

ARTICLE

*LOCAL REGULATING OF DRONE ACTIVITY IN LOWER AIRSPACE

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I. INTRODUCTION

Since September 2001, guarding the skies above America's land boundaries against attack by enemies is indisputably crucial. Unsurprisingly, the Federal Aviation Agency (FAA) in February 2016 announced a ten hour-long ban of aircraft flying below 18,000 feet within 36 miles (more or less) of Levi's Stadium in Santa Clara, California.¹ During the National Football League's regular season, the usual "overflight ban" is three and one half miles around the home team's stadium for a period of five hours.² While the FAA needs the discretion to make these flexible decisions, negative consequences follow, among them stifling local governments' exercise of their land planning prerogatives. How may Santa Clara use long-range land planning for siting facilities like Level 1 trauma centers if the FAA arbitrarily, with little notice and no comment period, may permanently determine lower airspace transit corridors for UAVs in populated areas?³ A trauma center requires MedEvac helicopter transport without interruption. Trauma center patients and their beloveds do not care that summary decrees governing flight are a routine practice in hosting public entertainments like the Super Bowl.⁴

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¹ Jack Nicas, *FAA Orders Big No-Fly Zone for Drones at the Super Bowl*, WALL ST. J., Feb 5, 2016, at B4. Levi's Stadium hosted Super Bowl 50 on February 7, 2016. *Id.*

² *Id.*

³ This may seem a small matter until the reader considers that (a) each such use requires substantial acreage, (b) such-sized tracts are rarely available in heavily-developed central business districts, and (c) from necessity, they may be located proximately, the case in circumstances such as historic stadiums in downtowns, university arenas and stadiums next to university hospitals and in revitalization projects where expansion of hospital beds and updating venues is an economic development opportunity.

⁴ That is because the initial nation-wide study from 2011 indicates that helicopter transport increases the survival rate for seriously injured patients. Joshua B. Brown et al., *Helicopters Improve Survival in Seriously Injured Patients*, 70 J. TRAUMA: INJURY INFECTION & CRITICAL CARE 310, 313 (2011).

The National Transportation Safety Board ruled in November 2014 that drones are considered aircrafts, and thus, are subject to the Federal Aviation Administration's regulation and other U.S. aviation law,⁵ which propelled the FAA to promulgate regulations for drone usage. One lobbyist observed in this instance that “[t]he F.A.A. is saying it has jurisdiction over all airspace — that means from the top of blades of grass to infinity”⁶ In adopting these new drone guidelines,⁷ the FAA asserted its authority over anything moving in the airspace — space not currently occupied by objects. The agency felt entitled to introduce new recreational drone rules, which include operator registration requirements in a national database.⁸ A right of the landowner to control low-altitude airspace immediately over her private property may conflict with the right of a registered drone owner to operate her UAV in the same airspace. The FAA has not advised anyone at what altitude, if any, drone flights will constitute a trespass. The U.S. Supreme Court has already advised, however, that a pilot's naked-eye surveillance of private property below is legal without constituting invasion of privacy.⁹ Helicopters are not required to stay above the 500-foot navigable airspace floor,¹⁰ so the Supreme Court has held that pilots' observations made from as little as 400 feet aloft are not an invasion of privacy.¹¹ The same leniency applies to blimps and hot air balloons.

⁵ Huerta v. Pirker, Docket No. CP-217, 12 (Nov. 18, 2014), <http://www.nts.gov/legal/alj/Documents/5730.pdf> [<https://perma.cc/E9L8-LKHZ>].

⁶ Cecilia Kang, *Localities Object as F.A.A. Asserts Drone Authority*, N.Y. TIMES, Dec. 28, 2015, at B1, B3 (quoting Tom McMahon, Vice President for the Association for Unmanned Vehicle Systems International, a lobbying group representing drone makers).

⁷ See FAA Interim Final Rule, *Registration and Marking Requirements for Small Unmanned Aircraft*, 14 C.F.R. pt. 48 (2015), http://www.faa.gov/news/updates/media/20151213_ifr.pdf [<https://perma.cc/GG9K-NENK>].

⁸ See 14 C.F.R. §§ 48.15, 48.25 (The guidelines require pilots 13 years and older to register if they are American citizens flying UAVs between .55 lbs. and 55 lbs. on takeoff). See also 49 U.S.C. § 40103(b)(1) (2012) (directing the FAA to develop both plans and policy “for the use of the navigable airspace” and to assign “the use of the airspace necessary to ensure the safety of aircraft and the efficient use of the airspace.” 49 U.S.C. § 40103(b)(2) (directing the FAA to use that airspace to prevent collision between aircraft and between them and land or water vehicles, as well as between them and other airborne objects).

⁹ *California v. Ciraolo*, 476 U.S. 207, 215 (1986).

¹⁰ Airspace classified as navigable airspace that the FAA manages under a plethora of regulations “means airspace above the minimum altitudes of flight prescribed by” the Secretary of Commerce. See, e.g., 49 U.S.C. § 40102(32); see also 49 U.S.C. § 40103(a) (2) (stating that a “citizen of the United States has a public right of transit through the navigable airspace”); 14 C.F.R. § 77.23 (2009). The “navigable airspace line” is higher in some dense urban areas to accommodate high rise development. See 14 C.F.R. § 91.119(b) (2010) (devising an altitude of 1,000 feet above “the highest obstacle within a horizontal radius of 2,000 feet of the aircraft”). That line is lower near airports, which facilitates takeoffs and landings. 14 C.F.R. § 77.17 (2015).

¹¹ *Florida v. Riley*, 488 U.S. 445, 454-55 (1989) (Powell, J., concurring).

The FAA's stance augurs for clashes across the country, since local and state lawmakers, concerned about the safety and privacy risks that drones pose, have passed rules about UAV devices at a rapid pace.¹² More than twenty states approved drone laws in 2015, as have major cities like Chicago, Los Angeles, Miami, and Santa Clara.¹³ Many of these new regulations place tough restrictions on areas where over flight is permitted and clamp down on drones used to invade the privacy of residential neighbors.¹⁴ The problem, it seems, is that UAVs impact citizens below their flight paths in ways jets moving higher above ground do not, bursts of noise and contrail conspiracies notwithstanding. City officials believe they are more sensitive at the finer grained level of management to the complaints of their citizens; but the FAA to date has not shown inclination to cede any of its authority over flights, even at ground level.¹⁵

Complete federal oversight of drone regulation seems peculiar, especially when contrasted with agency coordination at the confluence of water law and land use law. In the latter intersection, lines of authority seem clearly drawn. There are two primary reasons why the water law/land law interface is simpler to navigate. The first is that Hugo Grotius' *Mare Liberum* (1608) has been well-parsed and articulated for centuries, confirming that excepting so-called "territorial waters," international customary law forbids claims of sovereign rights to use the open seas, recognizing thereby the right of innocent passage,¹⁶ confirmed by the United Nations Convention on the Sea.¹⁷ Consequently,

¹² See generally Henry H. Perritt, Jr. & Albert J. Plawinski, *One Centimeter Over My Back Yard: Where Does Federal Preemption of State Drone Regulation Start?*, 17 N.C. J.L. & TECH. 307, 364–8 (2015) (tracking the rapid increase in rules from 2013 to 2015 specifically addressing the privacy and safety risks that drones bring forth); Nabiha Syed & Michael Berry, *Journo-Drones: A Flight over the Legal Landscape*, 30 COMM. LAW. 1, 27 (2014).

¹³ Kang, *supra* note 6; Troy A. Rule, *Drone Zoning*, 94 N.C. L. REV. (forthcoming 2016) (manuscript at 44, n.182); see generally Unmanned Aircraft System, SANTA CLARA (CAL.) CITY CODE ch. 8.60, § 8.60.030 (2016) <http://www.codepublishing.com/CA/SantaClara/html/SantaClara08/SantaClara0860.html> [<https://perma.cc/2XHR-9LKK>] (prohibiting all commercial and consumer drone flights around large venue special events in public parks and facilities attracting large audiences); see also CAL. CIV. CODE § 1708.8 (2015) (providing a person is liable for invasion of privacy by invading airspace to photograph or video record private events); CAL. CIV. CODE § 1708.10 (making use of a drone fewer than 350 feet above ground level without express authority a civil trespass).

¹⁴ See Kang, *supra* note 6.

¹⁵ See Perritt & Plawinski, *supra* note 12, at 376.

¹⁶ HUGO GROTIUS, *THE FREEDOM OF THE SEAS*, 43–44 (James B. Scott ed., Ralph Van Deman Magoffin trans., Oxford University Press 1916) (1608), <http://oll.libertyfund.org/titles/552> [<https://perma.cc/L7LV-NTK9>] (noting "innocent passage is not justly to be denied to persons of any country").

¹⁷ See U.N. Convention on The Law of the Sea, § 3, art. 17–19, http://www.un.org/depts/los/convention_agreements/texts/unclos/unclos_e.pdf [<https://perma.cc/YD5F-RB8S>].

American federal law governs in oceanic law impacting the United States as a sovereign state; but federal law is limited in regard to lake and stream law.¹⁸ By contrast, the law of airspace became the subject to treaties beginning after the armistice ending World War I, with the Paris Convention of October 13, 1919, and later the Chicago Convention of 1944.¹⁹ Sorting out authority over waters of our land had a 300-year head start over matters addressing airspace, so to speak.

Until the First World War, international airspace had not been sufficiently saturated by humankind to require much regulation. The fundamental concept originally articulated by Cino da Pistoia,²⁰ that the owner of the soil owned limitlessly above to the heavens, until 1901 remained the conceded principal of control. In 1902, French legal scholar Paul Fauchille articulated for the first time the freedom of use of air space above 1,500 meters.²¹ Fauchille's views summarily were rejected by scholars like the British lawyer John Westlake, who in 1906 advocated continuing state sovereignty of the air (without upward limit) and terminating transit rights of balloons and wireless telegraph equipment above-ground.²² The Chicago Convention recognizes state sovereignty to the extent that a non-native operating air service must seek permission from another sovereign state, operate according to the terms of such permission as may be

¹⁸ That does not suggest no federal intervention occurs in matters of American stream law. For instance, the federal government (through the Federal Emergency Management Agency that delineates floodplains and the U.S. Army Corps of Engineers, among other agencies) intervenes to prevent potential flood events or damage to riparian habitats of navigable waters within the nation under the National Environmental Policy Act and the Clean Water Act, among other regulatory schemes. *See, e.g.,* Tony Davis, *Corps is reviewing Benson project's permit*, ARIZ. DAILY STAR (July 17, 2015, 8:15 PM), http://tucson.com/news/local/corps-is-reviewing-benson-project-s-permit/article_e1b8cbb9-eb12-5060-9dca-614b4d83e8f9.html [<https://perma.cc/CW8J-EYLR>]; Annie Snider & Debra Kahn, *Water Policy: Salt pond saga raises questions about feds' regulatory reach*, ENV'T & ENERGY PUB. (Mar. 12, 2015, 4:16 PM), <http://www.eenews.net/stories/1060014942> [<https://perma.cc/Y2Z9-CG6V>].

¹⁹ *See generally* Convention Relating to the Regulation of Aerial Navigation Signed at Paris, Oct. 13, 1919, 138 L.N.T.S. 418, http://www.spacelaw.olemiss.edu/library/aviation/IntAgr/multilateral/1919_Paris_convention.pdf [<https://perma.cc/NHV8-3RL3>]; Convention on International Civil Aviation, Chicago, Dec. 7, 1944, 15 U.N.T.S. 295, http://www.icao.int/publications/Documents/7300_orig.pdf [<https://perma.cc/3RE2-85AS>]; William Latey, *The Law of the Air*, 7 TRANSACTIONS GROTIUS SOC'Y 73, 73 (1921) (noting the “somewhat embryonic corpus juris” from recent advances in aerial navigation).

²⁰ *See* Stuart S. Ball, *The Vertical Extent of Ownership in Land*, 76 U. PA. L. REV. 631, 631 (1928); *see also* 1 WILLIAM BLACKSTONE, COMMENTARIES *18-19.

²¹ *See* Sheila F. Macbrayne, *The Right of Innocent Passage*, 1 MCGILL L.J. 271, 272 (1955) (discussing the novel idea set forth in Fauchille's *Le Domaine Aerien*).

²² *See* John Cobb Cooper, *High Altitude Flight and National Sovereignty*, reprinted in JOHN COBB COOPER, EXPLORATIONS IN AEROSPACE LAW 257, 258–59 (Ivan A. Vlasic ed., McGill University Press 1968). Apparently, however, Westlake supported a right of “innocent passage” for foreign aircraft such as that allowed on the seas.

granted, and in all events be controlled by the permission-seeking State or its citizens.²³ In the United States, Congress enacted the Air Commerce Act of 1926²⁴ to avoid the necessity of airlines needing to acquire indeterminate numbers of aviation easements from fee owners for long flights.²⁵

Another contrast between air and water rights' intersection with local land use regulation is a question of boundary. The place where water law apparently ends and land use control begins is readily-enough visible,²⁶ albeit morphing due to accretion and avulsion (of riverbanks) and wave motion in the case of lakes, bays, seas and oceans. Water flows across, through and under this planet's land mass, and laps against its edges. In contrast, while breezes flow across land and through caverns beneath the ground, its "edges" are detectable only through solid reference points. This contributes to confusion about the basis for determining where the rights of the federal regulators might end – is it really atop the soil's surface, or through just portions of land unoccupied by structures and other vertical objects like poles or siloes? The navigable airspace at 500 feet above ground level²⁷ is arbitrary, but bears some basis in logic.

Federal agencies' control of what happens within municipal boundaries down to 500 feet above natural grade as "navigable airspace" to a degree mirrors federal control over matters involving tall buildings, billboards and cellular

²³ See generally Convention on International Civil Aviation Done at Chicago, Dec. 7, 1944, 15 U.N.T.S. 295, http://www.icao.int/publications/Documents/7300_orig.pdf [<https://perma.cc/3RE2-85AS>].

²⁴ Air Commerce Act of 1926, Pub. L. No. 69-254, ch. 344, § 14, 44 Stat. 568 (1926).

²⁵ See FED. AVIATION ADMIN., NO. 150/5100-17, LAND ACQUISITION AND RELOCATION ASSISTANCE FOR AIRPORT IMPROVEMENT PROGRAM (AIP) ASSISTED PROJECTS (Nov. 7, 2005) (providing that if fee title is not necessary, an aviation easement may be obtained to secure airspace for airport and runway approach protection and for noise compatibility programs). An aviation easement conveys airspace over another owner's property for use by the airport for overflight and other applicable restrictions on the servient owner's use and development of his parcel. *Id.* "Easement rights acquired typically include the right-of-flight of aircraft; the right to generate noise, dust, odors and so on; the right to remove all objects protruding into the airspace together with the right to prohibit future obstructions or interference in the airspace; and the right of ingress/egress on the servient land to exercise these rights." *Id.* The aviation easement runs with the land binding all future owners of the servient. So, the aviation easement provides the airport an indemnity from any future actions from the property owner from airport impacts. *Id.*

²⁶ But see Sharon Megdal et al., *The Forgotten Sector: Arizona Water Law and the Environment*, 1 ARIZ. J. ENVTL. L. & POL'Y 243, 277-8 (2011) (discussing the phenomenon of underground streams, site of "subflow," creating some confusion as to whether surface water or percolating ground water rights are in play). Of course, rivers overflow their banks and dams may burst; but generally in developed areas, water is more predictable and even "tamable" than is largely invisible (tornados excepted) and unreliable wind.

²⁷ See Civil Aeronautics Act of 1938, ch. 601, §§ 1(24), 3, 52 Stat. 973, 979-80, (stating that "Navigable Air Space" is determined at minimum altitudes); Air Commerce Act of 1926, Pub. L. No. 69-254, § 10, 44 Stat. 568 (setting the minimum safe altitude for "Navigable Air Space" as the level prescribed by the Secretary of Commerce).

towers – all structures anchored to the ground. Tall buildings programmed for erection within proximity of Class B airports must obtain permission of the FAA if they potentially interfere with current landing and takeoff patterns of aircraft, as federal law preempts local regulation of aircraft operations.²⁸ Since billboards mainly adjoin interstate and federal highways today, the federal Department of Transportation has some (but not exclusive) jurisdiction with respect to their placement.²⁹ The siting of cellular towers is likewise subject to oversight by the Federal Communications Commission.³⁰ Federal law does not preempt municipal law, which generally is preserved by Section 704 of the federal Telecommunications Act of 1996.³¹ Cities generally cannot enact a moratorium on siting, or altogether deny siting, personal wireless facilities' towers on aesthetic grounds unless the municipality's decision is supported by substantial evidence applying to the adjudicative facts of the application.³²

If federal agencies (or any government agencies – although preemption principles favor federal jurisdiction) actually have the right to appropriate air space for UAVs, several concerns arise. Does this mean the end of private ownership of air space, contrary to *United States v. Causby*?³³ There, the U.S. Supreme Court ruled that a landowner “owns at least as much of the space above the ground as he can occupy or use in connection with the land,” and invasions of that airspace “are in the same category as invasions of the surface.”³⁴ Further, the court held that the military aircraft's owners had the right to occupy navigable airspace for a legitimate purpose (thus, that the doctrine of *ad coelum*

²⁸ See *City of Burbank v. Lockheed Air Terminal, Inc.*, 411 U.S. 624, 633-4 (1973) (finding that the FAA has complete control over regulation of aircraft noise, which preempts state and local control).

²⁹ See *A History and Overview of the Federal Outdoor Advertising Control Program*, U.S. DEPARTMENT OF TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION (1997), http://www.fhwa.dot.gov/real_estate/oac/oacprog.cfm [<https://perma.cc/M9E6-VV2Q>] (noting that federal law permits removal of signs under the Highway Beautification Act, so long as just compensation is paid for the rights and interests of the sign owner and, if applicable, the site owner).

³⁰ See *Tower and Antenna Siting*, FEDERAL COMMUNICATIONS COMMISSION, <https://www.fcc.gov/general/tower-and-antenna-siting> [<https://perma.cc/4XJA-TSUS>]. A new tower requires compliance with the National Environmental Policy Act (NEPA); compliance with the National Historic Preservation Act (NHPA); and, additionally, the FCC may require owners to notify the FAA of the installed structure. *Id.*

³¹ Telecommunications Act of 1996, Pub. L. No. 104-104, § 704, 110 Stat. 56, 151.

³² See John W. Pestle, *Cellular Tower Zoning and Siting: Federal Developments and Municipal Interests*, 33-34 (2012), http://www.varnumlaw.com/files/documents/publications/Cellular_Tower_Zoning_Paper_I_MLA_December_6_2012.pdf [<https://perma.cc/A3WQ-GXNE>]. In other words, generalized expressions of aesthetics objections are not substantial evidence supporting a municipal denial. *See id.* at 35-36.

³³ *United States v. Causby*, 328 U.S. 256 (1946).

³⁴ *Id.* at 258-59.

was *finis* as to an ill-defined “upper zone”); but since the resulting easement through private property, at just sixty-seven feet above their home, implicated a taking, Causby was owed compensation under the Takings Clause.³⁵ All we learn from *Causby* for certain is that Congress placed navigable airspace, wherever found, into the public domain.³⁶

Likewise, if “lower zone” airspace ownership survives new federal regulations, is there a separate public domain right of avigation, thus defeating a landowner’s claim of nuisance or trespass onto private property?³⁷ Further, does the right of avigation extend to drones employed only for private purposes, such as those pursued by hobbyists?³⁸ In short, have private property owners surrendered all their airspace rights? This question has been asked and tentative responses offered lately by Professor Rule,³⁹ drawing upon, among other principles, basics of fee simple title, including the right to exclude others from one’s property.⁴⁰ A correlative right is that to *include* others’ use of one’s property, including aerial rights, allowing monetization of the fee owner’s title. For instance, a landowner may grant a ground lease for siting facilities generating distributed wind power. If private owners are deemed to grant a *de jure* easement over its air rights to the federal government, only a non-exclusive easement grant leaves the fee owner monetizing opportunities. A non-exclusive

³⁵ *Id.* at 259.

³⁶ *Id.* at 260-61.

³⁷ It seems the answer here is “no” – otherwise, governments would not pay for avigation easements in low altitude airspace for takeoffs and landings. See Troy A. Rule, *Airspace in an Age of Drones*, 95 B.U. L. REV. 155, 183 (2015).

³⁸ A federal court will soon provide guidance, in response to a filed complaint, as to whether a fee owner, under state law, may use self-help to eliminate drone presence in Class G airspace (200’) above his land. See Complaint at 1, *Boggs v. Merideth*, No. 3:16-cv-6-DJH, 2016 WL 66951 (W.D. Ky.). This matter well illustrates the reason why governments must not engage in a “shoving match” much longer – because citizens galore are willing to undertake self-help, and entrepreneurs will enable them. See, e.g., Brian Sullivan, *Look! Up in the Sky!* 102 A.B.A. J. 71 (2016) (describing self-help episodes); Lisa Eadicicco, *Here’s the Perfect Weapon for Drone Haters*, FORTUNE (Mar. 5, 2016, 12:34 PM), <http://fortune.com/2016/03/05/skywall100-anti-drone-bazooka/> [https://perma.cc/Z8ZH-N4XU] (OpenWorks Engineering invented commercial net-deploying bazooka that downs drones by “netting” them, forcing them to earth).

³⁹ See Rule, *supra* note 37, at 183. Professor Rule ultimately argues for legislation giving landowners strict rights to exclude aircrafts from a clearly-defined column of low-altitude airspace directly over their parcels, thereby clarifying landowners’ entitlements in low-altitude airspace; *id.* at 182-3; accord McNeal, *infra* note 71, at 9-11. Such a solution enables the permitting advocated for in Part V, *infra* and local control of that airspace, without depriving the fee owner of opportunities to monetize her owned airspace or otherwise to optimize the use of space above her land.

⁴⁰ See Rule, *supra* note 37, at 175, 178; Henry E. Smith, *The Persistence of System in Property Law*, U. PENN. L. REV. 2055, 2060 (2015) (stating that fee simple title does not incorporate precluding others from “viewing”).

easement permits state and local regimes regulating this lower air space, raising the issue whether regulators will limit use that air space for example, according to the principle of “first in time, first in right.” Is there a proper place for land use law, a local regulatory prerogative, at the airspace law intersection with the ground? If the reply is affirmative, what limits exist on the exercise of the local community’s delegated police power? First, however, does municipal regulatory discretion over lower airspace add much, in the realm of UAVs?

II. COMMUNITY REGULATION CONUNDRUM

The underlying issues in this clash of aerial regulatory prerogatives exceed an abstract jurisdictional war; for highly urbanized areas, a variety of quality of life issues are at stake. Initially, elevated ground transportation’s last opportunity may be lost to low-altitude flight authorization. Second, municipalities are whipsawed between lack of local control over siting of air lanes and demand for city and town ongoing approval of development projects proximate to potential new flight-ways. Municipal moratoria pending sequential federal regulation adoption is a recipe for regulatory takings claims under federal court authority like *Lucas* or *First English Evangelical Lutheran Church*.⁴¹ Third, local regulators do not crave bureaucracy in addition to state and present federal oversight of their activities, especially when, as in the transportation realm, such decisions are regionally reached — already engaging numbers of jurisdictions. Delicately balancing multi-jurisdictional inputs can turn haywire by several federal agencies generating concurrent yet conflicting signals about what is (and will not be) permissible for regulation at the regional scale.

Additionally, nimbleness in decision-making for land and transportation use at the regional scale can be hobbled by federal demands that Environmental Impact Statement (EIS) and other studies’ protocols be satisfied prior to reaching any decisions at all. Accordingly, when Elon Musk arrives with the prototype of the Hyperloop⁴² and proposes to install a beta-test track at the second-story level

⁴¹ See *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1016, n.7 (1992) (observing mere diminution of value of the tract as a whole is not compensable); *First English Evangelical Lutheran Church of Glendale v. Los Angeles Cty., Cal.*, 482 U.S. 304, 319 (1987) (finding temporary land use restrictions that deprive a property owner of all economically beneficial use of property require payment of just compensation, unless a state law background principle (e.g., nuisance) excuses the payment of just compensation); *but see Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Authority*, 535 U.S. 302, 341–42 (2002) (noting a regulation prohibiting any economic use of land for a 32-month period may not be a taking if *Penn Central* (investment-backed expectations) analysis applies).

⁴² See HYPERLOOP TRANSPORTATION TECHNOLOGY, <http://hyperlooptech.com/> [<https://perma.cc/XN7E-4NHA>]; Jared Green, *How Autonomous Vehicles Will Change the Built Environment*, THE DIRT (Oct. 14, 2015), <http://dirt.asla.org/2015/10/14/imagine-a-driverless-future/> [<https://perma.cc/E77W-CMZ2>]; David Z. Morris, *Could the Hyperloop soon be a reality, or are we getting taken for a ride?*, FORTUNE (Sept. 11, 2015, 4:47 PM), <http://fortune.com/2015/09/11/is-elon-musks-hyperloop-fatally-flawed/> [<https://perma.cc/B7KE-UKCG>].

of downtown buildings, the city's bureaucracy may need politely to decline to accept that first opportunity to revolutionize their central business district's traffic flow pending federal clearance of an EIS.⁴³ Further, there may be more than one federal agency's jurisdiction in play. Suppose a group of communities decides to generate electricity at utility scale through wind power, implementing a wind turbine project – which federal agency will lead? Is the FAA in charge of deciding whether wind turbines can be placed in a particular location proposed for airspace for commercial delivery – or is the Department of Energy the final authority?

Fourth, cities and towns may seek to deploy their own UAVs within city limits – or even over municipal property – for a variety of socially purposeful reasons such as traffic studies or public safety.⁴⁴ A city's leadership may not desire advance federal approval of these salutary initiatives. For example, the Papago Buttes is a topographical feature within the City of Phoenix, popular with hikers and rock climbers. Drones operated by the city may aid in locating (from higher altitude) a hidden, but stranded outdoorsperson. Should the city need FAA approval before dispatching a search drone over those rock formations for no reason other than they lay inside a radius described by the Sky Harbor International Airport's flight patterns? Fifth, cities like Phoenix approve the siting of helipads and heliports within its boundaries, often for provision of emergency health services.⁴⁵ Must those locations be relegated to leftover locations after municipal airspace is allocated by federal agencies to persons engaged in less urgent or purposeful endeavors? Sixth, some cities trade in transfer of development rights, affording a developer currency in the form of potential development opportunities foregone in areas of the community restricted by height limits or historic designations. In such trades, property in another high-density zone obtains a development bonus, sometimes in the form of the exchanging developer's ability to build to greater heights. At other times municipalities sell air rights over public rights of ways and other public lands.⁴⁶

⁴³ See Sean Hackbarth, *Regulatory System Could Crush Hyperloop Dream*, FREE ENTERPRISE (Aug. 13, 2013), <http://archive.freeenterprise.com/infrastructure/regulatory-system-could-crush-hyperloop-dream> [<https://perma.cc/XC53-LRB5>].

⁴⁴ See *Drones Will Elevate Urban Design*, THE DIRT (Mar. 10, 2015), <http://dirt.asla.org/2015/03/10/drones-will-redefine-the-image-of-the-city/> [<https://perma.cc/2MM6-AJ48>] (noting that UAVs may enable planners to examine the existing social and environmental conditions of sites, documenting accurate circulation through transit corridors and shifting urban and demographic patterns, as well as topographical and hydrologic changes and environmental degradation).

⁴⁵ PHOENIX, ARIZ., (AZ) ZONING ORDINANCE, ORD. § 647(A)(2)(c) (2012), <http://www.codepublishing.com/AZ/Phoenix/frameless/index.pl?path=../html/PhoenixZ06/PhoenixZ0647.html> [<https://perma.cc/M55V-AUNA>].

⁴⁶ See Martin A. Schwartz, *It's Up in the Air: Air Rights in Modern Development*, 89 FLA. B. J. 42, 44 (Apr. 2015), <https://www.floridabar.org/divcom/jn/jnjournal01.nsf/8c9f13012b96736985256aa900624829/d49eb1e82c6deaf485257e1400671f58!OpenDocument> [<https://perma.cc/8RX9-N9FX>].

Are these municipal prerogatives gone, if the FAA has all authority over lower airspace? In short, if there is a community-wide aviation easement in favor of federal regulators indulging their flexibility in determining airspace rights, what of airspace is left to the local community for its allocation and watchdogging?

III. SEGMENTING LOWER AIRSPACE

Airspace is divisible and identifiable by legal description federally, locally and privately. The FAA periodically modifies its system of legally describing airspace by modifying its aeronautical charts or via FAA Orders. It announces these changes periodically in the Federal Register.⁴⁷ At the local governing level, zoning maps are not restricted to two dimensions; they can be used in three dimensions to model the lower airspace.⁴⁸ Providing three-dimensional geometry around community sectors to restrict flight patterns, for one function, can be provided online, for example in a downloadable CAD file; this data can be used with Google Earth or like GIS software by a drone operator.⁴⁹ If data such as GPS and time sequencing were programmed into flight patterns, travel lanes could be identified. Private owners likewise can describe their airspace rights. It is possible legally to describe the “air plane” (analogous to a layer of a rectangular wedding cake, viewed in three dimensions) occupied by improvements above ground level;⁵⁰ accordingly, an owner of an air plane’s occupancy rights can be issued title insurance coverage, to the degree desirable to the airspace grantee or its grantor.⁵¹ These opportunities illustrate the fundamental point that the lower airspace can be partitioned and modeled; and this exercise is susceptible to travel-time sequencing. For instance, one area restricting commercial drone use during the workday could be modeled to lift

⁴⁷ See, e.g., Modification of Legal Description of Class D Airspace; Rapid City, SD; Modification of Legal Description of Class D Airspace; Rapid City Ellsworth AFB, SD, 70 Fed. Reg. 62,236 (Oct. 31, 2005) (codified at 14 C.F.R. pt. 71).

⁴⁸ See Mitchell Sutika Sipus, *Zoning and Urban Land Use Planning for Drones*, HUMANITARIAN SPACE (Aug. 18, 2014), <http://www.thehumanitarianspace.com/2014/08/zoning-and-urban-land-use-planning-for.html> [https://perma.cc/TE5V-99NA].

⁴⁹ See *id.* (demonstrating visually a three-dimensional model for Chicago’s downtown and environs on the Humanitarian Space webpage).

⁵⁰ See, e.g., Michael Wolff, *Real Estate Property Rights*, RIGHT OF WAY, 12-21 (Jan./Feb. 2005), <https://www.irwaonline.org/EWEB/upload/0105c.pdf> [https://perma.cc/RNX6-YX74]; Jantien Stoter & Peter van Oosterom, *Cadastral Registration of Real Estate Objects in Three Dimension*, 15 URISA J. 47 (2003), http://www.gdmc.nl/publications/2003/3D_real_estate_objects.pdf [https://perma.cc/HGJ2-QAFL].

⁵¹ See Richard F. Bales, *Practical Aspects Concerning the Creation of Air Parcels* (Feb. 2000), <http://www.titlegeek.com/illaw/Practical%20Aspects%20Concerning%20Air%20Parcels.pdf> [https://perma.cc/E5WJ-J2EC]. This method is how airspace is divided to stack uses in a mixed use development with multiple ownerships.

UAV travel bans after 6:00 P.M. local time with respect to a particular portion of the air plane, and with respect to another portion at a later time of day.⁵² If the technology to model the lower air space and define lanes for drone travel exists today, the remaining challenge is for governments to compel drone operators to remain in their lanes. Even for that element, technology exists to support asserted regulatory will.⁵³

IV. SORTING LOWER AIRSPACE ENTITLEMENTS' AUTHORITY

Consistent with their Congressional charge, federal authorities must continue their hegemony over certain aspects of drone flight. The FAA holds that a “patchwork quilt” of differing local regulations severely limits the flexibility of that agency in ensuring safety and an efficient air traffic flow.⁵⁴ One logical solution to questions of power and preemption is to segregate the jurisdictions of federal and local authority, segmenting the airspace accordingly.⁵⁵ If the decision nationally is to allow delivery drones in densely populated areas, then federal regulators ultimately will assert preemption if municipalities seek to prohibit absolutely.⁵⁶

⁵² See Sipus, *supra* note 48 (noting a community’s regulations “could lift the ban from 300-400 feet after 5 pm and 400-600 feet after 10 pm.”); see, e.g., Rule, *supra* note 13 (manuscript at 50 n. 206, 53 n. 217, 57).

⁵³ See Sipus, *supra* note 48 (suggesting the combined efforts of drones and Google Earth or other GIS software).

⁵⁴ See Perritt & Plawinski, *supra* note 12, at 6 (listing features that might be required as standard equipment in UAVs); Fowler, *infra* note 58 (indicating forward-moving drones build volumetric maps of objects in flight, a 3-D capability).

⁵⁵ See FAA OFFICE OF CHIEF COUNSEL, STATE AND LOCAL REGULATION OF UNMANNED AIRCRAFT SYSTEMS (UAS) FACT SHEET 3 (Dec. 17, 2015), http://www.faa.gov/uas/regulations_policies/media/UAS_Fact_Sheet_Final.pdf [<https://perma.cc/W6YC-9AS9>] (citing *Arizona v. United States*, 132 S. Ct. 2492 (2012) in describing the proposition that since Congress preempted the field of drone aviation, States and cities may not even adopt “complimentary” or “parallel” regulations).

⁵⁵ The simplest process would allow local control over all drone activity at elevations below 400 feet, subject to the federal requirement that local regulation cannot prohibit altogether UAV vertical takeoffs and landings except in cases where built-environment improvements erected from time to time impede safe vehicular transit and subject to national security considerations such as response to credible threats of terrorist activities in airspace at any elevation.

⁵⁶ See FAA UAS FACT SHEET, *supra* note 54, at 3 (citing impermissible operational restrictions on flight paths, altitudes or any regulation of the navigable airspace); Perritt & Plawinski, *supra* note 12, at 385, 387 (blanket bans of flight over the entire municipal territory, or limiting the kinds of drones permissible in municipal airspace, interfere with the national airspace system and are unlikely to survive federal scrutiny). “Delivery drones,” as I am using the term here, are those commercial-grade UAVs that require approval by the Secretary of Transportation under Section 333 of the FAA Modernization and Reform Act of 2012. See FAA Modernization and Reform Act of 2012, Pub. L. 112-95, § 333. UAVs

- Flying over occupied parts of the city's boundaries during daylight hours;
- Taking off or landing anywhere within the city's boundaries;
- Flying over all publicly-owned land, wherever situated or occupied; or
- Low-altitude flying everywhere that dense vertical improvements exist.

Nor will federal regulators allow local governments to enable UAV operators' use of "no-fly zones" established under federal rules. It is not unreasonable, however, for a community to require takeoffs and landings of commercial drones making deliveries to be nearly vertical in trajectory, eliminating to the greatest extent feasible extended glide-paths at low altitudes. Some municipal restrictions upon airspace below 500 feet ought not to be barred by preemption or the Commerce Clause,⁵⁷ such as:

1. Limiting night flying of drones in non-commercial zoning districts, due to their noise, ground-illuminating glare and other visually negative impacts;
2. Unpermitted (by the local community) flights over busy roads (non-federal highways) during peak drive times; or
3. Unpermitted (by the local community) flights through commercial building corridors (traversing a high-rise "canyon") if suitable alternative routes exist.⁵⁸

previously approved by the Secretary are found on the List of Approved Unmanned Aerial Systems (UAS) under Section 333. The list is posted at www.regulations.gov under docket number FAA-2007-3330; today it includes more than 1,100 makes and models of aircraft and continues to be updated monthly.

⁵⁷ Cf. Wendie L. Kellington & Michael Berger, *Why Land Use Lawyers Care About the Law of Unmanned Systems*, 37 ZONING & PLAN. L. REPT. 1, 8 (2014) (noting state and local governments successfully have regulated sites of airports and heliports if their regulations do not interfere with aircraft and airspace safety or specific FAA regulations; *but see* Paul Stephen Dempsey, *Local Airport Regulation: The Constitutional Tension between Police Power, Preemption & Takings*, 11 PENN. ST. ENVTL. L. REV. 1, 35-40 (2002) (noting limitations on local zoning regulation authority in the context of airport-area zoning). For example, there could be a preemption problem with the Commerce Clause if UAV operator compliance with local regulations interferes with the economies of scale needed to allow drone commerce to develop in an open market. *See* Perritt & Plawinski, *supra* note 12, at 385, 387-88.

⁵⁸ Taipei 101, one of the world's tallest inhabited buildings, has been struck multiple times by drones, including after the date drafts of amendments to Taiwan's Civil Aviation Act were approved by the Republic of China's Cabinet on September 24, 2015. *See* Jake Chung, *Taipei 101 hit by another drone, police investigate*, TAIPEI TIMES (Oct. 30, 2015), <http://www.taipetimes.com/News/taiwan/archives/2015/10/30/2003631283> [https://perma.cc/ZLK2-3YPR]. A drone can rebound after collision onto a sidewalk or fall into the street, which poses the threat of injuring numbers of pedestrians and drivers. *See id.* The FAA indicates that local governments' mandating equipment for UAVs likely is preempted. *See* FAA UAS FACT SHEET, *supra* note 54, at 3. However, if by federal law no drone trespass exists from lower airspace onto a parcel, then practically speaking, the drone

The tests for whether such local regulations will survive attack by the FAA or operators of UAVs essentially are whether they unreasonably burden interstate

is a mere neighbor of the landowners below. If that conclusion is logical, then (as to item 1. in the text above) a city's inability to require the drone-neighbor to "dim its lights" in over flights after dark is bizarre. Why? Neighbors on the ground may not allow their outdoor lights to exceed lumens beyond a particular intensity into neighboring property lines without sanction. Why, then, must the Commerce Clause protect a delivery drone casting Klieg-light glare onto surrounding residences in delivering an electric toothbrush at 2 A.M.? Items 2 and 3 in the text above, suggested by Chung, *supra*, are far more perilous issues. Power poles (electrical and telephone) are above ground in many cities and often are located within public rights of way. See NAT'L TELECOMM. AND INFO. ADMIN., 50-STATE SURVEY OF RIGHTS OF WAY STATUTES, <https://www.ntia.doc.gov/legacy/ntiahome/staterow/rowtable.pdf> [<https://perma.cc/3RR8-7PCT>]. In many instances, utilities wires run perpendicular to (across) pavement to the road's opposite side. While drones may be able to detect and avoid thick poles, wires are far smaller in diameter and irregular in altitude placement therefore drones can't yet "see" utilities lines. See Geoffrey A. Fowler, *A New, Safer Drone That Outsmarts Bad Pilots*, WALL ST. J., Mar. 2, 2016, at D1, D1-2. Their current "blindness" makes power and telephone wires flight damage-targets. See, e.g., Holly Branson-Potts, *After drone crashes into power lines, West Hollywood cracks down*, L.A. TIMES (Jan. 20, 2016, 2:22 PM), <http://www.latimes.com/local/lanow/la-me-ln-west-hollywood-drones-20160120-story.html> [<https://perma.cc/KFN9-3JAJ>]; but see Intel® RealSense™, *CES 2015 Intel Keynote: Intel RealSense Technology + AscTec Drones*, YOUTUBE (Jan. 14, 2015), <https://www.youtube.com/watch?v=UsOBqJvsF9k> [<https://perma.cc/NQY8-GBKK>] (showing that drones must sense and avoid each other, because one must zig while the other zags, lest they collide in midair during evasive maneuvers, either with one another or a third UAV). Since most current UAVs don't feature rear-mounted cameras, they could, in the course of avoidance maneuvers, back into one another. See *id.*; Fowler, *supra*. Fallen or low-hanging, live electric lines – and all heavy utilities lines – are hazardous, as they can energize other objects. See OCCUPATIONAL HEALTH AND SAFETY ADMIN., WORKING SAFELY AROUND DOWNED ELECTRICAL WIRES I (2005), https://www.osha.gov/OshDoc/data_General_Facts/downed_electrical_wires.pdf [<https://perma.cc/MW7S-B4FA>]. In numerous American communities, the local government owns the electric company. See e.g., *Publicly-Owned Utility Company Programs*, CAL. ENERGY COMMISSION, http://www.energy.ca.gov/sb1/pou_reports/Publicly_Owned_Utility_Company_Programs.pdf [<https://perma.cc/9KEK-V65A>] (California's municipal-owned utilities). These cities determine (in concert with other private utilities using overhead poles and lines) locating poles and wires within its service areas today and for future development. The FAA cannot unilaterally determine where UAVs may fly at low altitudes through developed portions of cities (along public rights of way or otherwise) without constant consultation with local governments – unless Congress either (a) mandates burial of all overhead utilities lines where drones will fly (at someone's astronomical expense), or (b) immunizes federal, state and local governments, and private utilities, from liability for personal injuries and property damage from drones downing utilities lines and the aftermath of plummeting live wires. Those options, like absolute exercise of regulatory power in neglect of persistent, actual peril, are asinine.

commerce⁵⁹ and whether these regulations substantially relate to the public's health, safety and general welfare.⁶⁰ What follows in the next subparts is how local communities potentially might manage their limited jurisdiction over UAVs through existing land use processes.

A. General Plan Amendments

If a local community's General Plan⁶¹ reflects for a certain parcel or district commercial uses, local regulators should be able to control the lower airspace up to the maximum height of structures allowed in any specific zoning district. To illustrate, in the City of Phoenix, the maximum structure height permitted in any zoning district that is not subject to the Downtown Code (a form based code) is 250 feet – prescribed by the so-called high rise district.⁶² Of course, some attention must be paid to billboard and cellular facilities installations' heights in the community. In contrast, if the General Plan for a district indicates it is form-based or planned unit development driven, the community should control regulation of the lower airspace up to the maximum permitted building height, assuming compliance with the development standards for taller buildings.⁶³

⁵⁹ See Dempsey, *supra* note 57, at 38. The Commerce Clause may be violated if UAV operator compliance with local regulations interferes with the economies of scale needed to allow drone commerce to develop in an open market. See Perritt & Plawinski, *supra* note 12, at 385, 387-88. For now, the right to fly an aircraft having a business purpose requires FAA permission initially couched as a "Certificate of Authorization." See FAA Modernization and Reform Act of 2012, Pub. L. 112-95, § 333; Fed. Aviation Agency, Advisory Circular FAA 2006-25714 (2007) (however, the agency later declared that COAs would issue only to public agencies); FAA National Policy Order 8130.34A, 72 Fed. Reg. 6689 (Oct. 27, 2010).

⁶⁰ See Dempsey, *supra* note 57, at 40. However, authors Perritt & Plawinski observe that a legitimate interest of government in local regulation applying to recreational drone activity might not equally apply to commercial drone activity. See Perritt & Plawinski, *supra* note 12, at 363.

⁶¹ A General Plan, comprehensive plan, master plan or similar words connoting visionary work is the town's narrative and pictorial statement for its future growth and development of the built environment, a policy blueprint for the expansion of its economy through development of the built environment. See Michael N. Widener, *Moderating Citizen Visioning in Town Comprehensive Planning: Deliberative Dialog Processes*, 59 WAYNE L. REV. 29, 31-32 (2013). The plan's transportation (or "circulation") element identifies major streets and boulevards and other transportation routes and terminals. See *id.* at 33. Modification of the long-range city plan to accommodate aerial transit corridors or alternative routes necessitates updating a general plan's transportation element.

⁶² PHOENIX, ARIZ., ZONING ORDINANCE, § 631(B)(2)(f) (2008), <http://www.codepublishing.com/AZ/Phoenix/frameless/index.pl?path=../html/PhoenixZ06/PhoenixZ0631.html#631> [https://perma.cc/UU9H-NGP8]. Under federal regulations, the "navigable" airspace, generally speaking, is above 1,000 feet in urban areas and that airspace needed to take off and land. See 14 C.F.R. §§ 91.119 (b)–(c) (2016).

⁶³ PHOENIX, ARIZ., ZONING ORDINANCE, § 1202(A)(2) (2013), <http://www.codepublishing.com/AZ/Phoenix/frameless/index.pl?path=../html/PhoenixZ12/P>

Attention must be paid to billboard and cell tower heights as well, as each use is permitted to a degree in some residential districts (as are utilities poles); and, in any case, some are non-conforming uses.

Naturally, exceptions arise to such simple airspace segmentation, for example:

- A. Overlay or PUD zoning districts allowing high-rise construction; here, local airspace control would consider the greater height and entail a radius of local control around the footprint of the tower.
- B. Houses of worship incorporating spires or other vertical monuments.
- C. Grain elevators or other vertical storage bins, and statues, clock towers or other public monuments.
- D. Public parks, where citizens expect public safety and modest privacy.
- E. Shopping centers or mixed use projects with tall architectural features.
- F. Schools and postsecondary institutions, and places of congregation like arenas or stadia, where greater attendance mandates extra protection, limiting carnage in a heavier drone-related accident. (Such risk increases if a UAV carries a substantial payload; free-fall kinetic energy delivers that payload with the force of a bomb.).

For these instances, federal regulators and community regulators through consultation should be able to negotiate a convention for the height of the lower airspace's regulatory dividing line.

Towns seeking to be competitive in embracing technology⁶⁴ can adopt in the transportation elements of their plans certain regional segments of drone corridors for direct delivery UAVs over non-residentially occupied property. Designating these in the transportation element of a community's general plan requires exploiting existing commercial zoning designations to enable limiting the damage attending regulatory takings claims. Drone corridors hardly will be ideal. They will be deemed optimal in view of the checkerboard nature of zoning in densely developed areas but they will resemble fixed-guideway mass transit system layouts, bicycle routes or trail systems in the inner city.⁶⁵ These will be

hoenixZ1202.html#1202 [https://perma.cc/VD7B-SMLV] (noting any approved height bonuses "shall not exceed the Airport Height Zoning").

⁶⁴ See Michael N. Widener, *Animating Performance Zoning at Sustainability's Competitive Edge*, 28.2 GEO. ENVTL. L. REV. (forthcoming 2016), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2638573 [https://perma.cc/B5AU-HE89]; *infra* Part IV.

⁶⁵ Professor Rule suggests that downtown areas of some major cities will benefit from looser drone restrictions, as drone-delivery service there is particularly valuable and fewer privacy issues reside there. See Rule, *supra* note 13 (manuscript at 57 & n. 223). I believe

disjointed paths that in many cases lack alignment. Hiatus areas must be managed by negotiating avigation easements with private owners or adopting a permitting system for commercial drones, illustrated by the type of system described in Part IV.

B. Specific Zoning

Towns will adopt overlay districts⁶⁶ enabling aerial transit. Aerial transit overlay districts will provide for implementing drone flight paths, magnetic levitation conveyance facilities and perhaps even Musk's "hyperloop" personal conveyance mode mounted on piers instead of at street level. These overlay districts likely will allow higher intensity of development in return for new or retrofitted development accommodating autonomous transit systems' operations. Overlay districts previously have not been described three-dimensionally in zoning codes.⁶⁷ Conceptually, however, they could extend

this to be a dangerous policy (if adopted un-thoughtfully) because of the potential carnage from a cargo-bearing drone plummeting into a busy street and sidewalk. Some drones will fail, *see* Henry H. Perritt & Albert J. Plawinski, *Making Civilian Drones Safe: Performance Standards, Self-Certification, and Post-sale Data Collection*, 14 NW. J. TECH. & INTELL. PROP. 1, 19-22 (2016) (describing certain types of UAV system defects). As I have a pragmatic view of the future, *see* Part VI, *infra*, I suspect some level of future UAV deliveries is inevitable in CBDs. *Accord*, Kellington & Berger, *supra* note 57, at 14. I propose that solutions for delivery completion incorporate new infrastructure such as an elevated drone track or conveyor belt. In the former case, the drone continues operating under its own battery power through the corridor to its cargo-drop stops, but in the process it flies along (or roll on casters) a channel with high vertical walls preventing its diversion and dropping to earth. In the latter case, the drones' batteries power off, and UAVs are dragged along the elevated belt until they reach their destinations' intersections, at which time they can power up and travel the last few feet under battery power. (Perhaps such a system of conveyors could be multi-purpose, conveying other devices such as autonomous wheeled vehicles moving other cargo or people.) Local governments must adopt regulations requiring all above-street grade drop zones in CBDs to be equipped with battery chargers, and for drones operating in downtowns to be equipped with sensors detecting "beacons" emanating continuously from each stop's charging device, so that when a drone's battery power is at 5% charge or below, its navigation system defaults (it loses its autonomy), bee-lining the UAV toward the closest charging station. If elevated mag-lev guideways are possible, so are these guideways; and just because drones fly doesn't mean they *must* fly in every location, when public safety is at risk. Nets in those corridors to snare falling drones may be a safety feature worth considering. Today's drones cannot "visualize" thin objects like netting – thus will not maneuver to avoid them. *See* Fowler, *supra* note 58, at D2.

⁶⁶ An overlay district imposes requirements in addition to the underlying base zoning district but also may catalyze novel development opportunities. *See* Michael N. Widener, *Curbside Service: Community Land Use Catalysts to Neighborhood Flowering during Transit Installations*, 45 URB. LAW. 407, 430-33 (2013). *See also* Rule, *supra* note 37, at 207.

⁶⁷ While some form-based codes may depict building massing in three dimensions, zoning *maps* that are legal sections of a community's zoning ordinance have not been calculated and depicted in three-dimensional space. Fort Worth, Texas is at the forefront of "modeling" its

vertically to establish layers of airspace and, in the process, define lanes for transit by different classes of UAV usage.⁶⁸ Doing so affords a clear delineation of how conflicts will be resolved between stationary improvements and mobile objects. Such overlay districts may provide for aerial drop zones (described in the following subpart) to be approved by a use permit or special condition. In cases where facilities like aerial drop zones are not incorporated as a use conditionally allowed within such an overlay district, a “floating zone,” existing on paper but not on the community’s official zoning map until a landowner has it approved legislatively, is an alternative approach to facilitate commercial UAV deliveries without local regulators constructing a specific drone flight path.⁶⁹

C. Zoning Adjustment

In aerial transit overlay districts, zoning adjustment enables last-mile deliveries⁷⁰ into residential areas through implementing aerial drop zones. Such drop zones will curb UAVs’ noise and light reflection and address neighbor privacy issues, all classic subjects of local land use control.⁷¹ These zones also

development process in three dimensions. See Havan Surat, *Three-Dimensional Spatial Analytics and Modeling is Now SOP for the City of Fort Worth*, ARCNEWS (Fall 2012), <http://www.esri.com/news/arcnews/fall12articles/three-dimensional-spatial-analytics-and-modeling-is-now-sop-for-the-city-of-forth-worth-texas.html> [perma.cc/T9SG-3MXL]. For example, a three-dimensional transparency study provides a medium to interpret current development patterns with the future possibilities for use in its downtown area. *Id.* Fort Worth plans to incorporate these maps in some zoning code brochures and planning documents. See *id.* These studies could reflect UAV overflight paths overlaid on depictions of skyscrapers, monuments and other built-environment objects.

⁶⁸ See Sipus, *supra* note 48; Ed Pilkington, *Amazon proposes drones-only airspace to facilitate high-speed delivery*, GUARDIAN (July 28, 2015), <http://www.theguardian.com/technology/2015/jul/28/amazon-autonomous-drones-only-airspace-package-delivery> [perma.cc/L3A3-8ZKP] (Amazon.com modeled layering of the lower airspace, creating one “no fly” zone while reserving one altitude range for commercial delivery drones and another for hobbyist UAV piloting); Rule, *supra* note 13 (manuscript at 47 & nn. 194-96). These three-dimensional maps will need to identify locations of affected overhead utilities lines.

⁶⁹ See Widener, *supra* note 66, at 434-5.

⁷⁰ Last mile dispatch is the “final delivery leg for goods that are sent directly to the consumer.” See Michael N. Widener, *Tactical Urbanism V2: Dynamic Land Use Regulation and Partnership Tools Regenerating First Suburbs*, 8 DREXEL L. REV. 113, 144 & n.156 (2015). Perhaps the last mile freight deliveries will be the future subject of competitive bidding open to all responsible bidders, including everyday citizens who drive in the gig economy when their vehicle trunks or truck beds are empty.

⁷¹ See William Hoffman, *Drones Will Need Air Traffic Control, Stanford and NASA Will Build It*, INVERSE (Apr. 11, 2016), <https://www.inverse.com/article/13951-drones-will-need-air-traffic-control-stanford-and-nasa-will-build-it> [https://perma.cc/6EXJ-B3ML] (noting possibility of a centralized “delivery area” or pod where packages could be dropped for later pickup by consumers). This paper says little about privacy issues, and here’s why: legal

may ameliorate the problems arising from 24-hour deliveries in residential areas.⁷² The community's zoning adjustment process will manage issues like separation of such zones, the size and character of the improvements in these zones and their individual hours of operation. Use permits will authorize drop zones generally; while variances may enable extraordinary relief in the event regulations in districts where drop zones are allowed cannot strictly be met. Communities likely can anticipate substantial stakeholder participation in such hearings.⁷³

scholars have discussed many property law issues engaging privacy in this realm of robotic aviation; one such scholar recommends an arbitrary 350'- high AGL "Causby ceiling" – a uniform upper limit on a landowner's overhead property rights. See Gregory McNeal, *Drones and Aerial Surveillance: Considerations for Legislators* 12-17 (Nov. 2014), <http://www.brookings.edu/research/reports2/2014/11/drones-and-aerial-surveillance> [<https://perma.cc/T3JC-4YCD>]. Hypothetical: Dietrich, who owns a quarter-acre lot, claims her 350' property right, wanting to be left alone. This vertical column of airspace is circumscribed by ground-perimeter boundaries. Next door to Dietrich is Marlene, who busies herself on Snapchat, Instagram, Pinterest, Facebook, MySpace and her other digital-disclosure accounts. A camera-equipped drone flies over unwitting Marlene's lot, camera angularly trained on *Dietrich's* back yard. Cf. Fowler, *supra* note 58, at D1. What if Dietrich's neighbors' tracts are unoccupied, or occupied by persons not sharing Dietrich's concerns; can Dietrich rely for her privacy on her neighbors' aerial columnar rights? McNeal, *supra*, says the landowner has the right, rather than an obligation, to exclude intrusions. See McNeal, *supra* note 71, at 14-15. If these rights abide whether or not the owner desires them, then the 350' AGL "no-fly" zone constitutes a "community blanket" and the individual's right to monetize those rights vanishes in the mist of paternalism. We return to the fundamental issues whether aerial cargo delivery and some forms of surveillance are commerce subject to federal supremacy and preemption, and whether property rights incorporate the individual's right to include others upon her property - homeowners' associations be hanged. (The right to include, of course, is compatible with grants of easements and licenses, so long as the initial such easement is not exclusive to its grantee and incorporates the entire fee parcel.) Finally, accepting McNeal's premises, if Marlene wants a bigger hard drive and rents her airspace to UAVoyeurcam.com to shoot images of Dietrich's yard, and Dietrich causes the drone to disappear from Marlene's airspace, what will Dietrich's defense or counterclaim be to Marlene's claim against her for contract interference? Are property rights less consequential – or defensible – than privacy rights? See *Stop the Beach Renourishment, Inc. v. Fla. Dep't of Env'tl. Prot.*, 560 U.S. 702, 707 (2010) (citing *Phillips v. Washington Legal Foundation*, 524 U.S. 156, 164 (1998)) ("Generally speaking, state law defines property interests. . . ."); Gregory S. Alexander, *Property as a Fundamental Constitutional Right? The German Example*, 88 CORNELL L. REV. 733, 734-5 (2003) (observing that property rights are a "poor relation" to liberty interests for substantive due process purposes).

⁷² According to some informed sources, mainland China will ban small drone usage for delivering packages to residents in urban areas. See He Heifeng, *China cracks down on drone usage with new regulations but most consumers needn't worry*, SOUTH CHINA MORNING POST (Dec. 1, 2015), <http://www.scmp.com/tech/social-gadgets/article/1885456/china-cracks-down-drone-usage-new-regulations-most-consumers> [perma.cc/D5X4-V4QY].

⁷³ Cf. Michael N. Widener, *Shared Spatial Regulating in Sharing Economy Districts*, 46 SETON HALL L. REV. 111, 176-8 (2015) (noting generational and technological differences of

These drop zones resemble automated cousins of CBD-based, manned distribution centers.⁷⁴ They begin with an above-ground or at-grade sorting stations made from essentially indestructible material such as a recycled cargo storage containers.⁷⁵ Drones will land on the roof of these containers and, employing a docking mechanism, lower by a chute its cargo into the container's interior.⁷⁶ Its delivery concluded, the drone returns to its origin point by the identical route. Aided by a QR Code,⁷⁷ conveyers or robots sort the cargo into bins that hold the appropriate customer order. Once the cargo is confirmed by a computer inside the station, a delivery driver, whether a corporate employee or a small contractor such as a Lyft or Uber driver,⁷⁸ would receive on her smart phone a second QR Code, this time containing a pass code affording access inside the sorting station and that specific bin containing the goods for delivery to their final destination. Yet a third QR Code transmitted to on the driver's smart phone or vehicle-dashboard device admits the driver into a gated community or another code-secured area to complete delivery to the customer's

perspective lead to zoning controversies).

⁷⁴ See Widener, *supra* note 70, at 116-17, 129-131 (discussing optimal settings within suburbs for distribution hubs). A drop zone, more than other features, needs a noise buffer from surrounding residential development and adequate parking for persons receiving cargo. While a church or school offers these amenities, and are proximate to residential property, a potential accident during class hours renders school grounds viable candidates only before and after the school day.

⁷⁵ See Michael N. Widener, *Cohousing: Joining Affordable, Sustainable and Collaboratively-Governed, Single Family Neighborhoods*, 39 REAL EST. L. J. 113, 121-6 (2010) (offering a primer on certain characteristics among the main features of ISOs: their affordability, ready availability, strength and geometric advantages; they are impregnable to those without a pass code or a metal-piercing arsenal).

⁷⁶ Google X is developing autonomous drones capable of such maneuvers and coordination with ground facilities. See Ido Lechner, *Google Drones Might Deliver Packages through Help of Receptacle Buddies*, PSFK (Feb. 9, 2016), <http://www.psfk.com/2016/02/malware-museum-computer-viruses-as-art.html> [<https://perma.cc/53SP-7PXJ>]; Alexis C. Madrigal, *Inside Google's Secret Drone-Delivery Program*, ATLANTIC (Aug. 28, 2014), <http://www.theatlantic.com/technology/archive/2014/08/inside-googles-secret-drone-delivery-program/379306/> [<https://perma.cc/UEQ7-UQ2T>].

⁷⁷ See Bill Slawski, *Google Files Patent for Drone Delivery Platform*, SEO BY THE SEA (Nov. 5, 2015), <http://www.seobythesea.com/2015/11/google-files-patent-for-drone-delivery-platform/> [<https://perma.cc/W5NL-A2JP>].

⁷⁸ Presumably, autonomous vehicles or some other wheeled robotic device will eventually replace human drivers altogether. See Tom Krishner & Justin Pritchard, *The federal government's highway safety agency agrees with Google: Computers that will control the cars of the future can be considered their driver*, U.S. NEWS (Feb. 10, 2016, 2:38 PM), <http://www.usnews.com/news/business/articles/2016-02-10/government-will-consider-google-computer-to-be-cars-driver> [<https://perma.cc/7R2D-LJQ4>] (computers controlling future cars meet the definition of "driver" for NHTSA regulatory purposes, advancing Google's prototypes toward eventual public usage).

doorstep. These routines may seem bizarre; but something like them⁷⁹ will be required unless federal regulators address preempting local governments or property owners' associations applying deliveries bans for residential areas.⁸⁰

V. COMMERCIAL DRONES PERMITTING

Since the future of drones implicates some elements of deliveries and of recording images, enterprises generating revenue from drone activities are positioned to pay some fees for the right to use lower airspace. Such fees are a legitimate assessment offsetting UAV negative operational impacts like exploitation of town emergency services or streets and sidewalks maintenance (ameliorating drone crashes). Below is a suggested program for issuing permits and collecting fees that in a minor fashion may compensate landowners for intrusions upon their property rights. Commercial drone operators should pay communities annually for aviation permits.⁸¹ Communities may share the permit revenue with responsible and cooperative landowners, entailing their waivers of takings claims against the governments involved and trespass, invasion of privacy, waste and nuisance claims against the permittees.⁸²

Following the receipt of entitlement to operate in the lower airspace from the community, the operator will report on the applicable layer of the airspace (in keeping with a community's specific plan) to be traversed by its UAVs. The price of a permit will be tied to the layer traversed.⁸³ In residential zoning

⁷⁹ Google recently registered a new patent on a rolling box called a "delivery receptacle" that coordinates with the UAV to avoid suspending packages in the air; upon cargo receipt, the receptacle shuttles it to a secure predetermined location. See Lechner, *supra* note 76.

⁸⁰ Cf. *In re Preemption of Local Zoning Regulations of Receive-Only Earth Stations*, 51 Fed. Reg. 5519, 5520 (Jan. 14, 1986) (to be codified at 47 C.F.R. pt. 25) (FCC ruling seeking to preempt Chicago ordinance banning any satellite earth station placement inside city boundaries without rigorous local certification process). In *Capital Cities Cable, Inc. v. Crisp*, the Supreme Court affirmed the FCC's preemptive power in the cable television field, as its regulations represented "a reasonable accommodation of competing policies" within that agency's domain." 467 U.S. 691, 708 (1984).

⁸¹ Perritt & Plawinski observe that transaction costs would rise substantially under an "advance approval" per flight regime, preferring blanket approvals for flights during a defined period. See Perritt & Plawinski, *supra* note 12, at 388.

⁸² The utility in so doing is trimming resources allocation to determining where a low-altitude, aerial trespass claim should lie. See Rule, *supra* note 37, at 170-7 (discussing the uncertainties in case law as to the scope of landowners' airspace rights, which causes difficulties for governments in deciding acceptable altitudes to fly drones to avoid trespassing). "Communities," as used in the text of this article, may indicate groups combining local jurisdictions; as in the instance of mass transit routes, drone flights transcend the boundaries of one jurisdiction.

⁸³ Since defection from the permitted flight layer by some operators is likely, only harsh regulatory penalties will send the proper message, such as a five year suspension from flying anywhere over the community. (The author assumes more than one provider will service each community.) UAVs can be calibrated to fly at specific altitudes. See Wendie L. Kellington,

districts, the lower elevation layers may be more expensive, due to the nuisance factors of noise and view shed interference.⁸⁴ In commercial zoning districts, some of the upper layers' permitting may be more expensive, since navigating through them may cause lost alternative economic opportunity to build or to lease for vertical development of a specialty nature, such as wind turbines, cellular towers or billboards, or sacrifice of the fee owner's potential transfer of development rights.

Permit fees would be assessed and remittances allocated annually under this program. The fee owner annually would submit an affidavit attesting to fee ownership and the current zoning of the fee property; and it would require the owner's waiver of all takings claims and nuisance, waste, privacy invasion and trespass claims against both the community and the drone operators (and, if different, their owners). The community will use a portion of the annual operator's permit fee to cover its administrative expenses (including the cost of updating a robust database of registrations and legal descriptions of airspace traversed, achievable in this era of Big Data) and costs of insurance covering the affiant owners of the property from and against claims of third parties related to drone-related damage. The balance of the fees collected is remitted to cooperating (opting-in) fee title owners. Owners who do not submit the annual affidavit will not receive payment under the permit program, but are free to pursue their own courses of action.⁸⁵

And what of military and first responder drone activity in the lower airspace? The public interest in community safety and national defense trumps those virtues of local regulation of larger drones in navigable airspace.⁸⁶ The FAA is

Unmanned Air Systems and Regulating Navigable Airspace 1, 45 (2013), <http://www.klgpc.com/articles/2013/Unmanned-Aerial-Systems-and-Regulating-Navigable-Airspace.pdf> [<https://perma.cc/6CU7-JRKV>] (describing "fences" which allows operation of UAVs in a defined route); Rule, *supra* note 13 (manuscript at 28-29). Repeated operator defection therefore bespeaks intention. And every violation of permitted airspace does not have to be sanctioned, if harsh sanctions are visited on the badly-intentioned miscreants.

⁸⁴ *Cf.* *Branning v. United States*, 654 F.2d 88, 98-99, 101-2 (Ct. Cl. 1981) (noting the issue in takings cases is impact, not merely whether there is physical invasion of land's superadjacent airspace, as a reasonable noise level cannot be measured only by reference to altitude).

⁸⁵ And, since the majority of owners are unable or unwilling to finance the cost of trespass and nuisance legal processes, and will not relish delay in adjudicating takings cases, many owners will engage in such a permit program. Conceivably, fee owners will decide to use proprietary databases to non-exclusively license use of their lower airspace, perhaps through an auction process under which free market principles will liberate pricing; some coordination with public authorities will be imperative here. Drone delivery services will tolerate only a certain number of detours, and towns will prefer not to have circuitous routing as longer-duration flights increase risk.

⁸⁶ *See* Rule, *supra* note 37, at 200 (discussing the FAA's ability to establish safety standards for drone activities, as evidenced by already existing federal legislation by the NHTSA regulating vehicle safety standards).

better positioned than local government to establish and enforce federal drone safety and performance standards,⁸⁷ especially for those specifications imbedded in procurement contracts involving experimental drone-type craft and perhaps classified avionics platforms. States should govern standards –setting for drone flights along state and interstate roads to the extent the National Highway Traffic Safety Administration and the FAA jointly cede regulatory authority.⁸⁸

VI. CONCLUSION

Excessive federal regulating of commercial drone use may solve some problems while tying the hands of businesses and stifling innovation. Americans are used to the idea that shortcomings in existing law can threaten promising economic advancement.⁸⁹ Meanwhile, land use regulation by cities, towns and counties anchors police power historically reserved to local jurisdiction. National defense always has been federal territory, but the United States need not defend neighborhoods from the menace of routine hobbyist drones flight; that governance properly should be local. Town governments strategize according to their desired community competitiveness level to attract high technology industries and their “cadres of knowledge workers.”⁹⁰ Many cities pursue tech firms with a variety of inducements,⁹¹ one being readily-available technology gadgetry supported by robust infrastructure backbones. Readily-available gadgets implicate rapid and convenient delivery using serially-disruptive technologies. Between the siren call of tech industry-driven economic advancement and lobbying by Amazon.com, Inc., Alphabet, Inc. and their competition, freight drones will deploy over communities before long, despite obvious advantages to providing a fixed “seclusion buffer”⁹² to residential landowners.

UAVs are not destined for dismissal as just another momentary trend. In early 2016, more drone pilots than U.S.-based commercial aviation pilots registered with the FAA.⁹³ Demand for cargo deliveries via UAVs in urbanized areas will

⁸⁷ *See id.*

⁸⁸ *Cf. id.* at 202.

⁸⁹ *See id.* at 186-7. Fracking is a recent illustration of this reality. *See* Coral Davenport, *New Federal Rules Are Set for Fracking*, N.Y. TIMES (Mar. 20, 2015), http://www.nytimes.com/2015/03/21/us/politics/obama-administration-unveils-federal-fracking-regulations.html?_r=0 [<https://perma.cc/6UJR-MNFA>] (noting industry resistance to fracking regulations, fearing that they could raise the cost of fracking and slow or freeze energy development).

⁹⁰ *See* Lauren Weber, *Firms Flock to Cities With Top Talent*, WALL ST. J., Apr. 13, 2016, at B11; Widener, *supra* note 64, at 29.

⁹¹ *See, e.g., id.* at 30; Eliot Brown, *City Life Lures Tech Firms*, WALL ST. J., Dec. 26, 2014, at A3.

⁹² *See* Rule, *supra* note 37, at 189-90.

⁹³ *See* Joan Lowy, *There are more drone operators than there are pilots in the US*, BUSINESS INSIDER (Feb. 9, 2016, 9:00 PM), <http://www.businessinsider.com/ap-faa-more->

grow unabated unless a well-reported tragedy of huge proportions turns public sentiment against drone use. Yet outrage over deaths by firearms has not accomplished their ban in many parts of America, so odds seem stacked against a long-term, low-altitude blanket exclusion of civilian drone flight. Increasing affordability of drones, and the general tendency of younger persons to engage routinely with vehicles for personal image sharing, undergirds momentum toward an eventual demise of low-altitude airspace for a privacy buffer.

The FAA today holds the airspace's trump cards,⁹⁴ but the likely process of regulatory acceptance begins with well-organized national interests exerting political influence at the federal level to cement basic operating rights under federal oversight to the extent tenable, consistent with competing policy interests such as defense.⁹⁵ In some towns, however, sufficiently engaged proponents of UAVs will influence local administrations to undertake pilot programs that, if successful, will branch out to additional communities. This momentum for tailored control of drone operations at the local level will build as programs like

registered-drone-operators-than-licensed-pilots-2016-2 [https://perma.cc/N7YA-4Q3K].

⁹⁴ The first cards in the next hand were dealt by an Aviation Rulemaking Committee appointed by the FAA's Administrator on April 2, 2016. See Joan Lowy, *Panel urges FAA to allow commercial drone flights over people*, BOSTON GLOBE (Apr. 3, 2016), http://www.bostonglobe.com/business/2016/04/03/panel-urges-faa-allow-commercial-drone-flights-over-people/r2jrg3V4t0UVAq5Elu7iSM/story.html?s_campaign=8315 [https://perma.cc/H5EZ-3DSL]. The committee's recommendations call for establishing four small drone categories. *Id.* The first category is for mini-drones weighing no more than a half-pound, while the three other categories have a maximum weight limit of 55 pounds (under FAA current regulations for "small drones"). *Id.* The three larger drone categories have different flight parameters; but drones in each of the three must fly at least 20 feet above the crowd and maintain a separation of at least 10 feet laterally. *Id.* In one category, drones may take sustained flights over crowds if its operator develops a so-called "congested area plan," showing how the operator will mitigate risks of injury or damage. *Id.* The risk of serious injury is required to be 30 percent or less. *Id.* The FAA under this category could limit the expected "maximum impact" of the drone crash. See *id.* This committee's report will trigger a new Notice of Proposed Rule-Making regarding drone activities; it may incorporate conditions for UAV flight over populated areas. See Thomas J. Dougherty, *New Rulemaking Committee Could Expand Drone Uses for Utilities and Other Industries*, NAT. L. REV. (Feb. 25, 2016), <http://www.natlawreview.com/article/new-rulemaking-committee-could-expand-drone-uses-utilities-and-other-industries> [https://perma.cc/W6X2-HHYA]. Likely no final rule will be forthcoming in 2016, taking into account mandated federal agency notice and comment periods and the diversity of views cleaving interested stakeholders. See *id.*

⁹⁵ See Perritt & Plawinski, *supra* note 12, at 377-8, 381 (noting that interest groups are less effective at state and local levels because they lack the resources to overcome public misinformation or disinterest). Evidence of this point is the "common sense" amendment proposed in the House of Representatives to the 2016 FAA reauthorization bill (the "AIRR Act," see note 98, *infra*); this amendment proposes reducing administrative restrictions on small drones that are camera equipped, an aid in journalism. This bill will likely be voted upon in the first half of 2016, as the agency's budget must be replenished.

that proposed in Part V complete a successful trial period.⁹⁶ Successful local experimentation will impel local governments to lobby the FAA and Congress to exercise their respective mandates⁹⁷ to encourage innovation and development of civil aeronautics, featuring growing of commercial drone markets to serve consumers and successive generations of knowledge-workers both adept at and desiring increasing amounts of technology use.⁹⁸ As the FAA

⁹⁶ See Associated Press, *Drone Delivers Package to Residential Area for First Time*, NBC NEWS TECH (Mar. 25, 2016, 11:25 PM) <http://www.nbcnews.com/tech/innovation/drone-delivers-package-residential-area-first-time-n545901> [<https://perma.cc/JE9N-PA86>] (Flirtey drone delivered a small package to a vacant residence in Hawthorne, Nevada).

⁹⁷ See 49 U.S.C. § 40101(c)(2) and (d)(3) (2014) (requiring the FAA's administrator to consider both "the public right of freedom of transit through the navigable airspace" and "encouraging and developing civil aeronautics, including new aviation technology.")

⁹⁸ Some readers ask "what's the hook?" to influence Congress and the FAA to decentralize control. Where Congress is concerned, that depends upon the national party in power of the House and Senate. Those leaning left of center should hear from lobbyists that commercial drone usage, regionally coordinated, will introduce cleaner fuels, further limiting air pollution both by decreasing use of petroleum products for deliveries and by removing motor vehicles from congested roads otherwise shopping by driving to stores. Those leaning right of center should hear that innovation redounds to the benefit of all, as more manufacturers in the UAV sector increase competition and momentum toward product improvements – an opportunity for military applications of drones as well as for those in the private sector. Congress and the FAA will be reminded that the agency already is subject to substantial criticism over air traffic control, leading to (among other things) introduction into Congress of the Aviation Innovation, Reform, and Reauthorization Act of 2016. See *Aviation Innovation, Reform, and Reauthorization Act of 2016*, H.R. 4441, 114th Cong. (2d Sess. 2016), <https://www.congress.gov/bill/114th-congress/house-bill/4441> [<https://perma.cc/F9GW-AVVD>]. This bill's sponsors have been candid about the FAA's inability to modernize the air traffic control system. See Press Release, U.S. House of Representatives Committee on Transportation & Infrastructure, Shuster Statement from Hearing on ATC Reform Proposals (Feb. 10, 2016), <http://transportation.house.gov/news/documentsingle.aspx?DocumentID=399766> [<https://perma.cc/BL7Z-2NSN>]. Legitimately, one may ask, if the FAA cannot manage passenger aircraft traffic well in the upper airspace (leading to calls for semi-privatization of air traffic control functions), what are federal regulator prospects, acting independently of local governments, for adequate management of drone volumes in the lower airspace? The question's answer likely explains why Google is engaged with NASA to create a separate drone air traffic control system. See Rene Marsh, *Google exec: Drone deliveries could come in one year*, CNN POLITICS (Jan. 11, 2016, 5:33 PM), <http://www.cnn.com/2016/01/11/politics/google-drone-deliveries/index.html> [<https://perma.cc/GZ36-H25B>]. NASA plans an unmanned aerial systems traffic management (UTM) system that does not involve human interaction; instead, drones are fitted with technology allowing connectivity to this cloud-based system providing constant communication, navigation (including dynamic route planning and management) and surveillance, warning UAVs of object congestion or severe weather ahead. Reports are that by January 2018, NASA expects to have internet-connected drones testing package delivery over suburbs and rural communities, and by March 2019, the UTM system will allow news-

will neither desire nor be resourced to administer simultaneously hundreds of different fronts of innovation, Congress or the agency's Administrator ultimately will acknowledge that encouraging innovation, community competitiveness and developing markets is advanced at least as successfully locally as it is federally.

Ultimately, governments will establish a fundamental individual right to operate drones in lower airspace, subject to the rights of states and local governments to limit that right under delegation from the FAA. That agency will maintain essential control of aircraft design and specifications, especially within the critical portions of the national airspace system. But federal regulators do forego imposing rules in the lower airspace, provided that states and towns do not abuse their limited powers of sector regulation while satisfying state and local preferences.⁹⁹ Blanket prohibitions on UAV operations within municipal boundaries, or local regulations increasing drone users' transaction costs to the breaking point, will not pass muster, because Congress has declared that commercial drone operations form part of the national airspace system.¹⁰⁰ But the FAA Modernization and Reform Act of 2012, in its provision entitled "Special Rule for Model Aircraft," introduced a concept known as "community-based organization" inputs for regulating these UAVs as well as "a community-based set of safety guidelines," suggesting that Congress expects the FAA to keep community preferences in mind in adopting some agency regulations.¹⁰¹

Segmenting the lower airspace into a coordinated regulatory pattern makes sense in addition to the federal bureaucracy's yielding some of that authority through the states to local land use regulators. The latter, recognizing needs and problems at a finer-grained level of management, better understand navigating a matrix of location, development, public safety and economic prosperity issues, as well as preferences of their citizens, should legislate for their communities' betterment. As today's UAVs have excellent navigation capability through GPS and other technologies,¹⁰² the permitting system recommended here should be replicable among multiple communities, enabling "user pays" systems to offset

gathering and delivery drones in urban environments beyond an operator's line of sight and autonomously avoiding other aircraft. See Mark Harris, *NASA plans smart air traffic control for drones*, NEW SCIENTIST (July 30, 2015), <https://www.newscientist.com/article/dn27979-nasa-plans-smart-air-traffic-control-for-drones/> [<https://perma.cc/7EBW-69DN>]; Hoffman, *supra* note 71 (Stanford aeronautics professor expects an autonomous drone air traffic control operating system to be available for implementation within five years).

⁹⁹ See Perritt & Plawinski, *supra* note 12, at 386.

¹⁰⁰ See *id.* at 321, 350 (statutorily mandating integration of drones into that navigable system).

¹⁰¹ See FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 336 (a) (2), 126 Stat. 11, 77 (2012).

¹⁰² See, e.g., Pierre-Jean Bristeau et al., *The Navigation and Control technology inside the AR.Drone micro UAV*, 18TH IFAC WORLD CONGRESS 1477, 1478-82 (2011), <http://cas.enscm.fr/~petit/papers/ifac11/PJB.pdf> [<https://perma.cc/C55D-QXJP>] (describing in detail the technology available for drone navigation and altitude maintenance).

local administrative costs to map optimal town drone routes and promulgate tolerant but even-handed UAV operations regulations.

Introducing this essay, I posed two distinctions between segmenting governance of waterways' intersection with land and the present regulatory problem. Further contributing to the dilemma of who governs are differing conceptualizations of waterways and airspace. From Colonial times, resident peoples used bodies of water to eat (food source and cooking medium) and drink, cleanse bodies and clothing, baptize, extinguish fires, heal, generate power for grinding wheels and water-powered manufacturing and, above all, to travel for trade and communication. Americans wrote songs about life on these bodies of water¹⁰³ and books about their use.¹⁰⁴ Waterways' utility was so consequential and ingrained in everyday life that watercourses became, conceptually, public goods. In contrast, it is unlikely early Americans conceived of boundary-less lower airspace as public goods, even while shooting birds in flight or harnessing a breath of wind.¹⁰⁵ Regulating the lower airspace today boils down to the problem of entitlement. This entails a delicate balancing, on the one hand, of respecting the airspace's owners' power of marketable exclusion with permitting state actors to control private transfers, or perhaps even to shift those ownership rights through an objective damages rule in takings cases.¹⁰⁶

¹⁰³ See THOMAS S. ALLEN, LOW BRIDGE, EVERYBODY DOWN (1905), <http://www.eriecanalsong.com/> [<https://perma.cc/J9PJ-CMXP>] (a song variously known as *Fifteen Years on the Erie Canal*, *Mule Named Sal* and *Fifteen Miles on the Erie Canal*). Jimmy Van Heusen and Sammy Cahn's *Come Fly with Me* (immortalized by Frank Sinatra) was written in 1957, by contrast.

¹⁰⁴ See, e.g., SAMUEL L. CLEMENS, LIFE ON THE MISSISSIPPI (1883).

¹⁰⁵ Windmill systems were perfected in the United States in the mid-19th century, beginning with the Halladay windmill in 1854. See *Illustrated History of Wind Power Development, Part I*, <http://www.telosnet.com/wind/early.html> [<https://perma.cc/Q6EZ-YKKX>]. Naturally, we need air to breathe, but concern about its quality was slow to gain momentum (except as to *visible* smoke emissions, the subject of Chicago and Cincinnati anti-smoke ordinances in 1881) until the federal Air Pollution Control Act of 1955 (Pub. L. 84-159) raised public awareness.

¹⁰⁶ Cf. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1090-1115 (1972).