] *See* U.S. v. Varig Airlines, 467 US 797, 816-17 (1984):

> In the exercise of this discretion, the FAA, as the Secretary's designee, has devised a system of compliance review that involves certification of aircraft design and manufacture at several stages of production. See supra, at 2760–2761. The FAA certification process is founded upon a relatively simple notion: the duty to ensure that an aircraft conforms to FAA safety regulations lies with the manufacturer and operator, while the FAA retains the responsibility for policing compliance. Thus, the manufacturer is required to develop the plans and specifications and perform the inspections and tests necessary to establish that an aircraft design comports with the applicable regulations; the FAA then reviews the data for conformity purposes by conducting a "spot check" of the manufacturer's work.

Id.

on a systems-engineering approach with the goal of designing systems free of unreasonable safety risks including those from potential cybersecurity threats and vulnerabilities."[103] The NHTSA also encourages industry sharing, documenting cybersecurity implementations and incorporating the best practices and design principles from other leading entities, such as the National Institute of Standards and Technology (NIST)and the NHTSA.[104]

Among the espoused benefits of this hands-off regulatory approach are that this oversight does not stifle innovation and it prevents the "emergence of a cyber monoculture where vulnerabilities are uniform across the system."[105] Unsurprisingly, there are downsides to this approach as well. Unlike the FAA, which "utilizes consensus standards as an acceptable means to demonstrate conformance with an existing safety rule," the NHTSA has chosen to solely rely on voluntary industry standards, indicating that the NHTSA, "especially when contrasted with the regulatory approaches taken by other agencies, [is] a regulatory body captured by the industry it is intended to regulate."[106]

While it is unlikely that the FAA will abandon its stringent certification requirements regarding airworthiness of new VTOL aircraft, it is important to strike a regulatory balance that fosters innovation and diversity, and enforces, rather than merely encourages, uniform safety standards. Additionally, the UAM industry must address the proper level of autonomy for VTOL air metro and air taxi services, an important issue still left unresolved in the autonomous automobile industry. From cell phones, laptops and automobiles, the consequences of a cyber-attack have only continued to rise. Based on the seemingly limitless opportunities for system intrusion, VTOL and UAM cybersecurity must embrace an adaptable approach that allows security systems to keep up with evolving malicious attacks both during flight operations and routine maintenance procedures.

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[103] Nat'l Highway Traffic Safety Admin., *Cybersecurity Best Practices for Modern Vehicles,* 12 (Oct. 2016) (Report No. DOT HS 812 333).

[104] *Id*. at 13-14.

[105] Suchodolski, *supra* note 92, at 178-79 (*citing* Caleb Watney & Cyril Draffin, *Addressing New Challenges in Automotive Cybersecurity* 7, R ST. POL'Y NO. 118, 12 (2017), https://www.bafuture.org/sites/default/files/key-topics/attachments/Addressing%20Automotive%C20Cybersecurity%C20Nov%202017.pdf.).

[106] *Id*. at 178-81.

IV. RECOMMENDATIONS AND CONCERNS

The vulnerability of software updates and requirements for automobiles highlights the same potential for vulnerability within aircraft,[107] and therefore adequate steps must be taken to ensure the cybersecurity of VTOL aircraft used for urban air mobility. The current "applicable airworthiness regulations do not contain adequate or appropriate safety standards" for many design features that are vulnerable to cyber-attacks.[108] There are several short-term solutions that should be taken until the FAA can provide comprehensive cybersecurity compliance standards.

In terms of preventative security, UAM leaders must enact a number of "handshake" mechanisms "to ensure that the source of upgrades—and the upgrades themselves—are legitimate and uncorrupted."[109] These are mechanisms that confirm "the identities of the connecting systems and allows additional communication to take place."[110] Additionally, VTOL software should equip and utilize artificial intelligence or machine learning to aid hybrid intrusion detection systems (IDS).[111] Hybrid IDS combine misuse-based

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[107] *See, e.g.,* Special Conditions: Boeing Model 777-200, -300, and -300ER Series Airplanes; Aircraft Electronic System Security Protection From Unauthorized Internal Access, 78 Fed. Reg. 68985 (Nov. 18, 2013) (According to a rule published by the FAA, Boeing applied for an installation of an onboard network system and additional functionality to its Boeing Model 777-200, -300, and -300ER Series Airplanes that enabled "connection to previously isolated data networks connected to systems that perform functions required for the safe operation of the airplane. This proposed data network and design integration may result in security vulnerabilities from intentional or unintentional corruption of data and systems critical to the safety and maintenance of the airplane.").

[108] *Id*.

[109] Anderson, *supra* note 81, at 70.

[110] *Handshake*, TECHTERMS, https://techterms.com/definition/handshake (last visited Sept. 21, 2020).

[111] *See* Aimee Laurence, *The Impact of Artificial Intelligence on Cyber Security*, CPO MAGAZINE (Aug. 22, 2019), https://www.cpomagazine.com/cyber-security/the-impact-of-artificial-intelligence-on-cyber-security/ ("AI can also be used to detect threats and other potentially malicious activities. Conventional systems simply cannot keep up with the sheer number of malware that is created every month, so this is a potential area for AI to step in and address this problem."); Francisco L. Loaiza et al., *Utility of Artificial Intelligence and Machine Learning in Cybersecurity*, INST. FOR DEF. LAWS., 3 (2019), https://www.ida.org/-/media/feature/publications/u/ut/utility-of-artificial-intelligence-and-machine-learning-in-cybersecurity/d-10694.ashx (A summary of findings conducted by the Institute for Defense Analyses found that "[artificial intelligence/machine learning] is viewed as a necessary response to the continuing growth in the number and complexity of threats, the evolving nature of threats, and the need for rapid (and therefore substantially automatic) responses to detected threats.").

and anomaly-based cyber analytics.[112] "Anomaly-based techniques model the normal network and system behavior, and identify anomalies as deviations from normal behavior."[113] These systems are useful in that they are able to identify novel attacks, however they are often subjected to higher rates of false alarms.[114] Misuse-based techniques "are designed to detect known attacks by using signatures of those attacks."[115] These systems have fewer false alarms but require "frequent manual updates of the database with rules and signatures."[116] Most IDS usually utilize a hybrid of these two methods.[117] The biggest downside of the widespread implementation of these systems is the inevitable effect on OEM costs, as AI systems "require an immense amount of resources including memory, data, and computing power."[118]

In terms of software regulation, the FAA currently operates under the guidance of Order 8110.49A, which details the necessary level of involvement for software conformity inspections and software installation inspections.[119] To reduce unnecessary or redundant oversight for less complex software reviews, the Order outlines factors that will determine the scope and number of software reviews (i.e. level of involvement).[120] Such factors may include "[p]roduct attributes (such as size, complexity, system functionality or novelty, and software design), [u]se of new technologies or unusual design features, [p]roposals for novel software methods or life cycle model(s) . . . [and] [a]vailability, experience, and authorization of designees."[121] However, the FAA may want to consider mandating higher levels of involvement regardless of the complexity of the system updated or if new technologies are introduced. The fact that malware has the potential to infiltrate more complex systems by concealing itself within basic software updates should cause the

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[112] *See* Buczak & Guven, *supra* note 75, at 1153.

[113] *Id*.

[114] *Id*.

[115] *Id*.

[116] *Id*.

[117] Buczak & Guven, *supra* note 75, at 1153.

[118] Laurence, *supra* note 111.

[119] *Software Approval Guidelines*, FED. AVIATION ADMIN., 2-1 (2018), https://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/1032976

[120] *Id*. at 2-2.

[121] *Id*.

FAA to err on the side of caution. At the very least, network security should also be a factor when determining the necessary level of involvement. Updates performed in more vulnerable locations or in a riskier method should require a higher level of involvement. While this may increase the regulatory burden, the FAA's recent realignment of the Aircraft Certification Service should hopefully improve system oversight and provide streamline certification.[122]

Lastly, UAM leaders, such as Uber, should guard against its ambition to achieve immediate semi-autonomy, as well as its goal to obtain full autonomy in the near future. While fully manual piloting and fully automated piloting each have their own set of pros and cons, the UAM industry must remain hesitant on lingering too long in the middle, where an amorphous combined role of pilots and automated system end up combining the worst of both worlds rather than the best. A fully autonomous network of vehicles purports to eliminate the risk of human error or incapacitation and unexpected variables such as weather and visibility,[123] but only when systems run properly without interference or malfunctions. A semi-autonomous system runs the potential risk of combining the inattentiveness and lower reaction capabilities of human pilots with the risk of system error, interreference, or malfunction. This is a lethal combination when transporting passengers at 200 miles per hour, one thousand feet above a dense urban environment.

V. CONCLUSION

There are still a number of hurdles standing between the current status of urban air mobility and the full scale aerial urban environment envisioned by society over the last century. While cybersecurity is far from the only issue needing to be addressed by the UAM community and regulators, it is certainly among the most important. Using artificial intelligence to detect and anticipate malicious attacks, increasing regulatory software oversight, and questioning the utility of semi-autonomous UAM provide a broad starting point in addressing the cybersecurity of new VTOL aircraft systems.

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[122] *Fact Sheet – Aircraft Certification Service,* FED. AVIATION ADMIN. (Jul. 20, 2017), https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=21315.

[123] Uber Elevate White Paper, *supra* note 34, at 18.

BOOK REVIEW

AVIATION LAW AND DRONES: UNMANNED AIRCRAFT AND THE FUTURE OF AVIATION

Review by Nestor Delgado[*]

As a number of countries, such as the United States, and private organizations, such as the United Parcel Service, begin to integrate drones into their existing operating models, the legal community must be made aware of the benefits and risks that are posed by the new technology. A number of high profile cases, including *Singer v. City of Newton*[1] and *Taylor v. Huerta,*[2] have dominated the discussion among legal scholars interested in aviation law and its impact on cases involving the operation of uncrewed aircraft. Until now, there has not been a considerable piece of literature to address the international response to the integration of drones into the global airspace. David Hodgkinson and Rebecca Johnston, both partners at HodgkinsonJohnston and Professors at the University of Western Australia, identified this gap in academia and critically address the constantly evolving legal global ecosystem of drones in

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[1] Singer v. City of Newton, 284 F. Supp. 3d 125, 127 (D. Mass. 2017) (the District Court's holding that a number of ordinances passed by the City of Newton were preempted by FAA regulations illustrated that states are going to have to get creative as to how they regulate the drone industry).

[2] Taylor v. Huerta, 856 F.3d 1089, 1090 (D.C. Cir. 2017) (then-Circuit Judge Kavanaugh's holding was important because it illustrated that regulations regarding the recreational operation of drones were not preempted by FAA regulations and that political subdivisions were free to address the area).

a jointly-authored book, *Aviation Law and Drones: Unmanned Aircraft and the Future of Aviation*.[3]

The book guides the reader through the maze of aviation law, its impact on the integration of drones into the national airspace and considerations of what a global framework for the regulation of drones should ideally look like. Beginning with armed hot air balloons and concluding with Amazon PrimeAir and the utilization of the smartphone as a remote controller, Part I provides a concise, informative evolution of the vernacular of drones in a number of organizations worldwide; offers the reader with a wild ride through the evolution of drone technology in both the military and civilian context; and highlights the "turning points" in aviation which include the development of aircraft, the Chicago Convention and finally the drone.[4] Further, the authors highlight privacy, security and safety as concerns posed by the integration of drones into the national airspace and then expound upon the regulatory scheme of uncrewed aircraft across the world. The authors mention that in 2003, the International Civil Aviation Organization (ICAO) recognized that drones were considered to be "aircraft" in terms of international treaties. After this distinction, Australia, the United Kingdom and the United States began to develop domestic regulatory schemes for recreational and commercial operations as a number of international conventions, as currently drafted, are inapplicable to drones because they regulate human activity on aircraft. Additional international impediments are identified: the requirements of certificates of airworthiness for crewed aircraft are incompatible with the requirements that would be necessary for uncrewed aircraft; country-by-country tort laws addressing the operation of uncrewed aircraft are inconsistent; and the patchwork of domestic regulations across the United States is a concern as they are not uniform in effect and nature. Finally, the conclusion of Part I addresses the issues that legislators face as far as passing legislation addressing the integration of drones into the national airspace. While drone operator identification and enforcing restricted airspace ordinances are identified as the most critical existing problems in the regulation of drone operations, new issues are rising at a greater rate than

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[3] DAVID HODGKINSON & REBECCA JOHNSTON, AVIATION L. AND DRONES: UNMANNED AIRCRAFT AND THE FUTURE OF AVIATION (2018).

[4] *Id.* at 11-12.

legislators are capable of introducing, passing and enforcing drone legislation.

The authors cite a Fortune 500 executive in noting that the integration of drones poses one of the greatest "clash of cultures" in our current lifetime as incrementalism has been the approach of the aviation industry since the early 20th Century, however drone industry leaders are eager for instantaneous results.[5] In Part II, the authors emphasize that harmonization is key to uniformity for the future of global drone regulation. The patchwork of privacy legislation in a number of foreign countries does not address the unique issues that drones pose and the authors consider it "less than ideal."[6] While Germany and France were cited to have the most extensive privacy laws related to drone operations—German drone operations must be accompanied by a signed data collection statement and all French drone operation that captures photography and videos are subject to data privacy law[7]—states in the United States who have considered privacy concerns have only addressed the 2000s hot-button issue of the use of drones for voyeurism. Further, a number of considerations including urban canyon environments, a lack of operator training and geofencing will dictate discussions of safety, security and privacy moving forward as policymakers develop the framework for licensing, registration and airspace restrictions for drones. The 2020s will prove to be a significant time for international drone regulation development as European Union Aviation Safety Agency has gone farther than the mission of ICAO, which is solely concerned with safety, by developing drone regulations with environmental and privacy considerations in mind. The authors advocate for a tiered approach to regulating drone operation categorized by the objective risk operations present based on the principle that regulators should focus on things they can regulate *well* rather than what they can regulate in general.

In order to provide a historical context, Part III guides the reader through the evolution of aviation law and how a number of conventions are poised to impact the future of drone regulations. The authors begin by explaining how the fundamental concepts of maritime law influenced the direction of aviation law. Beginning

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[5] *Id.* at 53.
[6] *Id* at 30.
[7] *Id* at 32.

with the Warsaw Convention of 1929 and ending with the Convention on Compensation for Damage to Third Parties Resulting from Acts of Unlawful Interference Involving Aircraft of 2009, the authors provide a detailed timeline of the conventions that influenced the evolution of the aviation industry, touching upon air carrier liability, code-sharing operations, the criminalization of unlawful activity on board aircraft, and airplane hijacking. Following a look into specific Conventions that addressed issues in the aviation industry, Part IV takes a step back to provide a background to international and national lawmaking in general. Starting with the Vienna Convention's impact on how treaties are created and enforced, the authors go through the intricate details of international law vernacular, including terms such as ratification, bilateral treaties, multilateral treaties, annexes, customary law and guiding principles. The authors then address the conflict of laws that occurs when national and international law collide by describing the two approaches to the intersection of international and national law: monist, where international law is but one element of domestic law; and dualist, where they are two, separate legal systems existing side by side with different spheres of action. The authors go further by describing Australia as a unique system where the judicial and executive branch tend to be dualist while the legislative branch has embraced a more monist approach to the duties and responsibilities of the Civil Aviation Safety Authority. The deviation in treaty-making processes between the United States, United Kingdom and France are then explained to highlight that treaties impact states in a number of ways; not all treaties are immediately incorporated into a state's common law once agreed to at a convention. The authors conclude Part IV by providing perspective on how drone law should be approached in an international law context—the myriad issues surrounding drone regulation requires some level of uniformity and consistency, which will be achieved by a top-down international approach.[8]

Part V is by far the most important section of this book. The authors draft "Guiding Principles" for states to keep in consideration when developing drone regulations moving forward. Throughout the book, the authors acknowledge that a number of important

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[8] *Id* at 96.

conventions, such as the Chicago Convention and the Cape Town Convention, are ill-equipped to handle the legal challenges posed by the drone industry. In response to the lack of consideration that international treaties have toward the drone industry, the authors lay out the safety, security, social and financial interests necessary to have a framework appropriate for the integration of drones into the global airspace. The authors note that in the short term, time and political will stands in the way of developing a global regulatory scheme for drones and even if a treaty is drafted, unanimous ratification is not guaranteed. Further, an international treaty to regulate drones at this point is unwise and unlikely given the rapid pace of drone technology development. In the long term, a treaty is possible, and likely necessary, as cross-border application will need to be addressed. In the meantime, the guiding principles provide States a roadmap, while keeping the future of drone regulations under consideration.

The most interesting principle that the authors introduce is "Principle 6: International Drone Operation," wherein the authors write that "[i]f States wish to permit cross-border operations, States shall cooperate in good faith and use best endeavors to negotiate relevant exchange of rights."[9] In order to provide uniformity and clarity, the authors then provide amendments to the appendixes and annexes of the Chicago Convention so that the Chicago Convention can reflect the guiding principles offered by the authors. Addressing the operations of drones between states is vastly important, albeit not so much in North America as it is in the European Union. Drafting proactive policy to address the shipment of a good from France to Germany using a drone is important to ensure that the regulations in the country of lift-off are similar, if not identical, to the regulations in the country that the drones lands in.

In Part VI, the authors look to the future of drone technology and highlight the significant impact a number of technologies will have on the aviation industry: the miniaturization of drones; drones as the most cost-effective mode of transportation; fully autonomous drone technologies; the practice of drone swarming;" more enduring and energy efficient technologies; and refining drones as environmentally friendly alternatives. The authors illustrate how vastly

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[9] *Id* at 100.

different wildlife conservation, weather tracking, package delivery and taxi services will be in the decades to come because of drone technology. Although issues of privacy, "driver liability," autonomous technology, safety and cyber security exist, with technological innovation comes regulatory concerns and the authors point out that the potential of drone technology is limitless.

As the authors accurately highlight, the number of uncrewed aircraft already outnumbers the number of crewed aircraft in the global airspace and this number will only continue to increase. Further, balancing regulatory protection and technological advancement will be difficult and require an innovative approach from policymakers but the future of drones is promising, with package delivery and uniform traffic management at the forefront of the current conversation.

This book is an excellent resource for policy makers who are searching for guidance on how to draft statutory language that will likely complement future regulations released by leading international regulatory bodies, such as ICAO. In addition, the work is a great resource for any undergraduate public policy or law professor who strives to provide students with an in-depth background to aviation law, a current look at the issues looming in the drone industry and regulatory considerations of the drone industry moving forward. Don't wait until drones are buzzing over your home to learn about the national and international regulatory framework addressing drones; check this textbook out, you won't regret it.

BOOK REVIEW

ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM

Review by Matthew Russ[*]

Society continues to delve deeper and deeper into the uses of various technological advancements. Humankind's curiosity is growing at a rapid pace as we recognize the potential that technology can have on our everyday lives. One of these technological advancements is the use of Uncrewed Aircraft Systems ("UAS"), commonly referred to as drones. In the United States, the use of UAS and crewed aircraft is regulated by the Federal Aviation Administration ("FAA"). When the FAA was established, the aircraft being regulated were all crewed. Because of this, the FAA had extremely stringent safety standards to ensure that these aircraft were safe before they were used to transport people through the air; however, the use of UAS is becoming more prevalent. Despite UAS not carrying people through the air, the FAA has maintained stringent safety guidelines which is halting the progression of UAS. Not only is the FAA refusing to approve applications for the use of UAS, the process for getting UAS approved is unnecessarily long. Aware of this issue, the National Academies of Science formed of the Committee of on Assessing the Risks of UAS Integration into the National Airspace (Committee) to study the risks posed by integrating UAS into the national airspace and develop ways that the FAA can adequately regulate the use of UAS without hindering UAS development. The Committee looked at recent developments of UAS and

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discussed the issues with various experts in government, industry, and academia. By doing this, the Committee was able to better understand the FAA's concerns and craft recommendations for the FAA that they could use to regulate UAS.

In *Assessing the Risks of Integrating Unmanned Aircraft Systems into the National Airspace System*, the Committee takes a look at the history of aviation dating all the way back to the Wright brothers.[1] The Committee acknowledges that initially aircraft were incredibly dangerous, however, even though they were dangerous people and businesses were willing to take more risks in order to advance the technology.[2] Currently, the rules that guide aviation are much stricter than they were at its inception.[3] Considering that aircraft eventually advanced to carry people across the world, stringent safety guidelines were necessary to prevent catastrophic events taking place, such as the crashing of crewed aircrafts. Even though these sorts of events do take place, they are few and far between. Further, even though these accidents do occur, it is a fact of life that travelling on a plane is safer than travelling via car. This is largely due to the strict guidelines that were created by governments across the globe to regulate the safety and uses of crewed aircrafts; however, these strict guidelines have created a risk averse culture in the FAA.[4] While being risk averse is generally applauded, being risk averse restricts UAS development.

The Committee does not recommend having no safety guidelines, however, they recommend that the FAA adopt new guidelines for the use of UAS because UAS presents far less of a risk to humankind than crewed aircrafts.[5] The reason is obvious, UAS do not carry passengers; therefore, a crash of a UAS will likely not result in a fatal accident.[6] The Committee acknowledges, however, that this will not always be the case. It is possible that UAS could collide with a crewed aircraft system causing a crash, or fall onto people or damage property on the ground. Even considering this risk, the

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[1] NAT'L ACAD. OF SCI., ENG'G, & MED., ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM, 16 (2018).

[2] *Id*. at 16.

[3] *Id*.

[4] *Id*. at 17.

[5] *Id*.

[6] ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM, *supra* note 1, at 17.

Committee believes that UAS could be used to prevent a lot of fatal accidents that occur from dangerous jobs. The Committee provides several examples of life saving uses of UAS: (1) Long-range inspection of rail lines to prevent derailments; (2) inspection of power lines and cell phone towers; (3) delivery of medicine and defibrillators to people in cardiac distress; (4) assessment of wildfires to assist firefighters; (5) transporting floating devices to people in distress in the ocean.[7]

An interesting aspect of the book is in Chapter Three which discusses the FAA's current practices concerning UAS.[8] One of the more interesting aspects of this section focuses on the clashing of cultures between the FAA and the technological revolution.[9] The culture at the FAA is conservative and risk averse, compared to the culture of innovation and technology which is of rapid advancement, pushing the limits and having an entrepreneurial spirit.[10] Risk is typically avoided by the FAA; whereas, risk is awarded in technological advancements.

The Committee believes that the FAA's culture is driven by a fear of making a mistake which prevents UAS from developing to further benefit society. The Committee recommends that the two cultures merge into one and meet in the middle.[11] Clearly, safety is the top priority, however, the Committee believes that a shift in mentality from "how can we avoid risks" to "how can we keep people safe while also developing UAS" is a pivotal step in that the FAA should take.[12] The Committee states that in order to do this, it is first important to evaluate risks that the public is willing to take, and in order to do this the public must be aware of the risks that UAS could prevent, such as dangerous jobs that are performed by people every day, such as the examples mentioned above. It is a trade-off. UAS pose some risk, although a very small risk, but their utilization would prevent people from taking even greater risks. Even though some fatalities may occur from UAS, UAS will likely save far more lives than they take.

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[7] *Id*. at 14.
[8] *Id*. at 28.
[9] *Id*. at 29.
[10] *Id*. at 30.
[11] ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM, *supra* note 1, at 30.
[12] *Id*. at 33.

The Committee suggests that instead of avoiding risks and preventing the use certain applications of UAS, the FAA should shift to looking at it from the perspective of "how can we say yes to this without compromising safety."[13] In order to achieve this, the Committee recommends that the FAA adopt a new approach when deciding whether to approve a request for certification or operation.[14] They recommend that the FAA employ an internal board that reviews the applications and provides input to the applicant about their decision.[15] For example, if the FAA chooses not approve an application, they provide the application with a detailed response of why they did not approve it and inform them of the steps that the applicant must take in order to get it approved.[16]

Chapter Four of this book takes a detailed look at the FAA's decision-making process and recommends innovative ways to evolve that process to benefit UAS development. Currently, the FAA's safety management policy uses an approach known as the DIAAT approach which means, describe, identify, analyze, assess, and treat.[17] The Committee recognizes that this is a systematic approach, however, they believe that this method of risk analysis is fundamentally qualitative and subjective.[18] Because it is subjective, the people that are reviewing the UAS for approval must be experts in the area of UAS, which the FAA is not because the level of expertise required is one that the FAA does not possess.[19] Therefore, the committee recommends a shift from the DIAAT approach to one that is better suited for the development of UAS. The Committee suggests that the FAA evolve to an approach that relies more on the level of expertise of applicants and investment in risk analysis, modelling, and engineering assessments.[20] This type of risk analysis is practiced in other areas of federal regulations and the Committee believes that it will create a better quantitative

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[13] *Id*. at 33-34.

[14] *Id*. at 35.

[15] *Id*.

[16] *Id*.

[17] ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM, *supra* note 1, at 40-41.

[18] *Id*. at 42.

[19] *Id*.

[20] *Id*.

probabilistic analysis for FAA decisions.[21] Further, in this chapter, the Committee discusses the problems with the Certificate of Authorization (COA) applications. The issue with the FAA's COA process is that the standards are unclear, lack transparency, and the outcomes of whether one is approved or not remain uncertain.[22] Moreover, if a COA is granted, it is valid for a finite period of time and is still subject to FAA scrutiny.[23] These issues arise because the FAA is using the same amount scrutiny for UAS as they would for crewed aircraft, which is inappropriate because there is far less risk with the use of UAS. The FAA's process takes a long of amount of time to decide on an application for COA because it includes multiple cross-agency panels and a complex decision-making process.

The Committee recommends that the FAA create a separate standard for UAS as compared to crewed aircraft.[24] The FAA should consider not only the risk of UAS, but also the benefit that the UAS could have on society as a whole.[25] The FAA should conduct a form of cost-benefit analysis concerning UAS. For example, instead of solely looking at the risk that a UAS could present by flying over a populated area, look at that in addition to examining the benefit that the UAS possesses. UAS could perform dangerous tasks, instead of a human being, which could save lives. Furthermore, UAS could deliver medicine to a sick person that is in urgent need much faster than human beings would be able to deliver the medicine.[26] Even though there is some risk with using the UAS to perform these tasks, the risk is far less than the alternative. The Committee recommends that the FAA take a holistic approach concerning the approval of UAS. Even though the introduction of UAS may create a new aviation risk, the FAA should consider whether that new risk results in a reduction of the total risk to society.[27] In addition to this recommended new approach, the Committee recommends that the FAA publish specific guidelines that must be met for approval of a COA application. Creating specific guidelines will assist COA

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[21] *Id*. at 42-43

[22] *Id*. at 43.

[23] ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM, *supra* note 1, at 43.

[24] *Id*. at 44.

[25] *Id*.

[26] *Id*. at 45.

[27] *Id*. at 47.

applicants in understanding what criteria needs to be met before they apply for a COA which will enhance the development of UAS, while also assisting the FAA in their goal to maintain safety.[28]

Finally, in Chapter Five the Committee focuses on building the future of UAS and how the FAA can adjust their methods to help build that future by enhancing their risk assessment methods.[29] The Committee recommends that the FAA coordinate with other domestic and international agencies in order to establish a more productive risk assessment method for UAS.[30] They believe that the FAA should pursue a planned research program in probabilistic risk analysis, compared to their current subject and qualitative approach, so that the FAA can apply this probabilistic risk analysis for proposed technological innovations.[31]

Overall, this book takes a logical and sound approach in its attempt to encourage us to look at how we can improve the uses of UAS. This book is well-written and gives us a comprehensive look at how the FAA operates, concerning UAS. I recommend that you read this book and think about how the current system is inadvertently hindering our ability to advance UAS technology. I appreciate the research that the authors conducted to produce this book, as well as their knowledge on the subject. Furthermore, the authors do not only look at UAS from their perspective, but they look at both sides of the issue to address the concerns about the use of UAS. They propose great ideas, in addition to providing examples of the benefits their ideas would provide. Their ideas would not just aid in the advancement of UAS technology, but also could provide a great benefit to our society as a whole. They also do a great job of easing people's apprehension of the dangers that UAS technology may pose by using examples of how the benefits would outweigh the risks of using UAS. I would love for this book to be taken seriously and real changes come to rules surrounding UAS and see what impact it has on our everyday lives.

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[28] *Id*. at 49-51.

[29] ASSESSING THE RISKS OF INTEGRATING UNMANNED AIRCRAFT SYSTEMS INTO THE NATIONAL AIRSPACE SYSTEM, *supra* note 1, at 57.

[30] *Id*. at 58-59.

[31] *Id*. at 59.

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