

Municipal Drone Policy

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This paper explores municipal regulatory and policy approaches for Unmanned Aerial Systems (UAS), commonly known as drones. The paper first articulates legal considerations surrounding municipal regulation of commercial and recreational drone use and then discusses the legal issues implicated by municipal drone use.

Consumer drones are a relatively new technology with many applications for hobbyists, businesses, researchers and governments. However, some citizens and communities are concerned drone usage may be disruptive and intrusive. Tort laws such as nuisance and trespassing may provide citizens a remedy against invasive drone use. In addition, municipalities may contemplate local drone regulations to address community concerns.

Many potential municipal UAS regulations will likely be preempted by the federal government's authority over airspace and aviation regulations. Importantly, municipal drone regulations that target hobbyist use are less likely to be preempted in contrast to regulations that target commercial, or non-hobbyist use, which is subject to more federal regulation.

Municipal UAS regulations tied closely to traditional local police powers, such as UAS voyeurism prohibitions, present the least risk of being federally preempted. On the other hand, municipal UAS operational regulations that impact airspace use or aviation safety, such as a citywide drone ban, are more likely to be federally preempted. In between these ends of the spectrum, municipal UAS regulations pose varying risks of preemption.

Municipalities may be able to control recreational drone use by zoning the areas where hobbyists drone users can take off and land their craft. These regulations are not at great risk of preemption because they are connected to land use, a traditionally local power, and do not significantly impact airspace use. However, these zoned takeoff and landing areas may not be applicable to commercial drone use because 1) such zoning would severely limit commercial drone use applications and 2) commercial drone use is subject to more Federal Aviation Administration (FAA) regulation than

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hobbyist use. In addition, drone landing and takeoff zones should not be so restrictive as to effectively prevent hobbyist use.

At more risk of preemption, municipalities may enact prohibitions of low level drone flight immediately above property. The authority to enact this regulation would derive from an old Supreme Court case which held property owners have rights to their immediate airspace, therefore limiting federal authority over this airspace. However, such a regulation may impact drone applications, raising the risk of preemption. To increase effectiveness, this approach could allow for certain commercial UAS uses.

Some more legally conservative municipal UAS approaches include waiting for federal UAS law developments or amending existing ordinances, such as trespassing, to capture intrusive UAS conduct.

Apart from regulating private UAS use, some municipal governments may use drones in municipal work. These potential use cases include firefighting, mapping and surveying, assisting law enforcement, and search and rescue among others. However, municipal UAS use is likely to raise privacy concerns among citizens. Therefore, municipal UAS use should abide by public records requirements and the Fourth Amendment.

Subject to some privacy-related exceptions, flight data and footage collected from government use of UAS may be subject to state public records laws. Therefore, municipal UAS policies should develop IT infrastructure to handle UAS data as well as retention policies to comply with public records requests.

Municipal UAS surveillance must not violate the Fourth Amendment's prohibition against unreasonable searches. The existing case law on aerial surveillance holds generally that warrantless aerial searches that do not disturb property use are not unreasonable under the Fourth Amendment. However, the legality of UAS aggregate and close-range aerial surveillance searches is an unsettled question. Thus, municipalities should account for potential legal development and constituent concerns in adopting UAS use procedures.

As illustrated by this brief discussion, municipal UAS policy raises difficult questions. This paper aims to realistically articulate the relevant considerations on each side of the issue rather than advocating for a specific result.

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I. Private Citizen and Business Use of UAS

Drones offer a variety of recreational and commercial applications, including filmmaking, drone racing, surveying, and perhaps in the near future, package delivery. However, some are concerned that UAS technology will promote undesirable and illegal behavior, such as enabling invasion of privacy. Others are worried that drones may interfere with the character of a community or disrupt wildlife. Given the variety of drone uses and concomitant concerns, municipalities may contemplate drone regulations.

However, many municipal drone regulations, particularly those that regulate drone operation, may be federally preempted. Valid municipal UAS regulations must also survive state preemption. In addition, the Dormant Commerce Clause may restrict municipal drone regulations, especially if commercial drone use proliferates. Last, the First Amendment's right to record could affect the enforceability of municipal "no-drone" zones.

A. Specific Private Users and Uses

Drones, used by hobbyists, businesses and researchers, are growing in popularity.¹ In 2016, the FAA estimated combined hobbyist and commercial sales to increase from 2.5 million in 2016 to 7 million in 2020.² The expected increase in drone sales is in part driven by drones' diverse uses. Hobbyists enjoy interacting with the new technology, businesses use drones in a variety of commercial applications, and researchers employ drones in data gathering missions.

Currently, hobbyists are required to register their drone with the FAA and must fly under the Special Rule for Model Aircraft, which imposes some operational guidelines, including a visual line-of-sight requirement.³

Regulations on non-hobbyist UAS use are more extensive. Among other constraints, the FAA requires drones used in commercial or research operations to be flown during the day within line-of-sight of a certified remote pilot.⁴ Users can request, but might not receive, a waiver to many of these Part 107 provisions.⁵ However, enforcement of these rules is lax.⁶ In the future, technological

¹ FAA, FAA Releases 2016 to 2036 Aerospace Forecast, <https://www.faa.gov/news/updates/?newsId=85227> (last visited Apr. 14, 2018).

² *Id.*

³ FAA, Fly under the Special Rule for Model Aircraft, https://www.faa.gov/uas/getting_started/model_aircraft/ (last visited Apr. 5, 2018).

⁴ FAA, Fact Sheet – Small Unmanned Aircraft Regulations (Part 107), https://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=20516 (last visited Apr. 5, 2018).

⁵ FAA., Request a Part 107 Waiver or Operation in Controlled Airspace, https://www.faa.gov/uas/request_waiver/ (last visited Apr. 5, 2018).

⁶ Sally French, *Exclusive: Only One Drone Pilot Has Ever Been Busted for Flying Without a License — and He Got a Warning*, MarketWatch, <https://www.marketwatch.com/story/exclusive-only-one-drone-pilot-has-ever-been-busted-for-flying-without-a-license-he-got-a-warning-2018-02-08> (last visited Apr. 5, 2018).

improvements and increased pressure from companies such as Amazon may lead to FAA changes allowing for long-distance and completely automated commercial drone applications.

1. Hobbyists

Drones can vary significantly in price and available features. Retailers such as Walmart and Amazon market tiny quadcopters which lack a camera and have limited signal range and battery life as high-tech toys.⁷ Other more expensive drones, like DJI's Phantom 4, boast a greater range of features including automatic pitch stabilization, high resolution 4K video, 30 minutes of battery life, and a 3 mile signal range.⁸

These advanced drones allow users to produce aerial footage, often used in landscape or sports videography.⁹ Drone filming technology can also automatically track and film an individual at high speeds, a popular application for action sport films such as ski videos.¹⁰

Other recreationalists are more excited by drones' flight capabilities than videography. Drones are often flown by an operator within her visual line of sight. However, drone-mounted cameras can live-stream video to a receiving headset, virtually transporting the headset-wearing operator into the "cockpit" of the drone.¹¹ Indeed, drone flying can progress from hobby to profession.¹² In the Drone Racing League, televised on ESPN, pilots wearing these headsets race drones through various courses around the world for prize money.¹³ Drone racing is growing in popularity and hobbyists are beginning to form clubs and set up their own courses.¹⁴

These hobbyists are primarily concerned that drone regulations do not burden their drone use.

2. Commercial

Various commercial sectors are invested in drone technology. Some companies develop and manufacture UAS. Other companies use drones to market their services, gather data, and improve efficiency, among other applications.

⁷ Amazon, <https://www.amazon.com/Hobby-RC-Quadcopters-Multirotors/b?ie=UTF8&node=11608080011> (last visited Dec. 3, 2017).

⁸ DJI, <http://www.dji.com/phantom-4/info#specs> (last visited Dec. 3, 2017).

⁹ For some examples see: <https://www.youtube.com/watch?v=VYQx6OsNbto>

¹⁰ *Seven Best Follow You Drones*, Drone Enthusiast, <https://www.dronethusiast.com/drones-that-follow-you/> (last visited Dec. 3, 2017); Joe Mahon, *The 'poor man's selfie drone' could be the future of ski videos*, The Telegraph (May 10, 2017), <http://www.telegraph.co.uk/travel/ski/articles/poor-mans-selfie-drone-nicolas-vuignier-skiing-video/>.

¹¹ Christie Sounart, *Drone Racer*, <https://www.colorado.edu/coloradan/2018/03/01/drone-racer> (last visited Apr. 5, 2018).

¹² *Id.*

¹³ The Drone Racing League, <https://thedroneracingleague.com> (last visited Dec. 3, 2017).

¹⁴ Propwashed, <https://www.propwashed.com/category/community> (last visited Dec. 3, 2017).

UAS Technology Manufacturers. Consumer drone sales have proliferated in the US in recent years.¹⁵ Many of the largest consumer drone manufacturers, including the market leader DJI, are based in China, or other foreign countries.¹⁶ Given DJI's dominance, some American drone manufacturers such as 3D Robotics, have transitioned to developing drone software that can be used in surveying and other applications.¹⁷ Other American manufacturers such as GoPro or Black Swift Technologies, based in Boulder, seek to tap into the expanding drone market.¹⁸ Some drone manufacturers express concerns that municipal drone use regulations may burden drone users and therefore hurt drone sales.

The military is also developing drone technology that can be potentially used in non-militarized applications. For example, the LightningStrike (XV-21A), an experimental unmanned aircraft capable of high speeds and vertical take-off and landing, is designed to be used for resupply missions and casualty evacuation.¹⁹ If the LightningStrike were sold domestically, these capabilities could benefit police, fire, and search and rescue units. Therefore, drone manufacturers who contract with the government may also benefit from consistent and limited regulations if these drones become commercialized.

Commercial Use: UAS technology is projected to be increasingly used in commercial applications.²⁰ Currently, companies use UAS for photography and videography, surveying and monitoring, research and data collection, delivery and distribution systems, and other commercial purposes.

UAS are often used in photography and videography. Filmmakers use drones to capture unique perspectives, as evidenced by the winning submissions to the Los Angeles Drone Film Festival, one of many drone film festivals that have emerged in recent years.²¹ Wedding photographers may

¹⁵ Consumer Technology Association, *Sales of Consumer Drones to Dealers in the United States from 2013 to 2017 (in Million U.S. dollars)*, Statista, <https://www.statista.com/statistics/641932/us-consumer-drones-wholesale-sales/> (last visited Apr. 5, 2018).

¹⁶ April Glaser, *DJI is Running Away with the Drone Market*, Recode (Apr 14, 2017), <https://www.recode.net/2017/4/14/14690576/drone-market-share-growth-charts-dji-forecast>.

¹⁷ The Economist, *Commercial Drones Are the Fastest-Growing Part of the Market*, (June 10, 2017), <https://www.economist.com/news/technology-quarterly/21723003-most-drones-today-are-either-cheap-toys-or-expensive-weapons-interesting>.

¹⁸ Black Swift Technologies, <http://blackswifttech.com> (last visited Dec. 3, 2017).

¹⁹ Aurora Flight Sciences, *XV-24A LightningStrike*, <http://www.aurora.aero/lightningstrike/> (last visited Apr. 14, 2018).

²⁰ Tractica, *Projected Commercial Drone Revenue in North America from 2015 to 2025 (in million U.S. dollars)*, Statista, <https://www.statista.com/statistics/607769/commercial-drone-market-revenue-in-north-america-projection/> (last visited Apr. 5, 2018).

²¹ Loz Blain, *LA Drone Film Festival Winners Raise the Bar for Drone Cinematography*, New Atlas (Feb. 6, 2018), <https://newatlas.com/la-drone-film-festival-winners/53290/>; Garry Maddox, *Extreme Skiers, Landscapes and Superman: A festival Just for Drone Films*, Sydney Morning Herald (July 23, 2017),

market their services with UAS footage.²² Similarly, realtors may use drone footage or stills to showcase a property and enhance their listings.²³

Other industries use UAS to aerially capture visual and other forms of data. Drones can collect data that is used by surveyors and cartographers to determine break lines, reference points, digital elevation models, and contour lines.²⁴ Similarly, property inspectors may use drones to assist with roof and structural inspections.²⁵

Drones also may prove useful in agriculture. For example, Boulder tech start-up Agribotix loads specialized software and cameras onto drones to collect crop data.²⁶ Another startup, DroneSeed, employs drones to plant tree seeds in commercial forestry operations.²⁷ The company received an FAA Part 107 waiver to use drone swarms (multiple drones piloted by the same operator) and an exemption to spray agricultural substances.²⁸

Drones may also be used to monitor large-scale infrastructure such as oil and gas pipelines, powerlines, wind farms, and gas fracking operations.²⁹ This monitoring function can extend to security operations where drones can be used to detect, record, and discourage trespassers.³⁰ While current FAA rules limit long distance drone usage, some large-scale utility inspection, such as at windfarms, can be performed under current law. Other drone applications that may not be currently allowed by the FAA, such as long-distance oil pipeline inspection, may be performed more efficiently by drone than by manned aircraft or ground vehicles.³¹

<https://www.smh.com.au/entertainment/movies/extreme-skiers-landscapes-and-superman-a-festival-just-for-drone-films-20170721-gxg8h6.html>.

²² Maggie Seaver, *Everything You Need to Know About Hiring a Drone for Your Wedding*, The Knot <https://www.theknot.com/content/drone-wedding-photography> (last visited Apr. 3, 2018).

²³ Andrew Nixon, *Fly It, or Buy It? The Complete Guide to Using Camera Drones for Real Estate Marketing*, Best Drone For The Job (Oct. 1, 2017), <https://bestdroneforthejob.com/drone-buying-guides/fly-it-or-buy-it-the-complete-guide-to-using-camera-drones-for-real-estate-marketing/>.

²⁴ SenseFly, <https://www.sensefly.com/applications/surveying.html> (last visited Dec. 3, 2017).

²⁵ ABJDrones, <https://abjdrones.com/drone-roof-inspection-services/> (last visited Apr. 5, 2018).

²⁶ Agribotix, <https://agribotix.com/> (last visited Dec. 3, 2017).

²⁷ DroneSeed, <https://www.droneSeed.co/> (last visited Apr. 5, 2018).

²⁸ *DroneSeed Receives the First FAA Approval for Using Drone Swarming to Deliver Agricultural Payloads*, PRUnderground (May 16, 2017), <http://www.prunderground.com/droneSeed-receives-the-first-faa-approval-for-using-drone-swarming-to-deliver-agricultural-payloads/0093291/>.

²⁹ Adi Gaskell, *Using Drones to Monitor Oil Pipelines*, Huffington Post (June 8, 2017), https://www.huffingtonpost.com/entry/using-drones-to-monitor-oil-pipelines_us_59390907e4b014ae8c69ddd4.

³⁰ Tom Simonite, *Drone Security Guard Scolds Intruders from the Sky*, MIT Technology Review (Sept. 20, 2016), <https://www.technologyreview.com/s/602412/drone-security-guard-scolds-intruders-from-the-sky/?set=602416>.

³¹ Gaskell, *supra* note 29, at 8.

Package delivery, another salient commercial drone operation, is currently illegal in the United States. However, companies such as Amazon have publicized their intention to perform package delivery via UAS when FAA regulations and technological restrictions are eliminated.³²

3. Research

Drone technology also provides many uses for scientific researchers. For example, the IRISS (Integrated Remote and In Situ Sensing) program at the University of Colorado Boulder uses drones in several fields including atmospheric and environmental science, robotics, and aerospace engineering.³³

Wildlife conservationists find drones valuable in tracking and protecting threatened species particularly in remote areas.³⁴ Whale researchers have used a drone dubbed the SnotBot to capture blowhole spray used in monitoring the whales' health.³⁵ Engineering students at the University of Colorado have developed a drone they hope to use to research sperm whale vocalizations.³⁶ In the Serengeti, drones monitor for potential poaching, reducing the need for resource intensive ground-based searches.³⁷

Researchers are concerned that regulations may burden their work. For example, limits on flight distances or duration, expensive licensing requirements, or a patchwork of varying regulations would interfere with drone research applications. On the other hand, some wildlife researchers advocate for regulations that limit UAS interference with wildlife.³⁸

B. Concerns about Objectionable UAS Uses from Citizen Stakeholders

Invasive UAS use may harm people, wildlife, and communities.

³² Amazon, <https://www.amazon.com/Amazon-Prime-Air/b?node=8037720011> (last visited Dec. 3, 2017).

³³ Integrated Remote and In Situ Sensing, University of Colorado, <https://www.colorado.edu/iriss> (last visited Dec. 3, 2017).

³⁴ Kate Baggaley, *Drones Are Setting Their Sights on Wildlife*, Popular Science (Feb. 10, 2017), <https://www.popsci.com/drones-wildlife-biology-animal-research.>; Julie Linchant et al., *Are Unmanned Aircraft Systems (UASs) the Future of Wildlife Monitoring? A Review of Accomplishments and Challenges*, Mammal Review, October 2015, at 239.

³⁵ Iain Kerr, *SnotBot Alaska Expedition, Dispatch #5 – SnotBot Has a Brother*, Ocean Alliance News (Sept. 11, 2016), <https://www.whale.org/fresh-news/page/2/>.

³⁶ *How a CU Boulder Drone Will Track and Crack Hidden Language of Sperm Whales*, University of Colorado (Feb. 14, 2018), <https://www.colorado.edu/aerospace/2018/02/14/how-cu-boulder-drone-will-track-and-crack-hidden-language-sperm-whales>.

³⁷ Sally French, *Tanzania is Using Drones to Protect the Serengeti from Poaching*, The Drone Girl (Oct. 8, 2017), <http://thedronegirl.com/2017/10/08/tanzania-bathawk-recon/>.

³⁸ Margarita Mulero-Pázmány et al., *Unmanned aircraft systems as a new source of disturbance for wildlife: A systematic review*, PLoS ONE, <https://doi.org/10.1371/journal.pone.0178448>.

1. Nuisance

The noise produced by drones along with their potentially jarring visual presence may irritate some people and disturb communities. Indeed, one Colorado town proposed issuing hunting permits for residents to shoot down UAVs, but ultimately did not issue the licenses in part due to FAA intervention³⁹ The tort of nuisance, various local ordinances, and social norms may provide some protection against intrusive drone usage.

Material annoyances sufficient to impose damages may qualify as a nuisance.⁴⁰ However the level of material annoyance sufficient for nuisance differs between jurisdictions, ranging from a substantial impairment of another's right to peacefully enjoy their property to disturbance of another's peaceful property use.⁴¹ Under this varied framework, loud, consistent drone usage that impacts another's property use may qualify as a nuisance.⁴²

Drones are loud. DJI's drones operate between 75-80 decibels (dB), approximately the same volume as a full volume telephone ring or the sound of traffic from inside a vehicle.⁴³ As a further comparison, the U.S. Department of Housing and Urban Development requires special permitting for projects that will add more than 65 dB of noise to the environment, suggesting that the 75 dB produced by some drones is not insignificant.⁴⁴

To combat these noise concerns, municipalities may enact content-neutral noise regulations. However, noise ordinances that target drone usage would likely be preempted by the FAA's airspace authority, because such an ordinance would impact use of the airspace.

Besides these legal frameworks, social norms may mitigate against loud and intrusive drone usage in quiet neighborhoods, parks, and other areas.

2. Trespassing

Low-flying drone usage can also upset property owners. In 2015, a Kentucky man shot down a drone he believed to be flying over his property.⁴⁵ The drone operator brought suit in a federal

³⁹ Kathy Steinmetz, *Colorado Town Won't Issue Drone-Hunting Licenses*, Time (Apr. 2, 2014), <http://time.com/46327/drone-hunting-deer-trail/>.

⁴⁰ Paul M. Coltoff et al., Definition of Nuisance, Generally, 58 Am. Jur. 2d Nuisances § 1 (2018).

⁴¹ *Id.*

⁴² Beth Bates Holliday, Cause of Action for Private Nuisance Caused by Noise, Light, or Odors Emanating from Neighboring Property, 26 Causes of Action 2d 277 (2018).

⁴³ Tim Levin, *How Loud Is Your Drone? -The Drone Noise Test Of P2, P3P, P4P, I2...*, WeTalkUAV (Feb. 18, 2017), <https://www.wetalkuav.com/dji-drone-noise-test/>.

⁴⁴ 24 C.F.R. § 51.103.

⁴⁵ Cyrus Farivar, *Judge Rules in favor of "Drone Slayer," dismisses lawsuit filed by pilot*, ArsTechnica (Mar. 24, 2017), <https://arstechnica.com/tech-policy/2017/03/judge-rules-in-favor-of-drone-slayer-dismisses-lawsuit-filed-by-pilot/>.

court. The court, which may have ruled the drone was trespassing, instead dismissed the case for lack of jurisdiction.⁴⁶

Low-flying drone usage may amount to trespassing when operated above another's property. In *U.S. v. Causby*, decided in 1946, the Supreme Court held a farmer had property rights in the superadjacent airspace immediately above his property.⁴⁷ Based on this holding, the Court ruled the farmer's property rights were taken by military airplane flights 83 feet overhead that literally frightened the farmer's chickens to death.⁴⁸ Without these superadjacent airspace rights, the Court reasoned a property owner could not plant trees or even build fences.⁴⁹

However, the extent of a property owner's superadjacent airspace rights is uncertain. *Causby* arguably can be viewed as establishing private airspace rights up to at least 83 feet above private property. Courts may also interpret *Causby* as establishing superadjacent airspace rights against material disturbances, without regard to height above ground.

No matter their extent, property owners' superadjacent airspace rights are important in developing UAS policy. For example, UAS aviation easements may be necessary to effectuate low-flying drone delivery.⁵⁰ This private airspace right may also limit the FAA's authority over low-lying airspace, allowing for some municipal regulation of this low-lying airspace.

3. Invasion of Privacy

Drones' aerial capabilities raise real concerns about invasion of privacy and voyeurism. A Utah couple was charged with voyeurism for using a drone to record people in their bathrooms and bedrooms.⁵¹ "Drone voyeurism" and "drone peeping tom" are terms frequently discussed in media and online forums.⁵² While drone voyeurism may be captured under existing voyeurism statutes, municipalities may wish to enact drone voyeurism regulations to address citizen concerns.⁵³

⁴⁶ *Boggs v. Merideth*, No. 3:16-cv-00006-TBR, 2017 WL 1088093, at *1 (W.D. Ky. Mar. 21, 2017).

⁴⁷ 328 U.S. 256, 264 (1946).

⁴⁸ *Id.*

⁴⁹ *Id.*

⁵⁰ Chase D. Perkins et al., *Creating a Drone Superhighway Using the Blockchain*, AERO Token, 15-21 (2017), <https://aerotoken.com/aero-white-paper.pdf>; (Of course, if drone delivery mechanisms operated primarily above streets, trespassing would be minimized.)

⁵¹ Mary Papenfuss, *Utah Couple Arrested Over 'Peeping Tom' Drone*, Huffington Post (Feb. 17, 2017), <http://www.nydailynews.com/news/crime/couple-charged-voyeurism-recording-people-drone-article-1.2974236>.

⁵² Nick Bilton, *When Your Neighbor's Drone Pays an Unwelcome Visit*, N.Y. Times (Jan. 27, 2016), <https://www.entitymag.com/drones-peeping-toms-women-should-watch-for/>.

⁵³ See Discussion on page 37 on how people are concerned governmental drone use and surveillance might invade their privacy.

4. Disturbing Wildlife and Impacting Natural Areas

Drones may harm wildlife and disturb people who seek peace and quiet in natural habitats. Studies have shown that drones raise stress in animals even if the animals are exposed regularly to traffic, farming equipment, and other human activity.⁵⁴ This drone-induced anxiety can affect breeding and other behaviors.⁵⁵ In one instance, a low-flying drone scattered bighorn sheep, separating young from the adults.⁵⁶

In response to wildlife dangers and nuisance complaints, many governmental entities have adopted UAS bans for pristine areas. For example, the U.S. National Parks Service has banned drones from all national parks.⁵⁷ Boulder, Colorado has also adopted a take-off, landing, and operation ban in its Open Space and Mountain Parks.⁵⁸

5. Civilian Self-Help

People irritated by perceived intrusive drone use may attempt to disable drones through firearms, drone jammers, and other techniques.

As indicated in the trespassing section, some citizens have discharged firearms at drones.⁵⁹ In response, the FAA has confirmed that firing at a UAS is a felony because drones qualify as aircraft and firing at an aircraft is a felony under federal law.⁶⁰ To date, however, there have been no federal criminal prosecutions for discharging a weapon at a UAS.⁶¹

⁵⁴ Jennifer S. Holland, *How Drones Are Affecting Wildlife in Surprising Ways*, Nat'l Geographic (Aug. 25, 2015), <https://news.nationalgeographic.com/2015/08/150825-drones-animals-wildlife-bears-science-technology/>.

⁵⁵ *Id.*

⁵⁶ *Drone Harasses Bighorn Sheep at Zion National Park*, National Parks Service, <https://www.nps.gov/zion/learn/news/droneharassesbhs.htm> (last visited Apr. 7, 2018).

⁵⁷ *Unmanned Aircraft in the National Parks*, National Parks Service, <https://www.nps.gov/articles/unmanned-aircraft-in-the-national-parks.htm> (last visited Dec. 4, 2017).

⁵⁸ *Unmanned Aircraft System (Drone) Regulations*, City of Boulder Colorado, <https://bouldercolorado.gov/airport/drone-regulations> (last visited Dec. 4, 2017).

⁵⁹ Kelsey D. Atherton, *It Is A Federal Crime To Shoot Down A Drone, Says FAA*, Popular Sci., (Apr. 15, 2016), <https://www.popsci.com/it-is-federal-crime-to-shoot-down-drone-says-faa>.

⁶⁰ 18 U.S.C. § 32; John Goglia, *FAA Confirms Shooting A Drone Is A Federal Crime. So When Will U.S. Prosecute?*, Forbes (Apr. 13, 2016 12:55 PM) <https://www.forbes.com/sites/johngoglia/2016/04/13/faa-confirms-shooting-drone-federal-crime-so-when-will-us-prosecute/#2db619de2a25>.

⁶¹ Jamie Nafziger, *To Shoot or Not to Shoot? The Legality of Downing a Drone*, Dorsey & Whitney, (Sep. 27, 2017) <https://www.dorsey.com/newsresources/publications/client-alerts/2017/09/the-legality-of-downing-a-drone>.

Since drones are radio controlled devices, some people also “jam” UAS through interfering frequencies to disable the drone. Citizen drone “jamming” is likely unlawful and raises many legal and policy implications beyond the scope of this paper.⁶² However, despite their only uses being illegal, drone jammers can be bought online.⁶³ Anticipating UAS jamming issues, Amazon received a patent in 2016 that would allow its prototype drone delivery system to circumvent jamming techniques.⁶⁴

Despite these limits on self-help, FAA’s registration requirement for both hobbyist and commercial drones may help identify negligent drone operators if, for example, their drone crashes.

6. Governmental Self-Help

Municipalities may be able to disable drones flying illegally near wildfires or other emergency situations.⁶⁵ Recognizing the potential impact of recreational drone use on sensitive military operations, military drone jamming has been authorized by Congress.⁶⁶ Local law enforcement may also wish to receive an exemption to legally employ drone jamming to prevent civilian drone use from interfering with sensitive governmental operations. Recently, a police department in San Diego County bought a drone jammer to disable civilian drone operations near wildfires.⁶⁷ However, drone jamming without specific congressional permission is likely illegal.⁶⁸ Therefore is not clear whether municipalities can legally use drone jammers to counteract illegal civilian drone operations.

To summarize, social norms, torts, and, within pristine areas, drone bans, can mitigate against intrusive drone use. However, to further define the parameters of acceptable drone usage, a municipality may enact UAS ordinances.

⁶² Jonathan Rupprecht, *7 Big Problems with Counter Drone Technology (Drone Jammers, Anti Drone Guns, Etc.)*, Rupprecht Law: Drone Law Blog, <https://jrupprechtlaw.com/drone-jammer-gun-defender-legal-problems> (last visited Apr. 3, 2018).

⁶³ Drone Jammers, Jammers4U, <http://jammers4u.com/drones-jammer>.

⁶⁴ Jeff Daniels, *Amazon Gets US Patent for 'Countermeasures' to Protect Drone Delivery*, CNBC, (Dec. 22, 2016) <https://www.cnbc.com/2016/12/21/amazon-gets-us-patent-for-countermeasures-to-protect-drone-delivery.html>.

⁶⁵ 49 U.S.C. § 46320.

⁶⁶ National Defense Authorization Act for Fiscal Year 2017, Pub. L. No. 114-328 § 241, 130 STAT. 2000, 2070-71 (2017).

⁶⁷ Phil Diehl, *Police Get County's First 'Drone Killer'*, San Diego Union Trib. (Apr. 7, 2018 6:00 AM), <http://www.sandiegouniontribune.com/communities/north-county/sd-no-drone-killer-20180403-story.html>

⁶⁸ 47 U.S.C. § 333.

C. Preemption Limitations on Municipal Regulations

To address these various concerns, municipalities may wish to enact drone regulations. However, under the U.S. Constitution, federal laws can preempt related state and local laws, although the 10th Amendment reserves powers to the states that are not delegated to the federal government.⁶⁹

Municipal drone regulations that affect aviation safety or impact airspace use will likely be preempted by the FAA, the federal agency charged by Congress to regulate navigable airspace and integrate civilian drones into the national airspace. On the other hand, municipal drone regulations tied to 10th Amendment-derived police powers, such as regulations on what drones do or where they take off and land, are less likely to be preempted. Generally, municipal regulations that target hobbyist UAS use are less likely to be preempted than blanket drone regulations or commercial drone regulations because commercial drone use is more federally regulated than hobbyist drone use.

When federal law does not expressly preempt local law, two forms of implied federal preemption can invalidate local laws.⁷⁰ Field preemption occurs when the federal government so completely occupies an area of regulation as to preclude any local regulation within that area.⁷¹ Conflict preemption, as the name suggests, occurs when local laws conflict with specific federal laws.⁷²

Historically, the FAA's authority over airspace safety and navigable airspace has been interpreted by Courts to field preempt most state and local aviation regulations. However, because private drone use has only recently proliferated, courts may be reluctant to field preempt all local drone regulations without explicit Congressional intent. Indeed, in the only case on municipal UAS regulation, a federal district court relied primarily on conflict preemption to void a municipality's UAS regulations. In addition to federal preemption, valid municipal ordinances must survive the hurdle of state preemption.

1. Field Preemption

Under field preemption, if Congress delegates governing power exclusively to the federal government in a given field, that field cannot be subject to even complementary local regulation.⁷³

Because UAS qualify as aircraft under the FAA's governing statute, their operation is generally regulated by the FAA. Court precedent holds that state and local aviation regulations impacting the safe and efficient use of airspace are field preempted by the FAA.

⁶⁹ U.S. Const. art. VI., cl. 2; U.S. Const. amend. X.

⁷⁰ *Arizona v. United States*, 567 U.S. 387, 399 (2012).

⁷¹ *Id.*

⁷² *Id.*

⁷³ *Id.*

However, the FAA has stated municipalities may be able to regulate what drones *do*—for example warrant requirements for law enforcement UAS use, voyeurism, or harassment—under the municipality’s traditional police powers.⁷⁴

Importantly, the FAA’s statutory authority over low-lying airspace—where most drones operate—is less extensive when compared to its authority over higher, “navigable airspace.”⁷⁵ In light of this less extensive federal authority, the Supreme Court’s decision in *Causby* granting property owners some rights over their immediate airspace, and traditional municipal zoning powers, municipal regulations pertaining to low-lying airspace may survive field preemption. However, these low-lying airspace regulations may be preempted, especially if these regulations affect airspace safety or impact non-hobbyist drone operations.

a. Pre-UAS Case Law

Before the introduction of UAS, courts typically held state or local aviation regulations were field preempted by federal law:

- *City of Burbank v. Lockheed Air Terminal*: The U.S. Supreme Court federally field preempted a local aircraft noise ordinance because “uniform and exclusive” federal regulation of air traffic was required to fulfill the objectives of the Federal Aviation Act.⁷⁶ The Court reasoned that if multiple cities enacted noise curfews, this would impact air traffic flow, limiting the FAA’s ability to control air traffic.⁷⁷
- *Abdullah v. American Airlines*: The Third Circuit Court of Appeals held that state and local aviation safety regulations were federally field preempted, but that traditional state and territorial law remedies continue to exist for violations of federal aviation safety standards.⁷⁸
- *Montalvo v. Spirit Airlines*: The Ninth Circuit held that Congress’s intent for the federal government to be the sole regulator of aviation safety warranted field preemption of state law standards of care on air flights.⁷⁹
- *Skysign International, Inc. v. Honolulu*: The Ninth Circuit upheld a state aerial advertising regulation because this advertising was potentially dangerous to persons on the ground.⁸⁰ The Court stated that federal law did not field preempt state regulations which might “reach into the navigable airspace.”⁸¹

⁷⁴ FAA, Office of the Chief Counsel, State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet (2015) (hereinafter *State and Local Fact Sheet*).

⁷⁵ 49 U.S.C. § 40103.

⁷⁶ 411 U.S. 624 (1973).

⁷⁷ *Id.*

⁷⁸ 181 F.3d 363 (3d Cir. 1999).

⁷⁹ *Id.* at 474. In dicta, the Court noted that Congress may not have intended to field preempt air commerce.

⁸⁰ 276 F.3d 1109 (9th Cir. 2002).

⁸¹ *Id.* at 1116.

- *US Airways, Inc. v. O'Donnell*: The Tenth Circuit federally field preempted a state regulation of on-flight alcohol sales holding the FAA is the exclusive regulator in the field of airline safety.⁸²
- *Banner Advertising, Inc. v. City of Boulder*: In contrast to *Skysign*, the Colorado Supreme Court preempted a city aircraft banner towing ban reasoning the FAA exercised control over general aircraft flight activities including banner towing.⁸³
- *Big Stone Broad., Inc. v. Lindbloom*: A South Dakota district court held the state could not intervene in the approval process a proposed airport radio tower because this type of intervention would give the state veto power over federal agencies.⁸⁴

Because drones are a relatively new technology, and are subject to less extensive federal regulation, this precedent may not preempt all municipal UAS regulation.

b. Congressional Intent

Field preemption is based on an expansive Congressional grant of authority to the federal government in a certain field.

In 2012, Congress charged FAA with the duty to integrate civil UAS into the national airspace system.⁸⁵ Pursuant to this mandate, in 2016 the FAA promulgated its Part 107 requirements which regulate non-recreational drone operations.⁸⁶ Therefore, because non-recreational, or commercial, drone use is more federally regulated than recreational drone use, municipal ordinances that apply to commercial drone operations are more likely to be preempted than ordinances which target purely recreational use.

Municipal ordinances that apply to mostly recreational drone use may still be preempted by the FAA's authority over the airspace and aviation safety. Congress granted the U.S. Government sovereignty over the United States airspace in 1926.⁸⁷ Then, in 1958, in the aftermath of a mid-air collision between two passenger airplanes, Congress created the FAA.⁸⁸

In creating the FAA, Congress granted the FAA authority over the “navigable airspace” a term which extends above “minimum flight altitudes” and includes “airspace needed for safe takeoff and

⁸² 627 F.3d 1318 (10th Cir. 2010).

⁸³ 868 P.2d 1077 (Colo. 1994).

⁸⁴ 161 F. Supp. 2d 1009 (D.S.D. 2001).

⁸⁵ FAA Modernization and Reform Act of 2012, Pub.L.112-95 § 332, 126 Stat. 11, 73.

⁸⁶ Part 107 reqs.

⁸⁷ 49 U.S.C. § 40103(a)(1).

⁸⁸ FAA, *A Brief History of the FAA*, https://www.faa.gov/about/history/brief_history/ (last visited Apr. 15, 2018).

landing.”⁸⁹ Minimum flight altitudes vary, dropping to 500 feet above the ground level over uncongested areas and even lower over water and sparsely populated regions.⁹⁰

Besides authority over navigable airspace, the FAA has the duty to ensure the safety of aircraft and efficient use of airspace through regulations for:

- (A) navigating, protecting, and identifying aircraft;
- (B) protecting individuals and property on the ground;
- (C) using the navigable airspace efficiently; and
- (D) preventing collision between aircraft, between aircraft and land or water vehicles, and between aircraft and airborne objects.⁹¹

Because Congress defined “aircraft” broadly to include “any contrivance invented . . . [to] fly in the air”, the statutory language encompasses drones.⁹² Congress also granted the FAA authority to prescribe regulations “necessary for safety in air commerce and national security.”⁹³

However, the extent of federal field preemption over UAS regulations may be more limited than the statutory language indicates.

First, Congress has never expressly granted the federal government authority of the airspace over the states. The 1926 Air Commerce Act reads “The United States of *America* has exclusive *national* sovereignty of airspace of the United States (emphasis added).”⁹⁴ A House Report regarding the Act states: “The section in nowise affects the apportionment of sovereignty as between the several States and the United States, but only as between the United States and the rest of the world.”⁹⁵

The current United States Code text deviates from the original Act, reading “The United States *Government* has exclusive sovereignty of airspace of the United States.” The Code changes “America” to “Government” and “exclusive national sovereignty” to “exclusive sovereignty.”⁹⁶

The notes to the Code base this textual change implicitly on the expansive grant of federal authority over airspace to the FAA in the 1958 Federal Aviation Act.⁹⁷ The 1958 Act retains the original 1926 language under the heading “Foreign Aircraft” but otherwise does not contain any text overriding the Congressional intent expressed in the 1926 Air Commerce Act.

⁸⁹ 14 C.F.R. § 1.1.

⁹⁰ 14 C.F.R. § 91.119.

⁹¹ 49 U.S.C. § 40103.

⁹² 49 U.S.C. § 40102(a)(6).

⁹³ 49 U.S.C. § 44701.

⁹⁴ Air Commerce Act of 1926, Pub. L. No. 69-254, ch. 344, § 6, 44 Stat. 568, 572.

⁹⁵ Stephen J. Migala, *UAS: Understanding the Airspace of States*, 82 J. Air L. & Com. 3, 21 (2017) (citing Office of the Legislative Counsel, U.S. Senate, Legislative History of the Air Commerce Act of 1926, at 38 (1928)).

⁹⁶ 49 U.S.C. § 40103(a)(1).

⁹⁷ 49 U.S.C. § 40103 Historical and Statutory Notes.

Therefore, courts should be made aware of this codification change and decisions that reference the U.S.C. text should be reevaluated. For example, the only case concerning municipal UAS regulations quotes the U.S.C. text and its exclusive sovereignty language as something “Congress has stated.”⁹⁸

Moreover, because the FAA’s authority of airspace below navigable airspace is not as expansive as its authority over higher, navigable airspace, this may allow for municipal UAS regulations that don’t affect navigable airspace.

Much drone use and drone regulations occur in low-lying airspace below navigable airspace.⁹⁹ The FAA’s authority to regulate this low-lying airspace can be related back to several statutory provisions in the 1958 Federal Aviation Act:

- The FAA’s authority over the airspace needed for safe takeoff and landing for all aircraft;¹⁰⁰
- The FAA’s mandate to ensure the safety of all aircraft, including drones;¹⁰¹
- The FAA’s duty to enact aviation regulations that protect individuals and property on the ground;¹⁰²
- The FAA’s duty to promote the efficient use of navigable airspace, which may be served by enacting regulations that limit drone use in navigable airspace.¹⁰³

Against these statements of Congressional intent, municipal zoning powers and the *U.S. v. Causby* decision granting property owners’ rights in their immediate airspace indicate the federal government may not have exclusive control of this low airspace.

c. FAA Policy Statements

The FAA has interpreted statutes and precedent as preempting many local UAS regulations, but allowing for municipal UAS regulations closely tied to traditional police powers.¹⁰⁴ The FAA also urges local law enforcement agencies to report questionable UAS usage to the FAA.¹⁰⁵

These interpretations, advanced in Advisory Circulars, may be entitled to *Chevron* deference, a judicial doctrine under which courts defer to an agency’s reasonable interpretations of ambiguous statutes.¹⁰⁶ However, because the Circulars are advisory, they do not carry the “force of law” and

⁹⁸ *Singer v. City of Newton*, 284 F. Supp. 3d 125, 129 (D. Mass. 2017).

⁹⁹ *See e.g.*, 14 C.F.R. § 107.51B (the FAA prohibits commercial drones from operating more than 400 ft. above ground level without a waiver).

¹⁰⁰ 49 U.S.C. § 40103(b)(1); 49 U.S.C. § 40102(a)(32).

¹⁰¹ 49 U.S.C. § 40103(b)(1).

¹⁰² 49 U.S.C. § 40103(b)(2)(B).

¹⁰³ 49 U.S.C. § 40103(b)(2)(C).

¹⁰⁴ *State and Local Fact Sheet*, *supra* Note 74, at 15.

¹⁰⁵ Fed. Aviation. Admin., Office of Chief Counsel, Law Enforcement Guidance for Suspected Unauthorized UAS Operations Version 4 (2017) (hereinafter *Law Enforcement Guidance*).

¹⁰⁶ *See generally*, *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837 (1984).

thus may only be afforded *Skidmore* deference, where the FAA’s interpretation is entitled to “respect according to its persuasiveness.”¹⁰⁷

In an Advisory Circular regarding state and local drone regulations, the FAA reasoned that local regulation of UAS use may result in a “patchwork quilt” of differing restrictions inhibiting safe and efficient air traffic flow.¹⁰⁸ However, the FAA also states that:

UAS laws likely to fall within state and local government authority, [include] requirements for police to obtain a warrant prior to using UAS for surveillance; prohibitions on the use of UAS for voyeurism; exclusions on using UAS for hunting or fishing, or harassing individuals engaged in those activities; and prohibitions on attaching firearms or other weapons to a UAS.¹⁰⁹

In a different Advisory Circular written for local law enforcement agencies, the FAA reiterated its position that it alone can enact regulations on drone flight.¹¹⁰ The FAA continued to state that arrest, detention, and non-consensual searches in connection with questionable UAS usage almost always falls outside local law enforcement’s jurisdiction *unless* the drone is involved in a state criminal investigation.¹¹¹ The FAA recommends law enforcement to do the following in connection with questionable UAS operations:

- 1) Identify and interview witness;
- 2) Identify operators;
- 3) Determine viewing and recording location of the UAS activity;
- 4) Identify any sensitive locations, events, or activities;
- 5) Notify FAA Regional Operation Centers immediately of an incident;
- 6) Collect evidence from public or private security systems before the data is purged.¹¹²

In short, the FAA believes that local law enforcement is a reporting mechanism for questionable UAS use, and that the FAA is exclusively responsible for enforcing its UAS regulations. However, the FAA has stated that local UAS regulations relating to traditional police powers are not likely to be preempted.

d. Pending Legislation

The uncertainty around UAS field preemption may eventually be resolved by an act of Congress. Much like the FAA Act of 1958 created a presumption of field preemption for air traffic and aviation safety regulations, a UAS Act may define the extent of federal UAS preemption.

¹⁰⁷ United States v. Mead Corp., 533 U.S. 218, 221 (2001) (*citing* Skidmore v. Swift & Co., 323 U.S. 134 (1944)).

¹⁰⁸ *State and Local Fact Sheet*, *supra* note 74, at 15.

¹⁰⁹ *Id.*

¹¹⁰ *Law Enforcement Guidance*, *supra* note 105, at 18.

¹¹¹ *Id.*

¹¹² *Id.*

In 2017, Congressional members proposed two UAS bills. As of this writing neither had been heard in committee and both appear to be dead.

The first, Senator Dianne Feinstein's Drone Federalism Act, would give more power to states, tribes and localities to regulate drones.¹¹³ The proposed bill would allow local regulation of UAS flights within 200 feet above ground level or within a structure, preserving local powers relating to nuisance, privacy, and zoning.

In contrast, the SAFE Drone Act of 2017 would expand the FAA's preemptive power over local UAS regulations. This Act directs the Department of Transportation (DOT) and the FAA to develop a plan to unlock the "full operational capacity" of UAS air traffic management.¹¹⁴ The bill seeks to improve the air traffic use of UAS by improving inter-agency communication, establishing UAS flight education centers, and assessing components necessary for successful UAS air traffic management.

Executive action may also expand federal authority over UAS. In early November 2017, President Trump authorized the Department of Transportation to launch a pilot program to allow states to test new applications of drones, including package delivery.¹¹⁵ The FAA is also partnering with state, local, and tribal governments and private industry in a different pilot program to accelerate the integration of UAS into national airspace.¹¹⁶

Thus, federal field preemption of local UAS regulations may change with acts of Congress or executive action.

2. Conflict Preemption

Any local UAS regulation that is not field preempted must also survive conflict preemption. Conflict preemption arises when a) compliance with both local and federal regulations is impossible or b) if the local statute frustrates the purposes of the federal law.¹¹⁷

a. Case Law

Aviation conflict preemption case law is rare, because as discussed above, courts have frequently held local aviation regulations to be field preempted. On the infrequent occasions that a state or

¹¹³ Drone Federalism Act of 2017, S.1272, 115th Congress (2017).

¹¹⁴ Safe DRONE Act of 2017, S.1410, 115th Congress (2017).

¹¹⁵ Melanie Zanona, *Transportation Dept Launches Drone Program for Package Deliveries*, Hill (Nov. 2, 2017 02:38 PM), <http://thehill.com/policy/transportation/358473-transportation-department-launches-drone-program-to-allow-package>.

¹¹⁶ FAA, *UAS Integration Pilot Program*, https://www.faa.gov/uas/programs_partnerships/uas_integration_pilot_program/splash/ (last visited Dec. 8, 2017).

¹¹⁷ *Gibbons v. Ogden*, 22 U.S. 1, 16 (1824).

local aviation law is not field preempted, the local law often survives conflict preemption analysis. For example:

- The Second Circuit held that a state law tort claim against an aviation employer for misrepresentation was not conflict preempted.¹¹⁸
- The Supreme Court of Wisconsin held that a nuisance action against a privately-owned airport was not conflict preempted, reasoning Congress intended the airport proprietor to be primarily responsible for protecting residents against airport noise.¹¹⁹
- The Supreme Court of Washington held that state product liability claims for wrongful death caused by an aircraft carburetor were not preempted by the FAA.¹²⁰

As these cases illustrate, tort laws that apply to aviation operations are not conflict preempted if they do not frustrate the FAA's purpose of maintaining a safe and efficient airspace. Furthermore, while the FAA has the exclusive authority to determine the standard of care for aircraft operations, state and local remedies exist for violations of that standard of care.¹²¹

b. FAA Rules

To be complementary, a local UAS regulation may not conflict with the text or spirit of a federal FAA regulation or congressional statute. For example, current FAA rules require hobbyists to follow community based safety guidelines.¹²² A city could set community safety guidelines for hobbyists and not be at risk of preemption.

On the other hand, a local regulation allowing 15-year-olds to pilot UAS commercially would be conflict preempted because the FAA requires non-hobbyist UAS pilots to be at least 16 years old. To ensure that municipal regulation does not conflict with FAA rules, a summary table published by the FAA is included in Appendix A. Municipalities should also monitor FAA developments for any new UAS rules which would preempt any conflicting local ordinances.

3. Application of Field and Conflict Preemption to UAS: *Singer v. Newton*

These conflict and field preemption principles were discussed recently in *Singer v. City of Newton*, the first case on the validity of municipal UAS regulations.¹²³ Among other restrictions, Newton, Massachusetts' UAS ordinance imposed registration requirements on all UAS pilots, banned drone flight within 400 feet of private property, and prohibited flight beyond the visual line of sight. The judge analyzed the UAS ordinance for both conflict and field preemption, determining:

¹¹⁸ *Drake v. Lab. Corp. of Am. Holdings*, 458 F.3d 48 (2d Cir. 2006).

¹¹⁹ *Krueger v. Mitchell*, 112 Wis. 2d 88, 102 (1983).

¹²⁰ *Estate of Becker v. Avco Corp.*, 387 P.3d 1066 (2017).

¹²¹ *Abdullah v. Am. Airlines, Inc.*, 181 F.3d 363 (3d Cir. 1999).

¹²² FAA Fly under the Special Rule for Model Aircraft, https://www.faa.gov/uas/getting_started/model_aircraft/ (last visited Apr. 15, 2018).

¹²³ *Singer v. City of Newton*, 2017 U.S. Dist. LEXIS 153844 (D. Mass. Sep. 21, 2017).

- 1) That because the FAA’s “State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet” contemplated local regulation of pilotless aircraft, the ordinance was not necessarily field preempted;
- 2) That because Newton required registration of *all* drones, the registration requirement was conflict preempted due to FAA’s intention to be the exclusive register of UAS.¹²⁴
- 3) That because the ordinance’s prohibition on pilotless aircraft flight over public property without prior permission from Newton did not have an altitude limit, it therefore reached into navigable airspace and was conflict preempted;
- 4) That a ban on flight over private property below 400 ft. above ground level (AGL) was conflict preempted by the FAA’s rule that UAS must fly below 400 ft. AGL and Congress’ intention to integrate UAS into the national airspace system, and;
- 5) That a blanket ban on operating beyond visual line of sight was conflict preempted because the FAA has a waiver process to allow commercial drone flight beyond line of sight.

The case, brought by a *pro se* plaintiff, was withdrawn by Newton after it filed for appeal.¹²⁵ However, *Singer* is important because it illustrates a judicial reluctance to field preempt municipal UAS ordinances. Instead, the judge used conflict preemption to invalidate many of the municipal ordinances as frustrating federal objectives. This reliance on conflict preemption at least in principle allows Massachusetts municipalities to pass non-conflicting UAS ordinances.

However, field preemption may ultimately void some UAS ordinances when other courts review these issues. For example, the *Singer* court’s invalidation of a municipal ban on operating beyond the line of sight does not seem to conflict with the FAA rule that only permits operations beyond the line of sight with a waiver. Under a field preemption analysis however, the FAA has arguably regulated UAS operations so extensively that it occupies the entire field. The court’s invalidation of the ordinance’s prohibition of all drone flight over public property also relies on conflict preemption, when field preemption probably provides a more rational basis due to the FAA’s exclusive authority over navigable airspace.

4. State Preemption

Like federal preemption, municipal UAS regulations can also be state preempted. A municipal UAS ordinance is invalid if the ordinance falls outside the local government’s authority to enact or is preempted by conflicting state laws or interests.

State preemption analysis varies depending on whether the state follows the Dillon’s Rule or Home Rule structure. Under Dillon’s Rule, a local government only possesses the authority specifically delegated to it by the state. In contrast, localities in Home Rule states are presumed to possess all the authority exercisable by the state, unless subsequent state legislation removes some of that

¹²⁴ Congress has since reinstated a registration requirement for all drone operators.

¹²⁵ Motion to Dismiss, *Singer v. City of Newton*, 2017 U.S. Dist. LEXIS 153844 (D. Mass. Sep. 21, 2017).

authority.¹²⁶ Therefore, a municipality in a Home Rule state generally has more authority to regulate than a city in a Dillon's Rule state. Many states employ a combination of these two frameworks.¹²⁷

Even if a municipality has authority to regulate, the regulation may be preempted by state laws or interests. State courts employ different preemption analysis. For example, New York's preemption analysis centers on conflict preemption, while Colorado considers both field and conflict preemption.¹²⁸

In Colorado, preemption analysis turns on whether the matter regulated is of statewide concern, local concern, or mixed statewide and local concern.¹²⁹ If the matter is of statewide concern, localities are generally field preempted from regulating in that area. If the matter is of mixed concern, the court employs a conflict preemption analysis. However, if it is a matter of purely local concern then the local government can regulate.¹³⁰

Colorado courts will balance state and local interests to determine whether the interest is of statewide or local concern. The courts will consider four factors in this analysis:

- The need for statewide uniformity of regulation;
- The extraterritorial impacts of regulation;
- Whether the state has traditionally regulated in the area; and
- Whether the state's constitution has committed the matter to local or state discretion.¹³¹

In *City of Longmont v. Colorado Oil & Gas Ass'n*, the Colorado Supreme Court weighed these factors and determined that hydraulic fracturing was a matter of mixed local and state concern.¹³² The Court ultimately held Longmont's hydraulic fracturing ban was preempted as conflicting with state interests.¹³³

Based on *Longmont*, municipal UAS regulation currently appears to be a matter of mostly local concern. Non-federally preempted municipal UAS ordinances would most likely relate to traditional police powers, in which the locality has a strong interest, such as voyeurism, trespassing or land use. These type of UAS regulations would probably not have a large extraterritorial impact. However, if the FAA's visual line of sight rule is relaxed, or if drone use continues to proliferate, municipal

¹²⁶ James Kushner, *Enabling Legislation and Home Rule Power*, 1 *Subdivision Law and Growth Mgmt.* 2d. § 1:18 (2017).

¹²⁷ Jon D. Russell & Aaron Bostrom, *Federalism, Dillon Rule and Home Rule*, 8, American City and County Exchange (2016), <https://www.alec.org/app/uploads/2016/01/2016-ACCE-White-Paper-Dillon-House-Rule-Final.pdf>.

¹²⁸ See generally, *Wallach v. Town of Dryden*, 16 N.E.3d 1188 (N.Y. 2014); *City of Longmont v. Colorado Oil & Gas Ass'n*, 369 P.3d 573 (Colo. 2016).

¹²⁹ *City of Longmont v. Colorado Oil & Gas Ass'n*, 369 P.3d 573, 578 (Colo. 2016).

¹³⁰ *Id.* at 579.

¹³¹ *Id.* at 580.

¹³² *Id.* at 581.

¹³³ *Id.* at 573.

drone use ordinances may impair drone use sufficiently to demonstrate a need for statewide regulation.

D. Additional Limitations on Municipal Policy

Two additional legal doctrines inhibit municipal UAS regulation: The Dormant Commerce Clause and the First Amendment’s right to record.

1. Dormant Commerce Clause

The Dormant Commerce Clause is a judicial doctrine implied from the Commerce Clause, which grants Congress the authority to regulate interstate commerce. Because interstate commerce is of vital national importance, the Dormant Commerce Clause holds that a state may not unduly burden interstate commerce.¹³⁴

The Dormant Commerce Clause invalidates laws which discriminate against out-of-state commercial interests. Some invalidated regulations include prohibitions on out-of-state garbage or milk, or regulations that require products to be made near the municipality.¹³⁵

The Dormant Commerce Clause also invalidates non-discriminatory local laws if the burdens placed on interstate commerce outweigh any putative benefits provided by the law. For example, an Illinois law requiring truckers to use non-standard mud flaps burdened interstate commerce without providing much added safety benefits and was therefore invalidated.¹³⁶

However, local laws can favor local interests if the municipality is a “market participant” engaged in selling a product or offering jobs on projects funded by local taxpayer money.¹³⁷ In short, municipalities cannot enact regulations that unduly burden interstate commerce unless the municipality is a market participant.

Any patchwork of municipal regulations that would burden the use of UAS in interstate commerce might be voided under the Dormant Commerce Clause. For example:

- A municipal regulation allowing only businesses based in town to use UAS in commercial operations might be void as discriminatory against out-of-state interests.
- A regulation that required all drones flown for municipal purposes to be piloted by town residents would probably be valid under the market participant exception.
- If longer drone flights become more commonplace due to changes in FAA regulations, therefore crossing state lines, these drones would become instruments of interstate

¹³⁴ Dep't of Revenue of Ky. v. Davis, 553 U.S. 328, 338 (2008).

¹³⁵ City of Phila. v. New Jersey, 437 U.S. 617 (1978); H.P. Hood & Sons, Inc. v. Du Mond, 336 U.S. 525 (1949); Dean Milk Co. v. Madison, 340 U.S. 349 (1951).

¹³⁶ Bibb v. Navajo Freight Lines, 359 U.S. 520 (1959).

¹³⁷ Reeves, Inc. v Stake, 447 U.S. 429 (1980); White v. Mass. Council of Contrs. Emplrs, 460 U.S. 204 (1983).

commerce. Thus, local no-drone zones may burden interstate commerce by restricting long-distance UAS flight.

2. First Amendment and the Right to Record.

Municipal restrictions on drone recording and photography also might violate the First Amendment. The Third Circuit has held citizens have a First Amendment right to record the acts of public officers conducting their official duties.¹³⁸ However, this right to record has not been considered in the context of UAS regulations. It is uncertain whether the right to record encompasses the right to record by any means or if the government may restrict methods of recording.

Federal law prohibits UAS from interfering with wildfire suppression, law enforcement, or emergency response.¹³⁹ These UAS restrictions make it less likely that a drone operator has an unfettered right to record a public official in the course of their duty. For example, a drone operator filming a police officer must not interfere with any emergency response.

Because the First Amendment only protects the right to record public officials in the course of their duties, municipalities should not be concerned about UAS restrictions conflicting with the First Amendment during most flights. However, blanket no-drone zones in public spaces like parks may impair the right to record an on-duty police officer.

E. Potential Municipal Policy Approaches

Because the law surrounding municipal regulation of UAS is undeveloped, local lawmakers have several available options to address their community's concerns about UAS. Each carries with it some risk of litigation from private parties or the FAA. These methods include:

- 1) Waiting for developments in federal UAS law and policy;
- 2) Enforcing existing ordinances;
- 3) Amending existing ordinances to explicitly include drone violations;
- 4) UAS Zoning Measures;
- 5) Adopting UAS specific regulations and;
- 6) Passing through the FAA's regulations for local enforcement.

1. Wait-and-See

Municipalities may choose to defer UAS policy making until UAS law becomes more developed, relying on citizen tort suits and social norms to mitigate particularly invasive drone use. For example, a municipality may expend significant time and political capital to enact a UAS policy only to find it invalidated by new FAA regulations or a court case. However, this approach assumes that UAS law will develop quickly. Therefore, a wait-and-see policy may unnecessarily delay the resolution of problems within a municipality's police powers.

¹³⁸ *Fields v. City of Phila.*, 862 F.3d 353, 355-56 (3d Cir. 2017).

¹³⁹ 49 U.S.C. § 46320.

2. Applying Existing Ordinances to UAS

Another low-risk method entails enforcing existing municipal ordinances against questionable UAS activity. The FAA acknowledges that law enforcement officers may make arrests for drone-related activity when the drone is involved in a state criminal investigation.¹⁴⁰ Therefore, municipal enforcement officers may make arrests, confiscate UAS, or issue fines for UAS uses that violate existing ordinances.

Of course, the language of existing ordinances must be broad enough to encompass crimes committed using drones. This method could be applied to trespass, disturbing the peace, or other disruptive drone uses.

For example, a municipality might have an ordinance like the following sample voyeurism law:

Voyeurism is committed by any person who knowingly observes or takes a photograph of another person's intimate parts without that person's consent, and in a situation where the person photographed has a reasonable expectation of privacy.

This broad language would probably encompass voyeurism enabled by drone.

3. "Via Drone" Amendments to Existing Ordinances

If the language of existing ordinances does not encompass drone enabled crimes, municipal regulations can be amended.

For example, the Boulder municipal code on trespassing reads:

5-4-3. - Trespass. No person shall: (a) Enter or remain upon land or premises other than a dwelling of another in defiance of a legal request or order by the owner or some other authorized person; or (b) Enter into or upon land or a building other than a dwelling that is posted, locked, or otherwise fenced or enclosed in such a manner that a reasonably prudent person would understand that the owner does not want any such person on the land or in the building.

To make drone flight over private property illegal, the following clause might be added:

or

(c) Cause a UAS to be flown over the private property of another in a manner that disrupts the owner or tenant's quiet enjoyment of said property.

Municipalities should be aware that whenever an ordinance affects airspace usage, as this amendment might, there is a greater risk of preemption.

4. UAS Zoning Approach

Municipal drone regulation might also be accomplished through zoning. Zoning laws are traditional local police powers and are therefore at not much risk of federal preemption. However, when drone zoning laws begin to affect airspace use there is more risk of preemption.

¹⁴⁰ *State and Local Fact Sheet, supra* Note 74, at 15.

For example, a municipality could designate certain areas where recreational drone operators can stand while operating, taking off, and landing their craft. Because the acts of taking off and landing drones touch the ground where the FAA's jurisdiction is limited, and do not extend into the airspace, there is not a great risk of preemption.¹⁴¹ However, drone landing and takeoff zones should not be so limited in number or space as to effectively prevent all drone use.

Furthermore, these drone operator zones should not encompass all drone use because such an extensive zoning measure would hinder many commercial UAS operations, such as property inspections. Instead, municipalities could limit commercial operators from taking off and landing in areas where drone use presents safety, nuisance, and wildlife concerns. Again, municipal ordinances that encompass commercial UAS use are more likely to be preempted, because commercial operations are subject to more federal regulation than hobbyist uses.

Another, riskier, zoning solution entails limiting low-level drone flights. Municipalities could defend this approach by arguing that the FAA is not sovereign over states and that the FAA's jurisdiction is limited by property rights which extend into usable superadjacent airspace.¹⁴²

To limit ambiguity, a municipal regulation could define usable superadjacent airspace as extending up to a certain altitude above property.¹⁴³ However, placing a numerical value on a low-level flight restriction may increase the risk of preemption as suggested by *Singer v. City of Newton* where the court invalidated a prohibition on drone flight within 400 ft. above private property. Therefore, a municipality could prohibit sustained drone flight over airspace immediately superadjacent to property and avoid any numerical limit.

This low level drone flight restriction could also be tailored to superadjacent airspace over public areas where UAS use might impact safety or cause nuisances, such as parks or high traffic areas like pedestrian malls. In cities with building height restrictions, the FAA's authority over airspace below the height restriction may also be limited due to the city's assertion of control over that airspace and that airspace's limited navigability. However, even if this type of regulatory scheme is not preempted, the dormant commerce clause may restrict this approach, especially if UAS use proliferates. To better survive dormant commerce clause and preemption challenges, a low-level drone flight prohibition could allow for certain commercial uses and permit low-level drone operation necessary to take-off and land craft.

¹⁴¹ The "navigable airspace" over which the FAA has authority includes airspace needed for safe takeoff and landing. However, because small consumer drones may take off and land anywhere, reading the statute to encompass these acts would expand the term navigable airspace to encompass all airspace, rendering the term "navigable" a nullity. Therefore, the navigable airspace needed for safe takeoff and landing may be better read as limited to the airspace near airports.

¹⁴² *United States v. Causby*, 328 U.S. 256, 264, (1946); *Griggs v. Allegheny Cty.*, 369 U.S. 84, 89 (1962).

¹⁴³ To improve enforceability, this height limit should be less than the 83 feet above property found in *Causby* to be a violation of airspace rights.

Finally, although a municipality may wish to prohibit drone operation over public parks or other areas, these no-drone zones are likely to be preempted because they reach into the navigable airspace where the FAA asserts authority. No-drone zones effective in national parks and most ski resorts are implemented over federally-owned lands, and therefore do not raise the preemption concerns inherent when local policies conflict with federal laws. Furthermore, national park and ski areas are places where drone use presents significant safety, nuisance and wildlife concerns.

5. New UAS-Specific Ordinances

A fifth option is to develop a regulatory scheme specific to drone operation. Some examples include restricting the hours of operation, developing licensing requirements or other similar limits on when, how, or who operates UAS. These types of regulations were precisely the kind voided in *Singer v. City of Newton*.¹⁴⁴ With this route municipalities run the greatest risk of preemption because UAS in-flight operations are most likely field preempted.

6. Pass-through Adoption and Enforcement of FAA Regulations

Last, municipalities may choose to adopt and codify the FAA's commercial UAS operational regulations. Although the FAA is responsible for enforcing its rules, enforcement actions are rarely brought due to lack of agency resources. By passing through FAA regulations into municipal code, local law enforcement could then enforce FAA regulations. Since the municipal regulations are the FAA's own, there would be no conflict preemption because the municipal regulations further the FAA's objectives. However, this method is probably impermissible because the FAA wields field preemption over aviation operational regulations.

As an example, Chicago essentially codified the FAA's commercial UAS regulations *and* applied them to hobbyist UAS use.¹⁴⁵ Thus far, the FAA has not filed suit despite maintaining its field preemption over aviation operations.

The FAA's reluctance to bring suit may illustrate two principles. First, municipal hobbyist UAS regulations are probably less likely to be preempted because the FAA has not regulated as extensively in this area. Two, in cities or other areas where UAS use poses more safety and nuisance risks, a municipality has greater ability to regulate.

This method of municipal regulation might encounter the least resistance from those opposed to municipal UAS regulations. In interviews conducted with both commercial and research operators, these stakeholders repeatedly expressed opposition to any municipal level regulations. However, when asked what the best municipal regulation would look like, the common answer reiterated the theme that FAA regulations be enacted at a municipal level. However, if several municipalities were to codify FAA regulations, the FAA might challenge this approach in court.

II. Municipal UAS Use

Apart from regulating private drone use, municipalities may wish to use drones in governmental work. When used in conjunction with a thoroughly considered policy, UAS may prove to be useful

¹⁴⁴ See Discussion on page 21.

¹⁴⁵ Chi., Ill. Mun. Code, § 10-36-400 (2015).

tools for municipalities. Potential municipal UAS uses range from assisting firefighters and law enforcement to supporting workers in public works projects.

However, municipal drone use may implicate several areas of law. First, anyone who operates a UAS for municipal use must abide by FAA rules. Second, municipalities must comply with open records laws when collecting data with UAS. Third, municipalities cannot use UAS to perform unreasonable searches under the Fourth Amendment. Finally, municipalities should be aware that widespread municipal UAS use could implicate takings concerns.

A. Specific Municipal Uses

Municipalities may have several uses for UAS technology. These uses include firefighting, law enforcement, other emergency situations, and non-emergency administrative uses.

1. Firefighting

UAS technology such as infrared thermal imaging and signal boosting antennas may help improve safety and efficiency in firefighting.¹⁴⁶ Drone-mounted Infrared (IR) imaging captures heat signatures, enabling firefighters to concentrate resources on the hottest parts of fires.¹⁴⁷ By focusing on these hotspots, firefighters may prevent fires from spreading and causing more damage.¹⁴⁸ UAS equipped with IR can also be used to help identify when a fire has been extinguished.¹⁴⁹

UAS can also assist in fighting wildfires. Wildfires pose a significant danger in Boulder—and many other western areas—due to the dry climate and winds.¹⁵⁰ For instance, in March 2017, hundreds of homes were evacuated due to a wildfire only a few miles removed from downtown Boulder.¹⁵¹ Additionally, the foothills around Boulder can significantly reduce the line of sight for detecting fires, further endangering firefighters and citizens.

UAS can help mitigate wildfire danger by enabling quicker fire detection. A drone mounted camera can elevate a firefighters' vision above the mountainous terrain. Although helicopters and planes are traditionally used to spot fires over mountainous terrain, a UAS is portable and can provide a quick aerial view for firefighters on the ground, who would otherwise have to wait on manned aircraft.

¹⁴⁶ Deborah Findling & Jeneice Pettitt, *How Firefighters Are Using Drones as First Responders to Save Lives*, CNBC (Aug. 27, 2017, 10:39 ET), <https://www.cnbc.com/2017/08/26/skyfire-consulting-trains-firefighters-to-use-drones-to-save-lives.html>.

¹⁴⁷ FLIR, KF6 Thermal Camera for Aerial Firefighting Apparatus, <https://www.flir.com/products/kf6/> (last visited Apr. 7 2018).

¹⁴⁸ Brooks Hays, *10 Strategies for Fighting Wildfires*, Mental Floss (June 10, 2014), <http://mentalfloss.com/article/57094/10-strategies-fighting-wildfires>.

¹⁴⁹ *Fern Lake Fire*, Nat'l Park Serv., https://www.nps.gov/romo/learn/nature/fern_lake_fire.htm.

¹⁵⁰ *Fire Near Downtown Boulder, Colorado, Forces Evacuations*, Fox News U.S. (Mar. 19, 2017), <http://www.foxnews.com/us/2017/03/19/fire-near-downtown-boulder-colorado-forces-evacuations.html>.

¹⁵¹ *Id.*

Additionally, when combating wildfires, firefighters are sometimes dropped into remote areas and later need to be evacuated.¹⁵² Locating these firefighters can be challenging if there is no cell service or radio communication due to the rough terrain. A drone equipped with a service boosting antenna can help disconnected firefighters maintain contact with the rest of their team.

UAS can also help determine the size and strength of fires, enabling planning and tactical measures.¹⁵³ As mentioned above, drones can aid in spotting and detecting fires, while IR imaging can help determine the heat and strength of a fire. This information can help firefighters formulate a plan to fight the fire.¹⁵⁴

2. Law Enforcement

Law Enforcement Agencies (LEAs) also have potential use cases for drones. Drones can assist officers in documenting crime scenes, modeling car accidents, monitoring crisis situations, and surveillance.

Some LEAs hope to use drones in crime scene documentation.¹⁵⁵ Police officers often need a high vantage point to adequately document all the details of a crime scene.¹⁵⁶ To obtain this aerial view, LEAs may commission a cherry picker or a fire truck. In contrast, a drone mounted camera could take these elevated pictures without the logistics, delay, and expense of bringing out a larger vehicle.¹⁵⁷

Additionally, drones may mitigate human error in crime scene documentation. Currently, the evidence gathered from a crime scene is largely dependent on what the investigator determines is important at the time of the initial investigation.¹⁵⁸ Thus, drones, through their heightened vantage point, can gather a wider range of evidence, reducing the chance of investigator oversight.

¹⁵² Kevin Bonsor, *How Wildfires Work*, Science, <https://science.howstuffworks.com/nature/natural-disasters/wildfire4.htm> (last visited Dec. 1, 2017).

¹⁵³ See Rachael Myrow, *UC Berkeley Scientists Eye Drones to Contain Wildfires*, KQED (June 22, 2015) <https://ww2.kqed.org/forum/2015/06/22/uc-berkeley-scientists-eye-drones-to-contain-wildfires>; *Fighting Forest Fires with Technology: How Drones and Infrared Cameras Could Be Game-Changers*, Canadian Broad. Corp. Radio (July 14, 2017), <http://www.cbc.ca/radio/day6/episode-346-fighting-wildfires-with-technology-pizzagate-returns-impeach-o-meter-game-of-thrones-and-more-1.4203979/fighting-forest-fires-with-technology-how-drones-and-infrared-cameras-could-be-game-changers-1.4204045>.

¹⁵⁴ *Id.*

¹⁵⁵ Robert Galvin, *Capture the Crime Scene*, Officer (July 19, 2017), <https://www.officer.com/investigations/article/12339566/3d-crime-scene-documentation-for-law-enforcement>.

¹⁵⁶ *Id.*

¹⁵⁷ *Id.*

¹⁵⁸ *Id.*

Drone mounted cameras and 3D scanners, which collect information such as relative dimensions and distances, may be particularly helpful in auto accident reconstruction.¹⁵⁹ Accident reconstruction is used to assign liability and can also help municipalities determine if traffic procedures or policies are necessary to reduce the risk of reoccurrence. Currently, accidents are reconstructed primarily through ground-level photographs similar to crime scene documentation. Thus, a drone generated crime scene model may reduce the time, cost, and logistics of creating these models.¹⁶⁰

UAS may be used during active shooter situations and other incidents that pose high risks to law enforcement officers.¹⁶¹ Drones can be used to locate and track suspects, reducing danger to personnel and the public, while enabling first responders to respond more accurately.¹⁶²

In addition, drones can be used to aerially surveil citizens suspected of criminal activity. Drone surveillance can presumably be performed at less cost than aerial surveillance with planes or helicopters. However, drone surveillance raises significant privacy concerns.

3. Other Emergency Operations

As in firefighting and LEA usage, drones can be used in other emergency situations to promote safety and effective response. For example, drones can help flood recovery efforts, locate downed electrical wires, find stranded citizens, and identify the materials involved in a hazardous leak.

In June 2017 a train derailed in Boulder, spilling contents that first responders could not immediately identify.¹⁶³ The crash area was evacuated for an hour until, with the help of a UAS, responders determined the spilled car contained only plastic beads.¹⁶⁴ As this case illustrates, drones can gather information about hazardous situations, removing first responders from potential danger. Similarly, UAS can be used to locate, view, and help responders identify a suspected explosive device from a safe location.¹⁶⁵

¹⁵⁹ *Id.*

¹⁶⁰ ABJDrones, <https://abjdrones.com/drone-roof-inspection-services/> (last visited Apr. 5, 2018).

¹⁶¹ Cory Smith, *Drone Technology Helping Law Enforcement Respond to Active Shooter Situation*, NBC DFW (Oct. 18, 2017), <https://www.nbcdfw.com/news/local/Drone-Technology-Helping-Law-Enforcement-Respond-to-Active-Shooter-Situation-451547663.html>.

¹⁶² *Id.*; *Increasing Your Options: Active Shooter Response*, Law Enforcement Today (Jan. 2, 2017), <https://www.lawenforcementtoday.com/increasing-your-options-active-shooter-response/>.

¹⁶³ Stan Bush, *Train Derails In Boulder, Evacuation Lifted After Investigation*, CBS Denver (June 20, 2017), <http://denver.cbslocal.com/2017/06/20/train-derailment-boulder/>.

¹⁶⁴ Michael Konopasek, *Derailed Train Car Spills Plastic Beads in Boulder*, Fox 31 Denver (June 20, 2017), <http://kdvr.com/2017/06/20/train-derails-in-boulder-residents-asked-to-avoid-area/>.

¹⁶⁵ James Queally, *L.A. Sheriff's Department to Begin Using Drones to Respond to Bomb Threats, Hostage Crisis*, L.A. Times (Jan. 12, 2017), <http://beta.latimes.com/local/lanow/la-me-ln-sheriffs-drones-20170112-story.html>.

Drones can also help locate stranded flood survivors or other emergency situations where people might gather on building tops.¹⁶⁶ In one simulation, a UAS located a disaster victim in twenty minutes, while a five person ground team took almost two hours to find the same victim.¹⁶⁷

After flooding, UAS can survey damage and help focus recovery efforts.¹⁶⁸ A drone can locate flooded areas and inspect downed powerlines that would otherwise pose serious dangers to ground crews.¹⁶⁹ The data gathered from drones can also be used to create flood models, helping municipalities mitigate future flood damage.¹⁷⁰

UAS also may prove useful in search and rescue operations. The drone's elevated vantage point and unconstrained aerial movement may enable searchers to better investigate areas than ground-based operations.¹⁷¹ Drones may prove particularly helpful in rough terrain inaccessible to ground search crews.¹⁷² For example, Grand Canyon National Park employs a drone fleet for search and rescue operations.¹⁷³ Coordination between multiple drones may also improve search efficacy. Researchers at University of Colorado have developed a technology that allows drones to be flown in a swarming pattern optimizing search efficiency.¹⁷⁴

4. Non-Emergency Uses

Drones may also be helpful in non-emergencies. UAS can assist in maintenance work, building modeling, security operations, and environmental research.

¹⁶⁶ Michael Winn, *We Need to Be Using Drones to Rescue Harvey Victims*, Fortune (Sep. 1, 2017), <http://fortune.com/2017/09/01/drones-dji-hurricane-harvey-houston-rescue-faa/>.

¹⁶⁷ *Id.*

¹⁶⁸ Aarian Marshall, *Above Devastated Houston, Armies of Drones Prove Their Worth*, Wired, (Sept. 4, 2017 7:00am), <https://www.wired.com/story/houston-recovery-drones/>.

¹⁶⁹ *Id.*

¹⁷⁰ *Using Drone Imagery to Generate Flood Inundation Models*, Dar Ramani Huria (June 22, 2016), <http://ramanihuria.org/using-drone-imagery-generate-flood-inundation-models/>.

¹⁷¹ *Search and Rescue Drones*, Flymotion Unmanned Systems, <https://flymotionus.com/news/search-rescue-drones/> (last visited Dec. 1, 2017).

¹⁷² *Id.*

¹⁷³ *Drones Used in Major Grand Canyon Search and Rescue Operation for First Time*, RT (Apr. 23, 2017), <https://www.rt.com/usa/385726-drones-used-grand-canyon-search/>.

¹⁷⁴ *CU Researchers Develop 'Swarming Drones' Technology*, CBS Denver (Sep. 6, 2017), <http://denver.cbslocal.com/2017/09/06/cu-researchers-swarming-drones-technology/>.

A drone can inspect large municipal structures scheduled for maintenance, negating the need for ladders and trucks.¹⁷⁵ Similarly, property surveys may be performed more efficiently by UAS instead of through manual measurements and physical locomotion.¹⁷⁶

Drones can also streamline building and construction modeling.¹⁷⁷ Various technologies enable UAS to create 3D building models from flyovers, thus reducing the need for time-intensive Computer Assisted Design (CAD) modeling.¹⁷⁸ UAS may also be helpful for planning large-scale transportation projects, utilities, and other public works projects.¹⁷⁹

Drones can also enhance security of public buildings and areas.¹⁸⁰ A drone can monitor areas such as power plants, water treatment facilities, and other sensitive locations, perhaps reducing the number of employees needed to perform these investigatory tasks.¹⁸¹

Parks and Forest Services can use UAS to help research on vegetation type and health, wildlife, streams and reservoirs. By providing a high level aerial view, drone footage can be used to supplement or complement manual data collection.¹⁸² Along with environmental research, UAS can also detect illegal and hazardous activities on protected watersheds, reducing foot or vehicle traffic on these protected lands.¹⁸³

UAS may also be used to create videos and pictures used in city marketing. Municipalities can take high-level drone footage of large-scale events such as the BolderBoulder road race without the

¹⁷⁵ Norman Hallermann et al., *Vision-Based Deformation Monitoring of Large Scale Structures Using Unmanned Aerial Vehicles* (Sept. 2014), https://www.researchgate.net/publication/269671056_Vision-based_deformation_monitoring_of_large_scale_structures_using_Unmanned_Aerial_Systems.

¹⁷⁶ *Large Scale Industrial Surveying via Drone Photogrammetry*, Pix4D (June 16, 2016), <https://pix4d.com/large-scale-industrial-surveying-drone-photogrammetry/>.

¹⁷⁷ Matt Burgess, *Create a 3D Model of Your House with This Drone*, Wired (Dec. 13, 2016), <http://www.wired.co.uk/article/drone-map-house-model>.

¹⁷⁸ *Id.*; *Individual Survey & Enterprise 3D Modeling Solutions*, Arch Aerial, <http://archaerial.com/3d-modeling/> (last visited Dec. 2, 2017).

¹⁷⁹ Sense Hawk, <https://sensehawk.com/industries/roads> (last visited Dec. 2, 2017).

¹⁸⁰ Travis Hoiium, *How Drone Usage Will Revolutionize the Security Industry*, Motley Fool (Sep. 26, 2016), <https://www.fool.com/investing/2016/09/26/how-drone-usage-will-revolutionize-the-security-in.aspx>.

¹⁸¹ *Id.*

¹⁸² Mitchell B. Cruzan et al., *Small Unmanned Aerial Vehicles (Micro-UAVs, Drones) in Plant Ecology*, 4 *Applications in Plant Sci.* 9 (Sept. 2016) <http://www.bioone.org/doi/pdf/10.3732/apps.1600041>.

¹⁸³ John Speicher, *16 Drone Security Use Cases You've Never Thought Of*, Dart Drones (Apr. 4, 2017), <https://www.dartdrones.com/blog/drone-security/>.

potentially disrupting and more expensive use of a helicopter.¹⁸⁴ This event marketing can be complemented with scenic imagery of the municipality to create promotional material.¹⁸⁵

In short, UAS provide several potential uses for municipalities, particularly in emergency situations. If UAS and compatible technologies continue to develop, additional municipal UAS uses may emerge.

B. Legal Restrictions and Limitations on Municipal UAS Use

These diverse municipal uses implicate several bodies of law. In crafting its UAS policy, municipalities should consider Federal Aviation Administration (FAA) regulations, open records laws, the Fourth Amendment, and limitations on takings.

1. FAA Licensing and Certificate of Authorization

The FAA identifies two primary options for governments, including municipalities and law enforcement agencies, to operate UAS:¹⁸⁶

- 1) Municipal operators may fly under the small UAS rule, 14 C.F.R. § 107, which among other regulations, requires civil UAS pilots to be licensed through the FAA.
- 2) Alternatively, a municipality may obtain a blanket public Certificate of Waiver or Authorization (COA) which generally permits municipal UAS flights below 400 feet, allows municipalities to self-certify UAS pilots, and enables the municipality to obtain emergency COAs (e-COAs) for other UAS uses.¹⁸⁷

While the Part 107 FAA licensing requirement may be rigorous, it may ensure safer UAS operation than a municipality self-certifying operators through a public COA. Following the Part 107 rules may also promote greater public trust in municipal UAS use because the municipality does not control the certification process.

However, the intricacies of the FAA's licensing regime and other options available to municipal drone users are beyond the scope of this paper. Municipalities should start with the FAA's website and consult an aviation attorney or other experts to determine the best approach for their intended municipal drone uses.¹⁸⁸

¹⁸⁴ American Drone Industries, *Intown Ten Race: A Virginia-Highland 10K*, YouTube (Mar. 1, 2015), <https://www.youtube.com/watch?v=YQtmCMAM8J4>.

¹⁸⁵ Kjell Redal, *Above Boulder – 4K Drone Film*, vimeo (Sep. 6, 2016), <https://vimeo.com/181645979>.

¹⁸⁶ *Beyond the Basics*, https://www.faa.gov/uas/beyond_the_basics/#55 (last visited Apr. 7, 2018).

¹⁸⁷ *Id.*

¹⁸⁸ Fed. Aviation. Admin, *Certificates of Waiver or Authorization* (2018), https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/aim/organizations/uas/coa/; FAA, *Request a Part 107 Waiver or Operation in Controlled Airspace* (2018) https://www.faa.gov/uas/request_waiver/.

2. Open Records Acts

Open Records Acts impose other considerations on municipal UAS use. To promote governmental transparency, the federal government and all 50 states have enacted Open Records Acts.¹⁸⁹ Open Records Acts require governments to provide operational records to anyone who requests them unless a statutory exception applies.¹⁹⁰ Therefore, UAS footage and data may often be requested under Open Records Acts.

In Colorado, the Colorado Open Records Act (CORA) requires the government to make any saved, non-confidential records available to anyone upon request.¹⁹¹ CORA further requires the government to, when practical, provide requested records in an electronic format that is easy to manage and search.¹⁹²

The potential UAS uses described above will likely generate a large volume of data and records. In addition to UAS photographs and videos, other flight-related information such as the identity of the drone operator, licenses, and flight plans can be requested by a member of the public.

CORA creates a presumption in favor of making these type of government records accessible to the public. However, several exceptions to CORA apply to UAS data:¹⁹³

- Records that are part of bona fide state research projects, for example performed by a public university, are not required to be made public.¹⁹⁴
- Any records of criminal investigations performed by police, sheriff, or other law enforcement officer do not need to be made public.¹⁹⁵
- Real estate appraisals done for governmental purposes, such as property assessments performed by the assessor's office, do not need to be made public.¹⁹⁶
- Specialized details regarding the security of critical infrastructure are not required to be made public.¹⁹⁷ Thus, if a drone assists with maintenance on critical infrastructure such as water treatment or power facilities and the UAS footage could compromise the security of these facilities, the footage is not required to be made public.

¹⁸⁹ *State Public Record Laws*, FOIA Advocates, <http://www.foiadvocates.com/records.html/> (last visited Jan. 30, 2018).

¹⁹⁰ *Id.*

¹⁹¹ *Colorado Open Records Act (CORA)*, Colorado Secretary of State, https://www.sos.state.co.us/pubs/info_center/cora.html (last visited Apr. 7, 2018).

¹⁹² *Colorado Open Records Act Policy - Colorado Governor's Office*, Colorado Official State Web Portal, <https://www.colorado.gov/governor/CORA> (last visited Dec. 9, 2017).

¹⁹³ Colo. Rev. Stat. § 24-72-201 (2017).

¹⁹⁴ Colo. Rev. Stat. § 24-72-204(2)(a)(III) (2017).

¹⁹⁵ Colo. Rev. Stat. § 24-72-204(2)(a)(I)&(III) (2017).

¹⁹⁶ Colo. Rev. Stat. § 24-72-204(2)(a)(IV) (2017).

¹⁹⁷ Colo. Rev. Stat. § 24-72-204(2)(a)(VIII)(A) (2017).

- Records involving ongoing civil or administrative investigations are also not required to be made publicly available.¹⁹⁸ However, once the civil or administrative investigation is over, the records are required to be made available upon request.¹⁹⁹
- Records that are compiled or maintained by the Department of Natural Resources or its divisions and that can identify individual landowner’s property are not required to be made public.²⁰⁰

If UAS collected data falls under one of these exceptions, a governmental entity can choose whether or not to disseminate the requested records. If an exception does not apply, the government must produce the record. Other municipalities should consult their state’s open records act to locate the relevant exceptions.

However, the high cost of storing video footage may create challenges for the governmental transparency required by CORA and other disclosure statutes.²⁰¹ Storage costs for bodycam and dashcam footage alone can cost police departments hundreds of thousands of dollars per year.²⁰² Thus, this high cost of data storage incentivizes municipalities to not save UAS footage permanently.

Temporary and unneeded UAS footage does not need to be retained permanently. Governmental disposal of unneeded data is legal, particularly if disposed pursuant to a document retention policy.²⁰³ However, large-scale deletion of UAS data could raise concerns about governmental transparency. A municipal UAS data retention policy can help articulate a municipality’s position on UAS data, specifically outlining what types of UAS data are retained and what UAS data is discarded.

Additionally, governments may also consider publicizing UAS data before receiving Open Records requests. For example, municipal drone footage may be live streamed from a website. This dissemination promotes governmental transparency. Additionally, public real-time access to UAS data may result in fewer records requests and a greater trust of the government UAS usage.

3. Fourth Amendment Limitations on UAS Searches and Surveillance

The Fourth Amendment, which ensures people have a right against unreasonable searches, constrains governmental UAS surveillance.²⁰⁴ Generally, municipal UAS surveillance should be

¹⁹⁸ Colo. Rev. Stat. § 24-72-204(2)(a)(IX)(A) (2017).

¹⁹⁹ *Id.*

²⁰⁰ Colo. Rev. Stat. § 24-72-204(3)(a)(XXI) (2017).

²⁰¹ Tim Kridel, *Storage Wars: How the Federal Government is Tackling Data Growth*, FedTech Mag., <https://fedtechmagazine.com/article/2016/06/storage-wars-how-federal-government-tackling-data-growth> (last visited Apr. 7, 2018).

²⁰² Linzi Sheldon, *Millions of Dollars, Privacy Concerns Surround Seattle Police Department Body Camera Program*, KIRO 7 News (Feb. 7, 2018 9:42am) <http://www.kiro7.com/news/local/millions-of-dollars-privacy-concerns-surround-seattle-police-department-body-camera-program/692859188>.

²⁰³ Colo. Rev. Stat. § 24-72-203(1)(b)(I) (2017).

²⁰⁴ U.S. Const. amend. IV.

performed at heights that do not impact property use. Also, long-term UAS surveillance, in addition to being expensive, may violate the Fourth Amendment.

The legality of municipal UAS surveillance, which has not been considered by courts, can be analogized to other Fourth Amendment court cases concerning searches performed by helicopters and planes.

The Supreme Court in *Katz v. U.S.* held that citizens are entitled to protection from warrantless searches of places where a person would have a reasonable expectation of privacy.²⁰⁵ However, places that may be considered private to the tenant or property owner, such as fenced-in backyards and greenhouses, may not legally be protected by a “reasonable” expectation of privacy.

In *California v. Ciraolo*, the Supreme Court held a warrantless plain view aerial search of a fenced-in backyard performed via flyover at 1000 ft. did not violate the Fourth Amendment.²⁰⁶ The Court reasoned that if the area could be seen by unaided eyesight from navigable airspace, there was no expectation of privacy.²⁰⁷

Similarly, in *Florida v. Riley* the Supreme Court held a helicopter search of a greenhouse from 400ft did not interfere with the property owner’s reasonable expectation of privacy because helicopter flights at this altitude were legal and sufficiently commonplace.²⁰⁸ The Court also held the search was reasonable because the search did not damage or disturb the property, nor did it interfere with the normal use of the greenhouse.²⁰⁹ The search also did not reveal any “intimate details” connected with the use of the greenhouse.²¹⁰ Thus, the Court held the search was reasonable although observation from ground level was obstructed.

This Supreme Court precedent has been applied to state court cases determining the legality of helicopter searches:

- The New Mexico Supreme Court in *State v. Davis* held a warrantless helicopter search of a home violated the Fourth Amendment because it caused an “unreasonable intrusion on the ground.”²¹¹ The helicopter caused property damage, kicked up debris, produced excessive noise, and caused panic among the home’s residents.²¹² Although the helicopter allegedly flew as low as 50 feet, the Court did not base its holding on search altitude.²¹³

²⁰⁵ 389 US 347 (1967).

²⁰⁶ 476 U.S. 207 (2013).

²⁰⁷ *Id.*

²⁰⁸ 488 U.S. 445, 450 (1989).

²⁰⁹ *Id.* at 452.

²¹⁰ *Id.*

²¹¹ 360 P.3d 1161, 1171 (N.M. 2015).

²¹² *Id.* at 1171.

²¹³ *Id.* at 1164.

- The Colorado Court of Appeals held a 200 foot helicopter search violated the Fourth Amendment when it hovered for several minutes, causing numerous people to run outside.²¹⁴
- A later Colorado Supreme Court case held helicopter surveillance reasonable because there was little evidence of “noise, wind, dust, threat of injury” or interference with property use.²¹⁵ Furthermore, there was no indication any neighbors were disturbed by or noticed the helicopter.²¹⁶

Based on the Supreme Court cases and their application to state court helicopter search cases, a warrantless UAS search may be unreasonable if:

- It interferes with a person’s use of their property, for instance by causing panic in the home’s residents;
- It reveals private, intimate details connected with the use of the property;
- It disturbs neighbors; or
- It is flown at low altitude where flight is illegal, rare, or otherwise unexpected

Unlike helicopter searches, ground or property damage will not likely be determinative of the reasonability of a UAS search because UAS are generally small and lightweight. However, because most UAS are smaller than helicopters, UAS can fly much closer to property without causing disturbance. Even in the absence of the factors bulleted above, courts may find this close proximity UAS flight violative of a person’s reasonable expectation of privacy. To illustrate, a person is not likely to reasonably expect a drone hovering outside their second-story window.

The data collected from UAS surveillance raises other legal and privacy concerns. Drones offer many surveillance possibilities. Municipal UAS surveillance may be performed by a satellite of drones, or through more targeted searches. StingRays or DRT Boxes (dirtboxes)—devices which actively or passively surveil cellular communication signals—may be attached to a drone for surveillance.²¹⁷ A satellite of drones outfitted with StingRays could collect cellular records from many members of the public over a long period of time.²¹⁸

The Supreme Court is currently considering the legality of long-term data collection and storage under the Fourth Amendment in *Carpenter v. U.S.*²¹⁹ *Carpenter* concerns the collection of cellular

²¹⁴ *People v. Pollock*, 796 P.2d 63 (Colo. App. 1990)

²¹⁵ *Henderson v. People*, 879 P.2d 383, 389–90 (Colo. 1994) (en banc).

²¹⁶ *Id.*

²¹⁷ *Local Police Departments Invest In Cell Phone Spy Tools*, NPR (Feb. 17, 2017), <https://www.npr.org/2017/02/17/515841069/local-police-departments-invest-in-cell-phone-spy-tools>.

²¹⁸ Kim Zetter, *Florida Cops’ Secret Weapon: Warrantless Cellphone Tracking*, *Wired* (Mar. 3, 2014) <https://www.wired.com/2014/03/stingray/>.

²¹⁹ *Carpenter v. U.S.*, SCOTUSblog, <http://www.scotusblog.com/case-files/cases/carpenter-v-united-states-2/> (last visited Apr. 7, 2018).

records from a suspect over 127 days.²²⁰ The cellular records included information such as the suspect's location and movements.²²¹ *Carpenter* will contextualize two other recent Supreme Court cases concerning searches under the Fourth Amendment.

- In *U.S. v. Jones*, the Court held that warrantless use of a GPS tracker to relay the defendant's car movements for 28 days violated the Fourth Amendment because it was a "physical intrusion" on "private property for the purpose of obtaining information."²²²
- In *Riley v. California*, the Court held that warrantless cellphone searches violated the Fourth Amendment due to the amount of personal information held in a cell phone.²²³

In oral arguments on *Carpenter*, the Government reasoned that because cell-site information is knowingly provided to a third-party, the cell-provider, the cellular data is not protected under the Fourth Amendment.²²⁴ In contrast, the defendant argued that the length of time the cellular data was collected and the amount of personal information available from cellular records made the search unreasonable.²²⁵

Cellular data, like heat signatures detected by IR imaging, and listening devices, are all forms of non-visual data. Therefore, the Supreme Court may use *Carpenter* to outline the types of allowable non-visual data that may be reasonably gathered in a warrantless search as well as the length of time this data may be collected.²²⁶ *Carpenter* may also revisit the third-party doctrine, relied upon by the Government, so that some data would be protected by a reasonable expectation of privacy.

While the outcome of *Carpenter* will likely inform the legality of different types of UAS data collection, in the interim, governments should take care not to use UAS to collect or store long term surveillance data. For example, *Carpenter* may set an outer limit on the length of time cellular data, cell location, and other personal information can be collected under a reasonable search.

4. Takings

Widespread municipal UAS may implicate governmental taking of private property. In *U.S. v. Causby*, discussed in the trespassing section on page 11, the Supreme Court held that regular governmental air flight 83 feet above a chicken farm qualified as a taking because the low flight

²²⁰ *Id.*

²²¹ *Id.*

²²² 565 U.S. 400, 407 (2012).

²²³ 134 S. Ct. 2473, 2490 (2014)

²²⁴ Lee Matheson, *Reading the Tea Leaves in Carpenter v US*, Int'l Ass'n of Privacy Prof. (Dec. 1, 2017) <https://iapp.org/news/a/reading-the-tea-leaves-in-carpenter-v-us/>.

²²⁵ *Id.*

²²⁶ Orin Kerr, *Supreme Court Agrees to Hear 'Carpenter v. United States,' the Fourth Amendment Historical Cell-Site Case*, Wash. Post (June 5, 2017) https://www.washingtonpost.com/news/volokh-conspiracy/wp/2017/06/05/supreme-court-agrees-to-hear-carpenter-v-united-states-the-fourth-amendment-historical-cell-site-case/?utm_term=.09e208538dfc.

substantially impaired the farmers ability to raise chickens on his land.²²⁷ The regular flight also essentially rendered the property uninhabitable.²²⁸ By way of analogy, the Court reasoned an elevated railway 83 feet above private property would also amount to a taking.²²⁹

Theoretically then, high-volume, low-altitude municipal UAS use over private property might amount to a governmental taking. Based on *Causby's* elevated railway analogy, if a municipality designated an area close above a private property as a UAS corridor, that property owner may have cause to bring a takings claim.

* * *

This paper hopefully provides the reader with a useful foundation of the relevant legal principles to consider in developing municipal UAS policy. Future court cases or congressional action may further refine or alter the extent of federal authority over UAS regulation. In addition, municipal UAS use is subject to changes in FAA regulations and the imminent *Carpenter* decision which will inform the permissibility of different forms of UAS surveillance.

Other writers may explore UAS legal areas which were mentioned but not dissected in this paper. For example, drone “jamming” through spectrum interference offers a rich field of legal and policy considerations that merit in-depth examination. Additionally, the inability of the FAA to enforce many UAS violations presents the opportunity to discuss the differences between legal rules and the reality of enforcement. Furthermore, a writer may choose to focus on individual property owner’s rights against UAS use, for example, focusing on jurisdictional differences between common-law torts such as trespassing, nuisance, and voyeurism. And, given the breadth of legal considerations addressed in this paper, there are likely other unexamined legal and policy areas worth exploring.

²²⁷ *United States v. Causby*, 328 U.S. 256, 259 (1946).

²²⁸ *Id.*

²²⁹ *Id.* at 265.

Appendix A FAA Requirements for Hobbyist or Commercial Flight

Fly under the Special Rule for Model Aircraft (Section 336)	Fly under the FAA's Small UAS Rule (Part 107)
<ul style="list-style-type: none"> • Fly for hobby or recreation ONLY • Register your model aircraft • Follow community-based safety guidelines and fly within the programming of a nationwide community-based organization • Fly a model aircraft under 55 lbs. unless certified by a community-based organization • Fly within visual line-of-sight • Never fly near other aircraft • Notify the airport and air traffic control tower prior to flying within 5 miles of an airport • Never fly near emergency response efforts 	<ul style="list-style-type: none"> • Fly for recreational OR commercial use • Register your drone • Get a Remote Pilot Certificate from the FAA • Fly a drone under 55 lbs. • Fly within visual-line-of-sight* • Don't fly near other aircraft or over people* • Don't fly in controlled airspace near airports without FAA permission* • Fly only during daylight or civil twilight, at or below 400 feet* <p>* These rules are subject to waiver.</p>

Source: Fed. Aviation. Admin, Getting Started (2017) https://www.faa.gov/uas/getting_started/.