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Unmanned Aerial Systems: Domestic Statutory Issues

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Comment*

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I. INTRODUCTION

Unmanned Aerial Systems (UAS) include any mechanical device, heavier than air, capable of powered flight without a human operator on board. Also referred to as unmanned aerial vehicles (UAV) or drones, they range from devices small enough to fit in a human hand—weighing just a few ounces and capable of carrying a camera and relaying images back to its operator[1]—to flight systems as large as a Boeing 737 carrying advanced reconnaissance and weaponry.[2] UAS, which have been contemplated since before the Civil War, were first used around the time of the Second World War, and have been increasingly employed in military programs and applications.

As the utilization of UAS has increased, so has their popularity in all areas of society. Similar to other modern technologies, UAS trace their first practical applications to the military and now are being used by government agencies in the domestic United States.[3] Because of expanded governmental development and use, the cost of the technology has rapidly declined, and many private companies are contemplating and testing UAS for private commercial use.[4] As the costs of these systems continue to decrease, the practical private applications within the United States will increase, and even greater numbers of UAS will be utilized in our skies. It is simply a matter of when, and not if, UAS will be employed daily in domestic United States airspace by both government and private entities. In fact the Federal Aviation Administration (FAA) Modernization and Reform Act of 2012 requires the FAA to adopt regulations for the implementation of UAS in domestic airspace by September 2015.[5]

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1. *Your Personal Recognizance System*, PROX DYNAMICS, http://www.proxdynamics.com/home (last visited Apr. 16, 2014), *archived at* http://perma.unl.edu/6JQM-ZXW3.
2. *Eitan*, ISRAELI AIR FORCE, http://www.iaf.org.il/903-34557-en/IAF.aspx?indx=1 (last visited Apr. 16, 2014), *archived at* http://perma.unl.edu/S99K-TDVS.
3. *Fact Sheet—Unmanned Aircraft Systems (UAS)*, FED. AVIATION ADMIN. (Jan. 6, 2014), http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14153, *archived at* http://perma.unl.edu/7K4J-KMZB ("The FAA first authorized use of unmanned aircraft in the NAS in 1990. Since then, the agency has authorized limited use of UAS for important missions in the public interest, such as firefighting, disaster relief, search and rescue, law enforcement, border patrol, military training and testing and evaluation. Today, UAS perform border and port surveillance by the Department of Homeland Security, help with scientific research and environmental monitoring by NASA and NOAA, support public safety by law enforcement agencies, help state universities conduct research, and support various other missions for public (government) entities.").
4. Brian Handwerk, *5 Surprising Drone Uses (Besides Amazon Delivery)*, NAT'L GEOGRAPHIC, Dec. 2, 2013, http://news.nationalgeographic.com/news/2013/12/131202-drone-uav-uas-amazon-octocopter-bezos-science-aircraft-unmanned-robot/, *archived at* http://perma.unl.edu/8SKX-JWYB.
5. FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 332, 126 Stat. 11, 73–75.

The utilization of UAS domestically by both public and private entities has immense potential benefits. These include, but are not limited to, public safety, industrial applications, and personal convenience. However, the use of this technology in our airways carries with it some negative ramifications as well, including issues related to use by government entities for searches and surveillance, issues resulting from the increase in the amount of air traffic, issues with tort liability, and issues regarding intrusion onto private property.

A number of critics have already addressed the privacy issues associated primarily with the government's use of UAS to conduct surveillance activities.[6] This article will instead focus on airspace and other issues certain to result from the increased use of UAS domestically by both government and private entities, which should be addressed by laws and regulations. Part II will focus on a brief history of aviation, including UAS, and their potential future uses. Part III will focus on the current legal regulations regarding UAS operations in the domestic United States. Part IV will focus on foreseeable problems that could exist with the deployment of UAS in domestic airspace and positions for how the law should respond to these potential problems. One of the best ways to address the issues that arise with the domestic use of UAS is to reexamine how the airspace above the United States is regulated.

Currently, all control of U.S. airspace is ceded to the FAA, which is working on plans to implement the technology's use in domestic airspace. Such plans also should address, and ultimately relinquish, some control of low-altitude airspace to local jurisdictions. By giving a greater amount of airspace control to local jurisdictions, control over the operation of UAS can be managed at a local level and legislated closer to the people involved. By doing this, individuals will likely be more comfortable with, and more likely to accept, the use of UAS.

While the effects of the use of UAS in domestic airspace will be for the most part positive, the law will need to be proactive in its approach to the technology for these benefits to be fully realized. More than ever, people are wary of the negative effects of a new technology.

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6. *See* John Villasenor, *Observations from Above: Unmanned Aircraft Systems and Privacy*, 36 HARV. J.L. & PUB. POL'Y 457, 458 (2013); *see also* Hillary B. Farber, *Eyes in the Sky: Constitutional and Regulatory Approaches to Domestic Drone Deployment*, 64 SYRACUSE L. REV. 1, 3 (2014) (discussing drone capabilities and Fourth Amendment jurisprudence, as well as proposed state and federal regulations); Joseph J. Vacek, *Big Brother Will Soon Be Watching—Or Will He? Constitutional, Regulatory, and Operational Issues Surrounding the Use of Unmanned Aerial Vehicles in Law Enforcement*, 85 N.D. L. REV. 673, 674 (2009) (discussing the regulatory and constitutional limitations on unmanned aerial vehicles and exploring the potential development of Fourth Amendment jurisprudence in this area).

Contributing to this negative view is the fact that UAS to date have largely received attention for their military applications, including surveillance and antipersonnel uses.[7] Because of this, modifications in the law affecting UAS operation domestically need to be made, allowing individuals to be more comfortable with the technology operating over their homes and communities.

II. A BRIEF HISTORY OF AVIATION

Aviation began more than two thousand years ago, when the Chinese used kites in religious ceremonies[8] and has progressed to its current state. Throughout history, many different individuals contributed to man's ability to fly. Leonardo da Vinci made the first real studies of the theory of flight in the late 1400s. He created more than one hundred drawings illustrating these theories, one of which included the ornithopter, a flying machine never actually created[9]. (However, the modern-day helicopter is based on this concept.[10]) Around 1800, George Cayley designed many versions of gliders, which used body movements as a means of control. Over the next fifty years, Cayley made improvements on his designs, including changes in the shape of the wings to allow proper airflow over them and the addition of a tail for stability.[11] He also recognized successful sustained flight would require external power of some sort.[12]

German engineer Otto Lilienthal studied aerodynamics and was the first person to design a glider able to transport an individual over long distances. Lilienthal was fascinated with aviation, and conducted more than 2,500 flights with his designs. He also authored a

7. *Anger Rising at US Drone Attacks in Yemen*, YOUTUBE.COM (Sept. 13, 2014), https://www.youtube.com/watch?v=usM70MtPtHU, *archived at* http://perma.unl.edu/LQ7B-3DQW. *See also YouTube Videos of US Unmanned Drone Attacks in Afghanistan- RT 100105*, YOUTUBE.COM (Sept. 12, 2014), https://www.youtube.com/watch?v=UdbV5J20mpw, *archived at* http://perma.unl.edu/VC2D-AQVK.

8. *The Dream of Flight*, LIBRARY OF CONG., http://www.loc.gov/exhibits/treasures/wb-timeline.html (last visited Apr. 15, 2014), archived at http://perma.unl.edu/AVP7-SVED.

9. John Fuller, *Top 10 Bungled Attempts at One-Person Flight*, HOWSTUFFWORKS.COM, http://science.howstuffworks.com/transport/flight/classic/ten-bungled-flight-attempt2.htm (last visited Sept. 14, 2014), *archived at* http://perma.unl.edu/6CLZ-X7LT.

10. Mary Bellis, *History of the Helicopter—Igor Sikorsky and Other Early Pioneers*, ABOUT.COM, http://inventors.about.com/od/hstartinventions/a/helicopter.htm (last visited Apr. 24, 2014), *archived at* http://perma.unl.edu/E22Z-2E3Y.

11. *How Did We Learn to Fly Like Birds?*, NAT'L AERONAUTICS & SPACE ADMIN., http://www.grc.nasa.gov/WWW/k-12/UEET/StudentSite/historyofflight.html (last visited Sept. 14, 2014), *archived at* http://perma.unl.edu/9DP3-TB9Z.

12. Tom D. Crouch, *Sir George Cayley, 6th Baronet*, ENCYCLOPEDIA BRITANNICA (Sept. 10, 2013), http://www.britannica.com/EBchecked/topic/100795/Sir-George-Cayley-6th-Baronet, *archived at* http://perma.unl.edu/EG6K-49XX.

book on aerodynamics, which was published in 1889.[13] Ultimately, this text was used by the Wright Brothers as the basis for the designs of their airplane.[14] Like Cayley, astronomer Samuel Langley realized that external power was essential to sustained flight. He built a model of a plane, which he called an aerodrome, that included a steam-powered engine. In 1896, his model Aerodrome Number 5 made two successful flights.[15]

All of this experimentation with aviation contributed to man's first flight on December 17, 1903, when the Wright Brothers achieved a sustained powered flight at Kitty Hawk, North Carolina, and modern aviation was born. Since then, manned flight has made technological leaps and bounds. In more than one hundred years, what began as one man on a biplane weighing 605 pounds traveling at a ground speed of just less than seven miles per hour[16] has seen many milestones, including commercial jet travel,[17] transcontinental flights,[18] supersonic passenger travel,[19] manned space flight,[20] private travel into outer space,[21] and even the continuous presence of humans living

13. OTTO LILIENTHAL, BIRDFLIGHT AS THE BASIS OF AVIATION (1889).

14. *Lilienthal Glider*, SMITHSONIAN NAT'L AIR & SPACE MUSEUM, http://airandspace.si.edu/collections/artifact.cfm?object=nasm_A19060001000 (last visited Apr. 19, 2014), *archived at* http://perma.unl.edu/475L-CFBS.

15. *Langley Aerodrome Number 5*, SMITHSONIAN NAT'L AIR & SPACE MUSEUM, http://airandspace.si.edu/collections/artifact.cfm?id=A19050001000 (last visited Apr. 21, 2014), *archived a*t http://perma.unl.edu/RV5G-U4P6.

16. *The Wright Brothers—The Invention of the Aerial Age*, SMITHSONIAN NAT'L AIR & SPACE MUSEUM, http://airandspace.si.edu/exhibitions/wright-brothers/online/fly/1903/index.cfm (last visited Apr. 27, 2014), *archived at* http://perma.unl.edu/7ZJM-2DXY.

17. *Commercial Jet Aviation*, CENTURY OF FLIGHT, http://www.century-of-flight.net/Aviation%20history/jet%20age/commercial%20aviation2.htm (last visited Apr. 10, 2014), *archived at* http://perma.unl.edu/W3UW-K88M.

18. Davis L. Wright, *Flying the Overly Friendly Skies: Expanding the Definition of an "Accident" Under the Warsaw Convention to Include Co-Passenger Sexual Assaults,* 46 VILL. L. REV. 453 (2001).

19. Tim Hune, *Beyond Concorde: The Next Generation of Supersonic Flight*, CNN TECH (Aug. 23, 2012, 7:34 AM), http://www.cnn.com/2012/08/23/tech/innovation/beyond-concorde-supersonic-flight/, *archived at* http://perma.unl.edu/7NT3-VK8P

20. *Human Space Flight*, NAT'L AERONAUTICS & SPACE ADMIN., http://spaceflight.nasa.gov/history/ (last visited Apr. 27, 2014), *archived at* http://perma.unl.edu/C4SC-BYKB.

21. Michael Coran, *Private Craft Soars into Space, History*, CNN (July 14, 2004, 4:14 AM), http://www.cnn.com/2004/TECH/space/06/21/suborbital.test/index.html?iref=newssearch, *archived at* http://perma.unl.edu/8WBW-MSDW.

and working in outer space.[22] Among these advancements in aviation is the development and use of UAS.[23]

A. What Is an Unmanned Aerial System?

Unmanned Aerial Systems (UAS) are generally defined as "[a] powered, aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and carries a lethal or nonlethal payload."[24] Operation of an UAS can be as simple as using a handheld remote-control device while keeping visual contact with the vehicle,[25] or it can be more advanced, where the vehicle is controlled via a satellite link and remote ground stations—similar in makeup to the cockpits of traditional manned aircraft—located anywhere in the world.[26] Operation of UAS can even include autonomous or semiautonomous vehicles, which operate exclusive of human control, utilizing onboard computers and GPS technology to control the vehicle's flight operations.[27]

The vehicle component of UAS comes in many shapes and sizes. Some of the most recognized platforms are those used in military applications such as the Predator System,[28] the most common weaponized UAS used by the United States.[29] Similar in size to a smaller aircraft,[30] these systems have received a great amount of at-

22. *First Crew Starts Living and Working on the International Space Station*, INT'L SPACE STATION (Oct. 31, 2000), http://www.esa.int/Our_Activities/Human_Spaceflight/International_Space_Station/First_crew_starts_living_and_working_on_the_International_Space_Station, *archived at* http://perma.unl.edu/VNE2-WL9N.
23. John David Blom, *Unmanned Aerial Systems: A Historical Perspective*, U.S. ARMY COMBINED ARMS CTR. 47 (Sept. 2010), http://usacac.army.mil/cac2/cgsc/carl/download/csipubs/OP37.pdf, *archived at* http://perma.unl.edu/LU6P-ZNE3.
24. Chris Jenks, *Law from Above: Unmanned Aerial Systems, Use of Force, and the Law of Armed Conflict*, 85 N.D. L. REV. 649, 653 (2009).
25. Brian Stern & Matthias Rubekeil, *Coming Home to Roost—Domestic Use of Unmanned Aerial Vehicles*, R.I. BAR JOURNAL, Nov./Dec. 2013, at 5, 9.
26. One report indicates that the United States currently operates at least sixty UAS bases, including locations both in the United States and abroad. Nick Turse, *Mapping America's Shadowy Drone Wars*, TOMDISPATCH.COM (Oct. 16, 2011), http://www.tomdispatch.com/archive/175454, *archived at* http://perma.unl.edu/5HB3-NPLX.
27. Timothy T. Takahashi, *Drones and Privacy*, 14 COLUM. SCI. & TECH. L. REV. 72, 83 (2012).
28. *Predator UAS*, GEN. ATOMICS AERONAUTICAL, http://www.ga-asi.com/products/aircraft/predator.php (last visited Apr. 24, 2014), *archived at* http://perma.unl.edu/LH9Z-ZA38.
29. Thomas Michael McDonnell, *Sow What You Reap? Using Predator and Reaper Drones to Carry Out Assassinations or Targeted Killings of Suspected Islamic Terrorists*, 44 GEO. WASH. INT'L L. REV. 243, 251 (2012).
30. *See* Joel Baglole, *MQ-1 Predator - Unmanned Aerial Vehicle*, ABOUT.COM, http://usmilitary.about.com/od/uavs/a/mq1.htm (last visited April 19, 2014), *archived at* http://perma.unl.edu/ZQ6T-Z8YF. *See also Predator Drone Specifications*, MIL.

tention recently in the media, and have been named by Smithsonian's *Air & Space Magazine* as one of the "top ten aircraft that changed the world."[31] However, UAS range in size from microaerial vehicles such as the Black Hornet Nano,[32] weighing just over one-half ounce and used for reconnaissance,[33] to the RQ-11B Raven, a hand-launched system that can fit into a suitcase,[34] to the four-and-a-half-ton Eitan,[35] an Israeli UAS the size of a Boeing 737, which carries advanced reconnaissance equipment and weapons as well as combat countermeasures.[36]

B. Radio Controlled Airplanes

One cannot discuss the defining characteristics of UAS without also addressing radio-controlled (RC) aircraft. Most simply defined, RC aircraft are UAS and vice versa. Before the term UAS became well known to Americans, a large number of people enjoyed (and still do enjoy) flying RC aircraft for recreational purposes.

RC aircraft, while technically defined by the FAA as unmanned aircraft,[37] are differentiated from UAS when used strictly for recreational purposes.[38] The FAA has promulgated operating standards for model aircraft,[39] and when followed these stipulations exempt RC aircraft from FAA oversight, including operator certification.[40] UAS, by

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HIS. MONTHLY (May 11, 2012), http://www.military-history.org/articles/predator-drone-specifications.htm, *archived at* http://perma.unl.edu/7K64-TEZQ (discussing the predator drone and its specifications).

31. *See Predator UAS*, *supra* note 28.
32. *Your Personal Recognizance System*, *supra* note 1.
33. *Black Hornet Spycam is a 'Lifesaver' for British Troops*, BBC NEWS (Feb. 13, 2013, 11:36 AM), http://www.bbc.com/news/uk-21450456, *archived at* http://perma.unl.edu/WN4B-L2HL.
34. *UAS: RQ-11B Raven*, AEROVIRONMENT, https://www.avinc.com/uas/small_uas/raven/ (last visited Apr. 19, 2014), *archived at* http://perma.unl.edu/CB8E-Y6RW.
35. *Eitan*, *supra* note 2.
36. *Id. See also* Joe Pappalardo, *How Israel's Biggest Drone Could Take Out Iranian Nukes*, POPULAR MECHANICS, Feb. 23, 2010, http://www.popularmechanics.com/technology/military/planes-uavs/4346921, *archived at* http://perma.unl.edu/5MR4-QHX7 (discussing how Israeli UAV could work to combat nuclear weapons).
37. *Notice: Unmanned Aircraft Operations in the National Aerospace System (NAS)*, FED. AVIATION ADMIN. (July 11, 2014), http://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/1024929, *archived at* http://perma.unl.edu/N567-QCQ4.
38. *Drones vs. Radio-Controlled Aircraft: Operation Oversight*, RCFLIGHTLINE.COM, http://rcflightline.com/drones-vs-radio-controlled-aircraft-operation-oversight/ (last visited April 1, 2014), *archived at* http://perma.unl.edu/3G3K-NRU5.
39. R.J. VAN VUREN, FAA ADVISORY CIRCULAR, No. 91-57, MODEL AIRCRAFT OPERATING STANDARDS (1981), *archived at* http://perma.unl.edu/BT5F-CZCW.
40. FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 336, 126 Stat. 11, 77–78.

contrast, require FAA approval.[41] The rules require RC aircraft to be operated in accordance with a national community-based organization recognized by the FAA. For model airplanes, this organization is the Academy of Model Aeronautics (AMA).[42] However, AMA rules are simply best practices recommendations, and the association has no legal authority over the RC community.[43]

FAA guidance specifies model aircraft are to weigh less than fifty-five pounds, and their flights are limited to operation below 400 feet above ground level (AGL). In addition, they should be flown a sufficient distance from populated areas and full-scale aircraft, and the operator should maintain a visual line of sight.[44] In 2007, the FAA clarified that these guidelines apply only to modelers and specifically exclude individuals or companies flying model aircraft for business purposes.[45] Surprisingly, no limitations are placed on the cargo RC aircraft may carry, allowing them to be outfitted with a variety of equipment, including cameras.[46]

Ultimately, a gray area exists between what constitutes a UAS and a RC aircraft, and the actual classification depends on the motivation for the device's use. If used for recreation, the FAA considers it an RC aircraft; otherwise it will be considered a UAS. This line will continue to blur with time because new technology has lowered the cost of small UAS while also increasing their capabilities, such as flight performance and payload activity (e.g. photography).

For example, for as little as $479[47] an individual can obtain a Phantom 2 self-leveling quadcopter capable of an operating range of 1,000 meters from the hand-held remote control unit and able to carry a Go-Pro high-definition camera. In the event of a communications failure with its remote control, the Phantom 2, using an integrated GPS autopilot system, will automatically return to its home location and land. This same technology also allows the user to program no-fly zones, preventing the unit from inadvertently entering unauthorized

41. There are presently two methods of gaining FAA approval for flying UAS: Special Airworthiness Certificates—Experimental Category (SAC-EC) for civil aircraft, and Certificates of Waiver or Authorization (COA) for public aircraft. *See Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.

42. ACAD. MODEL AERONAUTICS, http://www.modelaircraft.org (last visited Apr. 23, 2014), *archived at* http://perma.unl.edu/HBP4-Z9L4.

43. *See Drones vs. Radio-Controlled Aircraft: Operation Oversight*, *supra* note 38.

44. *See* Van Vuren, *supra* note 39. *See also Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3 (discussing FAA guidelines on operating model aircraft).

45. *Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.

46. *Id.*

47. *DJI Phantom Aerial UAV Drone Quadcopter for GoPro*, AMAZON, http://www.amazon.com/dp/B00AGOSQI8?tag=bestquadcopter-20 (last visited Apr. 19, 2014), *archived at* http://perma.unl.edu/S2FM-AVJL.

airspace.[48] For just $300, one can obtain a Parrott AR Drone 2.0 Elite Edition Quadcopter.[49] Device control is accomplished via a tablet or smartphone. Operating at a range of 100 meters, it has a self-contained 720-megapixel camera capable of streaming live video from its flight and includes GPS return-home technology.[50] An individual using either of these systems is well within current regulations to operate them in domestic airspace so long as he or she follows the guidelines set forth in the FAA advisory opinion.[51] On the other hand, if the same individuals were to attempt to sell their photography, they could find themselves on the wrong side of federal regulations.[52]

This exact issue recently came to light in a decision handed down March 6, 2014, by a National Transportation Safety Board (NTSB) Administrative Law Judge (ALJ), which vacated a civil penalty issued by the FAA against a commercial user of a UAS. In *Huerta v. Pirker*,[53] the ALJ held FAA regulations were not enforceable against a user of a small UAS that would otherwise qualify as model aircraft.[54] On appeal by the FAA, the NTSB overturned the ALJ's decision,[55] finding instead that unmanned aircraft, regardless of their use (recreational or commercial), are nonetheless "aircraft" as defined by FAA regulations (FAR)[56] and the *United States Code*.[57] This allowed the FAA to enforce FAR § 91.13(a), which prohibits individuals from oper-

48. *Phantom 2*, DJI, http://www.dji.com/product/phantom-2/feature (last visited Apr. 19, 2014), *archived at* http://perma.unl.edu/R2YF-NXYF.
49. *Parrot AR.Drone 2.0 Elite Edition Quadricopter*, AMAZON, http://www.amazon.com/Parrot-AR-Drone-Elite-Edition-Quadricopter/dp/B00FS7SSD6/ref=sr_1_1?ie=UTF8&qid=1397972009&sr=8-1&keywords=parrot+ardrone (last visited Sept. 22, 2014), *archived at* http://perma.unl.edu/WY79-Q9R2.
50. *AR Drone 2.0*, PARROT, http://ardrone2.parrot.com (last visited Apr. 20, 2014), *archived at* http://perma.unl.edu/R59U-FCWF.
51. *See* Van Vuren, *supra* note 39.
52. Liz Klimas, *FAA Halts Man's Drone Photography Business over Regulations*, THE BLAZE (Mar. 15, 2013, 1:04 PM), http://www.theblaze.com/stories/2013/03/15/faa-halts-mans-drone-photography-business-over-regulations/, *archived at* http://perma.unl.edu/ZZM5-QMUJ.
53. No. CP-217 (N.T.S.B. Mar. 6, 2014), *archived at* http://perma.unl.edu/T5ZR-MV3N; *see also* Charles A. Blanchard & William Spyro Speros, *Huerta v. Pirker decision puts the remote control back in FAA's hands*, ARNOLD & PORTER LLP (March 10, 2014), http://www.lexology.com/library/detail.aspx?g=f947e58c-a8d1-482b-8299-f8d81490ac73, *archived at* http://perma.unl.edu/W8EA-GT5L (discussing the impact of the order, which assessed a fine for operating a drone in an unsafe manner).
54. *FAA Lacks Authority to Ground Small UAVs Used for Commercial Purposes*, LATHAM & WATKINS CLIENT ALERT COMMENT. (March 11, 2014), http://www.jdsupra.com/topics/drones/faa/page2/, *archived at* http://perma.unl.edu/M3AL-643H (follow "FAA Lacks Authority to Ground Small UAVs Used for Commercial Purposes" hyperlink).
55. Huerta v. Pirker, No. CP-217 (N.T.S.B. Nov. 18, 2014).
56. 14 C.F.R. § 1.1 (2014) (defining aircraft as a device that is used or intended to be used for flight in the air).
57. 49 U.S.C. § 40102(a)(6) (2012).

ating aircraft in a careless or reckless manner and endangering the life or property of another.[58] The case was remanded back to the ALJ to determine whether Pirker's UAS was, in fact, operated in a careless or reckless manner, but the NTSB refused to "address issues beyond the threshold question that produced the decisional order on appeal," which limited the decision only to the definition of "aircraft" and reserved other regulatory decision regarding UAS to the FAA.[59] This case highlights how quickly the capabilities of UAS have evolved, and how difficult it is for the regulations to keep up with the available technology.

C. History of Unmanned Aerial Systems

Like other modern technologies, advancements in aviation first took root in the military, then domestically, and as costs decreased practical civilian applications have been realized. UAS are no exception, having first been used in military applications over foreign airspace,[60] their use has experienced an increase in domestic applications.[61]

UAS use can be traced back to the Civil War, when both the Union and Confederate armies tried to use balloon bombs laden with incendiary and other explosives.[62] Samuel Langley is credited with the first UAS, when on May 6, 1896, he made two successful flights with his experimental aircraft, the Aerodome 5. This marked the world's first successful flight of an unpiloted, engine-driven, heavier-than-air craft of substantial size.[63] The first unmanned airplane to be flown successfully by radio remote control was a modified N9 Navy Seaplane that remained aloft for about twelve minutes during a September 1924 test, at a distance of several miles from the transmitter held by a ground-based pilot.[64] In the 1930s, actor Reginald Denny invented a toy remote-controlled aircraft and became interested in a military application for his invention.[65] During World War II, these remote-con-

58. 14 C.F.R. § 91.13(a) (2014).

59. *Pirker*, No. CP-217 (N.T.S.B. Nov. 18, 2014).

60. *See* Blom, *supra* note 23, at 47.

61. *Tens of Thousands of Domestic Drones Already in Use Nationwide, with More to Come*, DAILY NEWS (March 3, 2013 5:13 PM), http://www.nydailynews.com/news/national/drones-skies-domestically-article-1.1278342, *archived at* http://perma.unl.edu/K665-ED4Q.

62. Jim Garamone, *From U.S. Civil War to Afghanistan: A Short History of UAVs*, U.S. DEP'T OF DEF. (Apr. 16, 2002), http://www.defense.gov/news/newsarticle.aspx?id=44164, *archived at* http://perma.unl.edu/5TSF-GWZ6.

63. *See Langley Aerodrome Number 5*, *supra* note 15.

64. Villasenor, *supra* note 6, at 463.

65. *Actor's Toy Plane Is Military Factor*, PITTSBURGH PRESS, Aug. 15, 1938, at 8, *archived at* http://perma.unl.edu/7JCD-MZAA.

trolled aerial vehicles were built in large numbers and used for target practice in the training of anti-aircraft personnel.[66]

With the concept of UAS validated during the war, both the Army and Navy purchased them in great numbers for anti-aircraft target practice, and researchers began experimenting with them for other applications.[67] One of the earliest successful uses of the predecessor to modern UAS was the Ryan Firebee, a jet-propelled unmanned aircraft used as a target for the training of anti-aircraft gunners that first took flight in 1951.[68] During the 1950s and 1960s, the Army, Navy, and Air Force all developed new UAS platforms, as well as new missions for them, including weaponization.[69] From this time until the Vietnam War, advancements in technology allowed UAS to be more effective. For example, modified Firebee platforms flew more than 3,400 sorties[70] in the skies of Northern Vietnam,[71] including the first combat reconnaissance and propaganda missions.[72]

After the Vietnam War, the use and development of UAS continued over the next two decades. Collectively, the military forces of the United States, Russia, Canada, Israel, and European countries all possessed active programs.[73] Since the turn of the 21st century, a number of factors have allowed UAS to become a more practical reality.

> Since 2000, worldwide UAS use for both military and civilian applications has increased dramatically. One key factor contributing to this growth is the continuing advance of computing, imaging, and communications technologies. Computational power and storage that would have filled multiple rooms in the 1960s can now easily fit within a single chip. In the context of UAS, this has made it possible to equip even very small platforms with sophisticated onboard computational systems for tasks such as navigation and image processing. The advent of high-resolution, low-cost digital imaging systems, when combined with high-bandwidth communications links, enables high-resolution images and video acquired by an unmanned aircraft to be transmitted in real time to an observer 50 feet—or 5000 miles—away. Thanks to continuing

66. *See* Blom, *supra* note 23, at 47.
67. *Id*. at 48.
68. *Historical Overview*, RYAN AERONAUTICAL, http://www.ryanaero.org/history.html (last visited Apr. 21, 2014), *archived at* http://perma.unl.edu/FC8Q-F34L.
69. *See* Blom, *supra* note 23, at 49.
70. Sortie is a military term with several definitions including "a mission or attack by a single plane." *Sortie Definition*, MERRIAM-WEBSTER.COM, http://www.merriam-webster.com/dictionary/sortie (last visited Oct. 28, 2014), *archived at* http://perma.unl.edu/QY6M-LVQW.
71. Paul Joseph Springer, *Military Robots and Drones: A Reference Handbook*, GOOGLE BOOKS, http://books.google.com/books/about/Military_Robots_and_Drones_A_Reference_H.html?id=HmtJOp3Te-oC (last visited Apr. 3, 2014), *archived at* http://perma.unl.edu/WGT2-EHW2.
72. *See* Blom, *supra* note 23, at 58; *see also* Garamone, *supra* note 63 (discussing drone use during the Vietnam War).
73. STEVEN J. ZALOGA, UNMANNED AERIAL VEHICLES: ROBOTIC AIR WARFARE 1917–2007, at 16–24 (2008).

> innovations in airframe design and flight control algorithms, the cameras that can be mounted on UAS are becoming smaller and more agile.[74]

Future demands for the technology parallel, and even exceed, past growth. For example, the University of North Dakota currently offers a Bachelors of Science in Aeronautics with a Major in Unmanned Aircraft Systems Operations,[75] and the United States Air Force today is training more UAS pilots than traditional airmen.[76]

D. Domestic Use of Unmanned Aerial Systems

The FAA first authorized the utilization of UAS in the domestic United States in 1990, but their use was limited to the public interest, including "firefighting, disaster relief, search and rescue, law enforcement, border patrol, military training, testing, and evaluation."[77] Just a few of the federal agencies currently using the technology include the Department of Homeland Security's Customs and Border Protection (CBP), which uses unarmed Predator UAS for patrolling the borders between the United States, Mexico, and Canada;[78] the Federal Bureau of Investigation (FBI), which has been using UAS since 2006 to conduct surveillance;[79] and the National Aeronautics and Space Administration (NASA), which has elected to use UAS for hurricane research.[80]

Domestic use of UAS is not just limited to the federal government. For example, the Mesa County, Colorado Sheriff's Office was one of the first local government agencies to obtain a FAA Certificate of Authorization (COA). This COA allows the Sheriff's Office to use UAS platforms for actual operational activities, as opposed to training. To

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74. Villasenor, *supra* note 6, at 464.

75. *Bachelor of Science in Aeronautics Major in Unmanned Aircraft System Operations,* UND AEROSPACE, http://aviation.und.edu/ProspectiveStudents/Undergraduate/uasops.aspx (last visited Sept. 14, 2014), *archived at* http://perma.unl.edu/MBB3-MAV5.

76. Joe Wolverton II, *U.S. Air Force Training More Drone, Than Traditional, "Pilots*," NEW AM. (Aug. 4, 2012), http://www.thenewamerican.com/tech/item/12322-drone-technology-accelerates-usaf-turns-attention-to-training-drone-pilots, *archived at* http://perma.unl.edu/C57D-GMFV.

77. *Fact Sheet—Unmanned Aircraft Systems (UAS), supra* note 3.

78. Chad Haddal & Jeremiah Gertler, *Homeland Security: Unmanned Aerial Vehicles and Border Surveillance*, CONG. RES. SERV. (July 8, 2010), http://www.fas.org/sgp/crs/homesec/RS21698.pdf, *archived at* http://perma.unl.edu/VMQ-5YM5.

79. Letter from Stephen D. Kelly, Assistant Dir. of the FBI, Office of Cong. Affairs, to Senator Rand Paul (July 19, 2013), *archived at* http://perma.unl.edu/5HL3-ZS6N.

80. *NASA using surplus military drones to investigate hurricanes*, FOX NEWS (Sept. 14, 2013), http://www.foxnews.com/science/2013/09/14/nasa-reportedly-using-military-drones-to-investigate-hurricanes/, *archived at* http://perma.unl.edu/L2MN-MYK5.

date the program has flown more than fifty-five missions with 225 combined flight hours.[81]

In 2012, a U.S. district court upheld an arrest effected by a local law enforcement agency's use of assistance from a UAS.[82] In 2011, North Dakota cattle rancher Rodney Bossart became involved in an armed standoff with the Grand Forks, North Dakota Police Department.[83] Bossart was arrested by Grand Forks SWAT Team members with the assistance of a Predator UAS supplied by the Department of Homeland Security's CBP.[84] In January 2014, Bossart was sentenced for terrorizing police on authority after an earlier decision in 2012 by a U.S. district court judge upholding the use of the UAS in the case, saying "there was no improper use of an unmanned aerial vehicle."[85] This supplied a legal precedent supporting the use of UAS by law enforcement in its daily duties.

E. Future of Unmanned Aerial Systems

In 2012, nearly fifty companies developed approximately 150 different UAS systems,[86] resulting in a worldwide annual expenditure of $6 billion.[87] It is predicted that by 2020 $11.4 billion annually will be spent on UAS sales,[88] and the manufacturing and surrounding industries related to UAS will create seventy thousand new jobs, and more than one hundred thousand jobs by 2025.[89] Beyond the positive economic impacts, it is clear the expanded use of UAS domestically beyond government entities can be both practical and beneficial. A number of practical applications have been proposed for private UAS including agriculture monitoring, real estate sales, monitoring wildlife and the environment, aerial photography, and even delivery of medi-

81. *Unmanned Aerial System Team*, MESA COUNTY, http://sheriff.mesacounty.us/uav/ (last visited July 24, 2014), *archived at* http://perma.unl.edu/9P2S-PRPV.
82. Jason Koebler, *North Dakota Man Sentenced to Jail In Controversial Drone-Arrest Case*, U.S. NEWS & WORLD REP., Jan. 15, 2014, http://www.usnews.com/news/articles/2014/01/15/north-dakota-man-sentenced-to-jail-in-controversial-drone-arrest-case, *archived at* http://perma.unl.edu/KU85-BRCF.
83. *Id.*
84. *Id.*
85. *Id.* (internal quotation marks omitted).
86. Andy Pasztor & John Emshwiller, *Drone Use Takes Off on the Home Front*, WALL ST. J., Apr. 21, 2012, http://online.wsj.com/news/articles/SB10001424052702304331204577354331959335276, *archived at* http://perma.unl.edu/44PX-DXP3.
87. *Drones at Home Raise Fear of Surveillance Society*, FOX NEWS (June 19, 2012), http://www.foxnews.com/us/2012/06/19/talk-drones-patrolling-us-skies-spawns-anxiety, *archived at* http://perma.unl.edu/DUL5-ZQG8.
88. Sean Holstege, *Drones' Good Flies Hand in Hand with Bad, Experts Fear*, ARIZ. REPUBLIC (July 7, 2012, 10:17 PM), http://www.azcentral.com/arizonarepublic/news/articles/2012/07/07/20120707arizona-unmanned-drones-concerns.html, *archived at* http://perma.unl.edu/T8F5-V6NH.
89. Hillary B. Farber, *Eyes in the Sky: Constitutional and Regulatory Approaches to Domestic Drone Deployment*, 64 SYRACUSE L. REV. 1, 12 (2014).

cal assistance through the rapid transport and delivery of automated external defibrillators.[90]

Use of this technology outside of the United States is no exception, where UAS also have experienced use beyond military and government applications. Countries including Brazil, Japan, Australia, and New Zealand have authorized and promoted commercial UAS operation.[91] In fact, numerous organizations in New Zealand already have received governmental permission to use them for commercial purposes.[92] In December 2013, DHL Express (DHL) successfully used the technology to deliver prescription medications near the Rhine River.[93] In Peru, archaeologists are using UAS to map ancient sites threatened by development.[94]

These uses in foreign countries are consistent with the intentions of companies in the United States that seek to use UAS for commercial purposes. In January 2014, Minnesota brewery Lakemaid used YouTube[95] to chronicle its planned use of UAS for delivery of its delicious and refreshing product to local ice fisherman (which arguably is a necessity to make the sport of ice fishing tolerable) out upon the state's frozen lakes. But Lakemaid's plans were quashed by the FAA.[96] Despite Lakemaid's unsuccessful drone beer-delivery attempts, the potential applications for domestic UAS use by both public and private entities in the future are great.

Commercial uses in the domestic United States have been proposed by a number of businesses, including Amazon.com CEO Jeff Bezos, who is eager to use UAS for delivery of packages, dubbing the

90. Adam Clark Estes, *Some Good Things Drones Can (Actually) Do*, GIZMODO (Dec. 3, 2013), http://gizmodo.com/some-good-things-drones-can-actually-do-1475717696, *archived at* http://perma.unl.edu/86KP-H9BY.

91. *See FAA Lacks Authority to Ground Small UAVs Used for Commercial Purposes*, *supra* note 54.

92. Nicholas Jones, *Drones: Secrets in our skies*, N.Z. HERALD (Apr. 3, 2013, 5:30 AM), http://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=10874979, *archived at* http://perma.unl.edu/W8WY-6U6M.

93. Marcus Wohlsen, *Amazon Outdone by Drug-Delivering Euro Drone,* WIRED (Dec. 12, 2013, 9:30 AM), http://www.wired.com/2013/12/dhl-drug-drone/, *archived at* http://perma.unl.edu/6MKA-ELU5.

94. William Neuman & Ralph Blumenthal, *New to the Archaeologist's Tool Kit: The Drone,* N.Y. TIMES, Aug. 13. 2014, http://www.nytimes.com/2014/08/14/arts/design/drones-are-used-to-patrol-endangered-archaeological-sites.html?smid=fb-share&_r=1, *archived at* http://perma.unl.edu/8GGS-XL3K.

95. *Lakemaid Beer Drone Delivery*, YOUTUBE.COM (Jan. 24, 2014), https://www.youtube.com/watch?v=qmHwXf8JUOw, *archived at* http://perma.unl.edu/F54M-T429.

96. Heather Kelly, *Beer-delivery Drone Grounded by FAA*, CNN (Feb. 3, 2014, 10:03 AM), http://www.cnn.com/2014/01/31/tech/innovation/beer-drone-faa/, *archived at* http://perma.unl.edu/7WBM-PMDQ

service Amazon Prime Air;[97] Google, who has been working secretly for the last two years on "Project Wing," which would use UAS to deliver a large variety of items;[98] and Domino's Pizza, which foresees a day when delivery of pizza pies will come from the sky.[99] However, modification of the current regulations must occur before large-scale commercial use of UAS in domestic airspace will be realized.

III. CURRENT REGULATIONS

The United States exercises complete and exclusive sovereignty over all of its airspace.[100] Congress enacted the Federal Aviation Act in 1958, which created the Federal Aviation Administration (FAA) and directed the agency to regulate "air commerce in such a way to promote its development and safety and fulfill the requirements of national defense."[101] The Administrator of the FAA is given broad authority to regulate the use of this airspace.[102] Beyond the control of the actual airspace, this authority also covers regulation and licensure of aircraft[103] and pilots in command.[104]

The use of UAS in domestic airspace is affected by many laws, including federal and local regulation of airspace, FAA policies on equipment, local laws regarding UAS themselves, and private property rights. Additionally, a number of laws have been proposed at different jurisdictional levels. The underlying theme of all proposed legislation largely deals with privacy concerns, which are inherent with the use of UAS.

A. Federal Regulation of Airspace in the United States

Federal regulations require in part that the use of airspace by any type of aircraft in the United States must correlate with the different types of airports around the country. A basic understanding of airspace regulation is necessary to understand how the implementation and parameters of UAS operation will take place domestically. First,

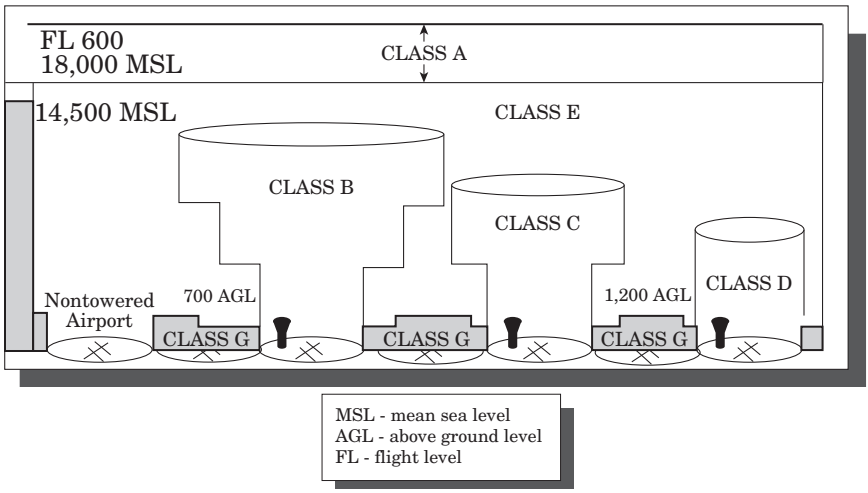
97. *See Amazon Prime Air*, AMAZON, http://www.amazon.com/b?node=8037720011 (last visited Aug. 14, 2014), *archived at* http://perma.unl.edu/62EP-EMUZ.
98. Corinne Iozzio, *Google's Delivery Drones Will Airlift Supplies Practically Anywhere,* SMITHSONIAN.COM, September 5, 2014, http://www.smithsonianmag.com/innovation/googles-delivery-drones-will-airlift-supplies-practically-anywhere-180952607/?no-ist, *archived at* http://perma.unl.edu/62JK-MGXB.
99. Julianne Pepitone, *Domino's tests drone pizza delivery*, CNN MONEY (June 4, 2013, 6:29 PM), http://money.cnn.com/2013/06/04/technology/innovation/dominos-pizza-drone/, *archived at* http://perma.unl.edu/V8XV-YR83.
100. 49 U.S.C. § 40103 (2012).
101. Federal Aviation Act of 1958, Pub. L. No. 85–726, § 102, 72 Stat. 737, 740 (codified as amended at 49 U.S.C. § 40101 (2012)).
102. City of Burbank v. Lockheed Air Terminal Inc., 411 U.S. 624, 626–27 (1973).
103. *See* 14 C.F.R. §§ 21–49 (2014).
104. *See id.* § 61 (2014).

the airspace over the United States is divided into several classes,[105] illustrated in figure 3-2-1[106] reproduced *infra*, with the entry and use of each class having differing requirements.[107] Class A airspace lies between 18,000 feet above sea level (ASL) and 60,000 feet ASL.[108] Class B and Class C airspace are used to control traffic flow around airports with major and moderate traffic,[109] while Class D airspace is used for traffic control at smaller airports, typically with no control tower.[110] Operation within Class A, B, C, and D airspaces each has specific requirements, such as contact and clearance from Air Traffic Control (ATC) or communication with the corresponding airport.

The remaining airspace classifications are Classes E and G, which are not as heavily regulated as Classes A–D. Class E airspace consists of areas not encompassed by Class A, B, C, or D airspace,[111] and while still controlled, there is no requirement to contact ATC or obtain any clearance before entering it.[112] Finally, Class G airspace (uncontrolled) is that portion of airspace that has not been designated as Class A, B, C, D, or E airspace, which starts at the ground, and extends up to 700 to 1,200 feet AGL.[113] Pilots and aircraft operating in Class E or G airspaces require no additional equipment or qualification requirements beyond the minimum standards for flight prescribed by the FAA.[114]

105. *See id.* §§ 71.1–71.901 (2014).
106. FED. AVIATION ADMIN., U.S. DEP'T OF TRANSP., AERONAUTICAL INFORMATION MANUAL at 3-2-1 (2014), *archived at* http://perma.unl.edu/D9NP-TPMC [hereinafter AERONAUTICAL INFORMATION MANUAL].
107. *See id.* at 3-1-1 to 3-3-1.
108. *See* 14 C.F.R. §§ 71.31–71.33.
109. *See id.* §§ 71.41–71.51.
110. *Id.* § 71.61.
111. *Id.* § 71.71.
112. *Id.* § 71.1–71.901.
113. AERONAUTICAL INFORMATION MANUAL, *supra* note 107, at 3-1-1 to 3-3-1.
114. *Id.*

FIG 3–2–1
Airspace Classes



B. Local Laws Regarding Airspace

In theory, state and local governments possess few rights to regulate the airspace in their jurisdictions. "Since the passage of the Air Commerce act in 1926,[115] it has been settled that the federal government has exclusive control over the use and management of airspace."[116] The Federal Aviation Act also states that no state or political subdivision shall enact or enforce any rule relating to rates, routes, or services of any air carrier.[117] "This provision specifically preempts any state or local authority from regulating the use of navigable airspace."[118] Currently, "with respect to the regulation of 'navigable airspace,' Congress has legislated so pervasively that state provisions inhibiting that regulation, whether in the form of legislation or judicial decision, must be declared invalid under the supremacy clause."[119]

While federal regulations preempt local control of navigable airspace, courts have maintained that local jurisdictions can keep some limited control of the activities carried out by aircraft while in their

115. Air Commerce Act of 1926, ch. 344, §§ 171–84, *amended by* Pub. L. No. 97-195, § 1(c)(2), 96 Stat. 115 (1982).
116. Robert M. Hardaway, Airport Regulation, Law and Public Policy: The Management and Growth of Infrastructure 34 (1991).
117. 49 U.S.C § 41713 (2012).
118. Hardaway, *supra* note 117.
119. Fiese v. Sitorius, 247 Neb 227, 231, 526 N.W.2d 86, 90 (1995) (quoting United States v. City of New Haven, 367 F. Supp. 1338, 1340 (D. Conn. 1973), *aff'd*, 496 F.2d 452 (2d Cir. 1974)).

specific jurisdiction. In *Skysign International, Inc. v. City and County of Honolulu*,[120] the plaintiffs brought an action after local ordinances prevented them from conducting aerial advertising using signage, even though the FAA had issued a Certificate Of Waiver (COW) allowing Skysign to conduct its advertising flights.[121] The Ninth Circuit Court of Appeals held the local city and county's general signage and aerial signage ordinances were not preempted by federal aviation law, and the FAA COW provided to the plaintiff did not preclude enforcement of the local ordinances.[122] The decision effectively upheld previous decisions that the federal government controls the navigable airspace and the operation of aircraft when in that airspace, but it also held that local jurisdictions can maintain some control over specific operations of those aircraft while in their airspace.[123]

In *Skysign Int'l*, the court concluded that the FAA had not exerted its statutory authority to a degree that warranted a holding it had preempted the entire field, noting, "[T]he 'mere volume and complexity' of the FAA's regulatory scheme do not, without some affirmative accompanying indication, compel a conclusion that the agency has sought to occupy the field to the full."[124] However, the Ninth Circuit noted in its ruling that Congress had left open the door for the FAA to regulate aerial advertising should it choose to, through the use of its authority to develop regulations for the use of the navigable airspace.[125] However, in regards to UAS, the FAA clearly has exerted its authority over their operation, effectively excluding any local control over UAS.[126]

C. Current Federal Regulations Concerning UAS

As noted, the FAA controls all airspace over the domestic United States.[127] This includes the operation of aircraft, which the FAA defines as "a device that is used or intended to be used for flight in the air."[128] This definition encompasses the use and operation of UAS in domestic airspace. Recently, the FAA put forth a series of orders regarding the operation of UAS in United States airspace as a temporary stopgap, as many smaller UAS platforms could fall under the

120. 276 F.3d 1109 (9th Cir. 2002).
121. *Id.* at 1113–14.
122. *Id.* at 1115–18.
123. *Id.*
124. Skysign Int'l, Inc. v. City & Cnty. of Honolulu, 276 F.3d 1109, 1116 (9th Cir. 2002) (quoting Hillsborough County v. Automated Med. Labs., 471 U.S. 707, 719 (1985)).
125. *See id.*
126. *See Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.
127. *See* City of Burbank v. Lockheed Air Terminal Inc., 411 U.S. 624, 626–27 (1973).
128. 14 C.F.R. § 1.1 (2014).

definition of an RC aircraft.[129] The FAA's ability to regulate small, unmanned aircraft falling under the definition of RC aircraft was bolstered by the recent NTSB decision in *Huerta v. Pirker*.[130]

Currently, routine operation of UAS over densely populated areas is prohibited by the FAA,[131] and the use of UAS in domestic airspace is limited to that of government entities.[132] There are three pathways for lawful usage of UAS in the domestic United States: (1) public agencies must obtain a COA, (2) private entities must obtain specific FAA permission[133] in the form of an Experimental Airworthiness Certification,[134] or (3) a private entity must operate the UAV consistent with the model aircraft standards.[135] As of December 4, 2013, the FAA had issued only 545 active COAs to public agencies.[136] However the FAA Modernization and Reform Act of 2012[137] contained a congressional mandate for the FAA to devise a plan allowing implementation of UAS' use in the nation's airspace.[138] In November 2013, the FAA presented a roadmap for integration of civil UAS, as well as a comprehensive plan to accelerate this integration safely.[139]

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129. *See* Joseph J. Vacek, *Big Brother Will Soon Be Watching—or Will He? Constitutional, Regulatory, and Operational Issues Surrounding the Use of Unmanned Aerial Vehicles in Law Enforcement*, 85 N.D. L. Rev. 673, 678 (2009).

130. No. CP-217 (N.T.S.B. March 6, 2014), *see supra* notes 55–59 and accompanying text.

131. *See Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.

132. *See Press Release—FAA Selects Unmanned Aircraft Systems Research and Test Sites*, FED. AVIATION ADMIN. (Dec. 30, 2013), http://www.faa.gov/news/press_releases/news_story.cfm?newsid=15576, *archived at* http://perma.unl.edu/7DLM-8BAE.

133. The applicable regulations for an experimental certificate are found in 14 C.F.R. §§ 21.191, 21.193, 21.295 (2014).

134. > Obtaining an experimental airworthiness certificate for a particular UAS is currently the only way civil operators of unmanned aircraft are accessing the NAS (National Airspace System). Experimental certificate regulations preclude carrying people or property for compensation or hire, but do allow operations for research and development, flight and sales demonstrations and crew training.
>
> *Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.

135. *See* Unmanned Aircraft Operations in the National Airspace System, 72 Fed. Reg. 6689, 6690 (Feb. 13, 2007).

136. *Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.

137. FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, 126 Stat. 11 (2012).

138. *See id.* at §§ 332(a)(1), (a)(2)(A)(iii), 126 Stat at 73 ("[T]he Secretary of Transportation, in consultation with representatives of the aviation industry, Federal agencies that employ unmanned aircraft systems technology in the national airspace system, and the unmanned aircraft systems industry, shall develop a comprehensive plan to safely accelerate the integration of civil unmanned aircraft systems into the national airspace system.").

139. FED. AVIATION ASS'N, INTEGRATION OF CIVIL UNMANNED AIRCRAFT SYSTEMS (UAS) IN THE NATIONAL AIRSPACE SYSTEM (NAS) ROADMAP (1st ed. 2013), *archived at* http://perma.unl.edu/LS2J-YA6P; *see also* Letter to the Chairman of the Comm. on Commerce, Science and Transp. John D. Rockefeller IV from Sec'y of Transp.

The FAA has been active in its goal of incorporating UAS use in the United States. In December 2013, the FAA announced the selection of six test sites where this integration will be researched: Griffiss International Airport in New York, Virginia Polytechnic Institute and State University (Virginia Tech), the University of Alaska, the State of Nevada, the North Dakota Department of Commerce, and Texas A&M University–Corpus Christi.[140] These test sites were considered in part because of the different aspects they offer, including adverse weather, geographic diversity, and congested airspace.[141] The North Dakota Department of Commerce was granted a COA to begin operation of UAS at its Northern Plains Unmanned Aircraft Systems Test Site. The team was to begin flight operations the week of May 5, 2014.[142] As of August 13, 2014, all six test sites were operational,[143] and UAS flights began.[144] As of June 2014, the FAA issued an addi-

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Anthony R. Foxx (Nov. 6, 2013), *archived at* http://perma.unl.edu/ZN6N-8KTT (indicating availability of the UAS Comprehensive Plan).

140. *See* Fed. Aviation Ass'n, *FAA Selects Six Sites for Unmanned Aircraft Research*, FAA NEWS & UPDATES (Dec. 30, 2013), http://www.faa.gov/news/updates/?newsId=75399, *archived at* http://perma.unl.edu/E767-GL55 (indicating that Griffiss International Airport, a former Air Force base near Rome, New York, will conduct test flights in Cape Cod in Massachusetts; Virginia Tech will fly in Virginia and New Jersey, in partnership with Rutgers University; and the University of Alaska will conduct tests in Hawaii, Oregon, and Alaska).

141. *See Press Release—FAA Selects Unmanned Aircraft Systems Research and Test Sites*, *supra* note 133.

142. *See Press Release—FAA Announces First UAS Test Site Operational*, FED. AVIATION ADMIN. (April 21, 2014), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=16154&cid=TW213, *archived at* http://perma.unl.edu/U3CF-YEVC.

143. *See Press Release—FAA Announces Alaska UAS Test Site Begins Research Flights*, FED. AVIATION ADMIN. (May 5, 2014), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=16194, *archived at* http://perma.unl.edu/B42G-SQSM; *Press Release—FAA Announces Nevada UAS Test Site Now Operational*, FED. AVIATION ADMIN. (June 9, 2014), http://www.faa.gov/news/press_releases/news_story.cfm?newsid=16334, *archived at* http://perma.unl.edu/APL8-WS8J; *Press Release—FAA Announces New Virginia Tech UAS Test Site Now Operational*, FED. AVIATION ADMIN. (August 13, 2014), https://www.faa.gov/news/press_releases/news_story.cfm?newsId=16875, *archived at* http://perma.unl.edu/DP82-RY2V; *Press Release—FAA Announces New York UAS Test Site Now Operational*, FED. AVIATION ADMIN. (August 7, 2014), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=16834, *archived at* http://perma.unl.edu/KB98-XSJX; *Press Release—FAA Announces Texas UAS Test Site Now Operational*, FED. AVIATION ADMIN. (June 9, 2014), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=16454, *archived at* http://perma.unl.edu/393S-X3A7.

144. *Fully Operational Lone Star Center Conducts Drone Test Flights Over South Texas Ranchland*, TEX. A&M UNIV. CORPUS CHRISTI, http://tamucc.edu/news/2014/06/062614%20Lone%20Star%20UAS%20Center%20.html#.VBW9rUuxGzA (last visited Sept. 14, 2014), *archived at* http://perma.unl.edu/GTR9-EK68.

tional 481 COAs for governmental operations of UAS.[145] The FAA also approved the first commercial use of UAS by authorizing BP and Aerovironment[146] to operate UAS over BP's pipelines and property in Prudhoe Bay, Alaska.[147] This approval was the FAA's attempt toward regulated implementation of UAS into domestic use.

Unfortunately, the undeniable fact that the FAA is unable to implement regulations quickly enough to compensate for the speed of UAS technology, coupled with the problematic holding in *Huerta v. Pirker*,[148] has led to numerous confrontations between the FAA and users of UAS.[149] In certain circumstances the FAA's own deviation from its declared methods to operate UAS domestically continues to

145. *Freedom of Information Act Responses,* FED. AVIATION ADMIN., https://www.faa.gov/uas/public_operations/foia_responses/ (last visited Sept 13, 2014), *archived at* http://perma.unl.edu/7YEZ-6LWE.

146. BP—sometimes referred to by its former name British Petroleum—is a British multinational oil and gas company headquartered in London, England, works in alternative energy, oil exploration, production and refinement as well as the operation of more than 4,000 miles of pipelines in the United States. *BP: What We Do*, BP.COM, http://www.bp.com/en/global/corporate/about-bp/bp-worldwide/bp-in-america/our-us-operations.html (last visited Sept. 22, 2014), *archived at* http://perma.unl.edu/N7NT-765C.

> AeroVironment, Inc. designs, develops, produces and supports a portfolio of products and services. The Company operates in two segments: Unmanned Aircraft Systems (UAS) and Efficient Energy Systems (EES). The Company's UAS business segment focuses primarily on the design, development, production and support of UAS that provide situational awareness and other mission effects.

AeroVironment, Inc., GOOGLE FINANCE, https://www.google.com/finance?cid=710041 (last visited Sept. 22, 2014), *archived at* http://perma.unl.edu/BK9X-LQ6R.

147. Aimee Turner, *FAA Approves First Commercial UAS Over Land*, AIRTRAFFICMANAGEMENT.NET (June 10, 2014), http://www.airtrafficmanagement.net/2014/06/faa-approves-first-commercial-uas-over-land/, *archived at* http://perma.unl.edu/4P9P-PL26.

148. No. CP-217 (N.T.S.B. March 6, 2014). *See supra* notes 53–54 and accompanying text.

149. For example, Beatrice, Nebraska native Justin Kyser received warnings from the FAA that his planned commercial use of his UAS for aerial photography in and around Nebraska violated federal regulations. Richard Piersol, *Lincoln Has Its Own Drone Dust-Up with the Feds*, LINCOLN J. STAR (July 20, 2014), http://journalstar.com/business/local/lincoln-has-its-own-drone-dust-up-with-the-feds/article_4bac1a43-4d41-5789-9933-cd2d8ffefa30.html, *archived at* http://perma.unl.edu/ET2R-NMPW. In September of 2014, it was reported that a Philadelphia company, "DroneCast," operated an eleven-pound UAS carrying an advertising banner twenty feet above the Las Vegas Strip outside the Mirage Hotel in Las Vegas. This was a commercial use of UAS technology in the domestic United States, in a highly populated area, in direct opposition to current FAA standards. Richard Velotta, *That Strip Drone Flight? It Violated FAA Policy,* LAS VEGAS REV.-J. (Sept. 7, 2014), http://www.reviewjournal.com/business/aviation/strip-drone-flight-it-violated-faa-policy, *archived at* http://perma.unl.edu/XT92-HBEY. *See also* Shahani, *Are Filmmakers Using Drones Illegally? Looks Like it*, NPR: ALL TECH CONSIDERED (May 16, 2014, 3:41 AM) http://www.npr.org/blogs/alltechconsidered/2014/05/16/312487924/are-filmmakers-using-drones-illegally-looks-

complicate the legal framework.[150] While the FAA has put forth specific guidelines for the use of commercial UAS, confusion still remains on their legal operation. Because the decision in the *Pirker* appeal was limited in scope, until the FAA's final regulations are proposed and adopted (due in September of 2015), commercial use of UAS will continue in violation of current FAA regulations.[151]

A number of federal laws have been proposed regarding the use of UAS. The major theme among the proposed legislation seeks to regulate the use of the technology when used for government and law enforcement surveillance purposes.[152] In addition, individuals have some protection from government intrusion with the use of UAS by way of the Fourth Amendment and previous Court rulings regarding the use of emerging technology and government surveillance.[153]

One federal law that also would restrict the use of UAS by private individuals is the Safeguarding Privacy and Fostering Aerospace Innovation Act of 2013.[154] Introduced by Senior Senator Mark Udall of Colorado, the legislation would provide nationwide protection prohibiting private individuals from using UAS to gather surveillance, stalk,

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like-it, *archived at* http://perma.unl.edu/YQ7L-X2CY (indicating that filmmakers are using drones illegally).

150. In one instance, the FAA had previously ordered Texas EquuSearch, a nonprofit organization, to stop all operations of UAS, but granted Texas EquuSeach an emergency waiver from this order. This emergency waiver allowed the nonprofit organization to utilize its various UAS devices in an effort to search for a missing person, and effectively allowed the group to forego the typical COW required from the FAA. Eric Aasen, *FAA Authorizes Drone to Help Search for Missing North Texas Woman,* KERA NEWS (Sept. 11, 2014), http://keranews.org/post/faa-authorizes-drone-help-search-missing-north-texas-woman, *archived at* http://perma.unl.edu/K3YJ-GTQG; *see also* Craig Whitlock, *FAA Said to Be Planning to Let Filmmakers Operate Drones in Populated Areas*, WASH. POST (Sept. 24 2014, 8:37 PM) http://www.washingtonpost.com/world/national-security/faa-said-to-be-planning-to-let-filmmakers-operate-drones/2014/09/24/cea7bc60-4415-11e4-b437-1a7368204804_story.html, *archived at* http://perma.unl.edu/4GSK-SXRP (noting "the Federal Aviation Administration is planning to announce . . . it will permit Hollywood filmmakers to operate drones on movie sets").

151. Huerta v. Pirker, No. CP-217 (N.T.S.B. Nov. 18, 2014). *See supra* notes 55–59 and accompanying text.

152. *See* Drone Aircraft Privacy and Transparency Act of 2013, H.R. 2868, 113th Cong. (2013) (proposing strict guidelines for the collection and retention of data gathered through the operation of UAS); *see also* Preserving Freedom from Unwarranted Surveillance Act of 2012, S. 3287, 112th Cong. § 3 (2012) (proposing total prohibition of U.S. government use of UAS for surveillance).

153. *See* Kyllo v. United States, 533 U.S. 27 (2001) (holding law enforcement use of a thermal imaging camera to detect activity occurring inside of a residence was a search for purposes the Fourth Amendment); *see also* United States v. Jones, 132 S. Ct. 945 (2012) (holding law enforcements installation and use of Global-Positioning-System (GPS) tracking device for surveillance constituted a Fourth Amendment search requiring a warrant).

154. Safeguarding Privacy and Fostering Aerospace Innovation Act of 2013, S. 1057, 113th Cong. (2013).

or harass other individuals.[155] As of May 2013, this bill had been referred to committee.[156] There is some promise that the Constitution and potential federal regulations could offer protection from what many deem to be inappropriate use of UAS by regulating their use to conducting surveillance or recording individuals' activities. There is even more hope for additional protection from state legislation.

D. Local Laws Regulating UAS

Sixteen states have enacted twenty laws addressing UAS use, and as of April 2014 thirty-five states have considered UAS bills and resolutions.[157] Common issues addressed in the legislation include defining the technology; establishing categories of how UAS can be used by law enforcement, other state government agencies, and the general public; making regulations for its use in hunting game; and the FAA UAS test sites.[158]

Many of the enacted or proposed state laws deal specifically with law enforcement use of the technology, but fail to address other potential negative aspects related to UAS use. This specific problem was the case in Nebraska with Legislative Bill LB 412, called the Adopt the Freedom from Unwarranted Surveillance Act. The bill was introduced by Senator Paul Shumacher during the First Session of the 103rd Legislature of the Nebraska Unicameral.[159]

LB 412, which failed to proceed out of the judiciary committee, would have established Nebraska's definition of a UAS, made it illegal for state and local law enforcement agencies to gather evidence or information with a UAS, and excluded any evidence obtained from such unauthorized use. It also would have provided a right to initiate a civil action against law enforcement to obtain relief, arguably making enforcement of any violation of the law far more effective.[160] The proposed bill was an exceptional effort to provide some protection against foreseeable negative UAS uses, but it failed to address additional issues likely to present themselves when UAS use is fully implemented in domestic airspace. Specifically, it failed to address the use of the technology by private individuals to gather data, photographs, or simply operate their devices in a manner which disturbs individuals'

155. *See* Mike Saccone, *Udall Introduces Bill to Protect Americans' Privacy from Private Drone Operators*, MARK UDALL (May 23, 2013), http://www.markudall.senate.gov/?p=press_release&id=3450, *archived at* http://perma.unl.edu/LU5G-FJ7J.
156. S. 1057.
157. *See* Rich Williams, *Current Unmanned Aircraft State Law Landscape*, NAT'L CONFERENCE OF SATE LEGISLATURES (April 9, 2014), http://www.ncsl.org/research/civil-and-criminal-justice/current-uas-state-law-landscape.aspx, *archived at* http://perma.unl.edu/NGE8-G5BG.
158. *See id.*
159. LB 412, 103rd Leg., First Sess. (Neb. 2013).
160. *Id.*

peace and quiet. While both federal and state statutory schemes seek to offer protection from intrusions of UAS operation, some protection remains for personal property rights individuals possess in the airspace over their property.

E. Personal Property Rights Regarding Airspace

The first written theory of airspace property rights comes from the Roman maxim *cujus est solum, ejus est usque ad coelom* (whoever has the land possess all the space upwards to an indefinite extent),[161] and was later promoted in English common law by Sir Edwin Coke.[162] With the growth of aviation during the military buildup leading to the Second World War, including private civilian aviation, the American judiciary saw a number of airspace trespass and nuisance cases, and a great legal debate over airspace property rights occurred.[163]

This legal debate resulted in a full spectrum of different theories about the ownership individuals possess in the airspace over their private property. The spectrum ranged from absolute ownership, to ownership of a designated fixed height,[164] to absolutely no airspace ownership whatsoever.[165] One of the first cases dealing with private individuals' ownership of the airspace over their land was decided in 1946 by the United States Supreme Court in *United States v. Causby*.[166]

In *Causby*, the U.S. military began using an airport situated near the plaintiff's property, which included a chicken farm, to conduct flight operations at all hours of the day and night.[167] The Causbys brought a claim against the federal government based on rights under the Takings Clause of the Fifth Amendment, arguing that military

161. *See* John C. Cooper, *Roman Law and the Maxim* Cujus Est Solum *in International Air Law*, 1 McGill L.J. 23, 27–28 (1952); Herbert D. Klein, *Cujus Est Solum Ejus Est . . . Quousque Tandem?*, 26 J. Air L. & Com. 237, 240 (1959); Francesco Lardone, *Airspace Rights in Roman Law*, 2 Air L. Rev. 455 (1931).

162. *See generally* Robert A Wright, The Law of Airspace 11–30 (1st ed. 1968) (describing the historic common law approach of tying ownership of airspace with ownership of the land surface).

163. *See* Colin Cahoon, *Low Altitude Airspace: A Property Rights No-Man's Land*, 56 J. Air L. & Com. 157, 165 (1990).

164. Ownership to a fixed height theory proposes a landowner's property rights to airspace is strictly defined by a horizontal boundary, thereby dividing airspace into property "zones." All airspace above the boundary, a fixed altitude above ground level, is public property. All airspace below the boundary is the property of the landowner. *See id.* at 165; *see also* Burnham v. Beverly Airways, 42 N.E.2d 575, 579 (Mass. 1942) (describing the "navigable air space" as a "public right of air navigation"); Smith v. New England Aircraft Co. Inc., 170 N.E. 385, 393 (Mass. 1930) (holding low-altitude flyovers constitute a trespass by reason of noise and presence of aircraft and its occupants).

165. *See* Cahoon, *supra* note 164, at 166–67.

166. 328 U.S. 256 (1946).

167. *Id.* at 258–59.

aircraft taking off and landing directly over the chicken farm caused disruption of not only the Causby's peace and tranquility, but more importantly, the "death-by-panic" of many of the Causby's chickens induced by the noise and lights of the air traffic.[168]

In searching for an answer to the ownership of airspace rights, the Supreme Court rejected both Lord Coke's absolute ownership theory, as well as the theory that property owners enjoyed absolutely no right to the airspace over their land, and instead moved toward a middle ground.[169] Although the Court conceded the definition of property is normally obtained in reference to local law, the Court appeared to define airspace property independently from any state definition.[170] Most importantly, the Court concluded that airspace is property, and at a minimum a landowner owned as much of the airspace above his or her property that could be occupied and used in connection with the land.[171]

While not definitive, the court appeared to accept a "possible effective possession" theory, where a landowner's airspace property rights are limited to a fixed height depending on the nature of the land and its possible uses.[172] Despite the Supreme Court's decision in *Causby*, many courts continued to use trespass and nuisance doctrines to analyze airspace suits.[173]

Later, in *Griggs v. County of Allegheny,*[174] the Supreme Court faced the issue of individual ownership of airspace rights directly. In *Griggs*, the Court indicated flights above 500 feet occurred in navigable airspace and were not compensable. The area below this flight level still remained questionable.[175] Following *Griggs*, "[a]ll airspace considerations were consolidated into Section 159 of the Restatement (Second) [of Torts], which states in part, 'Flight by aircraft in the air-

168. *Id.*
169. *Id.* at 260–61; *see* Cahoon, *supra* note 164, at 168–69.
170. *Causby*, 328 U.S. at 266–67.
171. *Id.*; *see* Cahoon, *supra* note 164, at 168–69.
172. Cahoon, *supra* note 164, at 165–66. *See also* Swetland v. Curtiss Airports Corp., 55 F.2d 201, 203 (6th Cir. 1932) (noting a property owner has the "dominant right of occupancy" the airspace that he "may reasonably expect to use or occupy himself"); Delta Air Corp. v. Kersey, 20 S.E.2d 245 (1942) (holding use of airspace at a height that does not interfere with the reasonable use of the owner is not a trespass or nuisance); Thrasher v. City of Atlanta, 173 S.E. 817 (Ga. 1934) (same).
173. *See* Cahoon, *supra* note 164, at 173.
174. 369 U.S. 84, (1962).
175. Following the decision in the Causby case, Congress redefined 'navigable airspace' to mean 'airspace above the minimum altitudes of flight prescribed by regulations issued under this chapter, and shall include airspace needed to insure safety in take-off and landing of aircraft.' By the present regulations the 'minimum safe altitudes' within the meaning of the statute are defined, so far as relevant here, as heights of 500 feet or 1,000 feet, "(e)xcept where necessary for takeoff or landing."
Id. at 88 (citation omitted).

space above the land of another is a trespass if, but only if, (a) it enters into the immediate reaches of the airspace next to the land, and (b) it interferes substantially with the other's use and enjoyment of his land.'"[176]

The modern view recognizes that a gray area exists in regards to who owns the rights to altitudes below 500 to 1,000 feet AGL.[177] Most recent judicial opinions focus on interference with a landowner's use and enjoyment.[178] Ultimately, the rights and ownership of low-altitude airspace still have not been definitively determined, and this will be crucial to the successful implementation of UAS into domestic airspace. From ground level to between 700 and 1,200 feet AGL is considered Class G airspace,[179] and individuals operating aircraft in this area require no approval for either the operator or aircraft from ATC or the FAA.[180] Therefore the only real recourse landowners maintain for intrusions into the low-altitude airspace above their property is a private action in tort, placing the burden and expense upon the landowner to prosecute any trespasses that may occur against them.

Many imaginable issues present themselves with the implementation of UAS into the domestic airspace, which the laws have not addressed adequately. These include problems associated with increased air traffic, liability for damages caused by the technology, and concerns regarding privacy and nuisance associated with the use of UAS.

IV. SOME FORESEEABLE PROBLEMS OF DOMESTIC USE OF UNMANNED AERIAL SYSTEMS

A. Increased Air Traffic

The numbers of UAS operating in the domestic airspace is predicted to rise in the coming years,[181] which will result in a great amount of in-sky congestion. Some of this UAS traffic has already af-

176. *See* Cahoon, *supra* note 164, at 182 (quoting RESTATEMENT (SECOND) OF TORTS § 159).

177. Persyn v. United States, 34 Fed. Cl. 187, 195 (1995), *aff'd*, 106 F.3d 424 (Fed. Cir. 1996) ("Airspace above 1,000 feet in the congested areas of cities, towns or villages, and 500 feet in uncongested areas, is navigable, or public, airspace, see 14 C.F.R. § 91.79 (1982), and the owner of subadjacent land has no claim for compensation for its use.").

178. *See, e.g.*, Lacy v. United States, 595 F.2d 614, 618 (Ct. Cl. 1979).

179. *See* AERONAUTICAL INFORMATION MANUAL, *supra* note 107, at 3-1-1 to 3-3-1.

180. *See id.*

181. "The FAA currently estimates as many as 7,500 small commercial UAS may be in use by 2018, assuming the necessary regulations are in place. The number may be updated when the agency publishes the proposed rule on small UAS later this year." *FAA Fact Sheet—Myths about the FAA and Unmanned Aircraft*, FED. AVIATION ADMIN. (Feb. 26, 2014), http://www.faa.gov/news/updates/?newsId=76240, *archived at* http://perma.unl.edu/W4G7-E8CG.

fected commercial aviation.[182] However much of this air traffic from UAS will be in the form of flights at lower altitudes, and this will have the tendency to affect peace and tranquility within our homes. An analogy to this increased air traffic can be made in regards to current ground-based delivery services for items such as mail, packages, and food delivery.

Traffic from these delivery services can be bothersome, but it is controlled in part by local regulations, such as zoning ordinances. Limiting businesses that use delivery to certain areas allows people, when choosing where they live, to calculate what disturbances they will experience. This is also illustrated by examining land near flight paths of airports, in that individuals can have some advanced knowledge of the flight operations and how they are carried out before they take ownership of land.

However, because many smaller UAS will be operated at lower altitudes, their flight paths will be unknown. An individual could unknowingly find his or her property in the path of frequent UAS travel patterns. These examples alone do not account for what simply will be the increase in overall air traffic as businesses conceivably convert to aerial delivery. Arguably, with increased air traffic, we will witness an increase in the amount of property damages when some of those devices fail, or are involved in accidents.

B. Tort Liability

Tort liability will be an issue for UAS implementation in a number of ways. Nearly all mechanical devices will fail.[183] UAS will be no exception. Numerous UAS equipment failures have come to light.[184]

182. For example in July of 2014, two UAS nearly collided with a NYPD helicopter on patrol over the George Washington Bridge in Manhattan. Larry Celona, *2 Drones in Near-Miss with NYPD Chopper,* N.Y. POST, July 7, 2014, http://nypost.com/2014/07/07/two-drones-in-near-miss-with-nypd-copter-over-gwb/, *archived at* http://perma.unl.edu/Q3DA-M6TS. *See also* Jason Rabinowitz, *Pilots Report Drone Interfering with Flights on Approach to JFK Airport,* NYC AVIATION, http://www.nycaviation.com/2013/03/pilots-report-drone-interfereing-with-flights-on-approach-to-jfk-airport/#.VCGtUUuxGzA (last visited Sept. 22, 2014), *archived at* http://perma.unl.edu/7X68-AMTQ (reporting that drones have been interfering with airplane flight paths near the JFK airport).

183. *See* Robert Capps, *Why Things Fail: From Tires to Helicopter Blades, Everything Breaks Eventually*, WIRED (Oct. 19, 2012, 3:00 PM), http://www.wired.com/2012/10/ff-why-products-fail/.

184. Colin Schultz, *There Have Been 418 Major Drone Crashes Since 2001, Many of Them in the United States,* SMITHSONIAN.COM, June 26, 2014, http://www.smithsonianmag.com/smart-news/there-have-been-418-major-drone-crashes-2001-many-them-united-states-180951876/?no-ist, *archived at* http://perma.unl.edu/YB67-XTP3. *See also* Kate Grise and Dave Alsup, *Tourist Reportedly Crashes Drone into Yellowstone National Park's Largest Hot Spring,* CNN (Aug. 7, 2014), http://www.cnn.com/2014/08/07/us/drones-yellowstone/, *archived at* http://perma

One of the most alarming of these instances was a 375-pound Shadow reconnaissance UAS operated by the Army which crashed just outside of a Jonestown, Pennsylvania grade school, reportedly just missing the building while classes were in session.[185] With the increased number of apparatuses in the air comes the increased chance of property damage when failures occur. The question of who should be responsible when this technology fails and falls from the sky is one of the areas regulations pertaining to domestic UAS use will need to address.

Potential liability issues can also result when those who operate UAS do so in a negligent or reckless manner. Such a situation arose in 2011. Raphael Pirker was filming for the University of Virginia when he allegedly operated an "aircraft in a careless or reckless manner," in violation of federal regulations.[186] These allegations including flying the UAS below rooftop level, within twenty-five feet of buildings, within twenty feet of active streets, and within fifty feet of individuals—so low and close that pedestrians were forced to scatter.[187] As the number of flight systems increase, so too will the probability of operator mishaps and misuse of vehicles, potentially resulting in property damage and personal injury. This misuse also could include use of the technology to trespass and intrude on individual's privacy.

C. Trespass and Privacy Intrusion

One of the most important issues with the increased domestic use of UAS will be the trespass onto private property and intrusion of individual privacy.[188] Given the posture of the Supreme Court, and look-

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.unl.edu/5LDQ-5M7M (reporting that a drone crashed into a hot spring in Yellowstone National Park).

185. Craig Whitlock, *Crashes Mount as Military Flies More Drones in U.S.,* WASH. POST (June 22, 2014), http://www.washingtonpost.com/sf/investigative/2014/06/22/crashes-mount-as-military-flies-more-drones-in-u-s/, *archived at* http://perma.unl.edu/33QU-AYQV.

186. 14 C.F.R. § 91.13 (2014) ("No person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another.").

187. *See* LATHAM & WATKINS, *supra* note 54.

188. In the race for an exclusive wedding picture, Marti's colleague Claudio Meier came up cold. The freelance photographer equipped himself with the latest technology and launched a remote-controlled drone from in front of Tina Turner's estate. Meier wanted to fly the aircraft, a so-called quadrocopter, over Turner's extravagant garden in order to get a good shot of the event.

Martin Muller & Andreas Ulrich, *Snapping Tina's Wedding: Paparazzi Turn to Drones*, ABC NEWS (Aug. 3, 2013), http://abcnews.go.com/International/snapping-tinas-wedding-paparazzi-turn-drones/story?id=19842233, *archived at* http://perma.unl.edu/7CFR-5H62.

ing to decisions such as *Kyllo* and *Jones*,[189] government agencies will be constrained in the use of the technology. Additional protection exists against government use for surveillance under the Fourth Amendment[190] and individual state constitutions.[191] However, private parties are not constrained by the constitutional limits upon government entities.

UAS with surveillance capabilities are readily affordable today,[192] placing them easily within reach of many individuals and increasing the number of people with the ability to commit trespass and intrude against private individuals (e.g. photographing into an individual's home). Given the technological advances in cameras,[193] it would also be possible to position a UAV just a few hundred feet away from private property above a park or city street, allowing the operator to train and focus the camera into the home, committing the same intrusion while not actually trespassing into private property. While statutory and common law remedies exist to limit the ability of private UAS operators to violate privacy and property rights, large gaps continue to exist in regards to UAS, and will arguably be the biggest hurdle the technology will have to surmount to see successful implementation into domestic airspace.

As the Courts have found in decisions such as *Causby*[194] and *Griggs*,[195] individuals own as much of the space above the ground as they can occupy or make use of, and a landowner's property interest in his or her land extends to the airspace directly over the property to the extent the airspace can be used to benefit the underlying land. However, these decisions were decided at a time before UAS existed. Laws specifically relating to the use of UAS should be created in a proactive

189. *See* Kyllo v. United States, 533 U.S. 27 (2001) (holding law enforcement use of a thermal imaging camera to detect activity occurring inside of a residence was a search for purposes the Fourth Amendment); *see also* United States v. Jones, 132 S. Ct. 945 (2012) (holding law enforcements installation and use of Global-Positioning-System (GPS) tracking device for surveillance constituted a Fourth Amendment search requiring a warrant).

190. U.S. CONST. amend IV ("The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.").

191. *See, e.g.*, NEB. CONST. art. I, § 7 ("The right of the people to be secure in their persons, houses, papers, and effects against unreasonable searches and seizures shall not be violated; and no warrant shall issue but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the person or thing to be seized.").

192. *Parrot AR.Drone 2.0 Elite Edition Quadricopter*, *supra* note 49.

193. *See* John Villasenor, *Observations from Above: Unmanned Aircraft Systems and Privacy*, 36 HARV. J.L. & PUB. POL'Y 457, 464 (2013).

194. U.S. v Causby, 328 U.S. 256 (1946).

195. Griggs v. County of Allegheny, 369 U.S. 84 (1962).

manner to address rapidly changing technology, mitigate negative aspects of the technology, and allow successful implementation into the nation's airspace.

D. How Should the Law Respond?

UAS are by no means new technology.[196] But their use in domestic airspace is a relatively new concept.[197] Like other recent technologies put into domestic use, such as wireless communications, electronic commerce, and the Internet, the concept of domestic UAS has many potential means to enhance our daily lives by providing us with such things as convenience, cost savings, and public safety. However, potential for abuse of this technology also exists. Unfortunately for the implementation of domestic UAS, society has seen other emerging technologies evolve (e.g. the Internet) to produce not only benefits, but negative effects as well.

Because people today are more wary of the negative aspects of a new technology, the implementation of UAS into domestic airspace will realistically be met with some apprehension. Domestic use of UAS has many potential benefits, so it is important for the laws regarding their use to address negative ramifications in advance of implementation. Addressing these issues in advance will ensure their public acceptance, allowing the positive benefits to be fully realized.

Many proactive legislative approaches could address the downsides to use of UAS in domestic airspace. These approaches include better regulation of the technology, including operator and insurance requirements, better defining the individual ownership rights of their airspace over property, and ultimately the federal government's ceding some control of low-altitude airspace to local jurisdictions. It also will be important for the federal government to work closely with local governments when determining specific laws' passage.

1. Cede Control of Low Altitude Airspace to Local Jurisdictions

One approach to the negative aspects of domestic UAS use would be for the FAA to cede some control of low-altitude airspace to local jurisdictions. As established by jurisprudence, the ownership and control of airspace between the ground and 700 to 1,200 feet AGL is a gray area.[198] When combined with strong legal authority of the FAA for controlling airspace,[199] any air traffic occurring over 500 feet AGL

196. *See Langley Aerodrome Number 5*, *supra* note 15 (noting the first successful flight of an unpiloted, engine-driven aircraft in 1896).
197. *See Fact Sheet—Unmanned Aircraft Systems (UAS)*, *supra* note 3.
198. *See Griggs*, 369 U.S. 84. *See also* Cahoon, *supra* note 164, at 162 (noting there has been no resolution to the problem of property rights in low altitude airspace).
199. *See* 49 U.S.C. § 40103(a)(1) (2012) ("The United States Government has exclusive sovereignty of airspace of the United States.").

is preemptively controlled by the federal government.[200] This exclusive control was acceptable in an earlier time when air traffic consisted only of manned aircraft, whose costly operation limited the amount of potential traffic and intrusion into private property. The current climate, where domestic use of UAS is increasing as prices for equipment fall, creates a system of inadequate federal control.

Allowing local control of low-altitude airspace would alleviate many concerns about the technology. Granting local jurisdictions control allows regulatory decision making at a level at which individual property owners could more effectively reach those who legislate. Local control provides each community the ability to decide the level of protection from intrusions onto private property by UAS it desires. With this ability to control low-altitude airspace, states and municipalities would be able to legislate the technologies' use, even establishing UAS-free zones if desired.[201]

The strongest counterargument for the forsaking of FAA control of low-altitude airspace is that which occurred when aviation itself first became a reality. Free and open airways are vital to the success of air traffic.[202] It would be overly burdensome for aircraft traversing over several different states in short periods of time to comply with differing regulations when crossing state lines. To avoid issues with the flow of traditional commercial and civil air traffic, this local control of airspace could be narrowly tailored to specifically regulate UAS operation.

2. Establish a Fixed-Height Theory of Airspace Ownership over Private Property

Defining an individual's ownership of the airspace over his or her property to a fixed height of a higher altitude (e.g. 1,000 feet AGL) also would help with potential fears surrounding domestic UAS use. By defining ownership, individuals would know exactly what they owned, and if intruded upon would give property owners the ability to take action against the operators. Establishing this property right at the federal level would provide a minimum protection should an individual affected in some negative way by a UAS seek legal relief. Of

200. *See* Allegheny Airlines, Inc. v. Village of Cedarhurst, 238 F.2d 812, 815 (2d Cir. 1956) (holding that village ordinances forbidding airplanes from flying over at altitudes of less than 1,000 feet unconstitutionally preempt the exclusive authority of Congress to delegate the regulation of the navigable airspace).

201. *See* Scott Rasmussen, *From the frontier: Waldron Declares Itself 'Drone-Free Zone', Lobbies County Council to Follow Suit*, J. SAN JUAN ISLANDS (Dec. 31, 2013), http://www.sanjuanjournal.com/news/238311741.html, archived at http://perma.unl.edu/6RBV-48W9.

202. "To hold that every overflight was an actionable trespass would hamper the young industry and the military's ability to train . . . ." Cahoon, *supra* note 164, at 163.

course states could still be free to implement greater protections as they saw fit, especially if some control of low-altitude airspace were granted to the states. Additional protections could be had by providing federal rights of action[203] for damages against operators of UAS should they intrude into private individuals' airspace.

Minimum federal standards would benefit operators of UAS as well. Those who desired to use the technology in domestic airspace would be aware of the minimum protections afforded to private individuals regarding their property rights, providing a clear baseline for conduct when employing the equipment. These standards will help to alleviate the type of confusion that exists with the current legal rulings regarding the operation of UAS in the domestic United States, when the FAA finally allows commercial use.

3. Regulate Equipment and Operator Requirements

The FAA already regulates not only the nation's airspace,[204] but also the certifications of the operators and aircraft using that airspace.[205] UAS should be no exception. It will be important for the FAA to establish and ensure the actual aerial vehicles, those "piloting" them, and the associated technology (e.g. methods of communication between the operator and vehicle) are reliable and meet minimum standards for the safety of people and property on the ground. Because many UAS meet RC aircraft standards,[206] the FAA should reconsider its somewhat hands-off approach to model aircraft operation[207] and consider more stringent regulations of this hobby. Although in June of 2014, the FAA published a Federal Register notice regarding the interpretation of the special rules for model aircraft contained in the FAA Modernization and Reform Act of 2012,[208] it appears the FAA is taking a step in this direction. Besides maintaining minimum proficiency requirements to operate UAS, minimum insurance coverage should be mandated for individuals operating UAS in domestic airspace, similar to that which is required in various states for automobiles.[209] Additionally, certain requirements for outfitting

203. *See* 42 U.S.C. § 1983 (2012).
204. 49 U.S.C. § 40103 (2012).
205. 14 C.F.R. §§ 21–49, 61 (2014).
206. *See supra* note 39.
207. *See Drones vs. Radio Controlled Aircraft: Operational Oversight*, RCFLIGHTLINE, http://rcflightline.com/drones-vs-radio-controlled-aircraft-operation-oversight/ (last visited Aug. 13, 2014), *archived at* http://perma.unl.edu/SC7U-2VLC.
208. *Unmanned Aircraft Systems,* FED. AVIATION ADMIN., www.faa.gov/uas/ (last visited Sept. 12, 2014), *archived at* http://perma.unl.edu/7TZ3-SG4B.
209. "Automobile insurance may be required by either compulsory insurance statutes or financial responsibility laws. Twenty-one states have mandatory insurance laws." Regina Austin, *The Insurance Classification Controversy*, 131 U. PA. L. REV. 517, 520 n.9 (1983).

of the flight vehicle with specific safety equipment[210] should be required, such as the use of sense and avoid technology which is required on commercial aircraft.[211]

These are just a few examples of regulations to be considered in order to facilitate the implementation of UAS into domestic airspace. Regardless of what laws and regulations are ultimately put into place, the FAA should seek input from representatives of each state when making its decisions. This collaboration would result in a more uniform regulatory framework and avoid the creation of a patchwork of local laws from state to state and city to city, avoiding ambiguity from differing legislation. In the end proactive legislation would provide greater peace of mind to individuals to ameliorate the negative aspects that could accompany domestic use of UAS.

Ultimately, as with any new technology, it is impossible to foresee all contingencies, practical as well as legal. Therefore, domestic UAS use needs to be monitored closely and reevaluated periodically by regulatory authorities. At a minimum, quarterly reviews of the effects of laws and regulations regarding use should be completed. This would allow unexpected issues to be examined as they came to light, allowing regulations to be quickly modified, ensuring successful continued integration of UAS in the nation's domestic airspace.

V. CONCLUSION

UAS have great potential to benefit our society. From public-safety applications to commercial use, the technology stands to change drastically how we work and live, and has experienced great success to date in military and government applications. The technology allowing UAS to operate is growing by leaps and bounds, and the cost of the systems is falling dramatically, allowing greater use by greater numbers of the population. It is not a matter of if but when the integration and use of UAS will occur in our domestic airspace.

This new technology offers a plethora of benefits. Chief among them are more effective and efficient public safety, cost savings to industries, and convenience that would result from the availability of low-cost aerial transport and observation. Along with those potential benefits are negative aspects, including the increased number of vehicles using an already congested airspace, privacy violations, and questions of liability when damages from the use of UAS occur.

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210. Francis X Govers III, *General Atomics Tests UAV That Can "Sense and Avoid" Other Aircraft*, GIZMAG (Dec. 18, 2013), http://www.gizmag.com/uav-sense-avoid-test-general-atomics/30184/, *archived at* http://perma.unl.edu/9SBJ-MKXK.

211. *Traffic Alert and Collision Avoidance System (TCAS),* HONEYWELL AEROSPACE, http://aerospace.honeywell.com/en/products/safety-systems/traffic-alert-and-collision-systems (last visited Sept. 22, 2014), *archived at* http://perma.unl.edu/PSM6-GYGS.

To realize the benefits of UAS and counter potential negative uses of the technology, legislation must be implemented to facilitate the responsible use of UAS. This legislation should include allowing local governmental jurisdictions some regulatory authority over their low-altitude airspace, an area of the law under exclusive jurisdiction of the FAA, as well as tailored legislation addressing the certification and liabilities of entities operating UAS. Regardless of what is ultimately legislated, the issues surrounding the implementation and use of UAS should be dealt with in advance of the impending domestic use of the technology.