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Programmed to Protect and Serve: The Dawn of Drones and Robots in Law Enforcement

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PROGRAMMED TO PROTECT AND SERVE: THE DAWN OF DRONES AND ROBOTS IN LAW ENFORCEMENT

NANCI K. CARR, J.D.*

ABSTRACT

No longer does the field of law enforcement rely solely on human cognition and capability as drones have become first responders, responding to emergency calls with a drone rather than a human officer. Drone technology can transform police work, just as it has package delivery and military strategy. These drone officers allow for higher law enforcement efficiency, safer communities, and even saved lives. However, they also raise civil liberty concerns given that the drones have the power to track vehicles and people without consent, and they can collect and store video records of everyday life, reducing expectations of privacy. This article will discuss the use of autonomous drones and robotic law enforcement officers in the United States and the safety, liability, and constitutional implications thereof.

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I. INTRODUCTION

WITH EACH PASSING YEAR, technological developments proceed at rocket speed, introducing a plethora of artificially intelligent and autonomous vehicles. Remotely piloted aircraft known as “drones” are becoming increasingly popular with both individuals and businesses, and new uses are discovered daily. In fact, the Federal Aviation Administration (FAA) anticipates that by 2021, the number of recreational drones in use could reach as high as 2.94 million and that commercial drones could reach over 600,000.¹ Hobbyists fly drones for fun on a Sunday afternoon,² businesses use them to deliver goods,³ and

¹ FED. AVIATION ADMIN., FAA AEROSPACE FORECAST: FISCAL YEARS 2018–2038, at 41, 43 (2018), https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2018-38_FAA_Aerospace_Forecast.pdf [https://perma.cc/4ABU-E7SK].

² See Erin O’Neill, *Want to Go Fly a Drone? Here’s What You Need to Know to Stay Legal*, NJ.COM, https://www.nj.com/news/2015/08/want_to_go_fly_a_drone_heres_what_you_need_to_know_to_stay_legal.html [https://perma.cc/J9MF-RFN3] (Jan. 17, 2019).

³ See Annie Palmer, *Amazon Wins FAA Approval for Prime Air Drone Delivery Fleet*, CNBC, <https://www.cnbc.com/2020/08/31/amazon-prime-now-drone-delivery->

police use them to assist law enforcement.⁴ Drones are even being tested as a taxi service with the hope of transporting people.⁵

Unfortunately, the law has not been able to keep pace with technology, which is particularly significant when robots are used by law enforcement. For example, law enforcement personnel use robots to conduct searches with less personal risk to officers—but with a potential threat to constitutional rights and public safety.⁶ Following this Introduction, Section II will discuss what drones are and how they are used and regulated by the FAA. Section III will discuss the evolution of technology in law enforcement. Section IV will expand on the safety hazards and liability complications created by drones. Section V will address constitutional implications and proposals to ensure public safety and protect the rights of individuals, and Section VI will explore the state and local regulation of drones.

fleet-gets-faa-approval.html [https://perma.cc/NT5S-BQ22] (Aug. 31, 2020, 3:03 PM).

⁴ Stephen Rice, *10 Ways That Police Use Drones to Protect and Serve*, FORBES (Oct. 7, 2019, 7:12 AM), <https://www.forbes.com/sites/stephenrice1/2019/10/07/10-ways-that-police-use-drones-to-protect-and-serve/?sh=3d6e77956580> [https://perma.cc/9LJN-XQNX].

⁵ In Dubai, a “two-seater . . . unmanned vehicle [designed by German firm Volocopter] took off for a five-minute flight . . . [and] was watched by Crown Prince Sheikh Hamdan bin Mohammed.” Jane Wakefield, *Dubai Tests Drone Taxi Service*, BBC NEWS (Sept. 26, 2017), <https://www.bbc.com/news/technology-41399406> [https://perma.cc/B47A-T9UB]. Volocopter hopes to have unmanned taxis ready for commercial use within five years, and Dubai, wanting to be the “smartest city in the world,” looks forward to using these vehicles. *Id.* Noel Sharkey, a computer scientist and robotics expert at Sheffield University, says that “[t]he skies over Dubai could become uncomfortably crowded very quickly. The ground level of the city could become a dark place of intrigue and mystery like Blade Runner.” *Id.*

⁶ The use of drones for warrantless searches is subject to well-established search and seizure precedents under the Fourth Amendment. *See United States v. Jones*, 565 U.S. 400, 404 (2012) (holding that the attachment “of a GPS tracking device [to] a target’s vehicle, and [the government’s] use of that device to monitor the vehicle’s movements” on public streets constitutes a “search” within the meaning of the Fourth Amendment); *Kyllo v. United States*, 533 U.S. 27, 40 (2001) (holding that the use of sense-enhancing technology, or thermal imaging, to gather information regarding the interior of a home that could not otherwise have been obtained without physical intrusion into a constitutionally protected area constitutes a search requiring a warrant); *Florida v. Riley*, 488 U.S. 445, 455 (1989) (holding that a warrantless aerial observation of the interior of a partially covered greenhouse in a residential backyard from a helicopter flying at 400 feet was not unreasonable under the Fourth Amendment); *California v. Ciraolo*, 476 U.S. 207, 215 (1986) (holding that a warrantless aerial observation of fenced-in backyard from an aircraft flying at 1,000 feet was not unreasonable under the Fourth Amendment).

II. WHAT ARE DRONES, AND HOW ARE THEY USED?

A. WHAT ARE DRONES?

A drone is an unpowered aircraft, also known as an unmanned aerial vehicle (UAV).⁷ When expanded to include its remote controls, the ensemble is an unmanned aircraft system (UAS).⁸ There are two main classifications for drones in the United States: recreational drones (also known as “hobbyist” drones) and commercial drones.⁹

“UAVs can use engines powered by either a gasoline and oil mixture similar to those in lawnmowers or gas engines like those used in cars. However, electric motors, which use energy from batteries, solar cells, or fuel cells, are increasingly popular.”¹⁰ Hobbyists may pay up to \$500 for a UAS that includes the UAV, batteries, chargers, and the remote control.¹¹ Sometimes, the control is by a smartphone app rather than a separate device.¹² Generally, the basic drones can fly for “up to 10 minutes on a battery charge at up to 22 mph, with a range of about 150–200 feet.”¹³ As the hobby interest in UAVs increases, prices could move toward \$2,000 for more elaborate drones, which may include a camera.¹⁴ These better UAVs may be able to “remain airborne for [twenty-five] minutes with a range of half a mile.”¹⁵ “Commercial users may pay \$10,000 or more” for UAVs that will stay airborne longer with an extended range and payload-carry-

⁷ Elizabeth Howell, *What Is a Drone?*, SPACE (Oct. 3, 2018), <https://www.space.com/29544-what-is-a-drone.html> [<https://perma.cc/D6X4-WFS4>] (“Drones have been around for almost as long as airplanes have been used in warfare (1911), and that’s not even including bomb-filled balloons that were first used by Austria in the mid-1800s.”).

⁸ FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 331(8)–(9), 126 Stat. 11, 72; 14 C.F.R. § 107.3 (2016).

⁹ Andrew Meola, *The FAA Rules and Regulations You Need to Know to Keep Your Drone Use Legal*, BUS. INSIDER (July 25, 2017, 1:12 PM), https://www.icex.es/icex/wcm/idc/groups/public/documents/documento_anexo/mde4/nzc3/~edisp/dax2018777817.pdf [<https://perma.cc/4Q62-XM8E>].

¹⁰ 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, 150–51 (2019).

¹¹ BILL CANIS, CONG. RSCH. SERV., R44192, UNMANNED AIRCRAFT SYSTEMS (UAS): COMMERCIAL OUTLOOK FOR A NEW INDUSTRY 5 (2015), <https://fas.org/sgp/crs/misc/R44192.pdf> [<https://perma.cc/2FD6-KY2Z>].

¹² *Id.* at 4.

¹³ *Id.* at 5.

¹⁴ *Id.*

¹⁵ *Id.*

ing capability.¹⁶ Additionally, the extended range and payload capacity UAVs are often quieter than the low-end UAVs.¹⁷

B. HOW ARE DRONES USED?

Drones can change the way businesses operate and how hobbyists enjoy technology, enabling them to see the world from a bird's-eye view.¹⁸ Hobbyists and commercial operators often use drones for aerial photography purposes.¹⁹ Photography can range from families taking overhead pictures of a backyard barbeque to real estate agents taking pictures for a home listing, from professional videographers filming a documentary to anything in between. Skyris Imaging, an aerial photography, video, and Geographic Information System (GIS) company, does not take residential real estate companies as clients in order to avoid flying drones over private property.²⁰ According to its owner, Joe Vaughn, his company's focus is on commercial clients, which reduces potential privacy issues.²¹

It will not be long before businesses begin using drones in the shipment and delivery of their products.²² Companies like Amazon have bold plans to send drones from distribution centers directly to customers' homes to deliver products, which would

¹⁶ *Id.*

¹⁷ *Id.* at 7 (“The drone, weighing less than an ounce, can hover silently for more than eight minutes . . .”).

¹⁸ *Drone Vision: A Bird's-Eye View of an Emerging Market for Machine Vision*, ASS'N FOR ADVANCING AUTOMATION (Sept. 6, 2019), <https://www.automate.org/industry-insights/drone-vision-a-bird-s-eye-view-of-an-emerging-market-for-machine-vision> [<https://perma.cc/B7S9-UXYS>].

¹⁹ *E.g.*, David Schloss, *Drones for Photography*, OUTDOOR PHOTOGRAPHER, <https://www.outdoorphotographer.com/photography-gear/cameras/drones-for-photography/#> [<https://perma.cc/WGD7-9YW8>] (Oct. 23, 2019).

²⁰ Christina Sterbenz, *Should We Freak Out About Drones Looking in Our Windows?*, BUS. INSIDER (Sept. 24, 2014, 1:22 PM), <https://www.businessinsider.com/privacy-issues-with-commercial-drones-2014-9> [<https://perma.cc/7C7P-T49G>].

²¹ *See id.* (“If I were to point [a drone] at somebody's window, I'd have to be within feet to see anything . . .”).

²² *See* Jack Nicas, *Amazon Asks FAA for Permission to Test Drones; Retailer Expects Prime Air to be Able to Deliver Packages Under 30 Minutes*, WALL ST. J. (July 11, 2014, 7:28 PM), <https://www.wsj.com/articles/amazon-asks-faa-for-permission-to-fly-drones-1405088198> [<https://perma.cc/A4DY-UELR>]; Lois Weiss, *Amazon Eyes Midtown Lair on Avenue of the Americas*, N.Y. POST (July 16, 2014, 6:42 AM), <https://nypost.com/2014/07/16/amazon-eyes-midtown-lair-on-avenue-of-the-americas/> [<https://perma.cc/3CLD-VH73>] (suggesting that the 285,000 square foot facility Amazon was purportedly targeting would allow Bezos to test out drone deliveries).

require flight patterns through residential areas.²³ In fact, on December 7, 2016, Amazon made its first commercial drone delivery.²⁴ Google, UPS, FedEx, and various startups are also considering the possibilities of drone usage.²⁵ Of course, that could raise some problems with the neighbors. While the recipient may agree to drone delivery, just like implied consent for ground delivery from FedEx or UPS, neighbors may not want the delivery drone flying over their backyards to reach the recipient's property.

Drones equipped with special meteorological sensing equipment expedite the forecasting process.²⁶ As such, meteorologists use drones to help predict severe weather.²⁷ The ability of drones to monitor areas that are both out of reach for ground-based instruments and at altitudes below where satellites are effective makes drones extremely attractive in the weather industry and weather-related rescue efforts.²⁸ Additionally, organizations are increasingly using drones to assist disaster management operations.²⁹ For example, the American Red Cross has begun using drones to assist relief efforts after hurri-

²³ *Amazon Prime Air*, AMAZON, <https://www.amazon.com/Amazon-Prime-Air/b?ie=UTF8&node=8037720011> [<https://perma.cc/USS8-3F2C>].

²⁴ Jamie Condliffe, *An Amazon Drone Has Delivered Its First Products to a Paying Customer*, MIT TECH. REV. (Dec. 14, 2016), <https://www.technologyreview.com/s/603141/an-amazon-drone-has-delivered-its-first-products-to-a-paying-customer/> [<https://perma.cc/A36T-5SKC>] (reporting that Amazon delivered an Amazon Fire TV stick and a bag of popcorn—a lightweight payload—and that the test was conducted in Cambridge, U.K. because of challenges presented by FAA regulations requiring that drones fly within the line of sight).

²⁵ Will Knight, *Sorry, Shoppers: Delivery Drones Might Not Fly for a While*, MIT TECH. REV. (Mar. 30, 2016), <https://www.technologyreview.com/s/601117/sorry-shoppers-delivery-drones-might-not-fly-for-a-while/> [<https://perma.cc/SHA6-ZSK5>] (noting that since the FAA still prohibits commercial drone flights, these companies must all seek exemptions to proceed with their testing).

²⁶ Mike Boover, *Drones Are Being Used for Weather Forecasting by Meteorologists*, PROPHOTOUAV: BLOG, <https://www.prophotouav.com/meteorologists-storm-weather-drones/> [<https://perma.cc/VUR3-EUKB>].

²⁷ Jamie Leventhal, *Storm Drones Could Revolutionize Weather Forecasting*, QUARTZ (July 6, 2017), <https://qz.com/1022076/storm-drones-could-revolutionize-weather-forecasting/> [<https://perma.cc/5DMK-NQ9C>].

²⁸ *Id.*

²⁹ Chris Morris, *Here's How the Red Cross is Using Drones for Disaster Relief*, FORTUNE (Sept. 8, 2017, 10:02 AM), <https://fortune.com/2017/09/08/red-cross-drones-houston-harvey/> [<https://perma.cc/Y7NU-YZV>]; Alexandria Tomanelli, Note, *A Drone's Eye View: Why and How the Federal Aviation Administration Should Regulate Hobbyist Drone Use*, 34 *TOURO L. REV.* 867, 875–76 (2018) (discussing the FAA's use of drones to conduct damage assessments of infrastructure, homes, and rail lines in Texas after Hurricane Harvey passed through).

canes, tornadoes, and other natural disasters.³⁰ Drones can help locate missing individuals and assess which areas need the most aid.³¹ Drones can also help evaluate monetary damages for insurance purposes, which is a key component of a city's aid package.³²

The private sector is using drones for rescue efforts as well. Zipline, a company formed by Silicon Valley entrepreneurs, operates the “world’s only drone delivery system at national scale to send urgent medicines, such as blood and animal vaccines, to those in need—no matter where they live.”³³ Zipline currently operates within the African nation of Rwanda, making 50 to 150 deliveries per day using fifteen UAVs.³⁴ According to Margaret Chan, Director General of the World Health Organization, “[t]his visionary project in Rwanda has the potential to revolutionize public health, and its life-saving potential is vast.”³⁵ Interestingly, one of the poorest countries in the world³⁶ gets to take advantage of burgeoning technology because it is not burdened by the strict regulations and safety concerns that often delay progress in more well-developed countries.³⁷ The United States, for example, must worry about reliability, safety, air traffic control issues, and other concerns. Nicholas Roy, a Massachusetts Institute of Technology professor, notes that “[y]ou have to assume

³⁰ Morris, *supra* note 29.

³¹ See *id.*; see also Tomanelli, *supra* note 29.

³² Marianne Bonner, *How Insurers Are Using Drones*, BALANCE: SMALL BUS., <https://www.thebalancesmb.com/how-drones-change-insurance-industry-4125242> [<https://perma.cc/WM2Z-6TV7>] (June 12, 2019).

³³ Zipline, *Lifesaving Deliveries by Zipline Drone in Rwanda*, CHARLOTTE OBSERVER (Feb. 8, 2018, 6:49 PM), <https://www.charlotteobserver.com/news/business/article198436619.html> [<https://perma.cc/WE52-7US5>].

³⁴ Will Knight, *Why Rwanda Is Going to Get the World’s First Network of Delivery Drones*, MIT TECH. REV. (Apr. 4, 2016), <https://www.technologyreview.com/s/601190/why-rwanda-is-going-to-get-the-worlds-first-network-of-delivery-drones/> [<https://perma.cc/N44A-A9C4>].

³⁵ *Id.*

³⁶ John Markoff, *Drones Marshaled to Drop Lifesaving Supplies Over Rwandan Terrain*, N.Y. TIMES (Apr. 4, 2016), <https://www.nytimes.com/2016/04/05/technology/drones-marshaled-to-drop-lifesaving-supplies-over-rwandan-terrain.html> [<https://perma.cc/B374-ELB3>] (noting that in 2014, the International Monetary Fund ranked Rwanda 170th for gross domestic product).

³⁷ *Id.* (reporting that Michael Fairbanks, a member of the Rwandan President Paul Kagame’s presidential advisory council, applauded the ability of Rwanda to make a quick decision); see also Linda Chiem, *Drone Test Sites Give States Expanded Regulatory Role*, LAW360 (May 23, 2018, 7:29 PM), <https://www.law360.com/articles/1046392/drone-test-sites-give-states-expanded-regulatory-role> [<https://perma.cc/62F8-TAFM>] (“Put bluntly, federal regulators are not operating with the urgency necessary to keep abreast of industry development . . .”).

[drones will] fall out of the sky. . . . So how do you make sure these vehicles are reliable enough—both the hardware and the software?”³⁸

Journalists also make rescue efforts with drones. “What drones give you is anywhere, anytime access to the sky. . . . That perspective is something a journalist just wouldn’t have unless he waited for officials, or hired a plane,” according to Chris Anderson, who now runs a drone company after being an editor of *Wired* magazine.³⁹ But it is not just about getting the story. For example, British photographer Lewis Whyld launched a drone to film the destruction following Typhoon Haiyan in the Philippines and, in the process, discovered two bodies that authorities later recovered.⁴⁰ CNN broadcast Whyld’s, but the Associated Press, News Corporation, and the BBC have used drones to show the scale of large disasters as well.⁴¹

Compared to helicopters, UAVs can fly in tighter spaces, are far less expensive, and can hover closer to the targeted area—making them incredibly useful in search and rescue operations.⁴² One example of using UAVs for search and rescue occurred in January 2018, when two young men were caught in turbulent waves outside Sydney, Australia.⁴³ Australian life-guards noticed the two men during a practice session with the drone and dropped an inflatable “rescue pod” that helped save

³⁸ Knight, *supra* note 25.

³⁹ Leslie Kaufman & Ravi Somaiya, *Drones Offer Journalists a Wider View*, N.Y. TIMES (Nov. 24, 2013), <https://www.nytimes.com/2013/11/25/business/media/drones-offer-journalists-a-wider-view.html> [<https://perma.cc/B8TH-55G8>].

⁴⁰ *Id.*

⁴¹ *Id.*

⁴² See Carl Franzen, *Canadian Mounties Claim First Person’s Life Saved by a Police Drone*, VERGE (May 10, 2013, 12:23 PM), <https://www.theverge.com/2013/5/10/4318770/canada-dragonflyer-drone-claims-first-life-saved-search-rescue> [<https://perma.cc/4G74-4NSA>] (reporting that in 2013, an injured driver stranded in a snowy area of Saskatchewan, Canada, was located by Canadian police using a Dragonflyer X4-ES drone with an infrared camera after a helicopter search failed); Keith Nelson Jr., *Drones Can Help When Disaster Strikes, but Only When They’re Allowed To*, DIGITAL TRENDS (Sept. 28, 2017), <https://www.digitaltrends.com/cool-tech/rescue-drones-hurricane-flood-disaster-relief/> [<https://perma.cc/3QEF-BB2B>] (reporting that a recent study concluded drones helped save one life per week and noting that “in 2015, the Auburn (Maine) Fire Department used a DJI Phantom 3 to drop down life vests to an 18-year-old man stranded in the middle of the river.”).

⁴³ Isabella Kwai, *A Drone Saves Two Swimmers in Australia*, N.Y. TIMES (Jan. 18, 2018), <https://www.nytimes.com/2018/01/18/world/australia/drone-rescue-swimmers.html> [<https://perma.cc/9L6G-XACM>].

the young men.⁴⁴ The use of drones for similar operations will likely explode in the future.

Drones also give paparazzi a new way to follow and photograph celebrities.⁴⁵ In fact, there are so many opportunities to use drones in journalism that universities have started drone journalism courses.⁴⁶

GIS have utilized drones to deliver “high-resolution images in near real-time.”⁴⁷ The ability of drones to fly at altitudes much lower than manned aircrafts enable researchers to survey land with much greater accuracy than ever before.⁴⁸ Additionally, drones provide cheaper production costs in addition to superior survey photography capabilities.⁴⁹ Drones have also significantly reduced the time and cost of performing building inspections because they can perform facade, roof, and moisture inspections by attaching thermal imaging cameras.⁵⁰

The benefit of drones in the farming industry has become apparent in recent years. Farmers have used drones in several ways, from ranging and surveying property to crop dusting and spraying.⁵¹ Forecasters predict that agricultural use of drones will dramatically increase in the future.⁵² The American Farm Bureau estimated that farmers using drone services to monitor their crops could see a return on their investment of “\$12 per acre for

⁴⁴ *Id.*

⁴⁵ See Kaufman & Somaiya, *supra* note 39 (reporting that a drone flew over singer Tina Turner’s private wedding in Switzerland in August 2013 and that on another occasion, a picture of singer Beyoncé was captured by a drone on a roller coaster at Coney Island).

⁴⁶ *Id.* (listing the University of Missouri, University of Nebraska, and the Tow Center for Digital Journalism at Columbia University as institutions with such programs but noting that such programs must seek permission from the FAA for their educational flights).

⁴⁷ *How Are Surveying Drones Taking GIS Mapping to The Next Level?*, IDENTIFIED TECHS. (Oct. 21, 2017, 2:46 PM), <https://www.identifiedtech.com/blog/construction-uav/how-are-surveying-drones-taking-gis-mapping-to-the-next-level/> [<https://perma.cc/GA48-FY2P>].

⁴⁸ *Id.*

⁴⁹ *Id.*

⁵⁰ Adam Frumkin, *Drones: The Future of Building Inspections*, KIPCON (Feb. 26, 2017), <https://kipconengineering.com/drone-building-inspections/> [<https://perma.cc/BME9-Z7L9>].

⁵¹ Andrew Meola, *Exploring Agricultural Drones: The Future of Farming Is Precision Agriculture, Mapping, and Spraying*, BUS. INSIDER (Jan. 8, 2020, 10:57 PM), <https://www.businessinsider.in/science/news/exploring-agricultural-drones-the-future-of-farming-is-precision-agriculture-mapping-and-spraying/articleshow/73162165.cms> [<https://perma.cc/U3C8-AAYX>].

⁵² *Id.*

corn, \$2.60 per acre for soybeans, and \$2.30 per acre for wheat.”⁵³ Eventually, farmers might even use UAVs for targeted application of herbicides and pesticides.⁵⁴

The Teal Group, a U.S. aerospace consulting firm, sees a strong potential for drone growth in the aerospace industry.⁵⁵ It believes UAVs are “the most dynamic growth sector of the world aerospace industry,” and “[n]ew unmanned combat aerial vehicle programs, commercial, and consumer spending all promise to drive more than a tripling of the market over the next decade.”⁵⁶ For example, Boeing has unveiled a cargo delivery drone prototype that could transform the logistics industry.⁵⁷ Boeing’s new drone weighs nearly 750 pounds and could transport a load of around 500 pounds.⁵⁸ Cargo transport drones could help “deliver[] time-sensitive and high-value goods for individuals or organizations.”⁵⁹

C. FAA REGULATION OF AIRSPACE

With the proliferation of drones in the airspace, there must be regulations for safety purposes. Pursuant to the Federal Aviation Act of 1958, the FAA has the right to regulate airspace.⁶⁰ The FAA has clearly defined six major classifications of regulated airspace, including both controlled airspace (Class A through Class E) and uncontrolled airspace (Class G).⁶¹

Regulated, controlled airspace includes the following classes:

⁵³ Matt Hopkins, *American Farm Bureau Federation, Measure Launch Drone ROI Calculator*, PRECISIONAG (July 21, 2015), <https://www.precisionag.com/systems-management/data/american-farm-bureau-federation-launches-drone-roi-calculator/> [https://perma.cc/CJ74-Q5NC].

⁵⁴ Marco Margaritoff, *North Dakota State University’s Herbicide-Spraying Drone Covers 33 Acres in an Hour*, DRIVE (July 23, 2018), <https://www.thedrive.com/tech/22348/north-dakota-state-universitys-herbicide-spraying-drone-covers-33-acres-in-an-hour> [https://perma.cc/ZJ4G-B95K].

⁵⁵ *UAV Production Will Total \$93 Billion*, TEAL GRP. CORP. (Aug. 17, 2015), <https://www.tealgroup.com/index.php/pages/press-releases/34-uav-production-will-total-93-billion> [https://perma.cc/USJ4-Q8YF].

⁵⁶ *Id.*

⁵⁷ Lewis King, *Boeing’s Cargo UAV a Shot in The Arm for Drone Delivery Market [Video]*, AIR CARGO WORLD (Jan. 11, 2018), <https://aircargoworld.com/allposts/boeings-cargo-uav-a-shot-in-the-arm-for-drone-delivery-market-video/> [https://perma.cc/A6V6-FEQ9].

⁵⁸ *Id.*

⁵⁹ *Id.*

⁶⁰ Federal Aviation Act of 1958, Pub. L. No. 85-726, 72 Stat. 731.

⁶¹ FED. AVIATION ADMIN., PILOT’S HANDBOOK OF AERONAUTICAL KNOWLEDGE 15-2-15-3 (2016), https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/pilot_handbook.pdf [https://perma.cc/B486-GZZU].

Class A airspace is any airspace over 18,000 feet above mean sea level (MSL), and aircraft operating in this airspace need to operate via instrumental flight rules.⁶²

Class B airspace is airspace from surface level up to 10,000 feet above MSL.⁶³ This airspace surrounds the nation's busiest airports and requires air traffic control (ATC) clearance to enter.⁶⁴

Class C airspace is similar to Class B airspace and includes airspace from surface level up to 4,000 feet above the airport elevation charted in MSL.⁶⁵ Aircraft operators must maintain two-way ATC communication before entering.⁶⁶ Class C airspace does not surround the nation's busiest airports, but it surrounds those airports that operate with control towers, radar approach control, and instrumental flight rules.⁶⁷

Class D airspace covers the airspace around the smallest airports from surface level up to 2,500 feet above the airport elevation charted in MSL.⁶⁸ Like Class C airspace, Class D airspace requires any aircraft operator to establish two-way ATC communication before entering.⁶⁹

Class E airspace is all controlled airspace not included in Class A through Class D airspaces.⁷⁰ Most areas of Class E airspace begin at 1,200 feet above ground level up to the beginning of Class A airspace at 18,000 feet above MSL.⁷¹ Many other locations of Class E airspace begin at 700 feet above ground level.⁷²

Regulated, uncontrolled airspace includes the following class:

Class G uncontrolled airspace extends from surface level up to the beginning of the overlying Class E airspace, which, many times, is either 1,200 feet or 700 feet above MSL.⁷³ Pursuant to the FAA Modernization and Reform Act of 2012, UAV operators are required to fly aircrafts in Class G airspace.⁷⁴

UAV operators must be conscious of approaching Class B airspace near airports, even at heights of only a few hundred feet

⁶² *Id.* at 15-2.

⁶³ *Id.*

⁶⁴ *Id.*

⁶⁵ *Id.*

⁶⁶ *Id.*

⁶⁷ *Id.*

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ *Id.*

⁷¹ *Id.* at 15-3.

⁷² *Id.*

⁷³ *Id.*

⁷⁴ FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 334(c)(2)(C)(iv), 126 Stat. 11, 76.

above MSL.⁷⁵ Much of New York City has Class B controlled airspace because there are three nearby airports—LaGuardia, JFK, and Newark.⁷⁶

While Los Angeles has a major international airport, it also has many smaller airports that are surrounded by controlled airspace. Most of the controlled airspace around the smaller airports is Class D, which is the airspace with the most waivers.⁷⁷ Waivers around Class D airports are helpful for the dozens of film, television, and news companies that want to use that airspace.⁷⁸ Many open areas in the broad Los Angeles area, including downtown, are available for drone flights.⁷⁹ Drones are an efficient means to obtain aerial shots, whether for news or entertainment, and Hollywood producers are eager to explore uses for the new technology.⁸⁰ Unlike news agencies trying to capture an unfolding event, film and television productions work on a schedule and can apply for authorizations and waivers as needed.⁸¹

D. INTEGRATION OF UAVS INTO U.S. AIRSPACE

The FAA Modernization and Reform Act of 2012 required that the FAA safely integrate UAVs into U.S. airspace by September 30, 2015.⁸² Recognizing that recreational drones are by far the most common and numerous UAVs, the FAA decided that each recreational drone over 55 pounds must be registered with the FAA.⁸³ The FAA estimates that there were around 1.1 million recreational drones in 2016, with estimates for that amount to increase to as high as 2.94 million by 2021.⁸⁴ However, since many recreational drones are less than 55 pounds and, thus, do

⁷⁵ See Eric Ringer, *Drone Airspace in America's Largest Media Markets*, SKYWARD (Aug. 16, 2017), <https://skyward.io/drone-airspace-in-americas-largest-media-markets/> [https://perma.cc/4RPT-CUGP].

⁷⁶ *Id.*

⁷⁷ *Id.*; see generally Tariq Rashid, *How to Apply for a Part 107 Waiver*, SKYWARD (Mar. 1, 2017), <https://skyward.io/how-to-apply-for-a-part-107-waiver-from-the-faa-the-right-way/> [https://perma.cc/9G3F-V2HN] (noting types and procedure for waivers).

⁷⁸ Ringer, *supra* note 75.

⁷⁹ *Id.*

⁸⁰ *See id.*

⁸¹ *Id.*

⁸² FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 332(a)(3), 126 Stat. 11, 73.

⁸³ See FAADRONEZONE, <https://faadronezone.faa.gov/#/> [https://perma.cc/Z3MX-REKQ].

⁸⁴ FED. AVIATION ADMIN., *supra* note 1, at 40–41.

not meet the registration requirement,⁸⁵ the FAA's estimate is minimal. The Consumer Technology Association (CTA) reported that there were 2.4 million recreational drones sold in 2016, more than double the FAA's estimate.⁸⁶ This figure takes into account all recreational drones, no matter the size.⁸⁷ The CTA also estimates that recreational drone sales could increase to 29 million by 2021.⁸⁸

To use a small UAS, one must register it with the FAA, pay a \$5 fee, and hold a remote pilot certification with a small UAS rating.⁸⁹ However, obtaining the certification is not enough to understand the law related to operating a UAS; it is incumbent upon the pilot to take extra care to understand this law. In fact, “[t]he FAA strongly encourages all UAS pilots to check local and state laws before gathering information through remote sensing technology or photography” because privacy issues are beyond the FAA's scope.⁹⁰ However, the FAA does “provide all drone users with recommended privacy guidelines as part of the UAS registration process and through the FAA's B4UFLY mobile app.”⁹¹

In June 2016, the FAA issued the final rule for drone operation, known as Part 107, which set the parameters for commercial use of drones weighing up to 55 pounds.⁹² The regulations state that commercial drones:

- Can only be operated during daytime or civil twilight while with appropriate anti-collision lighting;⁹³

⁸⁵ See Andrew Meola, *Drone Market Shows Positive Outlook with Strong Industry Growth and Trends*, BUS. INSIDER (July 13, 2017) [<https://perma.cc/TM8K-6E3H>].

⁸⁶ See *id.*

⁸⁷ See *id.*

⁸⁸ *Id.*

⁸⁹ See 14 C.F.R. §§ 107.12–.13; *Register Your Drone*, FED. AVIATION ADMIN. (Dec. 2, 2020, 11:29 AM), https://www.faa.gov/uas/getting_started/register_drone/ [<https://perma.cc/WT85-CW7B>]; see also Juan Plaza, *FAA Remote Pilot Certification Reaches an Important Milestone*, COM. UAV NEWS (Aug. 7, 2018), <https://www.expouav.com/news/latest/faa-remote-pilot-certificates-milestone/> [<https://perma.cc/5C3C-WMRV>] (“On July 26th the Federal Aviation Administration (FAA) announced that more than 100,000 people have obtained a Remote Pilot Certificate to fly a drone for commercial and recreational uses (not qualifying as ‘model aircraft’).”).

⁹⁰ Press Release, Fed. Aviation Admin., DOT and FAA Finalize Rules for Small Unmanned Aircraft Systems (June 21, 2016), https://www.faa.gov/news/press_releases/news_story.cfm?newsId=20515 [<https://perma.cc/F9Q7-QF6E>].

⁹¹ *Id.*

⁹² 14 C.F.R. §§ 107.3, .11.

⁹³ *Id.* § 107.29.

- Can only be operated up to a maximum of 400 feet above ground level. If operated from a structure, it must be within 400 feet of the structure;⁹⁴
- Cannot be operated from a moving aircraft;⁹⁵
- Cannot be operated from a moving vehicle unless it is being operated over sparsely populated areas;⁹⁶
- Can only be operated when weather visibility is at least three miles from the control station;⁹⁷
- Can be operated in Class B, C, D, and E airspaces, with ATC permission;⁹⁸
- Can be operated in a Class G airspace even without ATC permission;⁹⁹ and
- Must remain in the Visual-Line-Of-Sight, while in operation.¹⁰⁰

Commercial drone operators may request a waiver from the restrictions listed above.¹⁰¹ However, the request process can be time-consuming, often taking months, because the FAA receives more than 3,000 waiver requests per week and has “a backlog in the . . . tens of thousands.”¹⁰²

Commercial drones operate to satisfy a wide variety of business activities. Pilots for commercial drones must satisfy the following requirements: hold a Remote Pilot Airman Certification, be at least sixteen years old, and pass vetting by the Transportation Security Administration.¹⁰³ Like recreational drones over 0.55 pounds, every commercial drone must be registered with

⁹⁴ *Id.* § 107.51.

⁹⁵ *Id.* § 107.25.

⁹⁶ *Id.*

⁹⁷ *Id.* § 107.51.

⁹⁸ *Id.* § 107.41.

⁹⁹ FED. AVIATION ADMIN., *supra* note 61, at 15-3.

¹⁰⁰ 14 C.F.R. § 107.31.

¹⁰¹ Waiver requests cover several scenarios. *Part 107 Waivers*, FED. AVIATION ADMIN., https://www.faa.gov/uas/commercial_operators/part_107_waivers/ [<https://perma.cc/3VP4-SLW6>] (Feb. 26, 2021, 11:24 AM); Rashid, *supra* note 77.

¹⁰² Rebecca Wilson, *Q&A: How Skyward Is Working with the FAA on LAANC*, SKYWARD (Aug. 7, 2017), <https://skyward.io/qa-how-skyward-is-working-with-the-faa-on-laanc/> [<https://perma.cc/5Z7D-Q4TU>].

¹⁰³ FED. AVIATION ADMIN., SUMMARY OF SMALL UNMANNED AIRCRAFT RULE (PART 107) (2016), https://www.faa.gov/uas/media/Part_107_Summary.pdf [<https://perma.cc/L3XG-5ST3>]; *Drone Certification: A Step-by-Step Guide to FAA Part 107 for U.S. Commercial Drone Pilots*, UAV COACH, <https://uavcoach.com/drone-certification/#1> [<https://perma.cc/MF69-PJNP>].

the FAA and have a unique registration number.¹⁰⁴ The FAA estimates that roughly 42,000 commercial drones were in use in 2016 and that by 2021, 442,000 to 1.6 million commercial drones will be in operation.¹⁰⁵ The FAA also estimates that there were 73,000 commercial drone pilots by the end of 2017 and that this number will increase to almost 300,000 pilots by 2022.¹⁰⁶ For comparison, *Business Insider (BI) Intelligence* estimated commercial drone shipments in 2016 at 102,600, nearly double the FAA's estimate.¹⁰⁷ *BI Intelligence* also estimates that by 2021, the number of commercial drone shipments will increase by 51% to 805,000.¹⁰⁸ The challenge, then, is regulating airspace in a manner that will permit the use of drones without interfering with landowners' property rights.¹⁰⁹

E. LINE OF SIGHT RESTRICTIONS

According to the FAA, drones must be operated within a user's visual line of sight (VLOS).¹¹⁰ VLOS means that drone operators must be able to visually see the drone without the aid of any optical device such as binoculars, zoom lenses, or telescopes.¹¹¹ In addition, VLOS prohibits using drones in dense fog, in clouds, or at night when users are unable to maintain eye contact with the UAV.¹¹²

With the technology currently available, many UAVs can fly well beyond a user's visual line of sight (BVLOS). However, without a waiver from the FAA regulation, it is prohibited in the

¹⁰⁴ *Register Your Drone*, *supra* note 89.

¹⁰⁵ David Shepardson, *U.S. Commercial Drone Use to Expand Tenfold by 2021: Government Agency*, REUTERS (Mar. 21, 2017, 3:22 PM), <https://www.reuters.com/article/us-usa-drones/u-s-commercial-drone-use-to-expand-tenfold-by-2021-government-agency-idUSKBN16S2NM> (reporting statements by the FAA regarding the growing use of commercial drones as the regulatory framework surrounding them evolves) [<https://perma.cc/WJT3-42P4>].

¹⁰⁶ FED. AVIATION ADMIN., *supra* note 1, at 44–45.

¹⁰⁷ Meola, *supra* note 85.

¹⁰⁸ *Id.*

¹⁰⁹ See Troy A. Rule, *Airspace in an Age of Drones*, 95 B.U. L. REV. 155, 163 (2015) (“Unfortunately, the United States will be unable to take full advantage of modern domestic drone technologies until federal, state, and local governments develop a more robust legal and regulatory structure to govern these high-tech devices.”).

¹¹⁰ FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95 § 336(c), 126 Stat. 11, 77–78; *see also* 14 C.F.R. § 107.31(a).

¹¹¹ *See* 14 C.F.R. § 107.31(a); FED. AVIATION ADMIN., *supra* note 103.

¹¹² 14 C.F.R. §§ 107.29(a), .51(c)–(d); FED. AVIATION ADMIN., *supra* note 103.

United States to operate a drone BVLOS.¹¹³ There are many potential commercial and government applications for drone use if owners are allowed to operate drones BVLOS, and as such, a future increase in waiver applications is anticipated.¹¹⁴ Pilots using the first-person view, which provides the UAV pilot a cockpit view via an onboard video camera to assist in navigation, are still operating a drone BVLOS and require the same FAA § 107.31 waiver.¹¹⁵

Extended visual line of sight (EVLOS) refers to a remote pilot in command (PIC) relying on remote observers of the UAV to keep the UAV in sight at all times once it is BVLOS of the PIC.¹¹⁶ Remote observers of the UAV relay important flight information to the PIC via radio or other communication.¹¹⁷ Pilots wishing to operate a drone EVLOS must obtain a waiver from the FAA regulation.¹¹⁸

For the commercial use of drones to be successful, there must be a BVLOS system in place. Toward that end, Alphabet's Project Wing is working with the FAA and National Aeronautics and Space Administration (NASA) to develop systems that can manage the air traffic control challenge of keeping drones from crashing into each other or property.¹¹⁹ Six simultaneously operating drones tested the "unmanned aircraft systems Air Traffic Management" software (UTM), which simulated package pick-up and drop-off.¹²⁰ UTM makes adjustments to the drones' flight paths as they fly without requiring pilot action.¹²¹ No-fly zones, such as airports, could be added to the UTM so that the

¹¹³ See FED. AVIATION ADMIN., *supra* note 101.

¹¹⁴ See Gigi Wood, *FAA Gives First-Ever Approval to American Robotics for Automated Commercial Drones*, FOR CONSTR. PROS (Jan. 18, 2021), <https://www.forconstructionpros.com/construction-technology/news/21232571/american-robotics-faa-gives-first-ever-approval-to-american-robotics-for-bvlos-drones> [https://perma.cc/5X4L-6QQR].

¹¹⁵ FED. AVIATION ADMIN., *supra* note 103.

¹¹⁶ ALLISON FERGUSON, ENABLING BEYOND LINE OF SIGHT WITH THE FAA PATH-FINDER PROGRAM: EXTENDED VISUAL LINE OF SIGHT 1 (2017), https://www.astm.org/COMMIT/XPO17Paper_Ferguson.pdf [https://perma.cc/RXC7-DGNQ].

¹¹⁷ *Id.* at 1–2.

¹¹⁸ See FED. AVIATION ADMIN., *supra* note 101.

¹¹⁹ Jamie Condliffe, *Alphabet's New Air Traffic Control System Steers Drones Away from Peril*, MIT TECH. REV. (June 7, 2017), <https://www.technologyreview.com/2017/06/07/105812/alphabets-new-air-traffic-control-system-steers-drones-away-from-peril/> [https://perma.cc/A2T6-ZCRA].

¹²⁰ *Id.*

¹²¹ *Id.*

software would know what areas the drones should avoid.¹²² While it was a successful test, the sample size of six drones is minimal, and extensive development is still needed.

Ground-based and airborne “sense and avoid” technologies, which can enable drones to sense objects in their path and change course to avoid collisions, are safety features under development that could help with BVLOS flights.¹²³ Other programs that are designed to automatically send drones back to the ground safely if they are disconnected from the remote operators’ signals, such as “lost-link” or “return-to-base,” would be valuable standard features for small drones.¹²⁴ Another UAV safety concern is hacking. One could potentially hack into a drone’s signal during flight to send rogue signals and take control of the drone, intentionally directing the drone to cause harm.¹²⁵ An anti-hacking system to prevent such signal interception is an additional recommended requirement.¹²⁶

One challenge landowners face when trying to report drone activity is the inability to sufficiently identify the drone for authorities to locate the drone owner.¹²⁷ Perhaps the FAA could require GPS software to be installed in drones so that they could be tracked. However, each of these proposed systems would cost time and money to develop while also increasing the cost of drones. Some might argue that increased cost is a good thing because it could potentially reduce the number of drones in the

¹²² *Id.*

¹²³ See Thomas Black, *Amazon’s Drone Dream Sets Off Race to Build Better Sensor*, BLOOMBERG (June 7, 2014, 12:01 AM), <https://www.bloomberg.com/news/articles/2014-06-06/amazon-s-drone-dream-sets-off-race-to-build-better-sensor> [<http://perma.cc/3K36-YLSS>] (“Sense and avoid is one of the biggest opportunities in the industry . . .”).

¹²⁴ See WENDIE L. KELLINGTON, UNMANNED AIR SYSTEMS AND REGULATING NAVIGABLE AIRSPACE 11 (2013), [<https://perma.cc/6CU7-JRKV>] (“UAVs often include programmed maneuvers to be automatically deployed if a command and control link is disrupted . . .”).

¹²⁵ Jayna Lock, *Can Drones Be Hacked, Tracked, and Carry Passengers?*, DIGI (Feb. 20, 2021), <https://www.digi.com/blog/post/can-drones-be-hacked-tracked-and-carry-passengers> [<https://perma.cc/T3R8-33L7>].

¹²⁶ See, e.g., Joshua Turner & Sara Baxenberg, *NASCAR Drone Countermeasures May Be Illegal*, LAW360 (Apr. 18, 2018, 4:55 PM), <https://www.law360.com/articles/1034908/nascar-drone-countermeasures-may-be-illegal> [<https://perma.cc/XJ3S-XSZK>].

¹²⁷ See Jamie Nafziger, *To Shoot or Not to Shoot? The Legality of Downing a Drone*, DORSEY & WHITNEY LLP (Sept. 25, 2017), <https://www.dorsey.com/newsresources/publications/client-alerts/2017/09/the-legality-of-downing-a-drone> [<https://perma.cc/75G2-Z9QX>].

air. However, if drones are going to be useful to businesses, then cost control is essential.

The FAA is developing the Low Altitude Authorization and Notification Capability system (LAANC) to give commercial operators “pre-approved flight zones and maximum altitudes for operating [UAVs] near airports” rather than requiring a waiver.¹²⁸ As of June 2021, “LAANC is available at 541 LAANC Enabled Facilities and 732 Airports.”¹²⁹ The goals of LAANC are to “automate the waiver application process, . . . reduc[e] the wait time for approvals[, and] . . . give recreational drone pilots a way to notify airport air traffic control when they . . . [will fly near] an airport.”¹³⁰ While LAANC provides more access to airspace, it is not an unmanned traffic management system, and it is not intended to be.¹³¹

III. AUTONOMOUS TECHNOLOGY IN LAW ENFORCEMENT

A. HOW HAS TECHNOLOGY IN LAW ENFORCEMENT EVOLVED?

Since the 1990s, law enforcement agencies’ adoption of cutting-edge technology has become commonplace in the United States. The creation of the Defense Logistics Agency’s 1033 Program, which grants law enforcement agencies access to military-grade equipment,¹³² along with the groundbreaking technologies introduced by the private sector each year, has allowed for a massive transformation of how law enforcement officers carry out their duties. Yet, despite the introduction of revolutionary devices—such as non-lethal, GPS-tracking bullets,¹³³ camera-embedded bulletproof vests and eyewear,¹³⁴ and handheld laser

¹²⁸ Wilson, *supra* note 102.

¹²⁹ *Airports Participating in LAANC*, FED. AVIATION ADMIN. (Apr. 29, 2021), https://www.faa.gov/uas/programs_partnerships/data_exchange/laanc_facilities/ [<https://perma.cc/BME9-9ZX9>].

¹³⁰ Wilson, *supra* note 102.

¹³¹ *See id.*

¹³² *See Join the 1033 Program*, U.S. DEF. LOGISTICS AGENCY, <https://www.dla.mil/DispositionServices/Offers/Reutilization/LawEnforcement/JoinTheProgram.aspx> [<https://perma.cc/Q7P9-BGXS>].

¹³³ *Case Study of a GPS Tracking Tool Designed to Aid in Police Vehicle Pursuits*, NAT’L INST. JUST. (July 11, 2017), <https://nij.ojp.gov/topics/articles/case-study-gps-tracking-tool-designed-aid-police-vehicle-pursuits> [<https://perma.cc/6BY9-TR7U>].

¹³⁴ *E.g.*, Brett Chapman, *Body-Worn Cameras: What the Evidence Tells Us*, NAT’L INST. JUST. (Nov. 14, 2018), <https://nij.ojp.gov/topics/articles/body-worn-camera-what-evidence-tells-us#note2> [<https://perma.cc/VNL5-RELS>].

spectroscopes used to identify chemical compounds of illicit drugs¹³⁵—no other technologies have come close to the safety and convenience afforded by unmanned, robotic devices.

With over 1,578 reported units throughout municipal, state, and federal law enforcement agencies in the United States as of 2020,¹³⁶ drones have proven to be indispensable surveillance supplements in the field. Guided to cover what may otherwise be impractical or impossible grounds, drones can aid in gathering aerial footage for evidence, follow persons of interest when an officer is unable to, and assist in the execution of search and rescue missions all by remote control.¹³⁷ To illustrate the vitality of the drone, law enforcement agencies throughout the country have recently utilized UAV enhancements—such as night vision and loudspeakers—to patrol and enforce lockdown orders given as a result of the COVID-19 pandemic.¹³⁸ This added layer of separation between officers and the community has helped ensure the safety and well-being of the public at large.

However, a salient trait shared by all technologies in law enforcement since the 1990s has recently been disregarded: the necessity of human control.¹³⁹ With officers at the helm of these supplemental technologies, any wrongful actions can be held against the officer or agencies responsible.¹⁴⁰ Contrastingly, the current technologies law enforcement agencies are adopting throughout the country, including drones and robotic patrol officers,¹⁴¹ introduce the characteristic of autonomy, or “the abil-

¹³⁵ *E.g.*, Rebecca Pool, *Raman Spectroscopy for Drug Safety*, SPIE (Apr. 1, 2017), <https://spie.org/news/spie-professional-magazine-archive/2017-april/raman-spectroscopy-for-drug-safety?SSO=1> [<https://perma.cc/TZU7-R3VM>].

¹³⁶ DAN GETTINGER, CTR. FOR THE STUDY OF THE DRONE AT BARD COLL., PUBLIC SAFETY DRONES (3d ed. 2020), <https://dronecenter.bard.edu/files/2020/03/CSD-Public-Safety-Drones-3rd-Edition-Web.pdf> [<https://perma.cc/FKP6-DYW7>].

¹³⁷ *Snapshot: First Responders Assess Drones for Search and Rescue Missions*, U.S. DEP’T HOMELAND SEC. (Apr. 2, 2020), <https://www.dhs.gov/science-and-technology/news/2020/04/02/snapshot-first-responders-assess-drones-search-and-rescue-missions> [<https://perma.cc/7LU9-V35R>].

¹³⁸ Patrick McGee & Kiran Stacey, *California Police to Use Drones to Patrol Coronavirus Lockdown*, FIN. TIMES (Mar. 20, 2020), <https://www.ft.com/content/c7d0dee1-6125-475c-9cc7-78f4671d7cea> [<https://perma.cc/DT9Y-3SKY>].

¹³⁹ See Michele C. Kirrane, *Civil Liability Arising Out of the Commercial Ownership and Operation of Drones*, LEXOLOGY (Apr. 15, 2016), <https://www.lexology.com/library/detail.aspx?g=064b7d54-fd69-4312-bc0b-73ca521de1b5> [<https://perma.cc/Y4SK-6GDB>].

¹⁴⁰ *Id.*

¹⁴¹ Pamela Bump, *Law Enforcement Robotics and Drones – 5 Current Applications*, EMERJ (May 20, 2019), <https://emerj.com/ai-sector-overviews/law-enforcement-robotics-and-drones/> [<https://perma.cc/SVG6-6QEL>]; *Here Are the World’s Largest*

ity to act and make decisions without being controlled by anyone.”¹⁴²

B. AUTONOMOUS DRONES AND ROBOTS IN LAW ENFORCEMENT

Despite the cutting-edge capabilities and benefits offered by current drone models, newly introduced autonomous drones push the boundaries of what was previously thought capable of these devices. Currently available to law enforcement agencies through either direct purchase or the previously mentioned Defense Logistics Agency’s 1033 Program, military-grade-capable drones, such as DJI Innovations’s (DJI) Phantom 4 and Mavic, offer a plethora of new tools to help officers in the field.¹⁴³ When paired with DroneDeploy’s 3D imaging and mapping software, these autonomous drones become capable of detecting and maneuvering around objects through enhanced vision processing, tracking moving subjects marked independently by operators, and hovering over and patrolling pre-set routes.¹⁴⁴

On the same note as DJI, security company Knightscope has broken the confines of the imaginable by introducing a line of fully autonomous, artificial intelligence-enhanced, robotic patrol officers to public and private consumers in the United States and several countries throughout the world.¹⁴⁵ Now serving domestically in forces such as California’s Huntington Park Police Department¹⁴⁶ and the North Central Texas College Police,¹⁴⁷ each autonomous patrol officer model in the Knightforce “K” line deploys with knowledge-expanding artifi-

Drone Companies and Manufacturers to Watch, BUS. INSIDER (Dec. 22, 2020, 1:46 PM), <https://www.businessinsider.com/drone-manufacturers-companies-invest-stocks> [<https://perma.cc/YHQ2-UB7A>] (noting that DJI Innovations, headquartered in Shenzhen, China, holds 70% of the drone market).

¹⁴² *Autonomy*, OXFORD LEARNERS DICTIONARY, https://www.oxfordlearnersdictionaries.com/definition/american_english/autonomy [<https://perma.cc/8RYG-XGAM>].

¹⁴³ Bump, *supra* note 141; BUS. INSIDER, *supra* note 141.

¹⁴⁴ Bump, *supra* note 141.

¹⁴⁵ *Reimagine Public Safety*, KNIGHTSCOPE, INC., <https://www.knightscope.com/about-us/> [<https://perma.cc/XBZ6-MBXR>].

¹⁴⁶ *E.g.*, Katie Flaherty, *A RoboCop, a Park and a Fight: How Expectations About Robots Are Clashing with Reality*, NBC NEWS (Oct. 4, 2019, 8:04 AM), www.nbcnews.com/tech/tech-news/robocop-park-fight-how-expectations-about-robots-are-clashing-reality-n1059671 [<https://perma.cc/4QYP-ZN5B>].

¹⁴⁷ *E.g.*, Megan Jefferson, *NCTC Welcomes the Future of Security*, N. CENT. TEX. COLL. (Aug. 14, 2019), www.nctc.edu/news/2019/08/nctc-welcomes-the-future-of-security.html [<https://perma.cc/J54D-GGQZ>].

cial intelligence software and a multitude of capabilities, including human detection and facial recognition, the ability to detect and report crimes such as burglaries and robberies, and force multiplying physical deterrence.¹⁴⁸ Similar to the use of closed-circuit television decreasing crime in car parks by 51%, the use of robots could have a similar or greater effect.¹⁴⁹ For example, Huntington Park, California's use of a robotic patrol officer resulted in:

- 10% reduction in calls for service;
- 46% reduction in crime reports;
- 27% increase in arrests; and
- 68% reduction in citations.¹⁵⁰

At a wage of seven dollars per hour to have a Knightscope officer independently patrol, many law enforcement agencies and businesses in need of private security have turned to this cheaper alternative.¹⁵¹ In addition, the robotic patrol officer allowed human officers to stay at a distance during the COVID-19 pandemic and has increased police department resources because recruiting is down and funding is cut due to recent protests against police violence.¹⁵² However, regardless of the safety and cost benefits offered, the foregoing incidents of these devices endangering the rights and safety of individuals with no legal ramifications prove that neither the technology nor the law is ready to replace human officers fully.

IV. SAFETY HAZARDS AND LIABILITY COMPLICATIONS

A. SAFETY HAZARDS

The ultimate downfall of autonomous technology in law enforcement is that, unlike their human counterparts, machines have neither the cognitive nor physical capacity to respond

¹⁴⁸ Paul Marrinan, *AI Robot Security – Making the US a Safer Place*, REBELLION RES. (Feb. 17, 2020), <https://www.rebellionresearch.com/blog/ai-robot-security-making-the-us-a-safer-place> [<https://perma.cc/V59Y-Q7AM>]. “Force Multiplying Physical Deterrence” refers to the ability of robots to provide a consistent presence, creating a visual and physical deterrence to criminals, similar to the halo effect created by closed-circuit television. *Id.*

¹⁴⁹ *Id.*

¹⁵⁰ *Id.*

¹⁵¹ Elizabeth E. Joh, *Policing Police Robots*, 64 UCLA L. REV. DISCOURSE 516, 520–21 (2016).

¹⁵² Cade Metz, *Police Drones Are Starting to Think for Themselves*, N.Y. TIMES (Dec. 5, 2020), <https://www.nytimes.com/2020/12/05/technology/police-drones.html> [<https://perma.cc/M3EN-LE7L>].

quickly to complex calls to action and, as such, cannot use discretion in complicated scenarios. Once faced with a dangerous situation it cannot handle alone, this combination of technological inability and human absence will make way for these devices to become safety hazards and liability complicators.

Since the rise of intelligent drones in 2016,¹⁵³ these devices have already established themselves as safety hazards in the United States. Painfully clear examples of the dangers posed by these machines come from cases in which drones have fallen from the sky and struck people in the head,¹⁵⁴ collided with cyclists,¹⁵⁵ and even sliced the tips of noses off.¹⁵⁶ Despite none of these extreme cases involving autonomous law enforcement drones specifically, DJI reports that they are equally prone to the most common causes of drone crashes: malfunctioning rotors, loss of GPS signal, power failure, and compass error.¹⁵⁷ Given the early stages of using autonomous drones in non-military settings, the possibility of these machines causing harm to civilians becomes strikingly evident.¹⁵⁸ On the same face, robotic officers pose similar threats as drones.¹⁵⁹

Despite the lack of legal precedent restricting the actions of robotic officers in the United States, ethical guidelines such as

¹⁵³ Luke Dormehl, *The History of Drones in 10 Milestones*, DIGITAL TRENDS (Sept. 11, 2018), <https://www.digitaltrends.com/cool-tech/history-of-drones/> [https://perma.cc/Y4S2-7UDX].

¹⁵⁴ *Woman Knocked Unconscious by Falling Drone During Seattle's Pride Parade*, SEATTLE TIMES, <https://www.seattletimes.com/seattle-news/crime/woman-knocked-unconscious-by-falling-drone-during-seattles-pride-parade/> [https://perma.cc/5X6A-9759] (June 30, 2015, 2:56 PM).

¹⁵⁵ *Crash After Drone Flies into Bike Race*, ABC11 (May 9, 2017), <https://abc11.com/news/crash-after-drone-flies-into-bike-race/1971533/> [https://perma.cc/3PBJ-2PLL].

¹⁵⁶ Karma Allen, *TGI Fridays Drone Delivers Bloody 'Mistletoe Mischief,'* CNBC, <https://www.cnn.com/2014/12/08/tgi-fridays-mistletoe-drone-chips-tip-off-customers-nosej.html> (Dec. 10, 2014, 10:46 AM) [https://perma.cc/J5QU-SKAE].

¹⁵⁷ *10 Tips for Preventing Drone Crashes*, DJI GUIDES (Apr. 8, 2018), <https://store.dji.com/guides/drone-crash/> [https://perma.cc/3TRB-9297].

¹⁵⁸ Sandra Krähenmann, Geneva Call & George Dvaladze, *Humanitarian Concerns Raised by the Use of Armed Drones*, RELIEFWEB (Nov. 6, 2020), <https://reliefweb.int/report/world/humanitarian-concerns-raised-use-armed-drones#:~:text=Beyond%20death%20and%20physical%20injury,increase%20capacity%20to%20undertake%20attacks> [https://perma.cc/S9FA-YUD6].

¹⁵⁹ See Alysha Stein-Manes, *Three is Company: Police Departments Usage of Drones and Robots and What It Means For Employer-Employee Relations*, CALIF. PUB. AG. LAB. & EMP. BLOG (July 30, 2019), <https://www.calpublicagencylaboremploymentblog.com/public-safety-issues/three-is-company-police-departments-usage-of-drones-and-robots-and-what-it-means-for-employer-employee-relations/> [https://perma.cc/BY3C-LKDB].

Isaac Asimov's Three Laws of Robotics have existed for well over eighty years and provide manufacturers such as Knightscope with the knowledge necessary to produce safety-conscious robots.¹⁶⁰ Nonetheless, cases have already arisen of Knightscope officers breaking Asimov's first and most salient law: "A robot may not injure a human being or, through inaction, allow a human being to come to harm."¹⁶¹

In September 2019, NBC News heavily scrutinized the Huntington Park Police Department after its Knightscope patrol officer blatantly ignored a woman's cries for help.¹⁶² When trying to report a fight by pressing the readily-equipped "emergency alert" button, the robotic patrol officer ordered the woman to step away before proceeding to business as usual.¹⁶³ In an even more alarming case, officials in Palo Alto, California, reported a Knightscope officer that knocked down a toddler before proceeding to run him over, causing bodily injuries.¹⁶⁴ Despite incurring minimal harm in both cases, the actions, or lack thereof, of these Knightscope officers showcase the failures of artificial intelligence software and the dangers posed by officers who do not possess human-level cognitive abilities. From a legal standpoint, this incapacity further complicates issues of determining officer negligence claims and liability for injuries caused.

B. "NEGLIGENT" AUTONOMOUS DEVICES AND LIABILITY

The legal concept of negligence allows for an appropriate amount of leeway to be granted to officers and agencies when they act out of line during the course of their employment; however, given the context of an autonomous device with a decision-making process set to a computed algorithm, deeming its wrongful actions as "negligent" becomes complicated. First, no determination has been made on whether an autonomous device can be compared to someone of "ordinary prudence."¹⁶⁵ Additionally, even if it is determined that autonomous devices

¹⁶⁰ *Asimov's Three Laws of Robotics + the Zeroth Law*, HISTORYOFINFORMATION.COM, <https://www.historyofinformation.com/detail.php?entryid=4108> [<https://perma.cc/N4TV-DBC9>].

¹⁶¹ *Id.*

¹⁶² Flaherty, *supra* note 146.

¹⁶³ *Id.*

¹⁶⁴ *Parents Upset After Stanford Shopping Center Security Robot Injures Child*, ABC 7 NEWS (July 12, 2016), <https://abc7news.com/news/parents-upset-after-stanford-mall-robot-injures-child/1423093/> [<https://perma.cc/YWN9-KHHV>].

¹⁶⁵ See RESTATEMENT (SECOND) OF TORTS § 283 cmt. c (AM. L. INST. 1965).

can be compared to someone of ordinary prudence, no determination has been made on whether they will be compared with their human counterparts or other artificially intelligent robots. This lack of clear guidance on negligence directly results in a similar issue when determining liability.

Theoretically, three parties may be held liable for wrongful actions committed by robotic devices: the manufacturers of these devices, the manufacturers of the artificial intelligence software embedded within these devices, and the law enforcement agency to which the officer belongs. As the party responsible for producing and distributing these autonomous devices for consumers, manufacturers, such as Knightscope, may be held liable under appropriate state product liability law for placing a faulty officer that acts wrongfully into the hands of an agency.¹⁶⁶ On the same note, artificial intelligence software manufacturers may also face liability due to the distribution of artificial intelligence software with algorithms that commonly lead many devices to act in ways so dangerously unintelligible that not even their developers can decipher why.¹⁶⁷ Lastly, the reasonable assumption that these fully autonomous, self-governing robots are a direct and equivalent substitution to human officers implies that they may be deemed able to act wrongfully, just as their human counterparts would. In this latter instance, wrongfully acting robotic officers and their law enforcement agencies would be open to legal action for any constitutional or civil rights violations committed.¹⁶⁸

V. CONSTITUTIONAL IMPLICATIONS AND POTENTIAL RESOLUTIONS

A. CONSTITUTIONAL IMPLICATIONS

If these autonomous devices are indeed a direct equivalent to human officers and can be held responsible for their actions, then federal law could find the robots and the law enforcement that deployed them liable for wrongfully infringing on the con-

¹⁶⁶ See RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 1 (AM. L. INST. 1998) (“One engaged in the business of selling or otherwise distributing products who sells or distributes a defective product is subject to liability for harm to persons or property caused by the defect.”).

¹⁶⁷ See, e.g., Kate Mattingly, *Revisited: “Machine Generated Culpability,”* BERKELEY CTR. FOR NEW MEDIA (Feb. 16, 2016), <http://bcnm.berkeley.edu/news-research/948/revisited-machine-generated-culpability> [<https://perma.cc/A6G3-HCC4>].

¹⁶⁸ See 42 U.S.C. § 1983 (2018).

stitutional or civil rights of an individual.¹⁶⁹ A 43 U.S.C. § 1983 (Section 1983) lawsuit alleging a civil rights violation may arise because of wrongful actions taken by these devices. Accordingly, the robotics and legal communities focus on wrongful actions committed by weaponized devices and advanced surveillance.¹⁷⁰

Weaponization has long been a concern for stakeholders of autonomous law enforcement drones and officers, namely because equipping these devices with lethal or nonlethal weapons, such as tasers or firearms, may lead to an increase in excessive force incidents.¹⁷¹ However, in the context of drones, it is currently illegal for any non-military personnel to fly a weaponized drone, and only the FAA can administer the sanction of a weaponized drone.¹⁷² As it now stands, then, it is seemingly improbable that law enforcement agencies will be able to possess any type of weaponized drone, regardless of possible access via the Defense Logistics Agency's 1033 Program.

Contrastingly, with no laws outright banning the development or employment of lethal autonomous weapons (LAWs) in the United States, the possibility of weaponized Knightscope officers still exists.¹⁷³ To combat the threat of these devices infringing on the constitutional protections and well-being of individuals, however, is the guidance of the Department of Defense Directive (DODD) 3000.09, which "requires that all systems, including LAWs, be designed to 'allow commanders and operators to exercise appropriate levels of human judgment over the use of force.'"¹⁷⁴ Further, significant efforts to ban LAWs by non-government organizations, such as the Campaign to Stop Killer Robots, have been met with resounding international support.¹⁷⁵ Nonetheless, the possibility of these weaponized officers remains open, and despite DODD 3000.09 requiring final human

¹⁶⁹ *See id.*

¹⁷⁰ Joh, *supra* note 151, at 534–35, 538.

¹⁷¹ *Weaponized Drones*, ACLU, www.aclu.org/other/weaponized-drones [<https://perma.cc/VQT5-JSCK>].

¹⁷² Michael Kan, *FAA: Sorry, It's Illegal to Weaponize a Drone*, PCMag (Aug. 23, 2019), <https://www.pcmag.com/news/faa-sorry-its-illegal-to-weaponize-a-drone> [<https://perma.cc/CWV9-BWY7>].

¹⁷³ *See* KELLEY M. SAYLER, CONG. RESEARCH SERV., IF11150, DEFENSE PRIMER: U.S. POLICY ON LETHAL AUTONOMOUS WEAPON SYSTEMS (2020), <https://fas.org/sgp/crs/natsec/IF11150.pdf> [<https://perma.cc/ZJR2-D3J3>].

¹⁷⁴ *Id.*

¹⁷⁵ Billy Perrigo, *A Global Arms Race for Killer Robots Is Transforming the Battlefield*, TIME, <https://time.com/5230567/killer-robots/> [<https://perma.cc/R65G-XSD8>] (Apr. 9, 2018, 2:12 PM).

judgment, the faulty artificial intelligence software in these Knightscope officers may result in wrongful actions and excessive force instances in the future.

The second possible gateway for a Section 1983 lawsuit comes from advanced vision enhancements, such as thermal imaging and facial recognition. These advanced features pose a direct threat to the implied constitutional right of privacy and the guaranteed constitutional protection against unreasonable searches.¹⁷⁶ DJI drone models and all Knightscope officer models use thermal imaging, making these devices capable of detecting people or things that are not detectible with the naked eye.¹⁷⁷ However, should these devices wrongfully or mistakenly use their thermal imaging software due to faulty artificial intelligence, they may directly violate an individual's Fourth Amendment protection against unreasonable searches.¹⁷⁸

Comparatively, except for a few states and law enforcement agencies banning its use, facial recognition technology on these drones and officers faces no regulation.¹⁷⁹ If federal guidelines do not come to fruition quickly, this biometric form of surveillance may allow Knightscope robotic officers and law enforcement drones on patrol to track individuals and access their data, such as driving and criminal records.¹⁸⁰ This glaring privacy concern stands merely as an example of the possible constitutional and privacy violations that autonomous drones and officers may commit. Therefore, both legislation and law enforcement agencies must adopt proper legislation in a timely manner.

¹⁷⁶ See *Kyllo v. United States*, 533 U.S. 27, 40 (2001).

¹⁷⁷ *Thermal Imaging Cameras Explained*, GRAINGER (Sept. 1, 2015), <https://www.grainger.com/know-how/equipment-information/kh-thermal-imaging-applications-uses-features-345-qt> [<https://perma.cc/P8LK-BTVR>]; *DJI Makes Thermal Imaging Portable With Mavic 2 Enterprise Dual*, DJI (Dec. 20, 2018), <https://www.dji.com/newsroom/news/dji-makes-thermal-imaging-portable-with-mavic-2-enterprise-dual> [<https://perma.cc/K2Z6-JL85>]; *Knightscope Announces K3 Indoor Autonomous Security Robot*, BUSINESSWIRE (Apr. 5, 2016, 10:00 AM), <https://www.businesswire.com/news/home/20160405005759/en/Knightscope-Announces-K3-Indoor-Autonomous-Security-Robot> [<https://perma.cc/8SHJ-LA7N>].

¹⁷⁸ See *Kyllo*, 533 U.S. at 40 (holding that thermal imaging “surveillance is a ‘search’ and is presumptively unreasonable without a warrant.”).

¹⁷⁹ Benjamin Hodges & Kelly Mennemeier, *The Varying Laws Governing Facial Recognition Technology*, IPWATCHDOG (Jan. 28, 2020), <https://www.ipwatchdog.com/2020/01/28/varying-laws-governing-facial-recognition-technology/id=118240/> [<https://perma.cc/UA2W-SEQ3>].

¹⁸⁰ See *Face Recognition Technology*, ACLU, <https://www.aclu.org/issues/privacy-technology/surveillance-technologies/face-recognition-technology> [<https://perma.cc/SRM9-Y8ZF>].

B. POTENTIAL RESOLUTIONS

Undoubtedly, the safety hazards, liability complications, and constitutional implications posed by autonomous drones and robotic officers each require specific resolutions. The two most viable courses of action concerning safety hazards would be “pilot programs” and “partner in command” initiatives. Aimed to “safely resolve dangerous, high-risk tactical situations and improve situational awareness capabilities,” pilot programs, such as that of the Los Angeles Police Department, allow agencies to beta test new technologies and help guide future policies concerning the technology.¹⁸¹ A beta testing program could allow autonomous drones and robotic officers to be used under periods of heavy surveillance, ensuring the protection of public safety from malfunctions and creating agency-specific policies.¹⁸²

However, at the macro level, a more appropriate course to be taken would be “partner in command” initiatives. Such an initiative, intended for both autonomous drones and robotic officers, would be modeled after the FAA’s Modernization and Reform Act of 2012, which requires law enforcement agencies to ensure that a PIC “has . . . override authority to assume control at all times during normal UAS operations.”¹⁸³ By adopting current FAA regulation and “partnering” these devices with a human officer at all times, any malfunction or questionable decision made by the artificial intelligence may be caught in real-time and overridden to ensure that such devices pose no threat to public safety.

Concerning liability complications, the most straightforward resolution would be to adopt either product liability law or agency law theory. Product liability law would hold manufacturers of autonomous drones, robotic officers, and the artificial intelligence software used by them liable when producing and

¹⁸¹ Betsy Lillian, *LAPD Finally Gets Green Light for UAS Pilot Program*, UNMANNED AERIAL ONLINE (Oct. 18, 2017), <https://unmanned-aerial.com/lapd-finally-gets-green-light-uas-pilot-program> [<https://perma.cc/U77P-U24V>].

¹⁸² *Id.*

¹⁸³ MARIA VALDOVINOS, JAMES SPECHT & JENNIFER ZEUNIK, OFF. OF CMTY. ORIENTED POLICING SERVS., COMMUNITY POLICING & UNMANNED AIRCRAFT SYSTEMS (UAS): GUIDELINES TO ENHANCE COMMUNITY TRUST 132 (2016), <https://www.policefoundation.org/wp-content/uploads/2016/11/UAS-Report.pdf> [<https://perma.cc/PL9B-2YVH>].

distributing a faulty product.¹⁸⁴ This would absolve agencies of any wrongdoing committed by these devices, as they would merely be consumers of these products. An illustration of this liability model is that of car manufacturers assuming liability for hardware malfunctions in their autonomous vehicles to “[give] them a financial incentive to subject the vehicle’s programming to reasonably safe methods of quality control.”¹⁸⁵

The alternative to product liability, and the resolution to the constitutional implications created, comes from agency theory. Agency theory would allow for a principle–agent relationship between law enforcement agencies and their autonomous devices.¹⁸⁶ By allowing this established legal theory to guide the future of autonomous technology, law enforcement agencies would be held vicariously liable for the wrongful actions committed by these devices within the scope of their employment via the doctrine of respondeat superior.¹⁸⁷ The creation of either state or federal legislation requiring law enforcement agencies to consider their autonomous devices directly equivalent to human officers would ensure that agencies assume full responsibility for any constitutional violations committed by autonomous devices. Lastly, Section 1983 lawsuits involving autonomous drones or robotic officers would be treated identically to cases involving humans.

VI. STATE AND LOCAL REGULATION OF DRONES

A. STATE REGULATION OF DRONES

The U.S. Department of Transportation (DOT) recently granted ten special licenses to UAS projects backed by state and local governments.¹⁸⁸ The DOT’s Unmanned Aircraft Systems

¹⁸⁴ See RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 1 (AM. L. INST. 1998) (“One engaged in the business of selling or otherwise distributing products who sells or distributes a defective product is subject to liability for harm to persons or property caused by the defect.”).

¹⁸⁵ Mark A. Geistfeld, *A Roadmap for Autonomous Vehicles: State Tort Liability, Automobile Insurance, and Federal Safety Regulation*, 105 CAL. L. REV. 1611, 1692 (2017).

¹⁸⁶ See RESTATEMENT (THIRD) OF AGENCY § 2.04 (AM. L. INST. 2006) (“An employer is subject to liability for torts committed by employees while acting within the scope of their employment.”).

¹⁸⁷ *Id.*

¹⁸⁸ Chiem, *supra* note 37 (reporting that Alaska, California, Florida, Kansas, Nevada, North Carolina, North Dakota, Oklahoma, Tennessee, and Virginia will participate in the DOT’s Unmanned Aircraft Systems Integration Pilot Program to test commercial drone operations that would typically require waivers, including package delivery and nighttime flights). Specifically, a 1,500-pound UAV will

Integration Pilot Program’s goal is to “foster a meaningful dialogue on the balance between local and national interests related to UAS integration, and provide actionable information to the USDOT on expanded and universal integration of UAS into the national airspace system.”¹⁸⁹ However, there is some concern about state regulations attempting to dilute federal regulations, particularly Part 107.¹⁹⁰

Congress gave the FAA the authority to regulate aviation safety, the scope of which includes drone operations, but states are implementing rules to regulate drone-related concerns such as property rights, liability, and privacy.¹⁹¹ Regulation of airspace below navigable airspace should belong to states because state tort law is implicated in such instances.¹⁹² States regulate drivers’ licenses, so why not regulate drone licenses?¹⁹³ While the FAA may regulate airspace,¹⁹⁴ state and local governments have some power to regulate the use of airspace and, therefore, the use of that airspace by drones.¹⁹⁵ Amanda Essex, a policy associate for the National Conference of State Legislatures, commented, “I wouldn’t necessarily say there is one state doing it better than the others. They’re all kind of taking their own approaches as to what they think is going to work for their state and what is best in their situation.”¹⁹⁶

monitor mosquitoes in Florida, and Flirtey, a medical equipment startup, will fly drones with emergency medical equipment to heart-attack victims in Nevada. David Shepardson & Jeffrey Dastin, *U.S. Drone Program Taps Apple, Passes over Amazon, China’s DJI*, REUTERS, <https://www.reuters.com/article/us-usa-drones-companies/us-drone-program-taps-alphabet-passes-over-amazon-chinas-dji-idUSKBN1IA2WC> [<https://perma.cc/7XAQ-CWVG>] (May 9, 2018, 12:27 PM).

¹⁸⁹ Chiem, *supra* note 37.

¹⁹⁰ See *Singer v. City of Newton*, 284 F. Supp. 3d 125, 130 (D. Mass. 2017); see generally Nicholas Cody, Comment, *Flight and Federalism: Federal Preemption of State and Local Drone Laws*, 93 WASH. L. REV. 1495, 1495 (2018).

¹⁹¹ See Eyrason Eidam, *Report: Drone Legislation a Priority for States Across the U.S.*, GOV’T TECH. (July 8, 2016), <https://www.govtech.com/policy/Report-Drone-Legislation-a-Priority-for-States-Across-the-US.html> [<https://perma.cc/FE4F-X96Z>].

¹⁹² Chiem, *supra* note 37.

¹⁹³ Rule, *supra* note 109, at 203 (“Through drone operator license tests, periodic safety inspections, liability insurance criteria, and related means, such licensing systems could do a great deal to promote drone safety and to ensure that drone users are familiar with laws relating to the devices.”).

¹⁹⁴ See Federal Aviation Act of 1958, Pub. L. No. 85-726, 72 Stat. 731.

¹⁹⁵ See Press Release, Fed. Aviation Admin., FAA Statement—Federal vs. Local Drone Authority (June 20, 2018), https://www.faa.gov/news/press_releases/news_story.cfm?newsId=22938 [<https://perma.cc/8P2W-LA8U>].

¹⁹⁶ Eidam, *supra* note 191.

In the 2017 legislative session, thirty-eight states considered UAS legislation, resulting in eighteen of those states passing twenty-four pieces of legislation.¹⁹⁷ Three states adopted resolutions to address UAS legislation in 2018.¹⁹⁸ “Alaska has a Task Force on UAS . . . [,] North Dakota supports the development of the UAS industry . . . [, and] Utah supports the building of a NASA drone testing facility and Command Control Center in Tooele County, Utah.”¹⁹⁹ Utah also passed legislation extending criminal trespass to drones and prohibiting the disturbance of livestock with drones.²⁰⁰ Virginia made it a misdemeanor for a UAS to trespass for spying.²⁰¹

Nineteen-year-old Austin Haughwout posted YouTube videos of a drone using a flamethrower to roast a turkey²⁰² and a drone holding and shooting a gun.²⁰³ The FAA has been investigating the videos, but Haughwout and his father argue that the FAA is exceeding its authority because “drones are models, not aircraft, and [that] his videos . . . [are of] a backyard hobby, not [commercial use].”²⁰⁴ Mario Cerame, Haughwout’s attorney, argued that “[c]onstruing small civilian drones as aircraft[s] is not consonant with the history and policy purpose of the FAA. . . . It was about airplanes, helicopters, and blimps, and the accoutrements that accompany them.”²⁰⁵ Those incidents led to a proposed

¹⁹⁷ *Current Unmanned Aircraft State Law Landscape*, NAT’L CONF. OF STATE LEGISLATURES (Feb. 1, 2018), <https://www.ncsl.org/research/transportation/current-unmanned-aircraft-state-law-landscape.aspx> [<https://perma.cc/XK95-2426>].

¹⁹⁸ *Id.*

¹⁹⁹ *Id.*

²⁰⁰ *See* UTAH CODE ANN. § 76-9-308(2)(c) (LexisNexis 2017) (“[A] person is guilty of harassment of livestock if the person intentionally, knowingly, or recklessly chases, with the intent of causing distress, or harms livestock through the use of . . . an unmanned aircraft system.”); *id.* § 76-6-206(2)(a) (“A person is guilty of criminal trespass if . . . the person . . . causes an unmanned aircraft to enter and remain unlawfully over property . . .”).

²⁰¹ NAT’L CONF. OF STATE LEGISLATURES, *supra* note 197; *see* VA. CODE ANN. § 18.2-130.1 (2021) (“It is unlawful [a Class 1 misdemeanor] for any person to knowingly and intentionally cause an electronic device to enter the property of another to secretly or furtively peep or spy . . . into . . . a dwelling . . .”).

²⁰² Hogwit, *Roasting the Holiday Turkey*, YOUTUBE (Dec. 7, 2015), <https://www.youtube.com/watch?v=LMD3rXUR1Tw> [<https://perma.cc/Z5FB-CG34>].

²⁰³ Hogwit, *Flying Gun*, YOUTUBE (July 10, 2015), <https://www.youtube.com/watch?v=XQHrTtvFFIs> [<https://perma.cc/6ZFC-69NC>].

²⁰⁴ Edmund H. Mahony, *Drone-Flying Teen and His Dad Go to Court to Fight FAA Investigation*, HARTFORD COURANT (July 6, 2016, 9:15 PM), <https://www.courant.com/news/connecticut/hc-drone-boy-0707-20160706-story.html> [<https://perma.cc/YP9R-XJ42>].

²⁰⁵ *Id.*

Connecticut law prohibiting the remote control of a deadly weapon.²⁰⁶

In California, a property owner's rights in the airspace over his land include rights to the "free or occupied space [above the property] for an indefinite distance upwards . . . subject to limitations upon the use of airspace imposed . . . by law."²⁰⁷ In September 2015—following several incidents between firefighters and drones—California state legislators passed a bill²⁰⁸ "grant[ing] immunity to emergency responders who damage a drone that gets in their way."²⁰⁹ In one case, a drone interfered with helicopters fighting a major fire in Northern California, which caused a ten-minute delay.²¹⁰ The drone pilot was given a citation, but he commented that he did not know that flying his

²⁰⁶ See H.R. Res. 7260, 115th Leg., 1st Sess. (Conn. 2017), <https://www.cga.ct.gov/2017/TOB/h/2017HB-07260-R00-HB.htm> [<https://perma.cc/665C-DR4J>] ("Except as . . . otherwise provided by law, no person . . . shall operate or use any computer software or other technology, including, but not limited to, an unmanned aerial vehicle, that allows a person, when not physically present, to release tear gas or any like or similar deleterious agent or to remotely control a deadly weapon, as defined in section 53a-3 of the general statutes, or an explosive or incendiary device, as defined in section 53-206b of the general statutes."); Miriam McNabb, *Connecticut Decides Against "Weaponized" Drones for Law Enforcement*, DRONELIFE (May 2, 2017), <https://dronelife.com/2017/05/02/connecticut-decides-weaponized-drones-law-enforcement/> [<https://perma.cc/ELX2-UKPM>] (reporting that Connecticut's House of Representatives did not take action on Connecticut House Bill 7260).

²⁰⁷ CAL. CIV. CODE § 659 (West 2021).

²⁰⁸ See *id.* § 43.101(a) ("An emergency responder shall not be liable for any damage to an unmanned aircraft or unmanned aircraft system, if that damage was caused while the emergency responder was providing, and the unmanned aircraft or unmanned aircraft system was interfering with, the operation, support, or enabling of the emergency services listed in Section 853 of the Government Code.").

²⁰⁹ Craig Whitlock, *Rogue Drones a Growing Nuisance Across the U.S.*, WASH. POST (Aug. 10, 2015), https://www.washingtonpost.com/world/national-security/how-rogue-drones-are-rapidly-becoming-a-national-nuisance/2015/08/10/9c05d63c-3f61-11e5-8d45-d815146f81fa_story.html [<https://perma.cc/2QMU-Z7LR>] (reporting that, in California, drones interfered with firefighters' efforts to battle wildfires and that, in New York, firefighters used their water hoses to knock down a drone that had been filming them as they battled a house blaze).

²¹⁰ Press Release, Petaluma Police Dep't, 24 Year Old Petaluma Resident Cited for Flying a Drone over the Petaluma Airport Halting Cal Fire Helicopters (Oct. 15, 2017, 10:10 PM), <http://www.nixle.us/9MZ35> (stating that 24-year-old Nestor Rodriguez received a citation for Impeding Emergency Personnel for flying a drone over the airport being used by the firefighting helicopters) [<https://perma.cc/SV24-QPGT>].

drone near the airport was illegal.²¹¹ In California, such interference is a misdemeanor.²¹²

In 2013, Oregon was one of the early states to enact a statute creating a civil claim for drone trespass.²¹³ The statute, as enacted, allows real property owners to bring claims against anyone who flies a drone over their property below 400 feet after their first such flight.²¹⁴ The property owner must have first asked the pilot not to fly over the property, and then, once the drone pilot flies the drone over the property for a second time, the property owner can bring a trespass claim.²¹⁵ In such a case, prevailing plaintiffs can recover treble damages for any injuries to persons or property caused by the unwanted drone and, in some cases, can recover attorney fees.²¹⁶

B. LOCAL REGULATION

1. Community Regulation

In addition to statewide regulations, states often delegate regulation of local community activities.²¹⁷ Municipalities regulate many activities that impact landowners and neighbors, ranging from the lighting of fireworks²¹⁸ to the raising of backyard chickens.²¹⁹ “In early 2013, Charlottesville, Virginia became the first city to pass an anti-drone resolution. And [Texas] House Bill

²¹¹ *Id.*

²¹² CAL. PEN. CODE § 402 (West 2021).

²¹³ See OR. REV. STAT. § 837.380 (2013).

²¹⁴ *Id.* § 837.380(1)(a).

²¹⁵ *Id.* § 837.380(1)(b).

²¹⁶ *Id.* § 837.380(3)–(4).

²¹⁷ See, e.g., Richard Briffault, *Home Rule for the Twenty-First Century*, 36 URB. LAW. 253, 258–59 (2004) (“If all political decisions were centralized at the state level, it would be difficult to vary these policies to take into account varying local needs, circumstances, and preferences Home rule permits cities and suburbs, liberal communities and conservative communities, ethnically diverse and ethnically homogeneous settings, to adopt policies that reflect their differing values and conditions. It thus increases the likelihood that people will be happy with their government.”).

²¹⁸ See 7A EUGENE MCQUILLIN, THE LAW OF MUNICIPAL CORPORATIONS § 24:471 (3d ed. 2020) (“Fireworks ordinances enacted by municipalities are ordinarily sustained as a valid exercise of their police power.”) (footnote omitted).

²¹⁹ See Jaime Bouvier, *Illegal Fowl: A Survey of Municipal Laws Relating to Backyard Poultry and a Model Ordinance for Regulating City Chickens*, 42 ENV'T L. REP. NEWS & ANALYSIS 10888, 10903–17 (2012) (surveying residential chicken-raising ordinances in the 100 most populous United States cities and determining that backyard chicken raising is permitted under certain conditions in residential areas within most of the nation’s largest cities).

912, also known as the Texas Privacy Act, makes using drones for surveillance a crime.”²²⁰

In Honolulu, Hawaii, Skysign International, Inc. held an FAA waiver certificate permitting its helicopters to carry lighted advertising signs beneath their fuselages.²²¹ The federal certificate specifically provided that “the operator, by exercising the privilege of this waiver, understands all local laws and ordinances relating to aerial signs, and accepts responsibility for all actions and consequences associated with such operations.”²²² Both the city and county of Honolulu bar the use of an aircraft to display “any sign or advertising device.”²²³ According to the Ninth Circuit Court of Appeals, the Honolulu aerial signage ordinance specifically targeted navigable airspace as “an area where there has been a history of significant federal presence”²²⁴ Skysign tried to argue that the federal regulation of airspace preempted the state regulations, but because the certificate specifically referenced state and local law, that argument ultimately failed.²²⁵

Some states focus on the purpose of the drone flight rather than the flight itself. In Tennessee, for example, it is a crime to use “a drone with the intent to conduct video surveillance of private citizens who are lawfully hunting or fishing without obtaining the written consent of the persons being surveilled prior to conducting the surveillance.”²²⁶ Similarly, in Barstow, California, a UAS cannot be operated “in a manner that harasses, startles, or annoys pedestrians or vehicles”²²⁷

2. *Prevention of Drones*

In addition to possible civil liability for unwelcome drone usage, some landowners take matters into their own hands. For example, NASCAR did not want drones flying over the Texas World Speedway during a race in Fort Worth, Texas, so it contracted with DroneShield to track and interdict unauthorized

²²⁰ Sterbenz, *supra* note 20.

²²¹ *Skysign Int’l, Inc. v. City of Honolulu*, 276 F.3d 1109, 1113 (9th Cir. 2002).

²²² *Id.*

²²³ HONOLULU, HAW., REV. ORDINANCES ch. 40, art. 6, § 1(a) (2021).

²²⁴ *Skysign Int’l*, 276 F.3d at 1116 (quoting *United States v. Locke*, 529 U.S. 89, 108 (2000)).

²²⁵ *Id.* at 1114, 1118.

²²⁶ TENN. CODE ANN. § 70-4-302(a)(6) (West 2014).

²²⁷ BARSTOW, CAL., CODE OF ORDINANCES § 9.66.020(b) (2020).

drones.²²⁸ DroneShield claims that it coordinated with state and local Texas authorities to implement its solution to use a high-powered directional radio jammer called a “DroneGun” to protect the race.²²⁹ However, the Federal Communications Commission warned that “it is illegal to use a cell phone jammer or any other type of device that blocks, jams or interferes with authorized communications. This prohibition extends to every entity that does not hold a federal authorization, including state and local law enforcement agencies.”²³⁰ In addition to prohibiting signal jamming, additional legal issues are associated with attempts to intercept and disable an aircraft, including an unmanned aircraft. Section 32(a)(1) of Title 18 provides that “[w]hoever willfully . . . sets fire to, damages, destroys, disables, or wrecks any aircraft” is guilty of a federal felony.²³¹ That provision has not yet been used in the context of drones, but it could be applied in the future. Typically, drone countermeasures, including signal jammers, are only permitted to be used by the United States Department of Defense to protect military installations.²³²

Another form of drone defense is the drone catcher, invented by Mo Rastgaar, an associate professor of mechanical engineering at Michigan Technological University.²³³ His theory is that even if there is a legitimate security interest to disable a drone, like threatening a military installation or the White House, shooting the drone down could create additional problems.²³⁴ So, he devised a way to catch drones with nets and bring them safely to the ground.²³⁵

²²⁸ Turner & Baxenberg, *supra* note 126.

²²⁹ *Id.*

²³⁰ *Id.*; see also 47 U.S.C. § 333 (“No person shall willfully or maliciously interfere with or cause interference to any radio communications of any station licensed or authorized by or under this chapter or operated by the United States Government.”).

²³¹ 18 U.S.C. § 32(a)(1).

²³² Turner & Baxenberg, *supra* note 126.

²³³ Marcia Goodrich, *Drone Catcher: “Robotic Falcon” Can Capture, Retrieve Renegade Drones*, MICH. TECH. U. (Jan. 7, 2016, 10:17 AM), <https://www.mtu.edu/news/stories/2016/january/drone-catcher-robotic-falcon-can-capture-retrieve-renegade-drones.html> [<https://perma.cc/P4S2-W8R3>].

²³⁴ *Id.*

²³⁵ *Id.* (“What makes this unique is that the net is attached to our catcher, so you can retrieve the rogue drone or drop it in a designated, secure area . . . It’s like robotic falconry.”).

3. University Regulation

Some universities are prohibiting the use of drones on campus. For example, the University of Notre Dame's Standards of Conduct state that "[t]he University prohibits any student from using Unmanned Aerial Systems (UAS), or Drones, on campus."²³⁶ Similarly, Janielle Tchakerian, assistant vice president for student affairs at Saint Mary's College, IN, stated that "[s]ince Saint Mary's College is in the flight path to the South Bend airport, we wanted to inform our students that for the safety of the manned aircrafts flying above our campus that drones are prohibited."²³⁷

VII. CONCLUSION

No longer does the field of law enforcement rely solely on human cognition and capability. Police departments, fire departments, and search and rescue units use drones for public safety concerns.²³⁸ With the introduction of autonomous technology in the form of drones and patrol officers, the future remains unpredictable and riddled with danger. The safety hazards posed by faulty artificial intelligence software and hardware malfunction are too significant to ignore and may result in liability complications that have no legal precedent to guide them. It is only a matter of time until the absence of legislation in this field allows for devastating consequences, such as constitutional violations and physical injury. However, viable resolutions exist to help sift out potential threats posed by these devices and allow for stricter regulation, whether federal, state,

²³⁶ *Prohibition on Drones and Unmanned Aerial Systems*, U. NOTRE DAME, <https://dulac.nd.edu/community-standards/standards/drones/> [https://perma.cc/K4SN-52NA]; see also Ami Driscoll, *Stadium Policies*, U. NOTRE DAME (Oct. 29, 2016), <https://gameday.nd.edu/news/stadium-bag-policy/> [https://perma.cc/8JTU-CP5C] ("The Federal Aviation Administration (FAA) prohibits the operation of any UAS within a 5 mile radius of an airport. Given the University's proximity to the South Bend International Airport (SBN), any use of UAS on campus is strictly prohibited."). However, the University of Notre Dame Wireless Institute is working with the city of South Bend to test advanced wireless research using a drone. Erin Blasko, *South Bend and Notre Dame Demonstrate Next-Gen Wireless*, S. BEND TRIB. (Mar. 21, 2017), https://www.southbendtribune.com/news/local/south-bend-and-notre-dame-demonstrate-next-gen-wireless/article_cf50c778-c15c-5d41-91aa-c60b696d2872.html [https://perma.cc/BAW7-7MB8].

²³⁷ Nicole Caratas, *Saint Mary's Bans 'Hoverboards' and Drones*, OBSERVER (Jan. 15, 2016), <https://ndsmcobserver.com/2016/01/hoverboards-and-drones-banned-at-smc/> [https://perma.cc/VMM7-YTAV].

²³⁸ See Franzen, *supra* note 42; see also Nelson, *supra* note 42.

or local. Pilot programs and “partner in command” initiatives may create safer field testing and human override in tricky situations, which would allow the ever-growing artificial intelligence software of autonomous devices to develop a safe and reliable algorithm. Adopting either product liability or agency theory laws may enable future lawsuits to be readily guided by established legal doctrines and result in fair and predictable outcomes. Lastly, the proper care and precaution afforded to autonomous technology may undoubtedly be rewarded with higher law enforcement efficiency, safer communities, and saved lives.