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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

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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.