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Drone Drain: How the FAA Can Avoid Draining (and Instead Spur) the American Drone Industry by Adding Nuance to Its Draft Small UAS Rules

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DRONE DRAIN: HOW THE FAA CAN AVOID DRAINING
(AND INSTEAD SPUR) THE AMERICAN DRONE INDUSTRY BY
ADDING NUANCE TO ITS DRAFT SMALL UAS RULES

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ABSTRACT

The Federal Aviation Administration has done much right in the past few months with its draft small UAS rules, but should add nuance to the draft to avoid draining America's nascent drone industry. This Article, which was submitted as an official comment to the FAA by the University of Washington's world-renowned College of Engineering, recommends five essential modifications to enable American competitiveness in this field. First, the FAA should maintain the line-of-sight requirement as a baseline, but allow uses beyond line-of-sight for pilots and aircraft certified to fly with First-Person View or autonomous technology. Second, the FAA should create exceptions to the largely sensible 500-foot ceiling for Small UAS flight, particularly in areas with few low-flying passenger aircraft, and adopt a licensing and certification process for advanced pilots and drones to fly above 500 feet. Third, the FAA should adopt proposed, more relaxed rules for Micro UAS weighing less than 4.4 pounds because different drones present different risks and so should be regulated differently. Fourth, the FAA should adopt an enabling philosophy toward drones, acknowledging that

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their immense economic potential justifies taking manageable safety risks. Fifth, the FAA should actively grant exemptions to the civil ban in the interim of permanent rules, testing drones in society and allowing the FAA to hone the draft rules before they are made permanent in 2017. If the FAA implements these recommendations, it will provide America's emerging drone industry the breathing room to innovative, grow, and compete on the global stage.

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INTRODUCTION

Facing the fast-paced development of unmanned aerial systems (UAS) technology, Congress passed the Federal Aviation Administration Modernization and Reform Act of 2012 (FMRA) to

require the FAA to integrate UAS into domestic airspace by September 30, 2015.¹ The FAA has been slow to act though; it appears that permanent rules will not be forthcoming until 2017, at the earliest.² Meanwhile, the interim ban on non-recreational, civil drone flights will remain in effect, disadvantaging the United States' drone industry against global competition.³ While the FAA submitted more moderate draft rules than many feared, it has a responsibility to listen to the voices of its constituents, improve its draft, and fully enable research and commercial applications in this field.⁴

The current draft small UAS rules do not fully enable American drone research and commercialization. To summarize, the draft rules require that non-recreational, civil Small UAS must stay within "line of sight" of the operator; remain under 500 feet; weigh less than 55 pounds, inclusive of any payload; not exceed 100 miles per hour; not fly over people or populated areas, unless a Micro UAS (under 4.4 pounds); only fly in daylight and conditions with 3-mile visibility; and not fly in class A airspace and get permission for class B, C, D, and E airspace. In addition, operators must pass a knowledge test at an FAA-approved center; obtain a UAS operator certificate; make drones available for testing upon request; report accidents causing injury or damage within ten days; keep their UAS in safe condition and inspect pre-flight; register their UAS with the FAA; and mark their UAS for identification.⁵

Most of these draft rules are sensible and encouraging, which is why the public reaction has generally been welcoming (the

¹ FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, 126 Stat. 11.

² Brian Fung, *The FAA Won't Make Up its Mind on Drone Rules Until 2017 – At the Earliest*, WASH. POST (Dec. 10, 2014), <http://www.washingtonpost.com/blogs/the-switch/wp/2014/12/10/the-faa-wont-make-up-its-mind-on-drone-rules-until-2017-at-the-earliest>.

³ Patrick McKay, *FOIA Response Reveals FAA Routinely Misrepresents the Law Regarding Unmanned Aircraft*, DIY DRONES (Feb. 4, 2014), <http://diydrone.com/m/blogpost?id=705844%3ABlogPost%3A1551726>.

⁴ *DOT and FAA Propose New Rules for Small Unmanned Aircraft Systems*, FED. AVIATION ADMIN. (Feb. 15, 2015), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295.

⁵ *Id.*

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Association for Unmanned Vehicle Systems even called them a “good first step”⁶). Yet, these rules will still prove overburdensome in relation to the risks. They will needlessly constrain many of the operations of researchers like those at University of Washington and at companies like Amazon. The FAA should, therefore, soften its draft Small UAS Rules in the five ways discussed below.

I. KEEP THE LINE-OF-SIGHT REQUIREMENT AS A BASELINE, BUT ALLOW CERTIFIED DRONES AND PILOTS TO FLY BEYOND

The FAA should not require that *all* civil drone operators keep their drones within line of sight while flying. While this may be a sensible baseline requirement, the FAA should allow drones to fly outside of line of sight if pilots and drones are certified to operate with First-Person View (FPV) technology or autonomous onboard Visual and Inertial (VI) sensing technology. These technologies can provide a level of situational awareness similar to that of a manned aircraft operating in similar conditions.

A. *Commercial Benefits and Emerging Technology*

The FAA must understand that many (if not most) of the commercial and scientific benefits of drone flight will be achieved outside of the operator’s direct line of sight. Such uses include surveying crops, pipelines, oceans, and forests, as well as delivering products and medical supplies, performing dangerous jobs, and providing emergency services like search and rescue. The benefits to farming, in particular, are immense. The Association for Unmanned Vehicle Systems International estimates drones will contribute more than \$75 billion to the U.S. agriculture industry in the first decade of its commercial use.⁷ The line-of-sight

⁶ *The Tethers Loosen*, ECONOMIST (Feb. 21, 2015), <http://www.economist.com/news/business/21644153-americas-new-rules-drones-will-keep-some-businesses-grounded-tethers-loosen>.

⁷ Mark Koba, *American Farmers to FAA: Hey, We Want Drones!*, NBC NEWS (Dec. 12, 2014), <http://www.nbcnews.com/tech/innovation/american-farmers-faa-hey-we-want-drones-n222296>.

requirement would cut off a substantial portion of these benefits. To do so without a compelling safety rationale would be an overstep, particularly when existing and emerging technologies are capable of adequately minimizing the risks.

FPV goggles are highly advanced today. The best versions can give an operator a high-definition, 140-degree, real-time view from a drone.⁸ This technology can enable exceptionally accurate flying with both copters and fixed-wing UAS.⁹ Companies such as FatShark and SkyZone sell high-quality FPV goggles and drone camera systems around the world at a relatively low cost of \$300–\$500.¹⁰ This already advanced technology is evolving rapidly. The technology behind immersive virtual reality headsets such as Facebook's Oculus and Microsoft's HoloLens will converge with drone FPV technology to greatly improve the safety of navigation.¹¹

B. Field-of-View Concerns and Solutions

One of the FAA's concerns with FPV technology is the field of view, which it argues is too limited and less capable than a human pilot of spotting surrounding aircraft and hazards. Yet, current camera technologies such as 1080p high-definition fish-eye video actually offer a wider field of vision than the human eye (up to 140 degrees).¹² Advances on this technology, along the lines of virtual reality headsets, will allow an operator to rotate his or her head to turn the on-board camera and look for surrounding aircraft or hazards. This technology will provide drone operators with

⁸ *First-Person View*, WIKIPEDIA, [http://en.wikipedia.org/wiki/First-person_view_\(radio_control\)](http://en.wikipedia.org/wiki/First-person_view_(radio_control)) (last visited Jun. 12, 2015).

⁹ Andberge, *Best FPV Moments of 2013*, YOUTUBE (DEC. 1, 2013), <https://www.youtube.com/watch?v=HrSEyS-GpZs> (last visited Apr. 20, 2015).

¹⁰ *FatShark Teleporter V3*, AMAZON.COM, <http://www.amazon.com/Fat-Shark-FATSHARK-TELEPORTER-GOGGLES/dp/B00I2LWAD4> (last visited Apr. 18, 2015).

¹¹ *First-Person View*, WIKIPEDIA, [http://en.wikipedia.org/wiki/First-person_view_\(radio_control\)](http://en.wikipedia.org/wiki/First-person_view_(radio_control)) (last visited Dec. 12, 2014).

¹² Neil Hughes, *Using the DJI Phantom 2 Vision+ Camera*, APPLE INSIDER (Aug. 3, 2014), <http://appleinsider.com/articles/14/08/03/review-using-the-dji-phantom-2-vision-camera-drone-with-apples-iphone>.

virtually identical range of vision to that of a pilot in a cockpit.

The application of multiple cameras on a drone for front, rear, side, above, and below views could also provide a far superior range of vision than that of a human pilot. Not only is current FPV technology likely capable of minimizing the risks associated with flight outside of human line of sight, but the next generation of FPV technology will almost certainly be adequate to do so.

The FAA's primary concern regarding limited field of vision is, moreover, largely addressed by requiring that drones fly under 500 feet. The Agency worries that drone operators will not see oncoming *passenger aircraft*, thus risking catastrophic collisions. Yet passenger aircraft are generally required to fly above 500 feet. Thus, requiring that UAS fly below this threshold should adequately minimize the risk of unwanted encounters.

Autonomous sensing technology, whether alone or in combination with FPV technology, can also adequately minimize the risks of drone flight outside the operator's line of sight. Sensors combined with software can allow drones to travel from point A to point B, avoid obstacles and other aircraft, and to safely "return home" automatically in the event that something goes wrong. Visual and inertial sensors (VI sensors), Flir thermal imaging, and Flasher light-emitting diodes (LEDs) can allow drones to maneuver and navigate fully autonomously.¹³ Three-dimensional mapping and collision avoidance software allow navigation in the unlikely event that the global positioning system (GPS) fails.¹⁴ Combined with gyros, accelerometers, magnetometers, altimeters, and GPS, drones can autonomously sense position, altitude, attitude, angular rate, acceleration, tilt, and magnetic heading.¹⁵ These technologies can currently allow drones to perform incredibly accurate and agile maneuvers.¹⁶ Many of these technologies are being successfully and safely used in autonomous vehicles (e.g., Google has driven its autonomous vehicles nearly

¹³ SKYBOTIX, <http://www.skybotix.com> (last visited Apr. 18, 2015).

¹⁴ *Id.*

¹⁵ *Id.*

¹⁶ Raffaello D'Andrea, *The Astounding Athletic Power of Quadcopters*, TED TALK (Jun. 11, 2013) http://www.ted.com/talks/raffaello_d_andrea_the_astounding_athletic_power_of_quadcopters?language=en.

one million miles without accident¹⁷). The level of airspace situational awareness that a UAS operator can achieve with a combination of these systems will likely be on par with or better than that of a human pilot. The FAA should recognize the state of this technology and acknowledge that it can adequately minimize the risk of drone operations outside the line of sight of a human operator.

Instead of banning all such operations, the FAA should require that pilots flying drones outside line of sight are trained and licensed to use appropriate technology. The Agency could also require special certifications of UAS with FPV and VI autonomous systems. Further, the Agency could condition certifications on pilots or UAS meeting flight-time requirements. This would appropriately match training and technical requirements to degrees of risk—the type of nuanced balancing the FAA should be engaged in. The objective of these types of measures is not to make it easy for *all* drones to fly beyond line of sight, but to set a high bar that *some* advanced drones and operators can meet.

II. KEEP THE 500-FOOT LIMIT AS A BASELINE BUT ALLOW CERTIFIED DRONES AND PILOTS TO FLY ABOVE IT

A. 500-Foot Limit on Drone Flight

The draft rules' 500-foot limit for drone flight is a sensible baseline, but exceptions should be permitted. This threshold is reasonably based on the fact that most large passenger aircraft can only fly in the “navigable airspace” above 500 feet, not below (unless taking off or landing). It defines where drones may present catastrophic risks (above the threshold, where collisions with passenger aircraft are a significant possibility) and more moderate risks (below the threshold, where small drones can cause only limited harm to people or property on the ground).

Below 500 feet, Small UAS generally present limited risks to those on the ground because they are small, typically between one

¹⁷ Chris Urmson, *The Latest Chapter for the Self-Driving Car: Mastering City Street Driving*, GOOGLE BLOG (Apr. 28, 2014), <http://googleblog.blogspot.com/2014/04/the-latest-chapter-for-self-driving-car.html>.

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and two feet in diameter, and usually weigh between 1 and 4.4 pounds. DJI, a world leader in small UAS, only sells products in this size and weight range.¹⁸ At this relatively small size and light weight, most Small UAS flown below 500 feet seem unlikely to cause death or serious injury to person or property on the ground below, although they certainly can cause some harm, such as a bad bruise, concussion, or laceration.

Above 500 feet, the risks increase because drones are more likely to collide with passenger aircrafts and subsequently cause catastrophic accidents. This could result from a drone entering a jetliner turbine, colliding with a cockpit, or causing structural damage to a wing or tail. Such collisions could down an airplane and kill dozens or hundreds of people. It could also cause hundreds of thousands or millions of dollars in property damage as well as additional casualties on the ground.¹⁹

The risks of drones colliding with passenger aircraft are real. In 2014, over 150 pilots and flight controllers reported drones in “close” proximity with an aircraft or an airport.²⁰ As The Wall Street Journal reported: “Some pilots described near misses, with drones coming within dozens of feet, a distance that amounts to a few seconds in aviation [and some] pilots had to take action to avoid the drones.”²¹

Of particular concern is that many of these incidents are occurring near or over major metropolitan areas like New York City, which has some of the world’s most congested airspace. In September 2014, for example, three small commercial passenger jets “reported a very close call” with a drone at 1,900 feet while approaching La Guardia Airport in New York.²² The risk is

¹⁸ *All Products*, DJI, <http://www.dji.com/products> (last visited Apr. 21, 2015).

¹⁹ Christopher W. Lum, Kristoffer Gauksheim, Tadej Kosel & Tad McGeer, *Assessing and Estimating Risk of Operating Unmanned Aerial Systems in Populated Areas*, U. WASH. AUTONOMOUS FLIGHT SYS. LABORATORY (Sept. 20, 2011), <http://arc.aiaa.org/doi/abs/10.2514/6.2011-6918>.

²⁰ Jack Nicas, *Increase in Drones Spotted near Aircraft*, WALL ST. J. (Nov. 26, 2014, 5:04 PM), <http://online.wsj.com/articles/faa-reports-more-aircraft-drone-near-misses-1417025519>.

²¹ *Id.*

²² *Id.*

elevated in such urban environments because there are far more airplanes and people.

The rate of “close calls” also seems to be increasing. While only three “close calls” were reported each month in the first half of 2014, the average increased to more than 31 reports per month between July and October.²³ This rate will no doubt continue to increase, particularly as drone sales accelerate.

These incidents suggest that the FAA’s draft rules prohibiting drone flights above 500 feet is a sensible baseline. But flight above 500 feet should not be completely prohibited. Instead, the FAA should set permitting and certification requirements for qualified pilots and drones to fly above 500 feet. Because the risk of drone flight above 500 feet relates primarily to encounters with passenger aircraft, the FAA should allow certified drones and pilots to fly above this threshold where the risk of encounters with passenger aircraft is very low (such as over rural farm land, forests, and water).

B. Proposed Exceptions to the 500-Foot Limit

In addition, passenger aircraft typically travel along well-defined *airways* (flight corridors at varying altitudes connecting specific locations).²⁴ Only specific, certified airplanes are allowed to fly in these defined airways.²⁵ Certified drones and pilots could, therefore, be allowed to safely fly outside of these airways at certain defined altitudes above 500 feet. In the long term, the FAA could designate standalone airways for drones, which could, just as with passenger aircraft, vary according to altitude, the class of drone, speed requirements, pilot certifications, and mission objectives. Such UAS airways would become particularly relevant as transporter drones move from current military applications to civilian applications, a near inevitability.²⁶

²³ *Id.*

²⁴ *Airway (Aviation)*, WIKIPEDIA, [http://en.wikipedia.org/wiki/Airway_\(aviation\)](http://en.wikipedia.org/wiki/Airway_(aviation)) (last visited Jun. 16, 2015).

²⁵ *Id.*

²⁶ *AirMule Transporter UAV, Israel*, AIRFORCE TECH., <http://www.airforce-technology.com/projects/airmule-uav> (last visited Mar. 1, 2015).

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Certifications and permits to fly above 500 feet would be particularly valuable in rural areas over large farms, forests, oil fields, or bodies of water. The FAA has already granted “restricted category type certificates” and Special Airworthiness Certificates (SACs) to an energy company as well as a whale-research institution in Alaska to operate the fifty-pound Boeing ScanEagle X200 and AeroVironment’s Puma.²⁷ The certifications contain no altitude limits. The same certification approach should be broadened for other “special purpose operations”²⁸ for varying classes of drones and mission objections above 500 feet.

While the FAA’s draft rules understandably prohibit drone flight above 500 feet, its permanent rules should create a clear process by which operators can obtain SACs and permits to fly above this threshold. Longer term, the FAA should consider designating special airways for drones outside of passenger flight airways. This will become particularly relevant as transporter drones and larger-class drones find commercial uses in our skies.

III. ADOPT THE PROPOSED MICRO UAS CATEGORY—REGULATE DIFFERENT DRONES AND RISKS DIFFERENTLY

A. Micro UAS Copter Classification

The FAA has proposed for comment a possible, less-regulated category for Micro UAS (drones that weigh less than 4.4 pounds).²⁹ This is a very good idea because it reflects a general principle that not all drones should be treated alike as different drones present very different risks. Regulations should proportionally address these risks by creating a handful of drone classifications, such as the Micro UAS category (but not necessarily stopping there). Early reports indicated that the FAA

²⁷ *One Giant Leap for Unmanned-kind*, FED. AVIATION ADMIN. (last updated Jul. 26, 2014), http://www.faa.gov/news/updates/?newsId=73118&omniRss=news_updatesAoc&cid=101_N_U.

²⁸ 14 C.F.R. § 21.25 (1975).

²⁹ *DOT and FAA Propose New Rules for Small Unmanned Aircraft Systems*, FED. AVIATION ADMIN. (Feb. 15, 2015), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295.

was going to regulate all drones under a single category.³⁰ This would be an error, analogous to regulating all passenger aircraft in the same way.

The proposed Micro UAS classification is important because most commercial drone quadcopters weigh between zero and five pounds and present low risk to people and property. The ubiquitous \$400–\$1,000 DJI Phantom drones weigh between one and five pounds and can travel no faster than thirty-five mph.³¹ Probably the worst these devices could do is cause a small dent on a car's hood, break a window, or give someone a bad bruise, concussion, or cut; they are unlikely to cause any major property damage or serious injury or death. There are many other types of drones that weigh less than 4.4 pounds and even less than one pound.³² It should be plain that they present minimal (although not negligible) risks.

This is why the FAA's proposed Micro UAS category is more flexible and allows, for example, flight over the heads of bystanders.³³ The proposed Micro UAS rules are bolstered by the fact that the entire category will become safer over time with cheaper and more advanced autonomous stabilizers, sensors, navigation, and obstacle avoidance systems.

In addition, existing tort law can likely handle most of the hazards Micro UAS present, including harm to property or person, trespassing within the "immediate reaches" above property, invasion of privacy, etc. Other basic tort concepts of negligence,

³⁰ *Free the Drones*, ECONOMIST (Dec. 6, 2014), <http://www.economist.com/news/leaders/21635489-drones-have-immense-commercial-potentialso-long-regulators-dont-try-tether-them>.

³¹ *Phantom*, DJI, <http://www.dji.com/product/phantom> (last visited Dec. 12, 2014).

³² See *STRHOBBY UDI U818A 2.4G 4CH 6 Axis RC Quadcopter*, LIGHTINTHEBOX, <http://bit.ly/1w39U6N> (last visited Apr. 15, 2015); *Seresroad CX-10 4CH 2.4GHz 6 Axis Gyro LED Rechargeable Mini Nano RC UFO Quadcopter*, AMAZON.COM, <http://amzn.to/1yf7E8e> (last visited Apr. 15, 2015).

³³ *DOT and FAA Propose New Rules for Small Unmanned Aircraft Systems*, FED. AVIATION ADMIN. (Feb. 15, 2015), http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295.

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gross negligence, nuisance, and reckless endangerment³⁴ will also apply. At a minimum, the FAA should create light-touch regulations for Micro UAS flown under 500 feet, allowing the common law to guide most judicial decisions and the threat of civil lawsuits to deter risky flying.

B. Small UAS Copter Classification

Small UAS copters between 4.4 and 55 pounds belong to a higher-risk category, warranting a separate classification and greater regulation. Amazon, for example, envisions package-delivery octocopter drones weighing up to fifty-five pounds, inclusive of payloads.³⁵ A fifty-five-pound octocopter falling out of the sky clearly presents greater risks to persons and property than smaller drones. The same goes for a ten-pound quadcopter or a twenty-pound hexacopter with heavy camera equipment.³⁶ These drones could cause more substantial injury or damage to property.

The FAA should regulate such drones in proportion to their slightly elevated risks.³⁷ The FAA's proposed rules set many of the right limits on these types of drones between 4.4 and 55 pounds, requiring drone registration with the FAA and passage of a pilot knowledge test. But banning their commercial use directly over non-operators (which would effectively prevent flight above urban environments) is over-burdensome. While Small UAS between 4.4 and 55 pounds present higher risks, the risks are still *relatively* low. For example, over 30,000 Americans are killed in car accidents each year, and yet we tolerate the risks in the interests of

³⁴ Huerta v. Pirker, N.T.S.B. Order No. EA-5730 (Nov. 18, 2014).

³⁵ Jillian D'Onfro, *Jeff Bezos Says Amazon's Delivery Drones Are 'Truly Remarkable,' but You Probably Won't See Them Soon*, BUS. INSIDER (Dec. 2, 2014), <http://www.businessinsider.com/amazon-jeff-bezos-delivery-drones-amazon-prime-air-2014-12>.

³⁶ David Shields, *What Is a Hexacopter?*, QUADCOPTER DEALS, <http://quadcopterdeals.com/what-is-a-hexacopter> (last visited Apr. 12, 2015).

³⁷ Christopher W. Lum & Blake Waggoner, *A Risk Based Paradigm and Model for Unmanned Aerial Systems in the National Airspace*, U. WASH. AUTONOMOUS FLIGHT SYS. LABORATORY (Mar. 2011), <http://arc.aiaa.org/doi/abs/10.2514/6.2011-1424>.

economic progress and broader freedoms.³⁸ By contrast, not a single fatality has been reported from civil or recreational UAS flight in the United States, despite accelerating use in recent years. The relatively low risks associated with mid-size UAS over non-operators are thus *tolerable* in light of the benefits they promise in services and economic development.

C. Fixed-Wing Drone Classification

Fixed-wing UAS belong to another elevated-risk category. Currently, the FAA draft rules treat them the same as copters by considering only a drone's weight and speed. But, it is important to recognize certain distinct risks presented by winged drones. As Raphael Pirker's dare-devil, fixed-wing flight over the University of Virginia demonstrated, these drones present greater potential for high-speed, reckless flying and for causing more substantial human injury and property damage.³⁹ It is basic physics that a fifty-five-pound winged drone travelling at 100 miles per hour will cause more damage than a fifty-five-pound quadcopter traveling at 35 miles per hour. Fixed-wing drones also have the potential for longer-range missions, which present greater risk of loss of electronic controls by the operator.⁴⁰

The FAA must recognize the varying risks presented by these different categories of UAS and regulate them with appropriate nuance. There are notable differences between 4.4-pound copters, 55-pound copters, and winged drones. The FAA should balance the relative risks with the rewards and set proportional limitations. In other words, the FAA should apply the same kind of nuance it applies to passenger aircraft to drones. The Micro UAS category is one good step in this direction, but the FAA need not stop there.

³⁸ *Fatality Analysis Reporting System (FARS) Encyclopedia*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., <http://www-fars.nhtsa.dot.gov/Main/index.aspx> (last visited Feb. 27, 2015).

³⁹ SUAS News, *Stunt Sheep Don't [sic] Try This at Home: Trappy's \$10k Fine UVA Video*, YOUTUBE, <https://www.youtube.com/watch?v=OZnJeuAja-4>.

⁴⁰ Joan Lowy, *FAA OKs Commercial Drone Flights over Land*, COLUMBIAN (Jun. 11, 2014, 6:00 AM), <http://www.columbian.com/news/2014/jun/11/faa-oks-commercial-drone-flights-over-land>.

IV. ADOPT AN ENABLING PHILOSOPHY TOWARD DRONES BASED ON THEIR GREAT ECONOMIC PROMISE AND TOLERABLE RISKS

The FAA has not expressed a clear philosophy toward drones. Announcing such a philosophy is the starting point for policies that aim to actively enable UAS or simply limit risks. The FAA should adopt a philosophy of active enablement, flowing from the recognition of the immense potential of UAS in industries and fields as wide-ranging as agriculture, product delivery, photography, journalism, emergency response, forestry, energy exploration, oceanography, and climate science, among others. The Association for Unmanned Vehicle Systems International (AUVSI) predicts the industry will create \$82 billion in economic revenue and 100,000 jobs over the next decade.⁴¹ It also predicts that continued regulatory delays will cost the United States as much as \$10 billion per year—\$27.6 million per day—in potential earnings from investments in drone research and development.⁴² The Teal Group, an aerospace and defense industry market intelligence firm, predicts Americans will spend in excess of \$11 billion on drone research, development, testing, evaluation, and procurement in the next decade.⁴³ The FAA itself estimates that drones will have an economic impact greater than \$100 million per year.⁴⁴ Whatever the precise economic contribution, it is clear that drones *can* contribute significantly to U.S. economic growth.

To foster these economic benefits, the FAA should commit to rules that *actively enable* the commercial, scientific, and educational applications of drones. The countervailing risks to

⁴¹ *Economic Report*, ASS'N UNMANNED VEHICLE SYS. INT'L, (AUVSI) (Mar. 2013), <http://www.auvsi.org/econreport>.

⁴² *Id.*

⁴³ Lamar Smith, *Economic Potential of Drones Delayed by Lack of Regulation*, INVESTOR'S BUS. DAILY (Feb. 24, 2015), available at <http://news.investors.com/ibd-editorials-perspective/022415-740680-drone-found-at-white-house-starts-regulation-debate.htm>.

⁴⁴ Gregory McNeal, *Leaked FAA Document Provides Glimpses into Drone Regulations*, FORBES (Feb. 14, 2015, 6:19 PM), <http://www.forbes.com/sites/gregorymcneal/2015/02/14/the-faa-may-get-drones-right-after-all-9-insights-into-forthcoming-regulations>.

people and property are simply not great enough to justify highly burdensome limits. While the FAA must establish boundaries, it should adopt only minimally burdensome ones necessary to secure *adequate* safety for people and property. Some risks, just as with cars, must be tolerated in order to strike the right balance between economic progress and safety concerns. The FAA should not shy away from an active enablement philosophy that performs this balancing. The United States' pioneering history provides ample support for such measured risk-taking.

V. ACTIVELY GRANT EXEMPTIONS TO THE INTERIM BAN IN ORDER TO INFORM AND IMPROVE THE DRAFT RULES

Applying an active enablement philosophy in the interim of permanent rules, the FAA should proactively grant exemptions to its interim ban on non-recreational, civil drone flights. It should speedily issue FMRA Section 333 Exemptions⁴⁵ for qualified commercial, scientific, and educational applicants; Certificates of Waiver or Authorization (COAs) for publicly-funded drone flights; and SACs for more advanced missions. The FAA has so far approved 24 Section 333 Exemptions out of 342 applications.⁴⁶ This is a conservative approval rate that is inconsistent with any active enablement philosophy. If the FAA is going to promulgate permanent rules that facilitate civil uses, it should start easing the transition by actively approving exemptions that comply with the basic parameters of the draft rules. These exemptions will provide valuable information regarding the efficacy of the rules and allow for modifications to the rules before they are made permanent.

Section 333 Exemptions and SACs should be granted especially aggressively in rural and farm areas. Because the agricultural industry is expected to generate a very large percentage of the economic benefits and because the risks in rural areas are much lower, applications from this industry should be

⁴⁵ FAA Modernization and Reform Act of 2012, Pub. L. No. 112-95, § 133, 126 Stat. 11, 75–76.

⁴⁶ Steven Pazar, *FAA's Proposed UAS Rules – A Missed Opportunity*, PAZAR L. (Feb. 19, 2015), <http://www.pazarlaw.com/faas-proposed-uas-rules-a-missed-opportunity>.

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fast-tracked.⁴⁷

The FAA should also more actively grant “restricted category type certificates” and SACs for “special purpose” advanced flights, particularly those beyond the line of sight of operators or above 500 feet. It granted these certificates in 2013 for operations in Alaska⁴⁸ and should accelerate their approval for use over low-risk farmland, rural areas, wilderness, and bodies of water. This will facilitate the development of drones that can *safely* fly beyond the line of sight of operators and above 500 feet using any combination of FPV video, IV sensors, GPS, and altimeters.

CONCLUSION

The FAA’s draft rules demonstrate that the FAA is intent on integrating UAS into America’s skies. But, the rules are still too burdensome relative to the safety risks presented by modern Small UAS technology. They are also over-burdensome relative to what other countries are doing and to America’s pioneering history. If the FAA adopts these draft rules without modification, America will fall behind the global competition in this field.

While the FAA sets valuable baseline limits for most drones with its line-of-sight requirements and 500-foot limit, these limits ignore the incredible capabilities of advanced drones and trained pilots to fly safely beyond line of sight and above 500 feet. The FAA should adopt advanced drone certifications and piloting requirements to allow qualified firms to safely add value beyond line of sight and above 500 feet. The agency should also place fewer burdens on less risky drones, and the proposed Micro UAS category is a very important step in this direction. Eventually, drones should be treated with the same level of nuance as passenger aircraft, matching greater risks to greater aircraft

⁴⁷ Chad Garland, *Drones May Provide Big Lift to Agriculture When FAA Allows Their Use*, L.A. TIMES (Sep. 13, 2014, 5:00 AM), <http://www.latimes.com/business/la-fi-drones-agriculture-20140913-story.html#page=1>.

⁴⁸ *Commercially Certified, ScanEagle Head for Alaska to Track Icebergs, Whales*, DEFENSE UPDATE (July 27, 2013), http://defense-update.com/20130727_scan_eagle_certifie.html#.VIA3pzHF-So.

certification and piloting requirements.

Much of the draft rules' weaknesses derive from an apparent lack of a guiding philosophy. The right philosophy is that drones have immense economic, scientific, and educational potential with limited (and tolerable) risks, and so should be actively enabled by the FAA. This philosophy should apply not only to the draft rules, but also to the FAA's approach to granting exemptions to the interim ban on civil flights, which will continue to stifle UW research and broader industry applications for another couple years. The FAA should actively grant exemptions, COAs, and SACs in order to learn as much as possible about drone use in society before the rules are made permanent. It should also more actively grant these exemptions so that America does not fall irreparably behind. The FAA's new streamlined program for "summary grants" of approval for drone operations is a great start.⁴⁹ It should keep moving in this direction.

The recent grant of authorization to Amazon to test its product-delivery drones is also very encouraging.⁵⁰ But the FAA's draft line-of-sight requirement would, ultimately, stymie any UAS product-delivery model. Facing such restrictive U.S. rules, great American companies like Amazon will continue to set up drone research operations in countries such as Canada, the UK, and Australia, instead of right here at home. This is a problem. The FAA has an opportunity to avoid such drone drain by making nuanced modifications to the first draft of its Small UAS rules.

⁴⁹ Brian Fung, *The FAA's Given Amazon the Official Go-Ahead for Drone Testing*, WASH. POST (Apr. 10, 2015), <http://www.washingtonpost.com/blogs/the-switch/wp/2015/04/10/the-faas-given-amazon-the-official-go-ahead-for-drone-testing>.

⁵⁰ *Id.*

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