

THE EMERGING AIRSPACE ECONOMY: A FRAMEWORK FOR AIRSPACE RIGHTS IN THE AGE OF DRONES

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Drone use in the United States has taken off in recent years, bolstered by rapid technological innovations, business needs, and societal changes. It may soon be common to see small, unmanned aircrafts flying above city streets, local fields, and residential and commercial properties across the country. With the capability to deliver packages and transport goods more efficiently and quickly than ever before, drone delivery services have the potential to revolutionize our everyday way of life. Legislators, landowners, and businesses are beginning to explore their future roles in the commercialization of low-altitude airspace. But few, if any, theories of airspace rights and economic regulation have generated a viable legal and regulatory framework that balances the often-competing business imperatives of a robust drone economy, property rights of landowners, and interests of federal, state, and local governments. This Article seeks to remedy that gap.

Under existing law, we argue, landowners exclusively own and control the “superadjacent,” low-altitude airspace directly above their land, and they are free to commercialize and sell access to, or to prohibit drones from entering, their private airspace. It remains unsettled whether the Federal Aviation Administration (FAA) has the statutory authority to regulate low-altitude airspace and whether the federal government can do so without committing a “taking” of property that, under the Fifth Amendment, requires compensating landowners. Likewise, the boundaries of privately owned low-altitude airspace and the legal status of the area between it and public, high-altitude “navigable airspace” remain entirely unclear. Essentially, the questions this Article seeks to answer are: who owns the sky and who should?

This Article proposes a legal and regulatory framework to fill in the information gaps surrounding the commercialization of airspace and offers a viable solution for controlling and using low-altitude airspace in the age of drones. We predict the emergence of a marketplace for parties to buy, sell, and lease valuable airspace to accommodate drone delivery, such that companies like Amazon or Walmart will compensate landowners, or even governments that own city streets and highways, for the airspace where drones will one day fly. To effectuate that marketplace, we argue that the FAA must redefine the public “navigable airspace” for it to lawfully regulate drone flight paths under

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500 feet. We also advocate for the division of airspace into four distinct regions, with different rights and responsibilities for those operating in each domain. Our proposal constitutes one of the first comprehensive efforts to establish a framework that balances the rights of federal, state, and local governments, landowners, and drone operators to ensure the safety and full potential of the emerging airspace economy.

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INTRODUCTION

From their infancy just a few years ago, unmanned aircraft systems (UAS)—better known as drones—have experienced robust growth in

popularity around the globe.¹ Drone registration has averaged nearly 12,500 per month in the United States alone, and UAS ownership has reached nearly every part of the country and the world.² Weekend hobbyists are taking advantage of falling equipment prices, improved technology, and user-friendly operating systems. Likewise, companies in various markets are beginning to realize the emerging technology's commercial uses, resulting in the modernization of businesses and government practices.³ One of the most innovative future uses of drones may be in commercial delivery services. To better meet consumer demand, create long-term shareholder value, and improve their carbon footprint, companies around the globe are working on solutions to leverage drones' unique capabilities for fast and cheap fulfillment services.⁴ Departments have been created to explore the exciting possibility of doorstep delivery. The commercial application of drones appears to be firmly within reach.

The proliferation of drones presents new challenges as courts and regulators seek to integrate them into existing legal frameworks. The guiding principle of airspace law that led English and American jurists for centuries was that land ownership extended vertically up to the periphery of the universe, all the way to the outer reaches of the sky.⁵ This definition of land ownership, however, has changed over time to reflect the reality of economic and social progress. The development of air travel, for example, necessitated an evolution in the common law understanding of airspace

1. This article uses the terms "drone" and UAS interchangeably to describe all modern, remote-controlled, unmanned aircraft systems, regardless of size, purpose, or design. See SARAH NILSSON, DRONES ACROSS AMERICA: UNMANNED AIRCRAFT SYSTEMS (UAS) REGULATION AND STATE LAWS 1 (2017) ("There is no consensus worldwide on what term should be used [to describe drones]. Other terms include unmanned aircraft (UA), unmanned aerial vehicle (UAV), remotely piloted aircraft (RPA), remotely piloted aircraft system (RPAS), and the misconstrued term, drone."). For a useful introduction to drones as well as federal and state statutes related to UAS, see generally Donna A. Dulo, *Introduction to Unmanned Aircraft Law*, in UNMANNED AIRCRAFT IN THE NATIONAL AIRSPACE: CRITICAL ISSUES, TECHNOLOGY, AND THE LAW (2012), which provides insight into the emerging areas of drone and unmanned aircraft law from a regulatory and technological perspective.

2. See FED. AVIATION ADMIN., FAA AEROSPACE FORECAST: FISCAL YEARS 2021–2041, at 44–46 (2021), https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FY2021-41_FAA_Aerospace_Forecast.pdf [<https://perma.cc/AG4X-GXF2>].

3. See Brian Cross, *The Three Business Benefits of Drones*, FORBES (Nov. 10, 2020, 4:10 PM), <https://www.forbes.com/sites/esri/2020/11/10/the-three-business-benefits-of-drones/?sh=4f5529342bf4> [<https://perma.cc/MCD7-YLFX>].

4. See Day One Team, *Prime Air*, ABOUT AMAZON (Mar. 29, 2018), <https://www.aboutamazon.eu/news/working-at-amazon/prime-air> [<https://perma.cc/UDM3-YE2B>] (describing Prime Air as looking like "science fiction, but it's real. . . . [O]ne day, seeing Prime Air vehicles will be as normal as seeing mail trucks on the road.").

5. See John A. Eubank, *Ownership of the Airspace*, 34 DICK. L. REV. 75, 77, 83–84 (1930).

ownership, as did the advent of multi-level condominiums.⁶ To address the doctrinal and logistical challenges posed by the newfound ability to travel through the sky, courts and legislators granted the public a free right of transit through sufficiently high navigable airspace and recognized that the ownership of airspace can be distinct from ownership of the land beneath it.⁷ Even under the new conception, however, landowners retained ownership in the “superadjacent” airspace above their property.⁸ The question of to what height that ownership extends, however, still persists today.⁹

In more recent years, Congress, recognizing the potential of commercial drones, has directed the Department of Transportation to develop a plan for the safe integration of UAS into the national airspace.¹⁰ The Department of Transportation has also instructed the FAA to develop guidelines for commercial drones, specifically, and for the appropriate roles and responsibilities of federal, state, and local authorities in the area. While those efforts have made some progress, the integration of commercial drones raises complex technological, legal, and policy questions that have yet to be comprehensively resolved. While most of the

6. See *id.* at 103–04 (highlighting how the development of aerospace technology left aeronautics law in an unsettled state in need of continuous refinement); see also Nicolas Torres, *On Solid Ground: How Sterling Strengthened Airspace Ownership Rights in Florida*, 30 U. MIA. BUS. L. REV. 29, 35–37 (discussing how the development of multi-level condominiums changed courts’ common law understanding of airspace ownership).

7. See *United States v. Causby*, 328 U.S. 256, 260 (1946); 49 U.S.C. § 40103(a)(2).

8. See, e.g., Pierce Giboney, *Don’t Ground Me Bro! Private Ownership of Airspace and How It Invalidates the FAA’s Blanket Prohibition on Low Altitude Commercial Drone Operations*, 67 FLA. L. REV. 2149, 2174 (2015) (explaining that “a landowner has a property interest in the superadjacent airspace above his land”).

9. See *id.*

10. See 49 U.S.C. § 44802.

scholarly¹¹ and legislative¹² activity relating to domestic drones focuses on drones' potential impact on privacy rights, tort claims, and criminal evidence gathering, far less attention is devoted to the unsettled questions of airspace property rights.

I. OVERVIEW AND DEVELOPMENT OF THE MODERN DRONE INDUSTRY

Once considered a technology reserved for governments and spy movies, drones now comprise an industry that is projected to reach tens of billions of dollars within the next few years.¹³ Fueled by a growing demand from the commercial and civil sectors, drones have evolved

11. See, e.g., STUART BANNER, WHO OWNS THE SKY?: THE STRUGGLE TO CONTROL AIRSPACE FROM THE WRIGHT BROTHERS ON 296 (2008); Marc Jonathan Blitz, James Grimsley, Stephen E. Henderson & Joseph Thai, *Regulating Drones Under the First and Fourth Amendments*, 57 WM. & MARY L. REV. 49 (2015); Marc Jonathan Blitz, *The Fourth Amendment Future of Public Surveillance: Remote Recording and Other Searches in Public Space*, 63 AM. U. L. REV. 21 (2013); Hillary B. Farber, *Keep Out! The Efficacy of Trespass, Nuisance and Privacy Torts as Applied to Drones*, 33 GA. ST. U. L. REV. 359 (2017) [hereinafter Farber, *Keep Out!*]; Hillary B. Farber, *Eyes in the Sky: Constitutional and Regulatory Approaches to Domestic Drone Deployment*, 64 SYRACUSE L. REV. 1, 13 (2014) [hereinafter Farber, *Eyes in the Sky*]; Troy A. Rule, *Airspace in an Age of Drones*, 95 B.U. L. REV. 155, 158 (2015); John Villasenor, *Observations from Above: Unmanned Aircraft Systems and Privacy*, 36 HARV. J. L. & PUB. POL'Y 457 (2013); cf. *Huerta v. Haughwout*, No. 3:16-CV-358 (JAM), 2016 WL 3919799 (D. Conn. July 18, 2016).

The most comprehensive analysis of these issues to date is U.S. GOV'T ACCOUNTABILITY OFF., B-330570, UNMANNED AIRCRAFT SYSTEMS: CURRENT JURISDICTIONAL, PROPERTY, AND PRIVACY LEGAL ISSUES REGARDING THE COMMERCIAL AND RECREATIONAL USE OF DRONES (2020), <https://www.gao.gov/assets/b-330570.pdf> [<https://perma.cc/4JFA-FRS3>] [hereinafter GAO Report].

12. See GAO Report, *supra* note 11, at app. I.C.; National Conference of State Legislatures, *Current Unmanned Aircraft State Law Landscape*, (Aug. 03, 2021), <https://www.ncsl.org/research/transportation/current-unmanned-aircraft-state-law-landscape.aspx> [<https://perma.cc/A55M-3UA9>]; see also, FED. AVIATION ADMIN., STATE AND LOCAL REGULATION OF UNMANNED AIRCRAFT SYSTEMS (UAS) FACT SHEET 1–2 (2015) (providing basic information about the federal framework for states and localities when considering UAS laws).

13. See FED. AVIATION ADMIN., FAA AEROSPACE FORECAST: FISCAL YEARS 2022–2042 (2022), https://www.faa.gov/sites/faa.gov/files/2022-06/FY2022_42_FAA_Aerospace_Forecast.pdf [<https://perma.cc/UNY4-VNWX>]; *Drone Market Outlook in 2022: Industry Growth Trends, Market Stats and Forecast*, INSIDER INTEL. (Apr. 15, 2022), <https://www.insiderintelligence.com/insights/drone-industry-analysis-market-trends-growth-forecasts> (highlighting that total global shipments are predicted to reach 2.4 million by 2023 across commercial industries such as agriculture, construction services, insurance, and telecommunications); see also *Brennan v. Dickson*, No. 21-1087, 4-5 (D.C. Cir. Jul. 29, 2022) (noting the “rapidly accelerating commercial uses and planned uses of drones” including “infrastructure inspection, real estate photography, . . . agriculture management,” research activities, delivery of medical supplies, governmental tasks “ranging from search-and-rescue missions to border patrol,” responding to emergencies, and package delivery).

beyond their military origins into powerful tools across industries—much like the internet and GPS before them.¹⁴ The technology is already being put to use generating climate data and monitoring the nation’s border.¹⁵ Job opportunities stemming from the industry are quickly growing.¹⁶ Seemingly overnight, a domestic drone market is attracting journalists, real estate agents, wedding photographers, and law enforcement agents. When a wildfire breaks out, firefighters now send drones equipped with thermal cameras to fly over the scene and identify hot spot coordinates.¹⁷ In the oil and gas industry, where companies are required to conduct monthly pipeline inspections, drones now survey hundreds of miles of pipeline per day, saving tens of thousands of dollars that businesses would otherwise have spent hiring a helicopter crew.¹⁸ The opportunities that drones present are also evident in places with poor infrastructure or challenging geographies. Armed with flight, speed, and high-resolution-imaging capabilities, drones are ideal tools for disaster recovery, medical

14. See Chelsea Leu, *The Secret History of World War II-Era Drones*, WIRED (Dec. 16, 2015, 7:00 AM), <https://www.wired.com/2015/12/the-secret-history-of-world-war-ii-era-drones/> (“Drones are the hallmark of tech-y modern warfare, but weapons piloted from afar have been around for more than a century.”); Ben Zimmer, *The Flight of ‘Drone’ from Bees to Planes*, WALL ST. J. (July 26, 2013, 7:36 PM), <https://www.wsj.com/articles/SB10001424127887324110404578625803736954968> (describing the Navy’s use of drones prior to World War II).

15. See Luisa Marin & Kamila Krajčiková, *Deploying Drones in Policing Southern European Borders: Constraints and Challenges for Data Protection and Human Rights*, in DRONES AND UNMANNED AERIAL SYSTEMS: LEGAL AND SOCIAL IMPLICATIONS FOR SECURITY AND SURVEILLANCE 101, 103 (Aleš Završnik ed., 2016) (“In the USA, drones have already been used for monitoring the southern borders since 2004 and, recently, some European states, such as Italy, have deployed them too.”); *A Bird’s Eye View of the Arctic—and Future Weather Research*, NAT’L OCEANIC & ATMOSPHERIC ADMIN. (July 5, 2018), <https://research.noaa.gov/News/ArtMID/451/ArticleID/2367/mediaid/1345> [<https://perma.cc/22QX-BG2Q>] (describing NOAA’s use of drones to cost-effectively collect weather data and contribute to the improvement of weather and climate predictions).

16. *Id.*

17. See Brian Smith, *Are Drones the Future of Firefighting?*, WASH. TIMES (July 5, 2014), <https://www.washingtontimes.com/news/2014/jul/5/are-drones-the-future-of-firefighting> [<https://perma.cc/2LFQ-ZCAJ>] (cataloguing numerous examples of drones used to battle fires); CNET, *Drones vs. California’s Wildfires: How They’re Helping Firefighters*, YOUTUBE (Sept. 2, 2018), <https://www.youtube.com/watch?v=D3BWPoJ6ijs> [<https://perma.cc/2VYF-TUG9>] (showing footage of drone assistance in a fire rescue).

18. See *Drones Take Natural Gas Pipeline Inspections to a New Level*, UTILITY EXPO, <https://www.theutilityexpo.com/news/drones-take-natural-gas-pipeline-inspections-to-a> (last visited Sept. 1, 2022) (discussing the impact of UAS on the oil and gas industry, where “the current process for inspecting infrastructure in hard-to-reach places is both expensive and dangerous, requiring helicopters or airplanes to fly over the area”); Mark Venables, *Drones Begin to Deliver on Their Potential for the Oil and Gas Sector*, FORBES (Dec. 28, 2018, 6:04 AM), <https://www.forbes.com/sites/markvenables/2018/12/28/drones-begin-to-deliver-on-their-potential-for-the-oil-and-gas-sector/?sh=4f3392b5bdd8> [<https://perma.cc/HH55-BFGZ>] (explaining the various benefits of drone use in the industry).

supply delivery, and aid in other life-saving situations.¹⁹ Drones even served as useful tools in the COVID-19 pandemic by helping distribute vaccines in developing countries around the world.²⁰

However, the most disruptive aspect of drone innovation is in the area of commercial delivery services. Companies around the globe are beginning to leveragedrones' unique capabilities for commercial delivery, finding better ways to meet consumer demand for fast and cheap fulfillment services.²¹ The use of drones to conduct deliveries comes with benefits such as improved safety, greater route flexibility, reduced roadway congestion, reduced greenhouse gas emissions, and reduced roadway and bridge maintenance costs—all on top of saving businesses and consumers time and money.²² Hundreds of companies—including aviation and aerospace behemoths, such as General Electric, Lockheed Martin, and Northrop Grumman—have invested billions of dollars into the up-and-coming technology.²³ Businesses, such as Alphabet, Amazon, and Walmart, maintain departments devoted to developing drone systems, and even the United States Postal Service has embraced the once mind-bending prospect of drone postal service.²⁴

19. See Eric Adams, *Drones Help Bring Back Electricity in Puerto Rico*, WIRED (Mar. 3, 2018, 7:00 AM), <https://www.wired.com/story/drones-electricity-puerto-rico/> [<https://perma.cc/KT94-VNMR>] (discussing drone use in Puerto Rico in the aftermath of Hurricane Maria); Ellen Rosen, *Skies Aren't Clogged with Drones Yet, but Don't Rule Them Out*, N.Y. TIMES (Mar. 19, 2019), <https://www.nytimes.com/2019/03/19/technology/drone-deliveries-faa-pilot-programs.html> (describing companies such as Zipline, which is distributing blood by drone in Rwanda, and Swoop Aero, which is using drones to dispense vaccines and other medication on Vanuatu in the Pacific); Jack Stewart, *FAA Relaxes Drone Restrictions with 10 New Programs*, WIRED (May 9, 2018, 7:56 PM), <https://www.wired.com/story/faa-relaxes-drone-restrictions-with-10-new-programs/> [<https://perma.cc/79AT-G7T9>] (discussing a company working to develop drones to deliver defibrillators in response to 911 calls using a network of FedEx stores as its bases); Golden Matonga, *Malawi Drone Initiative Takes Drugs to Remote Areas Faster*, FIN. TIMES (Nov. 28, 2019), <https://www.ft.com/content/aab0945c-f62c-11e9-bbe1-4db3476c5ff0> [<https://perma.cc/BZA4-JLZZ>] (highlighting that in Malawi, UNICEF is providing HIV testing kits to hospitals and clinics across the country via medical drones).

20. Sai Balasubramanian, *Drones Are Now Being Used to Deliver Covid-19 Vaccines*, FORBES (Mar. 6, 2021, 5:08 PM), [<https://perma.cc/N2FR-TQA6>]; UNICEF, *How Drones Can Be Used to combat COVID-19*.

21. See Day One Team, *supra* note 4.

22. *Drone Delivery*, FEHR & PEERS, [<https://perma.cc/9QQ5-FJPW>] (last visited Sept. 2, 2022) (listing drone delivery benefits). However, that same report details several limitations as well, including limited package weights, required collision avoidance systems and airspace control regulations, constrained flight times, irregular and/or unpredictable events, and difficult to determine designated drop-off locations. *Id.*

23. Richard Levick, *Drone Industry Just Beginning to Take Off*, FORBES (May 15, 2018, 12:44 PM), [<https://perma.cc/K28P-LF5B>].

24. See Farber, *Eyes in the Sky*, *supra* note 11, at 12–13 (highlighting the thousands of jobs expected to be created by the rapid growth of the drone industry,

While the prospect of commercializing remote-control planes once seemed far-fetched, it is no longer rare to read headlines about drones rising above treeless landscapes carrying packages and delivering them to customers' front doors.²⁵ In fact, one scholar predicts that, eventually, "a landscape without drones will be unusual. Just as we are now used to FedEx and UPS trucks on our local streets and highways, in fifteen years we will be equally or more used to, not to mention reliant upon, delivery and other drones for our day-to-day needs."²⁶ With the ability to reach end users in a matter of minutes from the sky, drones present a truly unique opportunity for commercialization.²⁷

To realize the full potential of the "drone economy," however, consumers, businesses, and governments must all work together to resolve several key regulatory, technical, and societal challenges that lie ahead. A single federal agency, the FAA, is generally responsible for developing

including research and development departments, aided by the "hundreds of types of drones, ranging in size from a small insect to a commercial aircraft"); *see also* OFF. OF INSPECTOR GEN., U.S. POSTAL SERV., RARC-WP-17-001, PUBLIC PERCEPTION OF DRONE DELIVERY IN THE UNITED STATES (2016), https://www.uspsoig.gov/sites/default/files/document-library-files/2016/RARC_WP-17-001.pdf [<https://perma.cc/T72S-3XB3>] (noting the United States Postal Service's consideration of including drones in its operations); *Why Amazon, UPS and Even Domino's Is Investing in Drone Delivery Services*, *INSIDER INTEL* (APR. 15, 2022), <https://www.insiderintelligence.com/insights/drone-delivery-services/> [<https://perma.cc/U9JW-URE5>] (discussing growing adoption of drones, particularly in the retail industry); *Drone Delivery: Future or Fad?*, *POSTAL RECORD*, May 2017, at 16, 17, https://www.nalc.org/news/the-postal-record/2017/may-2017/document/2017_05-drone.pdf [<https://perma.cc/P8HW-7Y3B>] (quoting Postmaster General Megan Brennan as saying, "[c]urrently, our engineering group is researching [drones] and we're probably on the peripheral of this advanced technology. We're exploring and recognizing what's happening in the industry"); Andy Pasztor, *Google Wins First FAA Approval for Regular Drone Delivery of Consumer Items*, *WALL ST. J.*, <https://www.wsj.com/articles/google-wins-first-faa-approval-for-regular-drone-delivery-of-consumer-items-11556053590> [<https://perma.cc/8LV2-DGYC>] (Apr. 23, 2019, 7:57 PM) (announcing that the FAA authorized its first company for consumer-goods delivery by unmanned aircraft).

25. *See* Jonathan B. Rupprecht & Donna A. Dulo, *A Brief History of Unmanned Aircraft*, in *UNMANNED AIRCRAFT IN THE NATIONAL AIRSPACE: CRITICAL ISSUES, TECHNOLOGY, AND THE LAW* 9, 12–18 (Donna A. Dulo ed., 2015) (reflecting on past uses of unmanned aircraft including testing for aeronautical engineering purposes, using them as weapons, adapting paper balloons as rockets in the third century, sending aerial lanterns to signal allied forces in the thirteenth century, etc.); *see also* Christopher Mims, *Your Drone-Delivered Coffee Is (Almost) Here*, *WALL ST. J.* (Mar. 30, 2019, 12:00 AM), <https://www.wsj.com/articles/your-drone-delivered-coffee-is-almost-here-11553918415?mod=searchresults&page=1&pos=4> [<https://perma.cc/5X9E-K7A5>] (providing examples of drone delivery in a commercial setting).

26. Wendie L. Kellington, *Drones*, 49 *URB. LAW.* 667, 667 (2017).

27. For the growing adoption of drones to be fully realized, several critical advancements must be realized, such as unmanned traffic management systems, remote ID, and general drone technical improvements in the areas of battery life, weight, and responsiveness to unforeseen occurrences. This Article does not delve into those issues and instead limits its focus to regulatory challenges the nascent drone industry must resolve.

the voluminous regulatory requirements that govern all aspects of manned aviation, from aircrafts' technical requirements to specifications for flight control systems and airport operations. But drone flight represents a paradigm shift, upending many operating assumptions of commercial aviation and the FAA. In the context of manned flight, generally, on-board pilots control the takeoff, flight, and landing of aircrafts to and from fixed site airports often owned and operated by state and local governments. Aircrafts fly through defined, high-altitude airspace corridors, and traffic control is directed by the FAA at each phase of an aircraft's flight operations.²⁸ Drones, on the other hand, are designed to operate safely in low-altitude airspace, where they are in close proximity to people (and potentially other drones).²⁹ Soon, a generic drone will be able to autonomously take off, fly, and land virtually anywhere using real-time data.

Although uncommon, commercial drone delivery is technically possible under FAA rules. The FAA first authorized the use of certain drones for commercial purposes in its 2016 Part 107 regulation. But in the absence of infallible technical safety features, the regulation restricted commercial drone flight (1) to daylight hours, (2) to areas not flying above people, (3) to stay within the visual line of sight of a human operator, and (4) to fly no more than 400 feet above the ground.³⁰ Second, between 2018 and 2020, the UAS Integration Pilot Program (IPP), along with private

28. *Brennan v. Dickson*, No. 21-1087, 5 (D.C. Cir. Jul. 29, 2022).

29. *Id.* ("The established U.S. air traffic control system depends on constant lines of communication between traffic controllers and pilots in flight to avert risks But drones have no operator on board to receive or transmit air-traffic communications, nor do they communicate with a centralized FAA tower to coordinate with nearby aircraft.").

30. See 14 C.F.R. pt. 107 (2022); 86 Fed. Reg. 4134–387, 4390–513 (Jan. 15, 2021) (codified at 14 C.F.R. Parts 1, 11, 47, 48, 89, 91, and 107); *Operation Last Mile: Critical Drone Delivery Testing*, DRONEUP (2020), https://www.updwg.org/wp-content/uploads/2020/11/Operation-Last-Mile-White-Paper_FINAL_6.1.20.pdf [<https://perma.cc/HW8V-K69V>]; Danielle Gagne, *DroneUp Discusses Key Takeaways, Learnings, and SOPs Gained from Their Recent Last Mile Drone Delivery Tests with UPS and CIT*, COMMERCIAL UAV NEWS (Apr. 28, 2020), <https://www.commercialuavnews.com/infrastructure/droneup-last-mile-drone-delivery-tests-with-ups-and-cit> [<https://perma.cc/CWF9-5YDR>] [hereinafter Gagne, *DroneUp*]; REGINALD C. GOVAN, DEAN E. GRIFFITH, JONATHAN W. CROSS, BRANDON C. GOLDBERG, CHIN PANN, JOHN C. WOOD & SCOTT A. REYGERS, *Aviation Law: Incorporating Unmanned Operations Into the National Airspace*, in HANDBOOK OF UNMANNED AERIAL VEHICLES 9–10 (K.P. Valavanis & G.J. Vachtsevanos eds., 2d ed. 2018); Danielle Gagne, *Why Did the FAA Go with Broadcast Remote ID for Drones Over Network?*, UAS COMMERCIAL NEWS (Jan. 28, 2021), <https://www.commercialuavnews.com/regulations/why-did-the-faa-go-with-broadcast-remote-id-for-drones-over-network> [<https://perma.cc/ZDU3-Q598>] (summarizing concerns that FAA's rule impedes rather than supports long-term growth of package delivery services) [hereinafter Gagne, *Why Did the FAA*]; Joshua Turner & Sara Baxenberg, *FAA Adopts Final Rules for UAS Remote ID, Flights over People, and at Night*, WILEY (Dec. 29, 2020), <https://www.wiley.law/alert-FAA-Adopts-Final-Rules-for-UAS-Remote-ID-Flights-over-People-and-at-Night> [<https://perma.cc/3V7S-H8BR>].

sector field partners, tested a variety of innovative drone applications, including package delivery in ten states and local jurisdictions.³¹ Lastly, the FAA approved limited Part 107 waivers on a case-by-case basis, permitting drone activities beyond the limited circumstances authorized under Part 107.³²

More recently, however, the FAA expanded and clarified the process to conduct package delivery, while allowing for more flexibility in drone operations.³³ Among other requirements, the agency now mandates safety certification to carry packages beyond the line of sight, asks that all drones broadcast identification and location information (essentially a drone license plate), and prescribes specific requirements for conducting drone operations over people and operations at night.³⁴ As a result, to date, delivery drones still have somewhat limited capabilities, typically

31. See 82 Fed. Reg. 51903 (Nov. 8, 2017); Unmanned Aircraft Systems Integration Pilot Program, 82 Fed. Reg. 50301 (Oct. 25, 2017); see also Reggie Govan, *Former FAA Chief Counsel: Integration Pilot Program Strengthens U.S. Leadership in Drones*, UNMANNED AERIAL ONLINE (May 22, 2018), https://www.americanbar.org/content/dam/aba/events/air_space/2019/2019_annual/chief_counsel.pdf [<https://perma.cc/A8UN-UYSQ>]. Due to a variety of institutional constraints and political considerations, the IPP did not fulfill its goal and, ultimately, the FAA initiated the BEYOND program to continue its relationship with eight of the original IPP participants. See Fed. Aviation Admin., *BEYOND*, https://www.faa.gov/uas/programs_partnerships/beyond [<https://perma.cc/Q68N-DG2J>] (last updated Aug. 16, 2022).

32. See Ken Dunlap & Paul Lewis, *Bridging the Gap: Sustaining UAS Progress While Pursuing a Permanent Regulatory Framework*, ENO CTR. FOR TRANSP. (2020), <https://www.enotrans.org/wp-content/uploads/2020/08/Bridging-the-Gap-Sustaining-UAS-Progress-While-Pursuing-a-Regulatory-Framework.pdf> [<https://perma.cc/H7JR-QWFJ>] (analyzing the extent of the use of the FAA's waivers process to authorize drone operations).

33. See Type Certification of Certain Unmanned Aircraft Systems, 85 Fed. Reg. 58251–55; Operation of Small Unmanned Aircraft Systems Over People, 86 Fed. Reg. 4314–87; Remote Identification of Unmanned Aircraft, 86 Fed. Reg. 4390–513 (Jan. 15, 2021); see also *Understanding the New FAA Type Certification for UAV's*, AIRSPACE LINK (Feb. 12, 2021), <https://airsacelink.com/media/Understanding-the-new-Faa-Type-Certification-for-UAVs>; Andy Pasztor, *FAA Moves Toward Certifying Specific Drones for Package Deliveries*, WALL ST. J. (Feb. 3, 2020, 4:21 PM), <https://www.wsj.com/articles/faa-moves-toward-certifying-specific-drones-for-package-deliveries-11580764882> [<https://perma.cc/5TZN-36EN>]. The FAA's European counterpart, the European Aviation Safety Authority (EASA), proposed airworthiness standards for drones based on the population density in their operational area. Brian Garrett-Glaser, *EASA Proposes Risk-Based Airworthiness Standards for Light Unmanned Aircraft*, AVIATION TODAY (July 21, 2020), <https://www.aviationtoday.com/2020/07/21/easa-proposes-risk-based-airworthiness-standards-light-unmanned-aircraft/#:~:text=EASA> [<https://perma.cc/EV9Q-PLG\>].

34. See 85 Fed. Reg. 58251–55; 86 Fed. Reg. 4314–87; 86 Fed. Reg. 4390–513 (Jan. 15, 2021); see also Gagne, *Why Did the FAA*, *supra* note 30; Turner & Baxenberg, *supra* note 30.

traveling short distances and following fixed, preprogrammed paths below 400 feet.³⁵

To promote widespread adoption of drones in the commercial space, technological advancements and new regulatory frameworks are critical. The necessary advancements in drone capabilities that pertain to communications, navigation, airspace and traffic management, avionics, UAS design and materials, energy storage, and more, all require grappling with complex technical issues.³⁶ Likewise, commercial and societal challenges—including concerns related to public opinion, privacy, security, equity, sustainable business standards, and unemployment—are yet to be resolved. While some of the issues may not yet be relevant, solving the technical, regulatory, and societal hurdles will be necessary to facilitate advancement of commercial drone adoption. Moreover, ensuring that there is a regulatory framework in place to support the nascent technology remains critical for all who will be affected by the coming airspace revolution.

35. See, e.g., *Drone and Deliver*, ROYAL AERONAUTICAL SOC'Y (Feb. 18, 2022), <https://www.aerosociety.com/news/drone-and-deliver/> [<https://perma.cc/XF7D-LVUB>]; Brian Foley, *Package Delivery By Drone Still Faces Practical Challenges*, FORBES (Jan. 22, 2019), <https://www.forbes.com/sites/brianfoley1/2019/01/22/package-delivery-by-drone-still-faces-practical-challenges/?sh=1934b0987c5a> [<https://perma.cc/9M78-LCR8>].

36. The ongoing work of organizations dedicated to developing the technical standards for industry entities to demonstrate their compliance with FAA regulations governing the airworthiness, maintenance, and operation of commercial drones are beyond the scope of this Article. See generally FED. AVIATION ADMIN., INTEGRATION OF CIVIL UNMANNED AIRCRAFT SYSTEMS (UAS) IN THE NATIONAL AIRSPACE SYSTEM (NAS) ROADMAP 20 (3d ed. 2020), https://www.faa.gov/uas/resources/policy_library/media/2019_UAS_Civil_Integration_Roadmap_third_edition.pdf [<https://perma.cc/8GKT-Z5CD>]; FED. AVIATION ADMIN., INTEGRATION OF CIVIL UNMANNED AIRCRAFT SYSTEMS (UAS) IN THE NATIONAL AIRSPACE SYSTEM (NAS) ROADMAP 25–28 (Second ed. 2018), https://www.faa.gov/uas/resources/policy_library/media/Second_Edition_Integration_of_Civil_UAS_NAS_Roadmap_July%202018.pdf [<https://perma.cc/L2NQ-XVTX>]; FED. AVIATION ADMIN., INTEGRATION OF CIVIL UNMANNED AIRCRAFT SYSTEMS (UAS) IN THE NATIONAL AIRSPACE SYSTEM (NAS) ROADMAP 16–20, 28–30, 39 (First ed. 2013), https://www.faa.gov/uas/resources/policy_library/media/uas_roadmap_2013.pdf [<https://perma.cc/NFP9-ZEQK>]; AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI), STANDARDIZATION ROADMAP FOR UNMANNED AIRCRAFT SYSTEMS, VERSION 2.0 34–35, 37–38, 51 (2006) <https://www.ansi.org/standards-coordination/collaborative-activities/unmanned-aircraft-systems-collaborative> [<https://perma.cc/F55T-CCGR>]; RADIO TECHNICAL COMMITTEE FOR AERONAUTICS (RTCA), RTCA SPECIAL COMMITTEE 228 MINIMUM PERFORMANCE STANDARDS FOR UNMANNED AIRCRAFT SYSTEMS (REV 10) 10–11 (June 11, 2020), https://www.rtca.org/wp-content/uploads/2020/08/sc-228_tor_rev_10_approved_06-11-2020.pdf [<https://perma.cc/599H-WXKY>]; *Committee F38 on Unmanned Aircraft Systems*, ASTM INTERNATIONAL, <https://www.astm.org/get-involved/technical-committees/committee-f38> [<https://perma.cc/R4Y4K-54WV>] (last visited Oct. 2, 2022).

II. FEDERAL, STATE, AND LOCAL INTERESTS IN AIRSPACE

Airspace—and, particularly, its use by UAS operators—is presently subject to oversight by regulators at multiple levels. Most significantly, Congress has authorized the FAA to set out rules for the skies, which the agency has done by limiting the use of UAS operations to a maximum of 400 feet above the ground. States and localities have also stepped in, setting restrictions on drone operations within their jurisdictions. Those competing sources of authority has generated some confusion, as courts have struggled to determine how much space state and municipal governments have to regulate in the face of significant federal regulatory oversight of airspace. It is that confusion that makes it so important to establish a cohesive regulatory regime, so that government officials, UAS operators, and landowners can have clarity regarding the source and substance of the rules of the (aerial) road.

A. Federal Regulation of UAS Operations

Congressional efforts to oversee activity in the skies date back nearly a century. Congress first enacted a series of aviation laws beginning in 1926 with the Air Commerce Act, which declared that the United States had “complete sovereignty” in its navigable airspace and granted all citizens “a public right of freedom of interstate and foreign air navigation” through that airspace.³⁷ The term “navigable airspace” was defined to include all the airspace “above the minimum safe altitudes of flight” as set by the Secretary of Commerce.³⁸ Following a series of fatal collisions between civilian and military aircraft operating under separate flight rules, Congress recognized the need for expanded aviation legislation by passing the landmark Federal Aviation Act of 1958,³⁹ which created one unified system of flight rules under the control of the new Federal Aviation Agency (later renamed the Federal Aviation Administration).⁴⁰ It was not until 2007, however, that the FAA distinguished between commercial and recreational drones and subjected commercial operators to mandatory regulations, including both minimum pilot qualifications and broad operations requirements.⁴¹

37. Air Commerce Act of 1926, Pub. L. No. 69-254, §§ 6(a), 10, 44 Stat. 568, 572, 574.

38. *Id.* § 10, 44 Stat. at 574.

39. John W. Gelder, Comment, *Air Law—The Federal Aviation Act of 1958*, 57 MICH. L. REV. 1214, 1214 (1959).

40. Federal Aviation Act of 1958, Pub. L. No. 85-726, §§ 301(a), 313(a), 601(a), 72 Stat. 731, 744, 752, 755.

41. Steve Calandrillo, Jason Oh & Ari Webb, *Deadly Drones? Why FAA Regulations Miss the Mark on Drone Safety*, 23 STAN. TECH. L. REV. 182, 188–89 (2020);

With the enactment of the FAA Modernization and Reform Act (FMRA) in 2012, Congress—for the first time—took meaningful action to regulate civil UAS operations.⁴² Reflecting on the potential benefits and challenges associated with advancing drone technology, Congress directed the FAA to determine whether civil UAS may operate safely in the national airspace system and to establish requirements for safe operation and integration into the national airspace.⁴³ More recently, in the FAA Reauthorization Act of 2018, Congress further instructed the agency to create updated guidelines that address questions pertaining to commercial drone operations and the appropriate roles and responsibilities of state and local authorities.⁴⁴

Above all, the FAA is tasked with regulating the use of airspace “to ensure the safety of aircraft and the efficient use of airspace,” while respecting the “public right of transit through the navigable airspace” afforded to every “citizen of the United States.”⁴⁵ Congress originally defined “navigable airspace” as the “airspace above the minimum safe altitudes of flight prescribed by the Secretary of Commerce,” but in 1958 it added the airspace needed for safe takeoffs and landings.⁴⁶ The definition of “navigable airspace” is now codified to encompass all “airspace *above* the minimum altitudes of flight prescribed by regulations.”⁴⁷ In other words, under current law: a public right of transit exists *above* 500 feet from the ground.⁴⁸

By contrast, the FAA’s Part 107 regulations obligate UAS operators to maintain a flight altitude *below* 400 feet from the ground, absent a

see also Unmanned Aircraft Operations in the National Airspace System, 72 Fed. Reg. 6689, 6690 (Feb. 13, 2007) (codified at 14 C.F.R. pt. 91); Stephen J. Migala, *UAS: Understanding the Airspace of States*, 82 J. AIR L. & COM. 3, 8–9 (2017).

42. FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 332, 126 Stat. 11, 77 (codified at 49 U.S.C. § 40101); Migala, *supra* note 41, at 9; *see also* FAA Extension, Safety, and Security Act of 2016, Pub. L. No. 114-190, 130 Stat. 615; FAA Reauthorization Act of 2018, Pub. L. No. 115-254, 132 Stat. 3186.

43. FAA Modernization and Reform Act § 332; *see also* Operation and Certification of Small Unmanned Aircraft Systems, 80 Fed. Reg. 9544, 9551 (Feb. 23, 2015) (codified at 14 C.F.R. pt. 21).

44. For the FAA’s most recent guidance for conducting small drone operations pursuant to Part 107, *see* FED. AVIATION ADMIN., ADVISORY CIRCULAR NO. 107-2A (2021), www.faa.gov/documentLibrary/media/Advisory_Circular/AC_107-2A.pdf [<https://perma.cc/KE23-RJ8M>].

45. 49 U.S.C. § 40103(a)(2), (b)(1). The general rulemaking powers for most federal agencies, including the FAA, are codified at 5 U.S.C. § 553(b)(3)(A).

46. Air Commerce Act of 1926, ch. 344, sec. 10, 44 Stat. 573, 574; Federal Aviation Act of 1958, Pub. L. No. 85-726, § 101(24), 72 Stat. 731, 739.

47. 49 U.S.C. § 40102(a)(32) (emphasis added).

48. *See infra* note 86.

waiver.⁴⁹ The restriction, however, immediately raised serious concerns as to whether the FAA was asserting national sovereignty over all airspace and redefining public navigable airspace as beginning at 0 feet—in other words, anything above “the blades of grass.”⁵⁰ Others defended the FAA, contending that drones can fly safely in low-altitude airspace, which has made 0 feet the de facto minimum safe altitude of flight. Furthermore, defenders argue that all flight—which now includes drone flight, wherever it may be—is subject to the FAA’s general authority to establish rules for safe flight operations.⁵¹

The FMRA restrictions were significant for a variety of impacted parties. They markedly affected drone operators who questioned whether all airspace was now open to the public, as well as landowners who had previously believed the airspace above their land until 500 feet to be theirs. States and localities, which had issued their own rules governing drone operations after growing weary of waiting for the FAA to issue guidance, also had to account for the federal government’s new regulatory action.

49. 14 C.F.R. § 107.51. Drawing the line at 400 feet, rather than 500 feet, creates a buffer zone to keep UAS and conventional airplanes safely far away from each other. *See infra* Section VI.B.

50. *See* GAO Report, *supra* note 11, at 6 (“Although FAA has issued no regulation prescribing minimum safe flight altitudes for UAS, DOT officials told us ‘it is the Department’s stance that, for purposes of the definition of the term *navigable airspace*, zero feet (“the blades of grass”) is the minimum altitude of flight for UAS.”).

51. *See* Joshua S. Turner & John T. Lin, *The Space Between: Who Controls the Airspace Where Small Unmanned Aircraft Systems (UAS) Fly?*, UAS VISION (Jan. 19, 2017), <https://www.uasvision.com/2017/01/19/the-space-between-who-controls-the-airspace-where-small-unmanned-aircraft-systems-uas-fly/> [<https://perma.cc/6U9V-J4M4>] (“[T]here is no reason to think that *Causby*’s recognition of the evolution in technology should be frozen in amber as of 1946 (*Causby*) or 1958 (Federal Aviation Act). To the contrary, the lesson of *Causby* is that as new classes of aircraft are developed that can operate safely at lower altitudes, the ‘navigable airspace’ should expand to embrace them, just as the traditional notion that the property owner had title to the airspace all the way to the stars had to yield to manned flight. . . . In legal terms, the FAA has already recognized this expansion by adopting Part 107, which dispenses with the 500-foot floor for small UAS and instead imposes a 400 foot ceiling.”); *see also* *Air Pegasus of D.C., Inc. v. United States*, 424 F.3d 1206, 1217 (Fed. Cir. 2005) (rejecting plaintiff’s claim to a private “right to access the *navigable* airspace from its heliport” for Fifth Amendment takings purposes) (emphasis added); Tom Karol, *Unmanned Aircraft: Defining Private Airspace*, NAMIC 4–5 (Jan. 2017), https://www.namic.org/pdf/drones/1703_privateairspace.pdf [<https://perma.cc/38LZ-4TJB>] (“By the FAA determination that all airspace—from the ground up—is federal navigable airspace for UAS, the FAA now claims authority to allow UAS access to all superadjacent airspace over private property. By authorizing all FAA-compliant UAS flights in this previously superadjacent airspace over private property, the FAA has opened to the general public an enormous amount and variety of space that had previously been the exclusive private property of the landowners’ reasonable use.”). For more details on the concepts addressed in this footnote, *see infra* Parts II and III.

B. State Regulation of UAS Operations and Preemption

Relying on their sovereign police powers to protect and govern people and property, many states and localities have issued their own regulations to oversee some aspects of UAS operations in the same low-altitude airspace where the FAA has asserted its regulatory authority.⁵² For example, some states and localities impose “reasonable time, place, and manner” restrictions on drone operations or threaten to use “counter-UAS” measures to respond to rogue drones caught flying in an unsafe manner or in unauthorized places.⁵³ By contrast, other states seek to encourage and promote UAS operations within their borders, particularly for commercial purposes.

As of 2019, forty-six states have enacted some type of UAS-specific legislation or otherwise issued UAS-specific regulations or executive orders.⁵⁴ Those policies cover many issues, including protecting personal privacy against intrusion, prohibiting UAS operations above certain areas such as prisons, banning the use of UAS for hunting, and preempting UAS regulations by localities.⁵⁵

C. Balancing Competing Regulations

The multiple levels of UAS regulations create potential inconsistencies and conflicts among policies enacted by different jurisdictions. Determining which rules win implicates principles of preemption. When the federal government acts within its constitutionally enumerated powers, the Constitution’s Supremacy Clause ensures that federal law prevails over state and local laws if it contains an express preemption provision, occupies an entire field of regulation, or conflicts with state law.⁵⁶ Thus, the issue becomes whether Congress has clearly manifested its intent that the FAA’s UAS regulations should preempt state and local UAS regulations in the same low-altitude airspace.

To date, few federal court decisions have raised UAS jurisdiction and federalism issues, with even fewer deciding those questions. As a starting

52. Brent Skorup, *Drone Technology, Airspace Design, and Aerial Law in States and Cities* (Mercatus Ctr., Working Paper, 2020), <https://www.mercatus.org/publications/technology-and-innovation/drone-technology-airspace-design-and-aerial-law-states-and> [<https://perma.cc/HRJ6-NFCV>].

53. GAO Report, *supra* note 11, at 8–9.

54. For a list of state regulations regarding UAS operations, see generally GAO Report, *supra* note 11, at app. IV; see also Nilsson, *supra* note 1, at 82–280.

55. Nilsson, *supra* note 1, at 82–280.

56. See generally JAY B. SYKES & NICOLE VANATKO, FEDERAL PREEMPTION: A LEGAL PRIMER (Congressional Research Service Report R45825, 2019), <https://sgp.fas.org/crs/misc/R45825.pdf> [<https://perma.cc/7PZV-ZESG>] (explaining the preemption powers of federal law over state law).

premise, many courts have held that Congress occupies the entire field of aviation safety, preempting any states or localities from regulating in that domain.⁵⁷ Thus, there is reason to think that a similar logic might apply in the realm of UAS operations. But, given the more grounded nature of some drone activities, the answer is not so obvious. In fact, there are significant arguments in favor of state and local involvement.

In *Singer v. Newton*,⁵⁸ a Massachusetts district court ruled that city ordinances effectively banning UAS operations within city limits were preempted as conflicting with FAA regulations.⁵⁹ In its holding, however, the court recognized that FAA regulations “explicitly contemplate[] state or local regulation of pilotless aircraft” and thus refused to hold that “the whole field is exclusive to the federal government.”⁶⁰ The decision was based on the conflict that existed between federal law and the particular ordinances, which “thwart[ed] not only the FAA’s objectives, but also those of Congress for the FAA to integrate drones into the national airspace.”⁶¹

Meanwhile, in *National Press Photographers Association v. McCraw*,⁶² a Texas district court found that FAA rules did not preempt state laws, prohibiting UAS operation over prisons, critical infrastructure facilities, and sports venues.⁶³ It reasoned that “federal law has not completely preempted the field regarding UAVs flying over certain buildings and structures,” since Congress and the FAA have both recognized a role for state and local regulation of UAS activities and nothing indicated that “Congress intended to prohibit states from passing additional regulations related to UAVs.”⁶⁴ The court also found no conflict between the Texas laws at issue and the federal goal of integrating UAS operations into the national airspace.⁶⁵

Also insightful is *Boggs v. Merideth*,⁶⁶ a federal case that followed the dismissal of state criminal charges against a landowner for shooting

57. See, e.g., *Goodspeed Airport LLC v. E. Haddam Inland Wetlands & Watercourses Comm’n*, 634 F.3d 206, 208 (2d Cir. 2011) (“Congress has established its intent to occupy the entire field of air safety, thereby preempting state regulation of that field.”); *US Airways, Inc. v. O’Donnell*, 627 F.3d 1318, 1326 (10th Cir. 2010) (“[F]ederal regulation occupies the field of aviation safety to the exclusion of state regulations.”); *Montalvo v. Spirit Airlines*, 508 F.3d 464, 470 (9th Cir. 2007) (“Congress has indicated its intent to occupy the field of aviation safety.”).

58. 284 F. Supp. 3d 125, 132 (D. Mass. 2017).

59. *Id.* at 132.

60. *Id.* at 130.

61. *Id.* at 132.

62. 504 F. Supp. 3d 568, 574–75 (W.D. Tex. 2020).

63. *Id.* at 574–75.

64. *Id.* at 589.

65. *Id.* at 590–91.

66. No. 3:16-CV-00006-TBR, 2017 WL 1088093 (W.D. Ky. Mar. 21, 2017)

down another's drone.⁶⁷ The drone operator sued the landowner, arguing that, from his perspective, the drone was an "aircraft" legally operating in federal navigable airspace within the United States' exclusive jurisdiction, rather than in the landowner's privately owned airspace, and that his actions could therefore not serve as a basis to subject him to state-law claims for aerial trespass or invasion of privacy.⁶⁸ The *Boggs* court dismissed the suit, finding that it lacked jurisdiction because any issues involving federal law were not sufficiently embedded within the plaintiff's state-law claim for trespass to chattels (predicated on the destruction of his drone).⁶⁹

Despite the clear federal interest in preventing patchwork legislation among states and localities, each of these geographic areas has unique needs and concerns, and Congress's and the FAA's exclusive authority over navigable airspace may not extend to the lower altitudes where drones may operate. And even if the federal government has primary authority in lower-altitude airspace, existing laws and rules recognizing a role for other jurisdictions' policies leave room on the field for state and local drone rules that do not interfere with the federal scheme—as the FAA itself has acknowledged.⁷⁰ Rather than waiting on these issues to percolate through judicial review of legal challenges, the FAA should institute clear regulatory guidance within its congressional authority so that drone operators and landowners know who to turn to for the rules of the road in the drone age.⁷¹

III. PRIVATE PROPERTY RIGHTS IN AIRSPACE

Determining how far down the FAA can reach in regulating airspace, and what kinds of regulations are permissible, requires an understanding of the various landowner property interests at play. Any law or regulation that intrudes on a protected property right, in the absence of just compensation to the landowner, would result in an unconstitutional taking in violation of the Fifth and Fourteenth Amendments, making it important to examine the scope and extent of landowners' control over the airspace above their land.

67. *Id.* at *1.

68. *Id.*

69. *Id.* at *16.

70. See FED. AVIATION ADMIN., STATE AND LOCAL REGULATION OF UNMANNED AIRCRAFT SYSTEMS (UAS) FACT SHEET (Dec. 17, 2015), https://www.faa.gov/uas/resources/policy_library/media/UAS_Fact_Sheet_Final.pdf [<https://perma.cc/DG8F-9ERP>].

71. See Migala, *supra* note 41, at 40.

A. Origins of Airspace Ownership

The property rights of a landowner in the air above his land have evolved dramatically over the centuries. In the days before mankind could actually travel through the air, a landowner at common law was entitled to ownership of all the airspace between the earth on his property and the heavens above. Once air travel emerged and became more prevalent, that common-law understanding faded away, in favor of a view—codified in federal law—that the upper reaches of the sky were a public highway, open to all comers.

1. COMMON LAW ROOTS OF AIRSPACE RIGHTS

Hundreds of years before airplanes and drones roamed the skies, Sir Edward Coke—among the most influential English common law jurists⁷²—wrote, “And lastly, the earth hath in law a great extent upwards, not only of water, as hath beene said, but of ayre and all other things even up to heaven; for *cujus est solum ejus est usque ad coelum*”⁷³ That Latin maxim dates back to the late-sixteenth-century case of *Bury v. Pope*⁷⁴ and means “he who owns the soil owns everything above and below, from heaven to hell.”⁷⁵ According to the *ad coelum* doctrine, ownership of airspace was tied to the land beneath it and extended upward indefinitely.⁷⁶ *Ad coelum* was promulgated and cemented as a fixture of

72. See Gareth H. Jones, *Sir Edward Coke*, ENCYCLOPEDIA BRITANNICA, <https://www.britannica.com/biography/Edward-Coke> [https://perma.cc/AQ7V-K3XM] (last updated Aug. 30, 2022) (“Sir Edward Coke, . . . British jurist and politician whose defense of the supremacy of the common law against Stuart claims of royal prerogative had a profound influence on the development of English law and the English constitution. . . . His knowledge of law, . . . was unequaled”).

73. EDWARD COKE, A COMMENTARY UPON LITTLETON 4 (Soc’y of Stationers, 1628).

74. *Cro. Eliz.* 118, 78 Eng. Rep. 375 (1587), <http://www.commonlii.org/uk/cases/EngR/1653/382.pdf>.

75. See Yehuda Abramovitch, *The Maxim “Cujus Est Solum Ejus Usque Ad Coelum” as Applied in Aviation*, 8 MCGILL L.J. 247, 247 (offering various meanings to the phrase by examining its origin and historical development); Stuart S. Ball, *The Vertical Extent of Ownership in Land*, 76 U. PA. L. REV. 631, 631 (1928) (arguing nearly a century ago that the phrase was outdated in the modern era). Two other early English cases, one in 1598 and another in 1610, involved landowners who were successfully sued by their neighbors for building houses that overhung the property line but did not trespass. See BANNER, *supra* note 11, at 13–16 (examining the history and development of the phrase from a scholarly perspective).

76. Legal historians debate the true origin of the principle and whether the maxim has its roots with Roman glossators, Hebraic texts, or whether Coke invented it. Robert R. Wright, *Airspace Utilization on Highway Rights of Way*, 55 IOWA L. REV. 761, 762 (1970); see, e.g., *Swetland v. Curtiss Airports*, 41 F.2d 929, 934–35 (N.D. Ohio 1930); see also John Cobb Cooper, *Roman Law and the Maxim Cujus Est Solum in International*

American common law when William Blackstone cited it in his *Commentaries* in the late nineteenth century.⁷⁷ As a theory of property law, the definition possessed the advantage of simplicity, and common sense commended it. Because the doctrine placed no upper boundary on the column of airspace held by landowners, that column theoretically extended to the outer reaches of the sky.⁷⁸

However, neither Lord Coke nor Blackstone rode on an airplane, piloted a drone, or even imagined these feats.⁷⁹ It eventually became clear

Air Law, 1 MCGILL L.J. 23, 60 (1952) (noting that reaching an arm across a property was a trespass because of “one of the oldest rules of property known to the law that the title of the owner of the soil extends . . . upward ‘usque ad coelum’”).

77. See 2 W. BLACKSTONE, COMMENTARIES *19 (Cooley ed. 1899); ROBERT R. WRIGHT, THE LAW OF AIRSPACE 35 (1968) (“Blackstone’s *Commentaries* . . . reiterated Coke’s viewpoint on ownership of airspace. These *Commentaries* burst upon the scene practically on the eve of American independence, and were accepted as ‘quasi authority’ in America.”).

78. The origins of airspace law can be traced back to English common law. See generally *Fay v. Prentice*, 135 Eng. Rep. 769 (1845) (involving rainwater falling into plaintiff’s garden from an overhanging cornice); *Pickering v. Rudd*, 171 Eng. Rep. 70 (1815) (involving a board nailed onto a house which projected into the airspace above a neighbor’s garden); *Clifton v. Viscount Bury*, 4 T.L.R. 8 (1887) (discussing projectiles within another’s airspace); *Arundel v. M’Culloch*, 10 Mass. (9 Tyng) 70 (1813) (involving the cutting down and tearing away of a bridge); *Wales v. Stetson*, 2 Mass. (1 Tyng) 143 (1806) (regarding the injury and destruction of a turnpike-gate); *James v. Hayward*, 79 Eng. Rep. 761 (1792) (involving the destruction of a public highway gate); *Lodie v. Arnold* 91 Eng. Rep. 396 (1795) (involving the breaking of a gate and destruction of materials); *Penruddock’s Case*, 77 Eng. Rep. 210 (1826) (framing a house’s overhang as nuisance); *Baten’s Case*, 77 Eng. Rep. 810 (involving a house’s overhang onto neighboring property); *Garey v. Ellis*, 55 Mass. (1 Cush.) 306 (1848) (involving a building that obstructed waterway traffic as a public nuisance). However, “[t]he passage of these concepts into American law followed the natural course through which we received the English common law.” Wright, *supra* note 76, at 765; see generally *Lemmon v. Webb* [1894] 1 AC (HL) 116 (appeal taken from Eng.) (involving the overhang of branches onto neighboring property); *Hoffman v. Armstrong*, 48 N. Y. 201 (1872) (involving the overhang of branches onto neighboring property); *Atkins v. Bordman*, 41 Mass. (2 Met.) 457 (1841) (involving the obstruction of a pathway); *Lyman v. Hale*, 11 Conn. 177 (1836) (involving the overhang of branches onto neighboring property); *Isham v. Morgan*, 9 Conn. 374 (1832) (involving the conveyance of land and accompanying buildings); *Ingraham v. Hutchinson*, 2 Conn. 584 (1818) (involving the obstruction of a river flowing to neighboring property).

Airspace law, it should be noted, is not the same as space law, the legal body governing outer space, although there may be overlap between the two. See I.H.PH. DIEDERIKS-VERSCHOOR, AN INTRODUCTION TO AIR LAW 2 (9th ed. Kluwer, 2012) (“The point has been raised on several occasions whether it was altogether necessary to introduce a special body of rules to govern the airspace.”); Paul Stephen Dempsey & Maria Manoli, *Suborbital Flights and the Delimitation of Air Space Vis-À-Vis Outer Space: Functionalism, Spatialism, and State Sovereignty*, in 42 ANNALS OF AIR AND SPACE LAW 214–18 (2017) (comparing airspace and space law).

79. See generally *The First Hot Air Balloon Flight*, CHATEAU DE VERSAILLES, <https://en.chateauversailles.fr/discover/history/key-dates/first-hot-air-balloon-flight> [https://perma.cc/9RNS-EZZZ] (last visited Oct. 2, 2022). Of course, Leonardo da Vinci

that a new doctrine of airspace rights was necessary to account for and accommodate traversing the air. Thus, two unique schools of thought developed in response to the social and economic realities of the day. The first was that airspace is inseparable from the land beneath it.⁸⁰ The second—advanced by Blackstone and Kent—regarded ownership of airspace as similar to that of land, not inextricably connected to the land below; “if he can sell it all, he can divide the usable space and sell it layer by layer.”⁸¹

English and American courts adopted and developed the latter philosophy, the “upper chamber principle,” in a way that made commercial and economic sense.⁸² Accordingly, the fundamental basis of airspace ownership became: (1) the space above a tract of land belongs to the owner of that land; but, (2) a parcel of space—for example, the upper portion of a building—may be separately owned and occupied by another.⁸³ The ultimate theory, for which Coke laid the foundations, Blackstone perpetuated, and Kent followed, changed to fit the growing economic and technological realities of the time.

2. THE INTRODUCTION OF PUBLIC NAVIGABLE AIRSPACE

In the early to mid-twentieth century, legislators shifted away from the *ad coelum* and upper chamber theories at common law and crafted a new statutory scheme to promote air transport, particularly in the aftermath

had envisioned the concept of manned flight several centuries earlier, but man only became airborne for the first time in the late eighteenth century, and the advent of the airplane occurred more than a century after that.

80. See Arthur K. Kuhn, *The Beginnings of an Aerial Law*, 4 AM. J. INT’L L. 109, 122–23 (1910) (introducing his philosophy of airspace private law closely adhering to the *ad coelum* approach of closely held property rights); Comment, *Ejectment—Removal of Telephone Wires*, 16 YALE L.J. 275 (1907) (adhering to and arguing for the airspace philosophy that airspace ownership is an absolute right that cannot be separated from the land); WRIGHT, *supra* note 76, at 67.

81. WRIGHT, *supra* note 76, at 68; see also BLACKSTONE, *supra* note 77; JAMES KENT, 3 COMMENTARIES ON AMERICAN LAW 487 (New York, William Kent 7th ed. 1851).

82. See WRIGHT, *supra* note 76, at 68 (“If airspace were inseparable from the surface, the result was economically stifling, and if it were an incorporeal thing, incapable of possession and of value only as it enhanced the use of the surface, then nothing much could be done with it. Since this was economically troublesome and constricting, without any corresponding benefit, the theory that it *was* something which could be possessed and sold was more likely to prevail.”) (emphasis in original).

83. See *Butler v. Frontier Tel. Co.*, 186 N.Y. 486 (1906); see also WRIGHT, *supra* note 76, at 99 (“To develop the principle that a vertical column of airspace may be divided horizontally and sold in layers or in specified units, however, you must of necessity have a legal concept which permits the surface owner to deal commercially in such superadjacent space by virtue of his surface ownership. Thus, the attempted refutation of the *ad coelum* maxim in all its particulars by the aviation writers contained the seeds of destruction or at the least, substantial limitation, as far as common law commercial transactions in airspace were concerned.”).

of World War I. At the time, the international community formally recognized that countries maintain sovereignty over the airspace above their territories.⁸⁴ Building on that, legislators in the United States codified the legal right to public transit at high altitudes in the 1926 Air Commerce Act.⁸⁵ Congress both declared the United States' "complete and exclusive national sovereignty" in its "navigable airspace" and granted all citizens a public right of transit through that airspace—everything above the minimum safe altitude of flight, which was subsequently defined as airspace at least 500 feet above the earth.⁸⁶ However, the legal status of the airspace below 500 feet was a more complicated question that was left unresolved.⁸⁷

In the decades that followed, Congress legislated only in navigable airspace, supporting the emerging commercial aviation industry (which was essentially national in scope), to the extent that it found necessary to serve the national interest.⁸⁸ Who controlled non-navigable airspace beneath it, however, remained unanswered. Congress had little interest in

84. This understanding was first enacted in the 1919 Paris Convention and reaffirmed in the 1944 Chicago Convention. *See* PABLO MENDES DE LEON, INTRODUCTION TO AIR LAW 8–9 (Kluwer Law International B.V., 10th ed. 2017); *see also* Pan American Convention on Commercial Aviation, U.S.-Cuba, Feb. 20, 1928, 47 Stat. 1901. This history is noted by BANNER, *supra* note 11, at 67–68 (“By the end of World War I, then, the world had settled on an aerial trespass rule at the national level. A nation had the right to exclude foreign aircraft from the airspace above its territory. . . . [U]nderlying the system of international air travel was the fundamental principle that a nation had complete control over its own airspace.”).

85. *See* Air Commerce Act of 1926, Pub. L. No. 69-254, 344 Stat. 568. The Act included an explicit declaration of a “public right of freedom of navigation by aircraft” in the nation’s “navigable airspace,” a term defined as all the airspace above the minimum safe altitudes of flight to be prescribed by the Department of Commerce. This declaration established a right to fly above private property, but only for flights crossing state or national boundaries. The report of the House Committee on Interstate and Foreign Commerce explained that this right of navigation through the air “is analogous to the easement of public right of navigation over the navigable waters of the United States.” But because “[t]he primary source of power to impose such an easement is the commerce clause,” Congress limited the easement to interstate flights. Air Commerce Act of 1926, Pub. L. No. 69-254, 344 Stat. 568, *reprinted in* COMM. ON INTERSTATE AND FOREIGN COMMERCE, LEGISLATIVE HISTORY OF THE AIR COMMERCE ACT OF 1926 TOGETHER WITH MISCELLANEOUS LEGAL MATERIALS RELATING TO CIVIL AIR NAVIGATION, at 42 (1928).

86. *See* 14 C.F.R. § 91.119 (2010). While 500 feet is still the default height, several limitations and exceptions to that line exist. Over bodies of water or in “sparsely populated areas,” for example, aircraft can fly less than 500 feet above the ground so long as they are not “operated closer than 500 feet to any person, vessel, vehicle, or structure.” *Id.* § 91.119(c). Additionally, within six miles of some airports, the navigable airspace line may commence at heights of less than 500 feet above ground level, to provide space for takeoffs and landings. *See* 14 C.F.R. §§ 77.17, 91.119(b) (2010). The Civil Aeronautics Act of 1938 provided similar statutory language but left many of the ambiguities unanswered. Pub. L. No. 75-706, 52 Stat. 973 (1938).

87. *See* CHARLES S. RHYNE, AIRPORTS AND THE COURTS 112–13 (1944).

88. *Id.*

addressing the local considerations and problems inherent in the regulation of low-altitude airspace, which was traditionally handled by states.⁸⁹ The question of non-navigable airspace ownership was thus left open,⁹⁰ until the 1946 decision of *U.S. v. Causby*.⁹¹

B. Causby and the Private Ownership of Airspace

The landmark case of *U.S. v. Causby* was borne from the confusion and divergent theories regarding the ownership of airspace above privately held land.⁹² *Causby* marked the judiciary's first major foray into the conflict between the then still-existent common law *ad coelum* doctrine and the statutory "navigable airspace" framework that reflected contemporary notions of airspace rights.⁹³ The stagnancy in the common law was partially due to the lack of decided cases to develop the issue. Few court decisions in the first part of the twentieth century concerned aerial trespass and even fewer decided claims addressing questions of navigable airspace. So, following nearly half a century of debate and ambiguity, the Supreme Court finally offered clarity.

For the fifty thousand residents of Greensboro, North Carolina, "it was just a good place to live."⁹⁴ A small municipal airport was built in the town in the late 1920s, but it never generated significant air traffic, mainly serving mail planes, private aircraft, and the occasional commercial flight.⁹⁵ That all changed in 1942 when the federal government first leased

89. *Id.*

90. *See generally* Migala, *supra* note 41, at 40.

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

92. No less than six separate theories were thrust into the airspace debate regarding the limits of airspace ownership. Those theories were developed in response to the confusion of early legislative and common-law disagreements, and they varied widely from one extreme (full private ownership of airspace above one's land) to the other (no private ownership of any airspace above one's land). *See* Colin Cahoon, Comment, *Low Altitude Airspace: A Property Rights No-Man's Land*, 56 J. AIR L. & COM. 157, 163–67 (1990).

93. *See* BANNER, *supra* note 11, at 86; *see Causby*, 328 U.S. at 258; *see also* Cahoon, *supra* note 92, at 168; *cf. Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104 (1978) (holding that no compensable regulatory taking resulted from a historic landmark ordinance's severe limitation on a landowner's rights to occupy valuable airspace above its property); *see also* Martin A. Schwartz, *It's Up in the Air: Air Rights in Modern Development*, BILZIN SUMBERG (Mar. 26, 2006), https://www.americanbar.org/content/dam/aba/publishing/rpte_ereport/2015/3-May/its_up_in_the_air.authcheckdam.pdf (concluding that although the common-law doctrine of ownership of airspace has been limited to allow for air travel, the concept of a landowner's ownership of airspace above the surface of owned land below "navigable airspace" remains well established). *See generally* BANNER, *supra* note 11, at 84–101.

94. *See* Transcript of Record at 35, *U.S. v. Causby*, 328 U.S. 256 (1946) (No. 630).

95. *Id.* at 8.

the airfield in the wake of the United States' entry into World War II.⁹⁶ Military aircraft soon began making regular use of the facility, and large, four-motored bombers nearly grazing neighboring fields became a frequent occurrence.⁹⁷ “[O]ne plane right after another,” the planes would “swoop down so close to the house that it seemed they were taking the roof off.”⁹⁸

The Causbys were local chicken farmers, with nearly three acres along the eastern edge of the airport.⁹⁹ They made a comfortable living raising approximately 400 breeding hens.¹⁰⁰ However, the airport glide path passed directly over the Causbys' property—a mere eighty-three feet above their land—and with military planes taking off at all hours of the day and night, the Causbys' lives were fundamentally changed.¹⁰¹ The family lost sleep because of the noise and bright lights, and their chickens were in even worse shape. Nearly half of the chickens died. As Mr. Causby put it at trial, “[t]hey would jump off the roost, get excited and jump against the side of the chicken house and the walls and burst themselves open and die.”¹⁰² And the Causbys' business was all but ruined. After reading about planes crashing into neighboring parcels, at one point killing a mother and three children, Mr. Causby—now distraught and losing more sleep than ever—filed suit against the United States, alleging that it had effected a taking of his property.¹⁰³

The Supreme Court agreed to hear the case¹⁰⁴ and ultimately ruled in Causby's favor, forever transforming the nature of airspace litigation.¹⁰⁵ The Court dismissed the “ancient” *ad coelum* doctrine as having “no place in the modern world.”¹⁰⁶ However, it also rejected the idea that landowners

96. *Id.* at 9.

97. *Id.* at 37–38.

98. *Id.* at 53.

99. *Id.* at 8.

100. *Id.*

101. *Id.* at 1, 8, 36–38.

102. *Id.* at 35–36, 51.

103. *See id.* at 59; *see also U.S. v. Causby*, 328 U.S. 256, 258–59 (1946).

104. One key factor in granting certiorari, as advanced by the Solicitor General, was the conflict among lower courts regarding the issue, particularly the inconsistency of the *Causby* lower court's decision with *Hinman v. Pac. Air Transp.*, 84 F.2d 755, 756 (9th Cir. 1936). *See Cahoon, supra* note 92, at 167–69. In *Hinman*, the Ninth Circuit held that flying through air space within 100 feet or even 5 feet of the surface was not a technical trespass upon the property of the landowner. 84 F.2d at 758–59. However, by the mid-1940s, *Hinman* was an outlier. Other courts had addressed the trespass question and held that ultra-low flights could constitute a trespass, although they disagreed on exactly how low a plane could go before entering private airspace. *See Cahoon, supra* note 92, at 173–82.

105. *See Lewis Wood, Chickens Upheld in Plane Decision: High Court Sends Farmer's Case Back to Claims Bench for Further Findings*, N.Y. TIMES, May 28, 1946.

106. *Causby*, 328 U.S. at 260–61.

have no property interest in the airspace above their land.¹⁰⁷ The Supreme Court thus adopted a middle ground theory: landowners own all the “superadjacent” airspace above their property, and an invasion of that airspace should be treated as if an actual invasion of the surface has occurred. The Court declared:

We have said that the airspace is a public highway. Yet it is obvious that if the landowner is to have full enjoyment of the land, he must have exclusive control of the immediate reaches of the enveloping atmosphere. Otherwise buildings could not be erected, trees could not be planted, and even fences could not be run. The principle is recognized when the law gives a remedy in case overhanging structures are erected on adjoining land. The landowner owns at least as much of the space above the ground as he can occupy or use in connection with the land. The fact that he does not occupy it in a physical sense—by the erection of buildings and the like—is not material. As we have said, the flight of airplanes, which skim the surface but do not touch it, is as much an appropriation of the use of the land as a more conventional entry upon it. . . . The reason is that there would be an intrusion so immediate and direct as to subtract from the owner’s full enjoyment of the property and to limit his exploitation of it. While the owner does not in any physical manner occupy that stratum of airspace or make use of it in the conventional sense, he does use it in somewhat the same sense that airspace left between buildings for the purpose of light and air is used. The superadjacent airspace at this low altitude is so close to the land that continuous invasions of it affect the use of the surface of the land itself. We think that the landowner, as an incident to ownership, has a claim to it and that invasions of it are in the same category as invasions of the surface.¹⁰⁸

The *Causby* Court thus held that private ownership of airspace exists as a matter of law, regardless of whether the low-altitude airspace is physically occupied by the landowner below, because any intrusion into that airspace “subtract[s] from the owner’s full enjoyment of the property.”¹⁰⁹

The Court did not determine the precise limits of this “superadjacent” airspace—all that was certain was that it fell somewhere between the

107. *Id.* at 261–62.

108. *Id.* at 264–68.

109. *See id.* at 264–65 (“While the owner does not in any physical manner occupy that stratum of airspace or make use of it in the conventional sense, he does use it in somewhat the same sense that space left between buildings for the purpose of light and air is used.”).

eighty-three feet above ground where the Causbys' property had been invaded and the 500-foot minimum safe altitude of flight where public navigable airspace begins.¹¹⁰ Still, the Court expressly confirmed that landowners have a "paramount and exclusive right to exercise the prerogatives of ownership in all of the airspace" that they possess, "or can effectively possess" in the future, and in any further amount of valuable airspace necessary to ensure full enjoyment of the property.¹¹¹ "[T]he practical effect . . . [was] to constrict the landowner's rights within the boundaries of reason, or to put it another way, within the boundaries of value."¹¹²

C. Causby's Successors: Strengthening Private Ownership of Low-Altitude Airspace

Because federal regulations at the time of *Causby* declared national sovereignty only in the airspace above the minimum safe altitude of flight, Congress reacted to the Court's ruling with the Federal Aviation Act of 1958.¹¹³ The Federal Aviation Act of 1958 expanded the definition of public navigable airspace also to include all airspace "needed to ensure safety in the takeoff and landing of aircraft," even at heights below 500 feet.¹¹⁴

Congress, however, did not get the last word. In 1962, a landowner sued Allegheny County, Pennsylvania, over what he alleged to be a constructive taking of an air easement over his property, which was located below the flight paths of a government-run airport.¹¹⁵ In *Griggs*, the Supreme Court ruled in the landowner's favor. Though the case primarily turned on which governmental body should be held liable for the constructive taking, *Griggs* is also notable for reaffirming *Causby*'s holding that landowners' property rights extend to the superadjacent

110. See Cahoon, *supra* note 92, at 169–70; see also *Causby*, 328 U.S. at 263–64.

111. See *Causby*, 328 U.S. at 265; see also WRIGHT, *supra* note 76, at 154–55, 207–08.

112. WRIGHT, *supra* note 76, at 208; see Cahoon, *supra* note 92, at 169 (“[F]rom this and other statements in the opinion, it can be inferred that interference with the enjoyment and use of the land occurs when the value of the property has diminished [or damage has been caused] due to the overflights.”). *Causby*, 328 U.S. at 262 (“[U]se of the airspace immediately above the land would limit the utility of the land and cause a diminution in its value.”). This understanding was strengthened by a subsequent case, *Griggs v. County of Allegheny*, 369 U.S. 84 (1962), which declared once again that “the use of land presupposes the use of some of the airspace above it. Otherwise no home could be built, no tree planted, no fence constructed, no chimney erected.” *Id.* at 88–89. A flight still constituted a taking if they crossed low enough over a landowner's property—in *Griggs*, a mere thirty feet above the plaintiff's roof. *Id.* at 86–90.

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

114. 49 U.S.C. § 40102(a)(32); Federal Aviation Act, 72 Stat. at 739.

115. *Griggs*, 369 U.S. at 84–90.

airspace above their land and that intrusions into that airspace are treated identically to intrusions onto the land below it for Takings Clause purposes:

[A]s we said in the *Causby* case, the use of land presupposes the use of some of the airspace above it. Otherwise no home could be built, no tree planted, no fence constructed, no chimney erected. An invasion of the “superadjacent airspace” will often “affect the use of the surface of the land itself.”¹¹⁶

The Supreme Court then held that the governmental use of the plaintiff’s airspace as a flight path for aircraft takeoffs and landings was a taking, even though the Federal Aviation Act of 1958 asserted that such airspace fell within the public domain of navigable airspace.¹¹⁷ *Griggs* therefore broadened *Causby*’s holding by making clear that even a legislative redefinition of public airspace would not overcome property rights when that definition reached into what the Court deemed a landowner’s superadjacent airspace.¹¹⁸

Lower courts have since continued to follow and refine the principle that a landowner’s full enjoyment of land necessarily includes the exclusive control of the immediate reaches of the airspace above it. The *Causby-Griggs* line of cases has come to represent not only how much airspace “belongs” to the landowner, but also what types of overflights “subtract from the owner’s full enjoyment of the property” and “limit [a landowner’s] exploitation of it” so as to constitute a taking.¹¹⁹ In declaring the airspace rights afforded to a landowner, the *Causby-Griggs* line of cases implicitly adopted a market value test to realize the full commercial value of airspace.¹²⁰

For instance, in *Branning v. United States*,¹²¹ a plaintiff sued regarding noise from overflights by military aircraft at 600 feet above his land—falling squarely in navigable airspace.¹²² The Court of Claims

116. *Id.* at 88–90.

117. *Id.* at 86–90.

118. *Id.* at 88–90.

119. See *U.S. v. Causby*, 328 U.S. 256, 264–65 (1946).

120. See Cahoon, *supra* note 92, at 168–72, 197; WRIGHT, *supra* note 76, at 155, 207. See generally William B. Harvey, *Landowners’ Rights in the Air Age: The Airport Dilemma*, 56 MICH. L. REV. 1313 (1958) (discussing the implications of *Causby* and how other cases consider market value); Roderick B. Anderson, *Some Aspects of Airspace Trespass*, 27 J. AIR L. & COM. 341 (1960); Richard A. Repp, *Wrongs and Rights in the Superterraneous Airspace: Causby and the Courts*, 9 WM. & MARY L. REV. 460 (1967) (discussing *Causby*’s impact in recognizing compensable property interests in the airspace above land).

121. *Branning v. United States*, 654 F.2d 88 (Ct. Cl. 1981), *aff’d*, 784 F.2d 361 (Fed. Cir. 1986).

122. *Id.*

rejected the idea that, because the flights took place above 500 feet, the plaintiff could not assert any property rights in that airspace. The court sided with the plaintiff; though its analysis turned on the particular kind of aircraft at issue and the activities in which the planes had been engaged, it observed:

The question thus raised is whether the 500-foot altitude is so critical a measure of the avigational servitude that liability can be avoided simply by flying noisier aircraft at a minimum altitude of 501 feet. Minimum safe altitude and minimum noise levels are concerned with two different things. While safety may be measured in terms of altitude, a reasonable noise level cannot be measured solely in terms of altitude.¹²³

In *Brown v. United States*,¹²⁴ meanwhile, the Court of Claims held that the plaintiff landowner whose airspace was intruded on was entitled to compensation for harm both to the present and immediate use of his land and to any potential future uses of the land.¹²⁵ Such loss, the court held, included the “market value” of any other use to which the land could reasonably be put.¹²⁶ *Brown’s* view of airspace rights confirmed the expansive ruling in *Causby*, allowing landowners to protect their air from overflights that might prevent future uses of property.¹²⁷

These and subsequent cases made clear that landowners are entitled to the exclusive control and ownership of the low-altitude airspace they seek, or could potentially seek, to use or enjoy above their land, and that they must be compensated fair market value for any overflights in that airspace.¹²⁸ The decisions ultimately fall on a court’s determination of whether an intrusion has occurred, regardless of flight path and altitude.

When assessing an act of intrusion, courts have protected the broad rights of landowners, even if no governmental instrumentality is involved

123. *Id.* at 101–02.

124. *Brown v. United States*, 73 F.3d 1100 (Fed. Cir. 1996).

125. *Id.*

126. *Id.* at 1104–05.

127. See Scott Keifer, *Aircraft Overflights as a Fifth Amendment Taking: The Extension of Damages for the Loss of Potential Future Uses to Aviation Easements*. *Brown v. United States*, 4 MO. ENV’T. L. & POL’Y REV. 88, 89–90 (1996).

128. Admittedly, some have argued that it is better to assess potential infringements on a landowner’s exclusive control of superadjacent airspace by asking whether the flight operations injured or diminished the habitability of the land itself. That view construes *Causby* narrowly to assume that airspace rights are anchored in the impact of overflights on actual or potential future uses of the land itself, rather than in the distinction between superadjacent airspace and public, navigable airspace. See *Air Pegasus of D.C. v. United States*, 424 F.3d 1206, 1211, 1219 (Fed. Cir. 2005); see also Cahoon, *supra* note 92, at 197–98; Lindsey P. Gustafson, *Arkansas Airspace Ownership and the Challenge of Drones*, 39 U. ARK. LITTLE ROCK L. REV. 245, 270–73 (2017).

and an overreaching regulation is the sole means of the taking. In 2021, the Supreme Court held in *Cedar Point Nursery v. Hassid*¹²⁹ that a California law requiring certain agricultural employers to permit union organizers (who are private entities) onto their property for certain periods of time every year constituted a *per se* physical taking.¹³⁰ The Court reasoned that the regulation “appropriate[d] for the enjoyment of third parties the owners’ right to exclude,” one of the “most treasured” rights belonging to a property owner.¹³¹ The government seizing an easement in the owners’ properties and allowing the public to enjoy that easement, the Court held, constituted a taking—a proposition that it adopted in reliance, in part, on *Causby*.

Cedar Point makes clear that granting UAS operators *carte blanche* to invade landowners’ superadjacent airspace would, absent just compensation to the landowner, constitute an unconstitutional taking. When Congress and the FAA inevitably clarify the lines where drones can freely operate without permission of landowners below, inadvertently taking an easement for the public in airspace that belongs to private landowners will be among the highest concern.

IV. THE COMMERCIALIZATION OF AIRSPACE

The developments in airspace property rights helped usher in expanding opportunities for landowners to capitalize on the airspace above their land. Over time, people began to figure out how to assign value to those air rights and how to use airspace productively and lucratively.

A. Airspace Market Value Test

Since *Causby* and *Griggs*, courts have continued to respect and protect landowners’ airspace property rights at low altitudes in the context of manned aviation. *Causby* adopted the principle that a landowner whose airspace has been appropriated by the government is typically entitled to recover the “market value fairly determined,” which “may reflect the use to which the land could readily be converted, as well as the existing use.”¹³² This “market value” test ensures that landowners are compensated fairly for any disruption to their enjoyment and use of their land and the superadjacent air.

Courts have quantified the harm caused by an invasion of a landowner’s airspace by treating the intrusion as effecting an

129. 141 S. Ct. 2063 (2021).

130. *Id.* at 2069–74 (2021). *Cedar Point* relied heavily on *Loretto v. Teleprompter Manhattan CATV Co.*, 458 U.S. 419 (1928), which is discussed *infra* Section IV.B.

131. *Cedar Point*, 141 S. Ct. at 2072.

132. *U.S. v. Causby*, 328 U.S. 256, 261 (1946).

appropriation of an airspace flight easement.¹³³ Now essentially known as an “avigation easement,” this legal mechanism has become the way by which airspace is valued and landowners are compensated for damages resulting from overflight in and around their airspace.¹³⁴

B. Historic Commercialization of Low-Altitude Airspace

In the nineteenth century, the emergence and eventual dominance of the railroad industry ushered in contemporaneous growth of the American economy.¹³⁵ Railroads, the new primary means of transportation, became inextricably linked to the economic development of cities, which devoted significant space to the railroad industry. But eventually, cities needed more space for businesses and other commercial activity, so they turned to an untapped solution: the airspace above railroad tracks. New York City was the first mover, with the construction of Grand Central Terminal.¹³⁶ The revolutionary two-level train terminal helped finally draw attention to the ways that airspace could be used productively.¹³⁷ Cities all over the

133. *Griggs v. County of Allegheny*, 369 U.S. 84, 90–94 (Black, J., dissenting); see also *Branning v. United States*, 654 F.2d 88, 102 (Ct. Cl. 1981), *aff’d*, 784 F.2d 361 (Fed. Cir. 1986) (“Since the subjacent property owner has suffered a diminution of the value of the property in this case, there has been a taking of an easement over and through the airspace superjacent the property of the plaintiff.”); *Brown v. United States*, 73 F.3d 1100, 1104 (“Enjoyment of property at common law contemplated the entire bundle of rights and privileges that attached to the ownership of land.”); *Aaron v. United States*, 311 F.2d 798, 798 (Ct. Cl. 1963); *Penn Central Transp. Co. v. New York City*, 438 U.S. 104, 104 (1978). Landlords potentially also have available other causes of action that do not directly involve the loss of their property’s value, including private nuisance claims and trespass actions. See, e.g., RESTATEMENT (SECOND) OF TORTS § 159(2) cmt. (AM. L. INST. 1965); *Geller v. Brownstone Condo. Ass’n*, 402 N.E.2d 807, 809 (Ill. App. Ct. 1980) (“[T]o constitute an actionable trespass, an intrusion has to be such as to subtract from the owner’s use of the property.”).

134. While this Article is not necessarily concerned with the causes of action that landowners can bring against unauthorized drone operators in their airspace, for a discussion of the topic, see GAO Report, *supra* note 11, at 12–15; Farber, *Keep Out!*, *supra* note 11, at 379–405.

Actual damages and diminution of value have actually been recognized as separate methods to trigger a further inquiry into the validity of a claim. For a showing of actual damages, see *Wildwood Mink Ranch v. United States*, 218 F. Supp. 67 (D. Minn. 1963); *Weisburg v. United States*, 193 F. Supp. 815 (D. Md. 1961); *Maitland v. Twin City Aviation Corp.*, 37 N.W.2d 74 (Wis. 1949). For a showing of diminution of value, see *A. J. Hodges Indus. v. United States*, 355 F.2d 592 (Ct. Cl. 1966); *Dick v. United States*, 169 F. Supp. 491 (Ct. Cl. 1959); *Pope v. United States*, 173 F. Supp. 36 (N.D. Tex. 1959); *City of Charlotte v. Spratt*, 140 S.E.2d 341 (N.C. 1965). See generally Cahoon, *supra* note 92, at 165, 176–77 (expounding on the two methods and explaining the “fixed height” debate).

135. Wright, *supra* note 76, at 766–67.

136. *Id.* at 767.

137. Grand Central Terminal was later embroiled in a dispute over a New York City landmarks law that prevented its owners from building a fifty-plus-story office

country followed course and took advantage of the newfound opportunity, including Philadelphia, Chicago, Detroit, Los Angeles, Miami, Milwaukee, Washington, D.C., and Cleveland.¹³⁸ This phenomenon helped cement the idea that ownership of airspace was a valuable property right and that it could be exploited for significant benefit.

The emergence of condominium properties also marked the growing appreciation of airspace rights. Urbanites increasingly showed interest in using condominiums to make up for the limited availability of residential real estate in city centers. Condominiums were the perfect solution, making it feasible for many to own a piece of property, even in densely populated areas.¹³⁹ But creating them required land developers to divide the air into discrete units, further inspiring a common understanding that property rights could exist above the ground—and thus be subject to all sorts of financial and legal ownership arrangements—just as much as they did on the ground.¹⁴⁰

The Supreme Court's 1982 decision in *Loretto v. Teleprompter Manhattan CATV Corporation*¹⁴¹ became another important development in the commercialization of airspace. In that case, New York law mandated that apartment owners give private cable companies access to run cables along their exterior walls and to place cable boxes on the roofs in order for landlords to fulfill their obligations to provide tenants with cable television.¹⁴² In exchange, the law promised landowners \$1.¹⁴³ The Supreme Court was unimpressed, holding that permanent physical invasions of an individual's property automatically constitute Fifth

building above the terminal to improve its commercial vitality. *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 115–19 (1978). The Supreme Court rejected the owners' takings claim against the city, finding the law to be a reasonable regulation of their ability to use the airspace but did not dispute the owner's argument, based on *Causby*, that "the airspace above the Terminal is a valuable property interest." *Id.* at 130; *see also id.* at 143 n.5 (Rehnquist, J., dissenting) ("This Court has previously held that the 'air rights' over an area of land are 'property' for purposes of the Fifth Amendment.") (first citing *United States v. Causby*, 328 U.S. 256 (1946); and then citing *Griggs v. Allegheny Cnty.*, 369 U.S. 84 (1962)).

138. *See* WRIGHT, *supra* note 77, at 261–71.

139. *See* Troy A. Rule, *Airspace in a Green Economy*, 59 UCLA L. REV. 270, 283 (2011) ("The enhanced value of urban airspace resulting from new high-rise construction techniques in the early twentieth century prompted calls for greater precision of airspace rights among property owners. It became increasingly common during this era for structures containing dozens of separately owned suites or apartments to sit atop single surface parcels. . . . Eventually, developments in condominium law helped clarify airspace ownership rights.").

140. Three landmark articles on this are Ball, *supra* note 75; Stuart S. Ball, *Division into Horizontal Strata of the Landspace Above the Surface*, 39 YALE L.J. 616 (1930); and Laird Bell, *Air Rights*, 23 ILL. L. REV. 250 (1928).

141. *Loretto v. Teleprompter Manhattan CATV Co.*, 458 U.S. 419 (1982).

142. 458 U.S. 419, 421–22 (1982).

143. *Id.* at 423–24.

Amendment takings that require compensation regardless of the government justification for the intrusion or the scope of the interference.¹⁴⁴ Such invasions, the Supreme Court reasoned, interfere with landowners' right to possess and use their property in whatever lawful ways they see fit and thus diminishes the value of that property.¹⁴⁵

C. Commercialization of Airspace in the Modern Day

In more recent years, the FAA has strived to recognize and respect airspace property rights in the context of manned flight by acquiring, at market value, any airspace interests affected by flight operations. "The FAA's directives governing its Airport Improvement Program (AIP) have long required airport sponsor-grantees to acquire title to all 'real property interests' needed for construction and operation of grant assisted airports"—presumably to avoid a modern-day *Causby* situation.¹⁴⁶ The FAA explicitly lists among these property interests avigation easements defined as "conveyance[s] of airspace over another property."¹⁴⁷ The agency generally requires airport sponsors to obtain a market value appraisal of any necessary avigation easements and to pay existing landowners just compensation for this "interest in . . . real property."¹⁴⁸ It also notes that sponsors may need to use their eminent domain power and institute formal condemnation proceedings to lawfully conduct a taking of the real property interests.¹⁴⁹

Whether it be rights of way above railroad yards, divided ownership of condominiums, government mandated television cables, avigation easements in the context of manned flight, or other examples, it is clear that the skies present a myriad of commercial opportunities because landowners can exercise the full bundle of property rights in conjunction with their airspace.¹⁵⁰ Setting a baseline for that market is the fair market value test, which remains the most just means of compensation for airspace rights. On the horizon, then, is an airspace marketplace—one to buy, sell, and lease valuable airspace to accommodate UAS.

144. *Id.* at 434–35, 441.

145. *Id.* at 435–36.

146. GAO report, *supra* note 11, at 12, apps. I, V.

147. *Id.*

148. *Id.*; U.S. Dep't of Transp., FAA, Advisory Circular on Land Acquisition and Relocation Assistance for Airport Improvement Program (AIP) Assisted Projects (Nov. 7, 2005) ("[A]n appraisal is required when necessary to evaluate the property and effect of the proposed [avigation] easement on the market value of the property.")

149. GAO report, *supra* note 11, at 12.

150. *Brown v. United States*, 73 F.3d 1100, 1104–05 (Ct. Cl. 1996).

V. SCOPE OF FEDERAL AUTHORITY TO REGULATE LOW-ALTITUDE
AIRSPACE

The threshold issue in deciding how to integrate UAS into the national airspace is determining who—the federal, state, or local government, or all of them—has the legal authority to make these decisions. Essential to conducting this debate is addressing whether regulating UAS operations over private property in intrastate, low-altitude airspace falls outside the scope of congressional and FAA regulatory power.

A. Congress's Authority over UAS

Few decisions have addressed whether the regulation of UAS is at all a matter for the federal government—that is, whether Congress has the constitutional authority to legislate in that domain. The only decision to give these issues any in-depth treatment is *Huerta v. Haughwout*.¹⁵¹ In *Haughwout*, the FAA issued an investigative subpoena to a father and son regarding their use of a drone-mounted firearm and flamethrower a few feet above their property.¹⁵² When the family challenged the FAA's authority to issue the subpoena, the FAA argued that it was investigating a possible violation of a statute prohibiting operation of an aircraft in a careless or reckless manner.¹⁵³

While the court enforced the subpoena, it expressed considerable skepticism about the FAA's authority to regulate UAS operations in low-altitude airspace over private property. The court scrutinized whether Congress itself has the authority to give the FAA such broad rights under the Commerce Clause. While acknowledging that the Commerce Clause has been broadly interpreted, the *Haughwout* court noted:

Congress surely understands that state and local authorities are (usually) well positioned to regulate what people do in their own backyards. The Constitution creates a limited national government in recognition of the traditional police power of state and local governments. No clause in the Constitution vests the federal government with a general police power overall of the air or all objects that leave the ground. Although the Commerce Clause allows for broad federal authority over interstate and foreign commerce, it is far from clear that Congress intends—or could constitutionally intend—to regulate

151. *Huerta v. Haughwout*, No. 3:16-cv-358 (JAM), 2016 WL 3919799 (D. Conn. July 18, 2016).

152. *Id.* at *1.

153. *Id.* at *2–3.

all that is airborne on one's own property and that poses no plausible threat to or substantial effect on air transport or interstate commerce in general.¹⁵⁴

While the Supreme Court's broad jurisprudence surrounding the Commerce Clause during the New Deal era could be read to justify congressional authority to regulate even a single drone flight in a backyard if Congress found that adding up all such drone flights across the country would, in the aggregate, have a substantial effect on interstate commerce,¹⁵⁵ the *Haughwout* court looked skeptically at federal authority over airspace by questioning where it would end.¹⁵⁶ Indeed, under modern precedents, the act of flying a drone—particularly at low-altitudes and over short, intrastate distances—is not necessarily commercial, which moots any aggregate economic effect and suggests that much local and low-altitude UAS activity may be out of congressional reach.¹⁵⁷

On the other hand, the Supreme Court has continued to permit regulation of “purely intrastate activity that is not itself ‘commercial’” if “failure to regulate that class of activity would undercut the regulation of the interstate market in that commodity.”¹⁵⁸ Even under modern doctrine, then, the federal government may claim that the need for a consistent, nationwide regulatory scheme for commercial airspace operations justifies federal oversight of even non-commercial, intrastate UAS activities. Nonetheless, it remains questionable whether Congress has the authority to regulate any drone the moment it lifts off the ground.¹⁵⁹

154. *Id.* at *4.

155. *See Wickard v. Filburn*, 317 U.S. 111, 127–28 (1942).

156. Specifically, the *Haughwout* court cited *United States v. Lopez*, 514 U.S. 549 (1995), where the Supreme Court cautioned that the Commerce Clause cannot be read to “obliterate the distinction between what is national and what is local and create a completely centralized government” or “to convert congressional authority under the Commerce Clause to a general police power of the sort retained by the States.” 514 U.S. at 557, 567 (quoting *NLRB v. Jones & Laughlin Steel Corp.*, 301 U.S. 1, 37 (1937)).

157. *See, e.g., Lopez*, 514 U.S. at 559–64; *United States v. Morrison*, 529 U.S. 596, 617 (2000) (“We accordingly reject the argument that Congress may regulate noneconomic . . . conduct based solely on that conduct’s aggregate effect on interstate commerce.”).

158. *Gonzales v. Raich*, 545 U.S. 1, 18, 22 (2005) (“[W]e have no difficulty concluding that Congress had a rational basis for believing that failure to regulate the intrastate manufacture and possession of marijuana would leave a gaping hole in [federal law]. Thus, as in *Wickard*, when it enacted comprehensive legislation to regulate the interstate market in a fungible commodity, Congress was acting well within its authority . . .”).

159. The FAA, for its part, disagrees that its low-altitude regulation of UAS operations exceeds Commerce Clause limits. In issuing Part 107, the FAA relied on 49 U.S.C. § 44701, which authorizes the FAA to prescribe “regulations and minimum standards for . . . practices, methods, and procedure the Administrator finds necessary for

Notwithstanding the boundaries on Congress's Commerce Clause powers, the FAA's authority to regulate UAS operations in all low-altitude airspace over private property may be in conflict with *Causby*, *Griggs*, and other subsequent cases. The *Causby* Court aptly noted that there may very well be limits on federal authority over low-altitude airspace and that "regulations allowing too low of a minimum safe altitude of flight would have presented them a question of the validity of the regulation."¹⁶⁰ The *Haughwout* court, too, noted (in dicta) with skepticism, any possibility that "the foundational principle[s of *Causby*] must vanish or yield to FAA dictate the moment that a person sets any object aloft . . . no matter how high in the airspace outside one's home[.]"¹⁶¹

B. FAA Authorization to Regulate UAS

Even assuming Congress has the power to authorize the FAA with broad authority to regulate UAS operations from the ground up, it is still unlikely that existing law grants the FAA such authority. As noted, the *Haughwout* court found it "far from clear that Congress intends [the FAA] . . . to regulate all that is airborne on one's property."¹⁶²

Firstly, it is unclear whether the FAA has properly implemented its authority pursuant to statutory requirements. As noted, the definition of "navigable airspace"—"airspace above the minimum altitudes of flight prescribed by regulations"—contemplates the issuance of regulations prescribing minimum flight altitudes for the relevant aircraft.¹⁶³ While the FAA has issued regulations prescribing explicit minimum flight altitudes for manned aircraft and an explicit maximum flight altitude for UAS, it has not issued any regulations prescribing an explicit minimum flight altitude for UAS or weighed on property rights issues.

In its Part 107 regulations, the FAA cites a number of statutory provisions mainly focused on its authority to promote safety in air commerce as the basis for authorizing its UAS regulations. Most on point, Congress has granted the FAA authority to "develop plans and policy for

safety in air commerce and national security." "[A]ir commerce" is defined to include "the operation of aircraft that directly affects, or may endanger safety in . . . interstate air commerce," and "interstate air commerce" is defined to include "the operation of aircraft [between two states] in furthering a business or vocation." 49 U.S.C. § 40102(a)(3), (24). In its Part 107 preamble, the FAA notes that courts have interpreted this statutory "air commerce" definition to include both commercial and non-commercial flights and both interstate and intrastate flights. Operation and Certification of Small Unmanned Aircraft Systems, 81 Fed. Reg. 42,064, 42,069 (June 28, 2016) (codified at 14 C.F.R. pt. 107).

160. See Migala, *supra* note 41, at 66 (quoting *United States v. Causby*, 328 U.S. 256, 263 (1946)).

161. *Huerta v. Haughwout*, No. 3:16-cv-358 (JAM), 2016 WL 3919799, at *5 (D. Conn. July 18, 2016).

162. *Id.* at *4.

163. § 40102(a)(32).

the use of the navigable airspace and assign by regulation or order the use of the airspace necessary to ensure the safety of aircraft and the efficient use of airspace.”¹⁶⁴ The FAA also has broad statutory authority to “promote safe flight of civil aircraft in air commerce” by prescribing, *inter alia*, “regulations and minimum standards for other practices, methods, and procedure the Administrator finds necessary for safety in air commerce and national security.”¹⁶⁵ That authority, however, is just one subsection of a provision that otherwise deals with setting standards for the construction and use of aircraft and related equipment and enforcing “minimum safety standards” for air carriers and airports, making it seem somewhat inapplicable to regulating UAS operations below the navigable airspace.¹⁶⁶ The FAA also cites a UAS-specific provision that instructs it to “determine if certain unmanned aircraft systems may operate safely in the national airspace system” and, if they do, “establish requirements for the safe operation of such aircraft systems in the national airspace system.”¹⁶⁷

However, notwithstanding its authority to promote safety in air commerce,¹⁶⁸ the FAA specifically maintained in Part 107 that:

Adjudicating private property rights is beyond the scope of this rule. However, the provisions of this rule are not the only set of laws that may apply to the operation of a small UAS. . . . [T]he FAA will address preemption issues on a case-by-case basis rather than doing so in a rule of general applicability.¹⁶⁹

Because property rights are beyond the scope of the rule,¹⁷⁰ the FAA leaves open the possibility of only having authority to control what can fly above the minimum safe altitude of flight, despite its skepticism otherwise.¹⁷¹

The most responsible and lawful way forward, then, is for the agency to redefine navigable and low-altitude airspace. Moving the line downward should not be arbitrary. Rather, it should be a logical move recognizing that “flight” has many new forms. Technological advances

164. § 40103(b)(1).

165. § 44701(a)(5).

166. § 44701(a)-(b).

167. § 44807.

168. See §§ 40103(b), 44701(a).

169. Operation and Certification of Small Unmanned Aircraft Systems, 81 Fed. Reg. 42064, 42069 (June 28, 2016) (codified at 14 C.F.R. pt. 107).

170. Notwithstanding the point, the FAA notes that depending on the specific nature of the small UAS operation, the remote pilot in command may need to comply with state and local trespassing laws. U.S. DEP’T OF TRANSP., FAA, LAW ENFORCEMENT GUIDANCE FOR SUSPECTED UNAUTHORIZED UAS OPERATIONS (2015).

171. But see GAO Report, *supra* note 11, at 6.

have made safe lower-altitude flight, both manned and unmanned, a reality; new regulations acknowledging that reality would both align the FAA with modern conceptions of airspace and facilitate the agency's ability to lawfully set policy under its existing statutory authorization (and constitutional authority).

VI. REDEFINING LOW-ALTITUDE AIRSPACE WITH A FOUR-REGION APPROACH

Clarifying the definition and extent of “navigable” and “low-altitude” airspace remains fundamental to the future use of UAS. Redefining navigable airspace to cover somewhat lower altitudes is just one step towards clarifying the UAS regulatory scheme. To realize the full potential of drone delivery, we propose that airspace be divided into four distinct regions: (1) manned flight; (2) a safety buffer zone; (3) drone flight paths; and (4) privately controlled airspace.¹⁷²

A. Region 1: Manned Flight in Airspace Above 500 Feet

As previously noted, Congress and the FAA consider 500 feet above the ground generally to be the minimum safe altitude for manned flight.¹⁷³ In most of the United States, then, this airspace is classified as navigable airspace—a publicly shared area over which the FAA has exclusive regulatory authority pursuant to congressional authorization.¹⁷⁴ Congress and the FAA expressly set aside this airspace as a “public highway” for air travel, and, as affirmed in *Causby*, that action created an open-access “commons” for businesses and individuals to benefit.¹⁷⁵

172. While we propose specific heights at which the different regions would start and end, we recognize that there may be grounds to adopt different metrics in certain regions—for instance, as the FAA currently does, over open water or sparsely populated areas (where everything could shift down) or over congested areas (where everything could shift up). See 14 C.F.R. § 91.119 (2021).

173. *Id.*; 49 U.S.C. §§ 40102(a)(32), 40103(a)(2), (b).

174. 14 C.F.R. § 91.119 (2021); Civil Aeronautics Act of 1938, Pub. L. No. 75-706, §§ 3, 201(a), 51 Stat. 973, 980–81; 49 U.S.C. § 40103(a)(2) (2006) (“A citizen of the United States has a public right of transit through the navigable airspace.”); 14 C.F.R. § 77.23 (2021). As previously noted, the FAA-designated navigable airspace line is higher in some dense urban areas to accommodate large high-rise buildings and is lower near many airports to facilitate takeoffs and landings. See 49 U.S.C. § 40102(32); see *supra* Section III. While many scholars argue in favor of courts defining an exact limit, there is not necessarily a precise “fixed theory,” and a property owner who suffers damage from aircraft even above 500 feet still may be able to recover damages. See Cahoon, *supra* note 92, at 166.

175. *United States v. Causby*, 328 U.S. 256, 261 (1945). This was as declared by Congress in the Air Commerce Act of 1926 and amended by the Civil Aeronautics Act of 1938. Air Commerce Act of 1926, Pub. L. No. 69-254 § 1, 44 Stat. 568; Civil Aeronautics Act of 1938, Pub. L. No. 75-706, §§ 3, 201(a), 51 Stat. 973, 980–81.

Continued adherence to that approach is sensible. Recognizing landowners' property rights in the high-altitude airspace above their land is impractical in the modern era, to say nothing of the cost of implementation and enforcement. After all, navigable airspace accommodates thousands of flights every day, giving millions of landowners a right to exclude aircrafts from high-altitude airspace above their properties would likely result in astronomical social and economic costs.

Moreover, deeming high-altitude airspace would be illogical. Landowners cannot use that property (or even reach it) or feel harmed if anyone intrudes on it. Nothing links that airspace to the land below. Certainly, "the right to exclude" others from a landowner's property is among the "most fundamental elements of property ownership."¹⁷⁶ But having the ability to exclude airplanes from flying thousands of feet above one's land is not "ownership" in any meaningful sense.¹⁷⁷

B. Region 2: Safety Buffer Zone in Airspace Between 500 and 400 Feet

Created and implemented by the FAA's Part 107 regulations, the airspace between 500 and 400 feet from the ground creates an important safety "buffer zone" between manned aircraft and drones as a regulatory safety mechanism.¹⁷⁸ This buffer separating UAS from manned aircraft helps protect the public highway so that air travel above it can persist unimpeded by the risk of drone activity getting in the way. With no inherent value to landowners given its height and the prohibition of drone flight above 400 feet, the safety buffer would likewise be exclusively controlled and regulated by the FAA.

C. Region 3: UAS Flight Paths in Airspace Between 400 and 200 Feet

The region between 400 and 200 feet from the ground is the airspace most ideal for UAS operations.¹⁷⁹ Notwithstanding Congress's directive to

176. *Ala. Ass'n of Realtors v. Dep't of Health & Hum. Servs.*, 141 S. Ct. 2485, 2489 (2021) (per curiam).

177. Of course, it is not hard to imagine intrusions onto property interests occurring 500 feet in the air, since sounds, lights, and smells can still invade an owner's land and adjoining airspace from above. But the potential for such invasions does not meaningfully interfere with landowners' property rights on a systematic level.

178. See 14 C.F.R. § 107.51(b) (2021).

179. The clear division of airspace into separate public and private corridors has been debated in industry. See, e.g., Letter from Alliance for Drone Innovation, to Anita Ramasastry et al., UNIF. L. COMM'N (July 1, 2019) <https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=0a96828a-a615-39ca-5bc1-ac1d1e037464&forceDialog=0> [<https://perma.cc/2DSB-YKGN>]; Letter from Commercial Drone Alliance to Anita

the FAA to integrate drones into the national airspace system, the agency has not firmly resolved how those flight paths will work. In any event, it is highly unlikely that they would be located in the navigable airspace above 500 feet, since allowing airplanes and drones to share flight paths would create a host of challenges. Accordingly, the FAA should redefine the minimum safe altitude of flight—the beginnings of navigable airspace—to 200 feet, which would squarely allow the FAA to remain within its statutory authority and regulatory purview. Segregating UAS flight paths to this airspace not only increases safety, but also accommodates the needs of landowners, drone operators, and governments.

While the FAA may be able to exercise exclusive regulatory control over this airspace by preempting state and local policies, ideally it should share its authority with state and local governments—and commit itself to doing so in its regulations. For example, it can work together with those bodies in determining and designating local flight paths. To ensure that cooperation happens, Congress should instruct the FAA to consider and engage with the perspectives of landowners and local and state governments. Alternatively, the FAA could concede the responsibility for developing UAS flights paths in the region to state and local governments in the first instance and then review those to ensure both safety and meaningful preservation of drone operator rights of transit in such airspace.

Under either approach, the FAA would have exclusive responsibility for ensuring the safety of flight and managing flight operational requirements, allowing it to assert and defend the federal government's interest in an efficient and safe nationwide airspace. Other governmental bodies would have the discretion to establish reasonable rules for flights in their jurisdictions, allowing states and localities to vindicate their own

Ramasastry et al., UNIF. L. COMM'N (July 23, 2018) <https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=a1fcc136-670b-43d5-7cdb-e3c0cc8ead95&forceDialog=0> [https://perma.cc/JXP3-SCBF]; Letter from Alliance for Drone Innovation et al. to Anita Ramasastry et al., UNIF. L. COMM'N (July 5, 2018) <https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=6ec36eed-5f99-8940-abf1-691f8eddeb03> [https://perma.cc/3J6A-F9HY] [hereinafter July 5 Letter from Alliance for Drone Innovation et al.]; see also Joshua S. Turner & Sara M. Baxenberg, *Clearing the Air: ULC Rightfully Rejects Property Rights Advocates' Line in the Sky*, AIR & SPACE LAW. (Am. Bar Ass'n, Chicago, Ill.), 2020, at 1; cf. Mark J. Connot & Jason J. Zummo, *United States: Navigable Airspace: Where Private Property Rights End and Navigable Airspace Begins*, MONDAQ (Jan. 18, 2016), <https://www.mondaq.com/unitedstates/aviation/459052/navigable-airspace-where-private-property-rights-end-and-navigable-airspace-begins> [https://perma.cc/7AS9-7ML4] (noting the FAA's contention that it has authority over all airspace down to the tops of the blades of grass primarily relies on its longstanding division of airspace regulation based on various altitudes, with Class G being "uncontrolled" airspace in which pilots fly pursuant visual flight rules).

interests in handling granular, local flight path issues particular to the needs of their communities.¹⁸⁰

D. Region 4: Privately Controlled Airspace Between 200 Feet and the Ground

The rest of the sky—everything below 200 feet—should be privately owned and controlled airspace. The top of this region will serve as a bright line defining the limits of previously more ambiguous concepts such as “low-altitude” airspace, “superadjacent” airspace, or the “immediate reaches” of the sky and drones will not be able to operate in the region without landowners’ consent.¹⁸¹ Airspace rights in the region are guaranteed by *Causby* and its successors, which recognize that landowners’ property interests in their lands also extend upwards to at least as much of the airspace as needed for the use and enjoyment of their land.¹⁸² In proposing 200 feet as the “property line” in the sky, we assume that the “superadjacent” airspace recognized by *Causby* lies somewhere beneath that point—since if it were higher, any government-authorized drone activity could constitute a taking, making UAS operations prohibitively expensive and complicated. Further, the reason for 200 feet is not arbitrary, and indeed is based on many of the original reasons that the 500-foot determination was made for navigable airspace.¹⁸³ Federal law requires the FAA to conduct an aeronautical study of proposed new construction or alteration to an existing structure, 200 feet above the ground to determine whether its height and markings compromise airport,

180. Congress has already recognized the important interests of state and local governments, as well as those landowners, in regulating drone flight in low-altitude airspace. Section 2209 of the FAA Extension, Safety and Security Act of 2016, as amended, requires the FAA to implement a process for allowing specified parties to petition the agency to adopt restrictions on UAS operations in the airspace above or adjacent to critical infrastructure facilities and amusement parks (like Disneyland). FAA Extension, Safety, and Security Act of 2016, Pub. L. No. 114-190, § 2209, 130 Stat. 615, 634. FAA Reauthorization Act of 2018, Pub. L. Section 115-254, § 369, 132 Stat. 3186, 3311. The FAA has yet to propose a process for governments and private landowners to vindicate their interests. Instead, it has relied on its existing authority under 14 CFR § 99.7 (2021) to limit drone overflight in response to national security concerns.

181. See *supra* Sections II–V; Rule, *supra* note 11, at 187–88; Skorup, *supra* note 51, at 6 (proposing 200 feet); Gregory S. McNeal, *Drones and the Future of Aerial Surveillance*, 84 GEO. WASH. L. REV. 354, 399–400 (2016) (proposing 200 feet); Lane Page, Note, *Drone Trespass and the Line Separating the National Airspace and Private Property*, 86 GEO. WASH. L. REV. 1152, 1173 (2018) (proposing 200 feet); Gustafson, *supra* note 127, at 264–66; Giboney, *supra* note 8, at 2169 (quoting *Causby*, 328 U.S. 256, 264 (1946)). But see Tyler Watson, *Maximizing the Value of America’s Newest Resource, Low-Altitude Airspace: An Economic Analysis of Aerial Trespass and Drones*, 95 IND. L.J. 1399, 1409 (2020).

182. *Causby*, 328 U.S. at 264–65.

183. See *supra* note 179.

navigational aid, or airport safety.¹⁸⁴ Importantly, to draw the line at 200 feet does not foreclose the possibility that the aerial action at that height and above it might, on a case-by-case basis, negatively affect the land below, potentially entitling the landowner to compensation.

* * * *

This proposal creates incentives that recognize the growing economic and social necessity of an airspace marketplace.¹⁸⁵ With public navigable airspace above 500 feet, a safety buffer zone between 500 and 400 feet, and a UAS flight path corridor between 400 and 200 feet, commercial manned and unmanned flight activities are perfectly possible without invading or taking the private airspace of landowners.

Businesses and drone operators seeking to take full advantage of the possibilities of drone flight would have 200 feet of altitude in which to operate freely—but that would not be their limit. Companies operating delivery services could seek to operate in airspace even lower than 200 feet, without needing to rely on regulatory fiat to obtain access.¹⁸⁶ Legal mechanisms to acquire airspace need not be different than those used to acquire low-altitude airspace in other contexts—left to the private

184. 14 C.F.R. §§ 77.5(c), 77.9(a) (2021). *See* Migala, *supra* note 41, at 40. *See generally* JASON SNEED & JOHN MICHAEL SEIBLER, HERITAGE FOUND., NO. 222, COOPERATIVE FEDERALISM AND LOW-ALTITUDE DRONE OPERATIONS (2017); Letter from Reginald C. Govan to Anita Ramasastry, President, Unif. L. Comm'n, (July 24, 2018) <https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=432e1803-0b68-03c9-aad4-d48c433cd84f> [<https://perma.cc/8W3H-FCU9>]; Bill Carey, *FAA Amenable to Discussing Jurisdictional Issues Over Drones*, AINONLINE (May 4, 2017, 5:10 PM), <https://www.ainonline.com/aviation-news/business-aviation/2017-05-04/faa-amenable-discussing-jurisdictional-issues-over-drones> [<https://perma.cc/CXE4-KCYL>].

185. *See* July 5 Letter from Alliance for Drone Innovation et al., *supra* note 179. While many states have indeed implemented a guideline review process or similar requirement through zoning, and the FAA has issued a model zoning ordinance to assist in that effort, the FAA defers to and relies on state government plenary police power over land use decisions to resolve any conflict between the proposed structure and federal concerns about airspace safety. *See* 49 U.S.C. § 44718; 14 C.F.R. § 77.17 (2021); U.S. DEP'T OF TRANSP., FED. AVIATION ADMIN., AC No. 150/5190-4A, A MODEL ZONING ORDINANCE TO LIMIT HEIGHT OF OBJECTS AROUND AIRPORTS (1987); *see also* Peter J. Kirsch, *Protecting Airports from Height Obstructions: Should We Be Scared?*, KAPLAN KIRSCH & ROCKWELL LLP (2007), https://www.kaplankirsch.com/portalresource/Protecting_Airports_from_height_obstructions_PJK.pdf [<https://perma.cc/7GP9-EFEA>].

186. Some states have adopted legislation with a regulatory framework that both grants landowners control of low-altitude airspace and limits their rights to bring an action under such statute. *See, e.g.*, OR. REV. STAT. § 837.380(1), (3) (2022); NEV. REV. STAT. §§ 493.050, 493.103(2)(d)(1), (d)(3) (2015).

market.¹⁸⁷ With a demand to buy, sell, or lease low-altitude airspace below 200 feet, a new, untapped market may be on the horizon, and we may soon attain an economically supported airspace economy.

VII. ENVISIONING A LOW-ALTITUDE AIRSPACE MARKETPLACE

While the 200-to-400-foot region will enable a significant volume of UAS operations, the drone industry will be able to achieve its full potential by investing in the zone beneath it. Rather than sitting empty, the low-altitude airspace should be commercialized through a marketplace in which landowners sell their consent to overflights over their properties. Delivery services and other heavy-duty drone operators can aggregate those consents into viable flight paths, and landowners can be compensated for the use of their airspace. Fortunately, a system built on requiring consent, aggregating small parcels of property into larger tracks, and compensating landowners is not a new regulatory or commercial phenomenon.

As a regulatory and commercial matter, requiring consent and compensation for the use of landowners' low-altitude airspace is no different than requiring consent and compensation for the use of their land.¹⁸⁸ In each case, the owner decides the terms and circumstances under which a third party may use the property, which are then documented in the public system of land records.¹⁸⁹ As previously noted, easements already play a role in airspace law; avigation easements in the context of airport operations authenticate an airport's rights to use low-altitude airspace for takeoff and landing and to prevent obstacles from interfering with manned aircraft. Those easements allow landowners to be compensated for the fair market value of the use of their airspace. Such systems of landowner-granted easements for low-altitude airspace use

187. See *supra* notes 11–12, 117–20; Cahoon, *supra* note 92, at 198 (“With no definitive standard yet enunciated, and courts mixed in their approach to the question, landowners must still wonder just exactly what their property rights are to the airspace above their land.”).

188. Practically speaking, the comparison remains true conceptually, but flight paths and schedules for drones are far more unpredictable—in terms of frequency and invasiveness—than those of manned flights. The system for tracking intrusions and methods of compensation would be far more challenging.

189. See *The Basics About Avigation Easements*, KY. RES. COUNCIL (Aug. 3, 2016), <https://www.kyrc.org/news/land-use-and-zoning/the-basics-about-avigation-easements> [<https://perma.cc/LCW3-B3KQ>]; *Avigation Easement Law and Legal Definition*, USLEGAL, <https://definitions.uslegal.com/a/avigation-easement/> [<https://perma.cc/9Q2R-E28R>] (last visited Sept. 14, 2022); HOWARD BECKMAN, *Taking of Property: Avigation Easements and Zoning Regulation*, AIRPORT NOISE LAW (Dec. 21, 2015), <https://web.archive.org/web/20180814184718/http://www.airportnoiselaw.org/takings.html> [<https://perma.cc/ER7E-TSS8>].

should be expanded to the context of UAS flight paths.¹⁹⁰ Admittedly, it is possible that this decentralized approach could result in regulatory and compliance burdens from a patchwork of inconsistent airspace policies—for example, differing UAS restrictions in each county or particular “airspace holdout” cities. The history of airspace commercialization, however, lends credence to the idea that a marketplace for airspace would only further innovation and commercial development while appropriately balancing the rights and concerns of individuals, businesses, and governments.

The combination of innovative technologies and existing infrastructure to support the development of a low-altitude airspace marketplace and commercially viable flight paths, importantly, would not burden the FAA with all drone operations and flights. The proposal does not necessitate the adoption of a “one Nation fits all” approach to develop flight paths above the diverse neighborhoods across the country. Rather, as envisioned, it relies on a combination of state and local governments that know their own needs and circumstances, the federal government for its technical, operational, and safety know-how on nationwide aspects of airspace, and a new marketplace to build a new economy from the ground up, while innovating beyond the scope of what seems possible today.

CONCLUSION

With the inevitable integration of drone delivery services and commercial UAS into society, our current legal and regulatory framework is ill-prepared for the opportunities and challenges that lie ahead. The FAA’s authority to define the parameters of “navigable airspace” has allowed it to essentially preempt the field, making itself the exclusive arbiter of the region, subject to constitutional limits. Because navigable airspace has been defined as the airspace above 500 feet for nearly a century, states and local governments have sometimes problematically stepped in to regulate the skies below. However, with the advent of commercial drones designed to operate safely and efficiently below 500 feet, the FAA is within its statutory authority to redefine by regulation navigable airspace and subsume a certain amount of lower altitude airspace.

Since landowners’ private ownership and exclusive control of at least some low-altitude airspace exists as a matter of right, the question as to how low the FAA’s authority may lawfully extend remains unsettled. To

190. Max Pedowicz, *Managing the Airspace: Maximizing the Easement Opportunities As Drones Proliferate*, RIGHT OF WAY, May/June 2016, at 26, 28; *Startup Takes High-Tech Approach to a Low-Tech Industry*, PITTSBURGH BUS. TIMES: BUS. J. (Oct. 22, 2019), <https://www.bizjournals.com/pittsburgh/news/2019/10/22/startup-takes-high-tech-approach-to-a-low-tech.html> [<https://perma.cc/5MV3-XTL8>].

solve the governance challenges arising in low-altitude airspace, we propose that (A) the FAA redefine navigable airspace to begin at 200 feet above the ground and (B) airspace be divided into four distinct regions. Balancing the interests of landowners, drone operators, and federal, state, and local governments, we envision regions for: (1) manned flight (above 500 feet); (2) a safety buffer zone (500 to 400 feet); (3) drone flight paths within navigable airspace (400 to 200 feet); and (4) privately owned and controlled airspace (below 200 feet), in which a marketplace to buy and sell airspace may soon develop. New systems of regulation and compensation need not necessarily be created because the concept of commercializing airspace is far from new. Despite the ever-increasing legal and regulatory uncertainties surrounding the future of airspace in the age of commercial drones, what remains clear is that the benefits and opportunities will only grow. Regulators can help the unmanned flight industry flourish by adopting an approach that ensures airspace safety while respecting landowners, drone operators, and the public alike and by recognizing the value of both federal and localized oversight of the skies.

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