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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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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

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\(^3\) 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-
Drones and Robots in Law Enforcement

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.

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\(^5\) 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.bcc.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 unpiloted aircraft, also known as an unmanned aerial vehicle (UAV). When expanded to include its remote controls, the ensemble is an unmanned aircraft system (UAS). There are two main classifications for drones in the United States: recreational drones (also known as “hobbyist” drones) and commercial drones.

“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.” Hobbyists may pay up to $500 for a UAS that includes the UAV, batteries, chargers, and the remote control. Sometimes, the control is by a smartphone app rather than a separate device. 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.” As the hobby interest in UAVs increases, prices could move toward $2,000 for more elaborate drones, which may include a camera. These better UAVs may be able to “remain airborne for [twenty-five] minutes with a range of half a mile.” Commercial users may pay $10,000 or more for UAVs that will stay airborne longer with an extended range and payload-carry-

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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.”)).


12 Id. at 4.

13 Id. at 5.

14 Id.

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

**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. Hobbyists and commercial operators often use drones for aerial photography purposes. Photography can range from families taking overhead pictures of a backyard barbecue 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. According to its owner, Joe Vaughn, his company’s focus is on commercial clients, which reduces potential privacy issues.

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

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16 Id.
17 Id. at 7 (“The drone, weighing less than an ounce, can hover silently for more than eight minutes . . . .”).
21 See id. (“If I were to point [a drone] at somebody’s window, I’d have to be within feet to see anything . . . .”).
require flight patterns through residential areas. In fact, on December 7, 2016, Amazon made its first commercial drone delivery. Google, UPS, FedEx, and various startups are also considering the possibilities of drone usage. 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. As such, meteorologists use drones to help predict severe weather. 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. Additionally, organizations are increasingly using drones to assist disaster management operations. For example, the American Red Cross has begun using drones to assist relief efforts after hurri-

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

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.” Zipline currently operates within the African nation of Rwanda, making 50 to 150 deliveries per day using fifteen UAVs. 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.” Interestingly, one of the poorest countries in the world 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. 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

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30 Morris, supra note 29.
31 See id.; see also Tomanelli, supra note 29.
35 Id.
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 lifeguards 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.


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.”).

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).
48 Id.
49 Id.
52 Id.
corn, $2.60 per acre for soybeans, and $2.30 per acre for wheat.53 Eventsually, 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:

56 Id.
58 Id.
59 Id.
Class A airspace is any airspace over 18,000 feet above mean sea level (MSL), and aircrafts 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.
above MSL.\textsuperscript{75} Much of New York City has Class B controlled airspace because there are three nearby airports—LaGuardia, JFK, and Newark.\textsuperscript{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.\textsuperscript{77} Waivers around Class D airports are helpful for the dozens of film, television, and news companies that want to use that airspace.\textsuperscript{78} Many open areas in the broad Los Angeles area, including downtown, are available for drone flights.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{84} However, since many recreational drones are less than 55 pounds and, thus, do

\begin{itemize}
  \item \textsuperscript{76} Id.
  \item \textsuperscript{78} Ringer, \textit{supra} note 75.
  \item \textsuperscript{79} Id.
  \item \textsuperscript{80} See id.
  \item \textsuperscript{81} Id.
  \item \textsuperscript{82} FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 332(a)(3), 126 Stat. 11, 73.
  \item \textsuperscript{83} See FAA DroneZone, https://faadronezone.faa.gov/#/ [https://perma.cc/Z3MX-REKQ].
  \item \textsuperscript{84} Fed. Aviation Admin., \textit{supra} note 1, at 40–41.
\end{itemize}
not meet the registration requirement, 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. This figure takes into account all recreational drones, no matter the size. The CTA also estimates that recreational drone sales could increase to 29 million by 2021.

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. 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. 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.”

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. The regulations state that commercial drones:

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

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86 See id.
87 See id.
88 Id.
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;\textsuperscript{94}
• Cannot be operated from a moving aircraft;\textsuperscript{95}
• Cannot be operated from a moving vehicle unless it is being operated over sparsely populated areas;\textsuperscript{96}
• Can only be operated when weather visibility is at least three miles from the control station;\textsuperscript{97}
• Can be operated in Class B, C, D, and E airspaces, with ATC permission;\textsuperscript{98}
• Can be operated in a Class G airspace even without ATC permission;\textsuperscript{99} and
• Must remain in the Visual-Line-Of-Sight, while in operation.\textsuperscript{100}

Commercial drone operators may request a waiver from the restrictions listed above.\textsuperscript{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.”\textsuperscript{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.\textsuperscript{103} Like recreational drones over 0.55 pounds, every commercial drone must be registered with

\textsuperscript{94} Id. § 107.51.
\textsuperscript{95} Id. § 107.25.
\textsuperscript{96} Id.
\textsuperscript{97} Id. § 107.51.
\textsuperscript{98} Id. § 107.41.
\textsuperscript{99} FED. AVIATION ADMIN., supra note 61, at 15-3.
\textsuperscript{100} 14 C.F.R. § 107.31.
the FAA and have a unique registration number. 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. 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. For comparison, Business Insider (BI) Intelligence estimated commercial drone shipments in 2016 at 102,600, nearly double the FAA’s estimate. BI Intelligence also estimates that by 2021, the number of commercial drone shipments will increase by 51% to 805,000. The challenge, then, is regulating airspace in a manner that will permit the use of drones without interfering with landowners’ property rights.

E. Line of Sight Restrictions

According to the FAA, drones must be operated within a user’s visual line of sight (VLOS). 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. 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.

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.
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. 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. 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.

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. Remote observers of the UAV relay important flight information to the PIC via radio or other communication. Pilots wishing to operate a drone EVLOS must obtain a waiver from the FAA regulation.

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. Six simultaneously operating drones tested the “unmanned aircraft systems Air Traffic Management” software (UTM), which simulated package pick-up and drop-off. UTM makes adjustments to the drones’ flight paths as they fly without requiring pilot action. No-fly zones, such as airports, could be added to the UTM so that the

115 Fed. Aviation Admin., supra note 103.
117 Id. at 1–2.
120 Id.
121 Id.
software would know what areas the drones should avoid. 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. 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. 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. An anti-hacking system to prevent such signal interception is an additional recommended requirement.

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. 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.
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 . . . .”).
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.\textsuperscript{128} As of June 2021, “LAANC is available at 541 LAANC Enabled Facilities and 732 Airports.”\textsuperscript{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.”\textsuperscript{130} While LAANC provides more access to airspace, it is not an unmanned traffic management system, and it is not intended to be.\textsuperscript{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,\textsuperscript{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,\textsuperscript{133} camera-embedded bulletproof vests and eyewear,\textsuperscript{134} and handheld laser

\textsuperscript{128} Wilson, supra note 102.


\textsuperscript{130} Wilson, supra note 102.

\textsuperscript{131} See id.


spectroscopes used to identify chemical compounds of illicit drugs—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, 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. 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. 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. With officers at the helm of these supplemental technologies, any wrongful actions can be held against the officer or agencies responsible. Contrastingly, the current technologies law enforcement agencies are adopting throughout the country, including drones and robotic patrol officers, introduce the characteristic of autonomy, or “the abil-

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138 Patrick McGee & Kiran Stacey, California Police to Use Drones to Patrol Coronavirus Lockdown, Fin. Times (Mar. 20, 2020), https://www.ft.com/content/c7d0dec1-6125-475e-9cc7-78f4671d7ce8 [https://perma.cc/DT9Y-3SKY].
140 Id.
ity to act and make decisions without being controlled by anyone.”

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. 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.

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. Now serving domestically in forces such as California’s Huntington Park Police Department and the North Central Texas College Police, each autonomous patrol officer model in the Knightforce “K” line deploys with knowledge-expanding artifi-
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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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

\textsuperscript{148} Paul Marrinan, \textit{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/V59V-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 effective created by closed-circuit television. \textit{Id.}

\textsuperscript{149} \textit{Id.}

\textsuperscript{150} \textit{Id.}

\textsuperscript{151} Elizabeth E. Joh, \textit{Policing Police Robots}, 64 UCLA L. REV. DISCOURSE 516, 520–21 (2016).

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, 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, collided with cyclists, and even sliced the tips of noses off. 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. Given the early stages of using autonomous drones in non-military settings, the possibility of these machines causing harm to civilians becomes strikingly evident. On the same face, robotic officers pose similar threats as drones.

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

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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. 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.”

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. 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. 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. 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. “NEGLIGENCE” 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.” Additionally, even if it is determined that autonomous devices

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161 Id.
162 Flaherty, supra note 146.
163 Id.
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.”).


stitional or civil rights of an individual. 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.

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. 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. 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. 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.’” 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. Nonetheless, the possibility of these weaponized officers remains open, and despite DODD 3000.09 requiring final human

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169 See id.
170 Joh, supra note 151, at 534–35, 538.
174 Id.
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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.


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


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. 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.

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.” 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


182 Id.

distributing a faulty product. 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.”

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. 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. 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. 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.”).


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
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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.” However, there is some concern about state regulations attempting to dilute federal regulations, particularly Part 107.

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. Regulation of airspace below navigable airspace should belong to states because state tort law is implicated in such instances. States regulate drivers’ licenses, so why not regulate drone licenses? While the FAA may regulate airspace, state and local governments have some power to regulate the use of airspace and, therefore, the use of that airspace by drones. 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.”


Chiem, supra note 37.

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.”).


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

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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=LMD3rXURITw [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].


²⁰⁵ Id.
Connecticut law prohibiting the remote control of a deadly weapon.\textsuperscript{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.”\textsuperscript{207} In September 2015—following several incidents between firefighters and drones—California state legislators passed a bill\textsuperscript{208} “grant[ing] immunity to emergency responders who damage a drone that gets in their way.”\textsuperscript{209} In one case, a drone interfered with helicopters fighting a major fire in Northern California, which caused a ten-minute delay.\textsuperscript{210} The drone pilot was given a citation, but he commented that he did not know that flying his

\textsuperscript{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).

\textsuperscript{207} CAL. CIV. CODE § 659 (West 2021).

\textsuperscript{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.”).

\textsuperscript{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).

\textsuperscript{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. In California, such interference is a misdemeanor.

In 2013, Oregon was one of the early states to enact a statute creating a civil claim for drone trespass. 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. 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. 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.

B. Local Regulation

1. Community Regulation

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

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211 Id.
212 CAL. PEN. CODE § 402 (West 2021).
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. L. 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.\textsuperscript{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.\textsuperscript{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.”\textsuperscript{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.\textsuperscript{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.\textsuperscript{232}

Another form of drone defense is the drone catcher, invented by Mo Rastgaar, an associate professor of mechanical engineering at Michigan Technological University.\textsuperscript{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.\textsuperscript{234} So, he devised a way to catch drones with nets and bring them safely to the ground.\textsuperscript{235}

\textsuperscript{228} Turner & Baxenberg, supra note 126.

\textsuperscript{229} Id.

\textsuperscript{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.”).

\textsuperscript{231} 18 U.S.C. § 32(a)(1).

\textsuperscript{232} Turner & Baxenberg, supra note 126.


\textsuperscript{234} Id.

\textsuperscript{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,
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.