UAS on Main Street: Policy and Enforcement at the Local Level

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ABSTRACT

Due to increasing system sophistication and affordability, unmanned aircraft systems (UAS) are becoming more popular among hobbyists and businesses. UAS also pose a threat to homeland security as they could be used for nefarious activity such as preoperational surveillance or as weapons. Consequently, law enforcement officers and fusion centers have experienced an increase in suspicious activity reporting related to UAS. The Federal Aviation Administration (FAA) has not yet finalized a policy for integrating UAS into the national airspace, leaving law enforcement officers without a clear protocol for contact with UAS operators. This paper first examines UAS policy at the federal, state, and local levels. A discussion of recent incidents is provided to demonstrate the threat of UAS and the enforcement action taken. To bridge the gap between current policy and enforcement tools, this paper proposes a solution of creating local ordinances restricting UAS operations to protect critical infrastructure and preserve public safety.

INTRODUCTION

The expansion of unmanned aircraft systems (UAS)[1] operations for defense applications in the last two decades has driven growth in the commercial UAS industry where the casual enthusiast can now purchase a ready-to-fly system for less than $300. UAS have emerged as inexpensive and innovative photography and video platforms, often drawing recreational and commercial operators to fly around infrastructure assets of regional or national significance. Sites such as reservoirs, stadiums, bridges, and ports are intriguing subjects for videography but also vulnerable critical facilities. As a result, law enforcement officers and fusion centers have experienced an increase in suspicious activity reporting related to UAS. Due to increasing availability and system sophistication, UAS pose a threat to homeland security as they could be used for nefarious activity such as preoperational surveillance or as weapons.

In addition to threatening critical infrastructure, UAS pose a threat to public safety. A UAS could crash and injure bystanders as the result of the operator losing control of the data link due to equipment malfunction or malicious hacking of the device. Furthermore, UAS could be accessorized with a firearm or improvised explosive and deployed in a crowded area. The responsibility for contacting and determining the motivation of UAS operators falls to local law enforcement.

Federal and state regulations have failed to provide the law enforcement community with any coherent guidelines for conducting encounters with UAS operators. This paper proposes a strategy to mitigate UAS threats to critical infrastructure and public safety whereby municipalities and county governments develop and implement registration criteria for UAS operators and "no-fly" zones around sensitive areas. The idea of using local ordinances to protect against loss-of-life and structural damage provides a rare occasion where the

aims of civil liberties groups, UAS hobbyists, and law enforcement officials may coincide.

Current Policy Environment

As the Federal Aviation Administration (FAA) struggles to implement a coherent UAS policy, local law enforcement officers need a more immediate solution to address the surge in popularity of UAS used for commercial and recreational purposes.

Congress first tasked the FAA with integrating UAS into the national airspace when it passed the *FAA Modernization and Reform Act of 2012* as Public Law 112-95 on February 14, 2012. The Act served the dual purpose of authorizing FAA funding for the next 4 years and prioritizing the safe integration of civil unmanned aircraft into the national airspace system by September 30, 2015.[2] The Act also stipulated that the FAA must publish a 5-year roadmap for UAS policy within 12 months of enactment detailing the process of introducing civil UAS into the national airspace.[3] The FAA published the roadmap 9 months late in November 2013. The FAA has missed other deadlines including the naming of 6 test ranges to conduct research for UAS integration. The sites were named in December 2013, one year and three months outside of the 180 day requirement specified in the Modernization and Reform Act. See Table 1 for a summary of FAA Regulations pertaining to UAS Operations.

In July 2014 the FAA published a notice consolidating FAA regulations and directives pertaining to UAS operations in the national airspace. The notice states that UAS users must obtain authority for operations under one of three programs: 1) For UAS operating as public aircraft, authority comes from the Certificate of Waiver or Authorization (COA) on a case-by case basis.[4] 2) For UAS operating as civil aircraft (private sector), authority is derived from a Special Airworthiness Certificate (SAC) and covers only limited operations.[5] 3) Lastly, model aircraft flights are governed by the Interpretation of the Special Rule for Model Aircraft.[6]

FAA regulations governing UAS operating as public aircraft are currently the most robust as they encompass use by the Department of Defense (DOD). The extension of federal UAS operations has been implemented through the COA process to include other agencies such as NASA, the Department of Homeland Security, and the Department of the Interior as well as state and local entities. These certificates are generally issued for a timeframe of 12-24 months and application is restricted to public operators for specific activities. As of December 4, 2013 the FAA listed only 545 active COAs.[7]

The *FAA Modernization and Reform Act* of 2012 established a streamlined COA approval process for local law enforcement, first responders, and academic institutions.[8] These public UAS may be used for varied purposes including ordnance detection, search and rescue, damage assessments, and –most controversially– surveillance. Such use cases represent a logical extension to federal agency operations. UAS eligible for the COA program must be operated by public agencies, weigh 4.4 pounds or less, operate within line-of-sight of controller, fly below 400 feet, during daylight hours, within Class G airspace,[9] and at least 5 statute miles from any airport, heliport, seaplane base, spaceport, or other location with aviation activities.[10] Initially, an organization will receive a COA for training and performance evaluation. Once the entity has demonstrated proficiency in flying its UAS, they will receive an operational COA expanding the allowable operational weight to 25 pounds.[11] Although law enforcement and emergency management applications for UAS show much potential, their use is entangled in debate over privacy considerations around the 4th Amendment prohibition of unreasonable search and seizure. This article deals specifically with threats to critical infrastructure and public safety and does not consider law enforcement and emergency management UAS significant threats to either. As a result, analysis of the policy and enforcement environment for public UAS is beyond the scope of this paper.

The criteria for obtaining an SAC apply only to the private sector (civil aircraft) and are more restrictive than those of the COA program. Experimental category SACs are issued for research and development, crew training, or

sales demonstration purposes and prohibit civilian companies from operating UAS for compensation or hire.[12] Companies with active experimental SACs include General Atomics, Lockheed, and Raytheon.[13] Restricted category SACs allow for commercial operations. To date only the Insitu ScanEagle and AeroVironment Puma are authorized in this category to conduct pipeline surveys for BP in Prudhoe Bay, Alaska.[14] On December 12, 2014 the FAA released Order 8000.372A which establishes a framework for granting SACs to UAS affiliated with the six UAS test ranges in the U.S.[15] These certificates will be issued in the experimental category and not for commercial purposes.[16]

The FAA began moving forward to expand commercial UAS use in September 2014. Section 333 of the FAA Modernization and Reform Act entitled "Special Rules for Certain Unmanned Aircraft Systems" gives the Secretary of Transportation authority to expedite operational approval for UAS that "do not create a hazard to users of the national airspace system or the public or pose a threat to national security."[17] The Act also allows the secretary to determine if these UAS require airworthiness certificates, COAs, or SACs.[18] Since September 25, 2014 the FAA has announced exemptions from existing certification requirements for 137 companies operating UAS for commercial purposes.[19] The first six exemptions went to businesses affiliated with the Motion Picture Association of America and were granted for aerial photography and videography.[20] The FAA has since approved requests for companies to use UAS for business purposes including construction site monitoring, aerial surveying, oil rig flare stack inspection, real estate marketing, and precision agriculture.[21] The fact that the initial exemptions were granted to single operators from several major segments of the commercial UAS market is symbolic and represents progress toward opening U.S. airspace to civil UAS. However the FAA was over 2 years late in meeting the deadline for invoking the Section 333 provision set out in the Modernization and Reform Act, increasing the likelihood that full integration of UAS into the national airspace will be delayed further.[22]

The Section 333 exemption process is onerous and may not prove sustainable for the FAA in the long run. Petitions and responses are lengthy, with detailed descriptions of the unmanned aircraft system, the pilot-in-command (PIC), the UAS operating parameters, and public interest involved in the proposed commercial activity.[23] In addition, the FAA requires each UAS pilot-in-command to maintain a current pilot certificate and valid airman medical certificate.[24] This statutory requirement comes from 49 USC § 44711 which prohibits a person from serving "in any capacity as an airman with respect to a civil aircraft engine, propeller, or appliance used, or intended for use, in air commerce…without an airman certificate authorizing the airman to serve in the capability for which the certificate was used."[25] The decision to require similar pilot certifications for both manned and unmanned aircraft operators may serve as a barrier to entry for low-budget companies seeking to use UAS, however as of April 2015 the FAA had received over 900 exemption requests.[26] Given their minimal success in enforcing UAS use restrictions to date, it is uncertain if the FAA will have appropriate staffing to deal with this surge of Section 333 petitions.

Due to the complexities and narrow criteria required to obtain a Special Airworthiness Certificate or Section 333 exemption for commercial operations, an ordinary citizen or company may claim to operate a UAS as a model aircraft to avoid regulation by the FAA. Although civil UAS blur the boundary between model aircraft and manned aircraft, the distinction between a model aircraft and UAS is significant. Section 336 of the FAA Modernization and Reform Act entitled "Special Rule for Model Aircraft" established an exemption for model aircraft from any future FAA regulation.[27] The Special Rule protects the longstanding legitimate use of model aircraft for recreational purposes. Section 336 acknowledges the importance of the Academy of Model Aeronautics in the U.S. as a "community-based organization" and their success in implementing an operational safety program for a legion of dedicated hobbyists. The statute requirements in Section 336

are similar to the FAA's 1981 Model Aircraft Advisory Circular 91-57 (AC 91-57), but provide added specificity and regulatory power. AC 91-57 was intended to apply to remote or radio controlled model aircraft and did not account for the expanded range, data link, and capabilities of the unmanned aircraft in use today. Unlike Section 336, AC 91-57 does not carry the weight of law and only encourages voluntary compliance.[28]

The FAA's "Interpretation of the Special Rule for Model Aircraft" issued in June 2014 draws on the statutory requirements of Section 336 to provide specific metrics by which to differentiate model aircraft from UAS. It outlines five criteria for classifying a model aircraft as 1) flown strictly for hobby or recreational use, 2) operated in accordance with a community-based set of safety guidelines, 3) limited to not more than 55 pounds, 4) operated in a manner that does not interfere with manned aircraft, and 5) when operating within 5 miles of an airport, the operator of the aircraft must provide the airport operator and the airport air traffic control tower with prior notice.[29] Section 336 also identifies line-of-sight operation as the distinguishing characteristic of a model aircraft.[30] Video feeds available to UAS operators often do not require line-of-sight contact to sustain flight and can serve as an easy way to distinguish a UAS from a model aircraft. Although Section 336 protects traditional modelers from forthcoming FAA regulations for UAS, it also states that the FAA retains authority to "pursue enforcement action against persons operating model aircraft who endanger the safety of the national airspace system."[31] Taken holistically, the FAA's interpretation of Section 336 may assist law enforcement officers in identifying UAS operations that require further scrutiny.

In February 2015 the FAA published a Notice of Proposed Rulemaking for the Operation and Certification of Small Unmanned Aircraft Systems to further integrate UAS operations into the national airspace. The proposed rule would allow small, registered UAS under 55 pounds to operate for business purposes without a COA, Section 333 exemption, private pilot's license, or airworthiness certification.[32] Although these provisions reduce the administrative requirements needed for commercial entities to fly a UAS, the rulemaking contains several operations-based restrictions. For example, devices must be operated only in line-of-sight range, during daylight hours, away from people, and below 500 feet.[33] These restrictions could stifle some forms of commercial activity that depend on distance or extended operations such as pipeline monitoring, surveying, or parcel delivery. It is important to note that the rulemaking becomes binding only after closure of a 60-day comment period and after the FAA reviews the findings and reissues it as a final rule. Until such time, Section 333 exemptions remain the only legitimate avenue to pursue commercial operation of a UAS. The FAA is already 9 months behind schedule in publishing that final rule, again making it unlikely that they will meet the final FAA Modernization and Reform Act deadline for safe integration of UAS into the national airspace system by September 30, 2015.[34]

Table 1. General FAA Regulations for UAS Operations

Civil (Commercial)

Special Airworthiness Certificate (SAC)	● Experimental Category SACs issued to companies for research, development, crew training, market surveys, prohibit commercial use ● Restricted Category SACs are more rare, issued for specific purposes allowing commercial use
Section 333- FAA Modernization and Reform Act	● Case-by-case exemptions for commercial UAS operations that do not threaten airspace safety or national security ● Requires operator to hold at least private pilot's license

Notice of Proposed Rulemaking for Small UAS	● Allows small UAS under 55 pounds to operate for commercial purposes without SAC as long as they are within line-of-sight, during daylight hours, and below 500 feet ● Streamlines Section 333 exemption; does not require private pilot's license for UAS operator ● Prohibits careless or reckless operation ● Nonbinding until reissued by FAA as a final rule
Public (Governments and Agencies)	
Certificate of Authorization (COA)	● Allows operation of specific aircraft for specific purpose in specific area ● Average 60-day timeline from application to approval
Model Aircraft (Recreational)	
Section 336- FAA Modernization and Reform Act	● No FAA approval needed for hobby or recreational use of UAS ● Device must weigh less than 55 pounds and operate within line -of-sight and at least 5 miles from an airport ● Prohibits interference with manned aircraft ● Exempts model aircraft from future FAA rulemaking

Although the FAA serves as the only federal agency with authority to regulate airspace safety, states retain some authority to restrict UAS use. For example, FAA regulations would preempt a state law attempting to limit the operation of an aircraft, set airworthiness standards, or create pilot requirements.[35] However, the FAA acknowledges that state legislation could restrict the use of certain aircraft –including UAS– by a state agency, local police or by a state department or university.[36] Such statutes could be used to supplement federal regulations. State and local governments also have authority to prohibit UAS aviation activities from their land or waterways.[37] For example, a UAS operator might be prohibited from flying a device while on state-owned property.[38]

States have acted quickly to pass laws governing UAS use to compensate for the FAA's slow pace in developing UAS policy. Since April 2013, legislation aiming to restrict UAS operations has passed in 15 states and deals primarily with constraining use by law enforcement agencies to protect the privacy of citizens.[39] These issues fall outside the FAA's mission to ensure airspace safety and state policy positions vary from complete prohibition to limited acceptance. A summary of state laws governing UAS use is provided in Table 2.

Early on, the states of Virginia and North Carolina took a conservative approach to UAS operations by enacting short term bans on their use by public agencies. This strategy allows more time for policymakers to develop privacy policies.[40] The Virginia ban extends through July 1, 2015 and the North Carolina prohibition extends to December 31, 2015. Taking the time to craft thorough policies from the outset will protect the law enforcement community, businesses, and private citizens in the long run, at which point such state laws will presumably be amended to allow UAS use. Other states including Florida, Illinois, Indiana, Montana, and Alaska have chosen a more metered approach to limit public agency use of UAS as it relates to the 4th Amendment prohibition of unreasonable search and seizure.

Some states have enacted legislation that goes beyond regulating public safety use of UAS. The states of Texas, Idaho, Tennessee, and North Carolina stand out for governing UAS use by recreational and commercial users as well. This approach shows that states recognize commercial entities and private citizens are flying UAS in ways that are not effectively regulated by the FAA. For example, real estate, delivery, and agricultural applications for UAS are well documented on YouTube despite

current FAA policy prohibiting commercial UAS operation without a Special Airworthiness Certificate (SAC) or exemption.[41] Implementing UAS policy at the state level builds a good foundation to encourage commercial growth while seeking to limit unlawful uses of UAS.

Tennessee Code was amended in May 2014 to define legitimate UAS business operations. Lawful commercial purposes in the Volunteer State include collecting data for routing, inspection, and maintenance of utility facilities, vegetation assessment, and real estate marketing.[42] Texas Government Code Chapter 223, also known as the Texas Privacy Act, entered into law on September 1, 2013 and centers on privacy concerns over images, recordings, and data collected by UAS. It prohibits UAS photography and filming of property or persons without consent.[43] The Act also outlines 19 legitimate purposes for UAS flights including assessing vegetation growth, real estate photography for marketing purposes, oil pipeline surveillance, and inspection of utility facilities.[44] Similar to the Texas regulations, Idaho Code Title 21-213, which was enacted April 11, 2013, establishes UAS use restrictions for unwarranted surveillance of persons or property while also providing a list of legitimate uses. Approved operations in Idaho include commercial photography, photographing public gatherings on public or private land, and owner inspection of land or facilities.[45]

Beyond legitimizing UAS operations for business purposes, in June of 2014 Louisiana enacted a law aiming to protect critical infrastructure assets from criminal UAS activity. Louisiana Revised Statute 14-337 defines unlawful UAS activity as the "intentional use of an unmanned aircraft system to conduct surveillance of, gather evidence, or collect information about, or photographically or electronically record a targeted facility without the prior written consent of the owner of the targeted facility."[46] It goes on to define targeted facilities as petroleum and alumina refineries, chemical and rubber manufacturing facilities, and nuclear power electric generation facilities.[47] While the FAA can regulate airspace, Louisiana's statute provides an added element of specificity on the ground. The classification of vulnerable infrastructure facilities varies due to regional geographic, economic, and industrial differences. The Louisiana legislation demonstrates that it may be more appropriate to classify such assets at the local or state level.

In addition to activity or asset-based UAS legislation, states can also enforce takeoff and landing restrictions on their real property. In April 2014 the State of Wisconsin enacted a UAS law that prohibits flying over state land and water in a way that is "imminently dangerous or damaging to persons or property lawfully on the land or water beneath."[48] The subjective nature of the terms "dangerous or damaging" allows for greater officer interpretation of the operating circumstances than would an outright UAS ban over state-owned or private property. As a result, the Wisconsin law may minimize the burden on law enforcement officers because they will presumably only conduct encounters with "dangerous or damaging" UAS operators rather than with every single one.

Oregon Revised Statute 837, enacted in July 2013, does not describe acceptable UAS use cases for the private sector, but does include proscriptions for all manner of nefarious operations. The law also outlines specific cases in which law enforcement may use a drone to acquire information. It goes on to require that any public agency operating a UAS first must register it with the Oregon Department of Aviation.[49] North Carolina's UAS law also sets out licensing requirements for commercial UAS operators through the state's Department of Aviation.[50] The act of assigning jurisdiction over UAS to a state agency establishes UAS into each state's existing aerospace framework. It also shows that lawmakers in Oregon and North Carolina believe UAS will become increasingly important assets in airspace. While a state-level foundation for UAS policy may fill in the gaps left by the FAA, the accompanying tools for enforcement are equally important to mitigate the threat environment.

Table 2. State UAS Laws

State	Citation	Key Points
Louisiana	LA. REV. STAT. § 14-337 (2014)	● Defines unlawful UAS activities ● Identifies infrastructure facilities that are vulnerable to targeting by UAS
Tennessee	TENN. ANN. CODE § 39-13 (2014)	● Identifies allowable commercial UAS operations ● UAS photography or videography requires consent of individual who owns or lawfully occupies property captured in the imagery
Idaho	IDAHO CODE § 21-213 (2013)	● Restricts UAS use for unwarranted surveillance of persons or property ● Identifies approved commercial operations
Oregon	OR. REV. STAT. 837 § 360 (2013)	● Prohibits weaponization of UAS ● Requires law enforcement to register UAS with Oregon Dept. of Aviation
Texas	TEX. GOV. CODE § 423-002 (2013)	● Identifies 19 legitimate commercial purposes for UAS operations ● Prohibits UAS photography and filming of property or persons without prior consent
Wisconsin	WIS. STAT. § 114.04 (2014)	● Prohibits "dangerous or damaging" flying of UAS over state land and waterways
North Carolina	N.C. GEN. STAT. § 14-63-96 (2014)	● Prohibits UAS surveillance of private property without owner or lessee consent ● Short term ban on UAS use by public agencies expires Dec 31, 2015
Illinois	725 ILCS § 167 (2015)	● Prohibits law enforcement use of UAS to gather information, except in special circumstances
Alaska	ALASKA STAT. § 18.65.900 (2014)	● Requires search warrant or exception for law enforcement use of UAS ● Sets limits for retention of law enforcement data collected by UAS
Utah	UTAH CODE § 63G-18-101 (2014)	● Requires search warrant for law enforcement to collect evidence using UAS
Indiana	I.C. § 35-33-5-11 (2014)	● Requires law enforcement to obtain search warrant before using UAS, provides exceptions ● Protects electronic data from search without warrant
Iowa	IOWA CODE § 808.15 (2014)	● Requires search warrant for law enforcement to collect evidence using UAS ● Prohibits UAS use for traffic enforcement
Florida	FLA. ADMIN. CODE § 47-934.50 (2103)	● Restricts law enforcement use of UAS to collect evidence ● Prohibits search and seizure using a UAS without a warrant

Montana	MONT. ADMIN. R. § 46-5-109 (2013)	• Limits information collected by UAS that is admissible in court
Virginia	VA. CODE ANN. § 755 (2013)	• Short term ban on UAS use by public agencies expires July 1, 2015

Threat

UAS threats to privacy have gained the broadest media coverage and state response, however commercial and recreational UAS threaten critical infrastructure and public safety at the local level. As a result of increasing availability and system sophistication, actors with malicious intent may exploit UAS capabilities to conduct pre-operational surveillance or use them as weapons in kinetic attacks. By nature of their reliance on datalink technology, UAS are vulnerable to accidents, which poses an intrinsic threat to public safety. Recent national case examples demonstrate that these threats remain largely unaddressed by FAA. This policy gap provides an opportunity for state government and local jurisdictions to implement their own UAS policies.

Out-of-the box UAS systems are freely available for purchase on manufacturer websites or through online retailers. Platforms range in quality from battery-operated toys mounted with cameras to diesel-powered craft capable of handling 20-pound payloads. Fixed-wing and multi-rotor devices can fly pre-programmed routes or via data link with flight times ranging from 5 minutes to 54 hours. Communications between the device and operator occur via Wi-Fi or radio frequency in the 2.4-2.485 GHz or 72-76 MHz range, respectively.[51] Typical Wi-Fi data link range is line-of-sight or about 1000 feet, however transmitter, receiver, and antenna upgrades on radio controlled models can extend the range from 1-3 miles.[52] The motion stability of multi-rotor systems is particularly attractive for collecting high-quality video. Due to this range of capabilities, UAS are popular among both casual enthusiasts and business enterprises.

The threat posed by UAS to infrastructure assets and public safety is linked directly to their improved capabilities over other attack vectors. The most unique characteristic of a UAS is its ability to fly automated routes using GPS or first-person view (FPV). FPV describes the experience where a UAS equipped with a camera uses Wi-Fi bandwidth to transmit a video signal to the control console in the hands of the operator. GPS flight paths and FPV allow malicious actors to bypass traditional physical security measures such as barriers or checkpoints and remain outside the fray. As a result, UAS may be used to conduct surveillance operations in areas where entry might otherwise be prohibited. UAS also do not require as much take-off and landing space as manned aircraft, and can navigate at low altitudes through crowded areas.[53]

While remote operation is desirable for conducting kinetic attacks, the threat of weaponized UAS is currently mitigated by payload capabilities. Off-the shelf recreational UAS weigh anywhere from 2 to 5 pounds and simply cannot support a significant payload of explosives. Larger, more expensive models can lift up to 20 pounds; however this quantity of explosive material would not be sufficient to cause significant structural damage to a building.[54] Such a detonation would definitely cause loss of life in a crowded area and for this reason the threat of a weaponized UAS in densely populated areas such as sporting events is particularly concerning. A UAS could operate as a dispersal mechanism for biological or chemical agents; however this threat is currently mitigated by the high level of expertise needed to aerosolize the agent and to build a remote dispersal capability.[55]

Despite the fact that the threat of weaponized UAS is currently mitigated by payload capabilities, malicious actors still possess the intent to use UAS in a kinetic attack. A pair of recent federal cases highlights the intent component of a physical UAS threat in the U.S.

On April 7, 2014 the FBI arrested Moroccan citizen El Mehdi Semlali Fathi as a part of an immigration investigation that also revealed his aspirations to conduct a bomb attack using a UAS.[56] According to FBI recordings, Fathi inquired to a third party about pliers, a cutter, and wires, claiming that the items were intended for a bomb.[57] He also stated that he made a chemical bomb in high school and discussed chemical explosives.[58] Specifically, Fathi spoke of his plans to fly bombs via "a plane, a remote-controlled hobby-type airplane" into a federal building.[59] In September 2014 Fathi pleaded guilty to one count of perjury in an immigration matter but was not charged with anything related to terrorism. Despite the lack of formal charges, the Fathi recordings illustrate the notional intent to use UAS in kinetic attacks.

In another federal case Rezwan Ferdaus was sentenced to 17 years in prison after pleading guilty to attempting to damage and destroy a federal building by means of an explosive and attempting to provide material support to terrorists in 2012.[60] For almost a year, Ferdaus planned and took steps to use remote controlled model aircraft as bombs to terrorize the U.S. Ferdaus informed undercover FBI agents, whom he believed to be members of al Qaeda, that he planned to obtain two remote controlled aircraft, fill them with explosives, and fly them into the Pentagon and U.S. Capitol using their built-in GPS systems.[61] Ferdaus sought 25 pounds of C-4 plastic explosives to be loaded onto the UAS for the attack.[62] This example demonstrates that Ferdaus believed existing UAS capabilities could be used to execute his terroristic intent.

In addition to posing a physical threat, UAS operated as surveillance platforms represent a passive collection threat to critical infrastructure. UAS may be used in the vicinity of critical infrastructure to gather visual information. The following national examples suggest that commercially available (sometimes homemade) systems have the capability to conduct surveillance on protected assets. They also illustrate the complexities involved in determining the intent of a UAS operator and the varied enforcement tools employed by law enforcement officers to take action against dangerous or potentially nefarious flight activities.

In the predawn hours of January 26 2015, a U.S. National Geospatial Intelligence Agency employee lost control of his DJI Phantom quadcopter while operating it for recreational purposes from his apartment near the White House. The device crashed on White House property and was recovered by the U.S. Secret Service.[63] The incident demonstrates the vulnerability of federal facilities to UAS overflights and the lack of physical security measures to protect against them, even for the most critical of infrastructure assets. The U.S. Department of Justice announced on March 18, 2015 that they would not press criminal charges against the UAS operator.[64] The FAA launched a review of the incident and may pursue administrative action against the operator because all Washington, DC is included in a Special Flight Rules Area of national defense airspace in which all model aircraft and UAS operations are prohibited.[65]

On May 5, 2014 a quad-copter crashed onto a 30th floor balcony of the Metropolitan Square Building in St. Louis, Missouri.[66] Police were not able to locate the operator of the UAS on-scene, however a man did come forward later that week to claim ownership of the device.[67] The man stated he was using the UAS to take video footage of historic buildings. Local police notified the FAA of the incident and the FAA responded that no Federal Air Regulations (FARs) had been violated.[68] Ultimately the police did not file charges against the operator due to lack of criminal intent. Although the downed UAS did not cause any physical damage to the Metropolitan building, this incident demonstrates the potential threat of UAS use for conducting surveillance of infrastructure locations.

New York City has successfully used its existing criminal statutes to bring charges against a dangerous UAS operator. In October 2013, the New York City Police Department (NYPD) arrested David Zablidowsky for flying his personal UAS over Manhattan. Zablidowsky's device crashed outside of Grand Central Station and while no one was injured, NYPD cited him for second degree "reckless

endangerment."[69] Specifically Zablidowsky was arrested for "flying a remote controlled helicopter off a balcony, losing control, causing it to crash to the ground from an unreasonable height creating a substantial risk of serious physical injury."[70] NYPD identified Zablidowsky by footage from the camera on his UAS, taken inadvertently while he was setting up to launch.[71] In New York, second degree reckless endangerment qualifies as a Class A misdemeanor and would carry a penalty of up to a year in prison if Zablidowsky is found guilty.[72] The State of New York has not yet passed any kind of UAS law that might play into the investigation.[73] It was not until March 2014 that the FAA independently attempted to assess Zablidowsky a $2200 civil penalty for violation of 14 CFR Sections 91.13(a) and 91.131(a)(1). This incident shows that unlike the FAA, local law enforcement can respond more efficiently to UAS incidents.

Another incident in New York State highlights the overlap between protecting critical infrastructure and preserving privacy. In a July 2014 incident, State Troopers in Kingston, NY used an existing statute to prohibit UAS activity. The troopers responded to an incident of a UAS flying outside of the Mid-Hudson medical facility. The device was equipped with a video camera and operating 10-15 feet from windows that looked in on patient examination rooms.[74] As a result of this UAS flight and accompanying videography, New York State Police charged David P. Beesmer with a Class E felony for unlawful surveillance in the second degree.[75] A class E felony carries a prison sentence of 6 months up to 4 years.[76]

Although the State Troopers took successful enforcement action against Beesmer, his case brings to light the potential benefits of enacting facilities-based UAS flight restrictions. Presidential Policy Directive 21 identifies Healthcare and Public Health assets as one of 16 designated critical infrastructure sectors.[77] Hospitals and medical facilities are so classified due to the life-saving services they provide in response to natural and manmade disasters.[78] A UAS flying around the Mid-Hudson Medical Center in the aftermath of a mass-casualty event could disrupt emergency services operations or potentially provide a malicious actor with information about treatment protocols. On a day-to-day basis, hospitals store hazardous chemicals and controlled substances, as well as radioactive material for their radiology departments and UAS could be used to gather information on ways to access these materials. In addition to threatening the general operations of the facility, the Beesmer case shows that UAS can compromise the privacy of patients through passive surveillance. In this instance, a regulation restricting UAS use around medical facilities would be desirable for civil liberties groups as well as for the public safety community.

The threat posed by UAS to public safety is underscored by a similar instance of a UAS endangering the public. In August 2013, a UAS crashed into the stands of the Petersburg, VA Motorsports Park during an event called the "Great Bull Run." The accident injured four people who were all successfully treated onsite.[79] Unlike the Zablidowsky and Beesmer cases, local law enforcement officials were not able to identify the UAS operator.[80] Although a local statute would probably do little to deter nefarious actors from flying a UAS over a crowded area, it would reduce the likelihood that casual enthusiasts would be flying over the event and therefore minimize the risk of accidental loss-of-control and crashing.

The UAS threat to public safety and critical infrastructure converges at high capacity stadium events. According to the U.S. Department of Homeland Security, stadiums themselves are part of the Commercial Facilities Sector of critical infrastructure and attract tens of thousands of people during scheduled events.[81] In October 2014 the FAA reissued a longstanding special security Notice to Airmen (NOTAM) that establishes Temporary Flight Restrictions (TFRs) for stadium sporting events to specifically prohibit UAS operations at NFL games, NCAA Division I football games, Major League Baseball games, and NASCAR Xfinity Cup races.[82] Local law enforcement officers are encouraged to report suspected violations of NOTAM 4/3621 to their local FAA Flight Standards District Office.[83] FAA Special Notice 4/0811 issued in 2009 advises pilots to avoid

airspace around power plants, dams, refineries, industrial complexes, military installations, and similar facilities.[84] The FAA has demonstrated its intent to apply this Special Notice 4/0811 to *all* aircraft including UAS to ensure airspace safety.[85] Unlike NOTAM 4/3621, Special Notice 4/0811 advises compliance but stops short of establishing a flight restriction. Table 3 summarizes specific FAA use restrictions for UAS that may impact local law enforcement personnel. The effectiveness of information sharing to take enforcement action against violators of these notices is still unknown as the FAA has not yet made public data on the number of reported violations they have received from local officers. Even so, the example of restricting UAS flights over stadiums could be implemented as a local policy for assets or events that attract large numbers of people such as shopping centers, parades, office buildings, or beaches.

Table 3. Event and Location-specific FAA restrictions for UAS

Regulation	Issued	Details
Notice to Airmen (NOTAM) 4/3621	2014	• Creates Temporary Flight Restrictions (TFRs) prohibiting UAS use at outdoor stadiums and sporting events • Includes NFL, MLB, NASCAR Xfinity Cup, Indy Car, and Div. I College Football games
Security Special Notice for Disney Theme Park	2014	• Permanently prohibits all aircraft operations over Disney Park in Orlando, FL • Includes unmanned and remotely piloted aircraft
Washington, DC Flight Restricted Zone (FRZ)	2010	• Designates Washington, DC as National Defense Airspace and Special Flight Rules Area • Permanently prohibits model aircraft and UAS operations
Special Notice 4/0811	2009	• Advises against aircraft operation in vicinity of power plants, dams, refineries, industrial complexes, military installations • Interpreted to include both manned and unmanned aircraft

In early January 2015, the FAA published a long-awaited letter entitled "Law Enforcement Guidance for Suspected Unauthorized UAS Operations."[86] The 12-page document does not contain any new regulations, but provides detailed information for law enforcement officers encountering UAS or UAS operators. It outlines the FAA's legal authority to restrict unauthorized and dangerous UAS operations and requests the support of local law enforcement to limit such activities. The document emphasizes the importance of local law enforcement officers in collecting field information on each UAS-related encounter and provides a list of actions that these officers can take to assist the FAA in ensuring the safety of the national airspace system. The FAA encourages immediate notification of suspected violations of federal UAS regulations to one of 6 FAA Regional Operations Centers.[87] Although a welcome resource, this Guidance Letter does not directly improve the enforcement options available to local officers. Instead it seems to confirm that the FAA lacks a sufficient staff of Special Agents to enforce federal regulations and intends to rely on local sworn personnel to collect information and report suspicious UAS activity. This strategy reaffirms the need to develop locally-based UAS restrictions to improve the enforcement environment.

Analysis of reported UAS incidents to the Northern California Regional Intelligence

Center (NCRIC) in 2013-2014 indicates that UAS use is increasing and places an additional responsibility on law enforcement to determine operator intent. NCRIC suspicious activity reporting provides an aggregate metric of UAS activity at the regional level. Located in San Francisco, the NCRIC functions as a clearinghouse for information sharing among law enforcement agencies for 15 counties in California and is one of 78 fusion centers across the U.S. As such, the center is ideally situated to gather, analyze, and disseminate information related to emerging threats such as UAS operations. In addition, local agencies look to the NCRIC to pass down information regarding new federal policies and initiatives. This function is particularly germane to UAS as the FAA is delayed in developing nationwide policy. The increasing popularity of UAS by recreational users has resulted in more suspicious activity reports primarily because it is difficult to evaluate intent of the operator. It should be noted that most instances of UAS activity involve harmless hobbyists and are not necessarily indicative of criminal or terrorist activity.

Based on first-hand database access, in the time period 2013-2014 the Northern California Regional Intelligence Center (NCRIC) observed an increase in suspicious activity reporting related to UAS. In the calendar year 2013 the NCRIC received two UAS-specific suspicious activity reports. In 2014 the NCRIC received nine reports for UAS-related activity. The increase in suspicious activity reporting over the past two years confirms that UAS are becoming more popular. The incidence of greater numbers of devices operating in the airspace raises the potential for accidents or injuries to bystanders and increases the threat to public safety. The majority of the reports came from densely-populated urban areas. This may be because urban settings provide more interesting subject matter for UAS operators to film and because there is a greater density of law enforcement officers available to respond to such activity. It is also significant that eight of the eleven total incidents involved flights near infrastructure assets such as structural landmarks or special events locations. This behavior has been observed in other metropolitan areas including Seattle, Charlotte, and Tampa.[88] The concentration of the incidents in highly developed locations highlights the importance of local ordinances for regulating UAS operations.

Enforcement

In addition to problems in developing UAS policy, the FAA suffers from a weak enforcement protocol. Rather than enforcing criminal law as do federal law enforcement agencies –FBI, DEA, CBP, ICE, etc.– the FAA serves as a regulatory agency tasked to create and enforce the rules published in the Code of Federal Regulations (14 CFR § 91), commonly called FARs. In order of severity the tools available to the FAA to enforce the FARs are "oral or written counseling; administrative action, including remedial training; legal enforcement action; and referral for criminal prosecution."[89] The FAA takes administrative action against safety violations by revoking pilot certificates or by seeking monetary civil penalties.[90] Cases dealing with suspected criminal conduct are referred to the Department of Transportation Office of the Inspector General or to the appropriate local, state, or federal law enforcement agency for prosecution.[91]

The current FAA enforcement mechanism does not translate well to the domain of unmanned aircraft. Whereas conventional pilots are certificated and fly registered aircraft from recognized locations (airports), UAS do not fit neatly into this existing regulatory framework.[92] Consider the following scenario: When the FAA receives a report of a traditional airplane pilot flying recklessly around a bridge; they typically open an investigation and consider the preponderance of evidence to determine whether or not to strip the pilot of his certificate.[93] If the pilot then attempted to fly without a certificate he would be in violation of Title 49 U.S. Code where an individual "knowingly and willfully operates or attempts to operate an aircraft eligible for registration under section 44102 of this Title knowing that the certificate of registration is suspended or revoked."[94] Now in violation of

U.S. Code, criminal penalties against the pilot would be enforced by a federal law enforcement agency, not the FAA.[95] The licensing situation is different with UAS. Unless a UAS has been granted a COA, SAC, or exemption by the FAA, the UAS operator will most likely have neither a pilot's license nor a registered device. Without these documents the FAA does not have the ability to take certificate action against most UAS operators and must rely more heavily on civil penalties.

FAA regulations also do not preclude a state or local agency from prosecuting criminal matters involving aviation or from implementing more restrictive guidelines for operations. As a regulatory body the FAA can only enforce civil or administrative law with respect to airspace, while local law enforcement agencies can act on their own criminal statutes.[96] For example, Class G airspace (1200 feet or lower above ground level) is considered uncontrolled airspace and not regulated by air traffic control.[97] States or cities may seek to control UAS operations in class G airspace to expand upon federal regulations or attempt to control specific UAS use cases that the FAA does not.

The status of the first case in which the FAA prosecuted a civil operator of a model airplane with a camera attached shows that FAA policy does not effectively safeguard local infrastructure assets and ensure public safety from UAS operations. The incident involved a subject named Raphael Pirker flying a Ritewing Zephyr model aircraft to take pictures of the University of Virginia Medical Center in 2011, a task for which he was paid. In this case, the FAA sought to assess Pirker a civil penalty of $10,000 for violating 14 U.S.C. § 91.13(a) which states that "no person may operate an aircraft in a careless or reckless manner so as to endanger the life or property of another."[98] Pirker claimed that he was operating a model aircraft rather than a UAS and filed a Motion to Dismiss the charges against him based on the fact that FARs do not have authority over model aircraft flight operations.[99] A judge from the National Transportation Safety Board – the agency charged with investigating and prosecuting all civil aviation-related incidents– initially granted Pirker's Motion to Dismiss finding that there does not exist an enforceable FAA rule or CFR that applies to model aircraft or for classifying model aircraft as a UAS.[100] The FAA Administrator appealed that decision and won a small victory when it was reversed on November 17, 2014. This NTSB judge cited 49 U.S.C. § 40102 (a)(6) where the term ""aircraft" means any contrivance intended, used, or designed to navigate, or fly in, the air" and found that the FAA does have authority to prohibit careless and reckless operation of unmanned aircraft based on 14 CFR § 91.13(a).[101] The November decision remanded the case back to the NTSB law judge to determine if Pirker did indeed operate his UAS in a careless or reckless manner.[102] The case was settled out of court in January 2015 when Pirker agreed to pay the FAA an $1100 fine.[103] Considering that the flight in question took place in 2011, the FAA's inability to take timely action against Pirker has been interpreted by the UAS community as a sign of federal enforcement impotence and demonstrates the need for local UAS laws to preserve public safety.

The Pirker case marks the first time the FAA attempted to fine an individual UAS operator, however the Administration has employed other enforcement tools and penalties to curtail civil UAS operations. Upon learning of unauthorized UAS flight activity, the FAA has implemented the following chain of consequences in order of severity: verbal warning, a warning letter, and an order to stop the operation.[104] For example, when Lakemaid Beer Company posted a YouTube video showing a UAS delivering a 12-pack of its beer to ice fisherman in Minnesota, FAA officials called the company president with a verbal warning to stop operations.[105] As of February 2014, the FAA had sent out 17 "cease and desist" letters to companies across the U.S.[106] In one such letter sent to TornadoVideos.net in Norman, Oklahoma, the FAA representative claimed that the company's website indicated that they may be operating UAS for the commercial purpose of selling videos and conducting tornado research without proper authorization.[107] Although it is unknown how many phone calls or emails the FAA has sent out to suspected operators,

all violators were discovered from complaints, open source information, advertising, or gray literature. This enforcement strategy aims to limit the growth of commercial UAS enterprise, however small scale operations could easily avoid FAA scrutiny by limiting their media exposure.

State legislation increases enforceability by describing penalties for illegal use of UAS. Tennessee's statute acknowledges that the sharing of data collected by UAS also poses a threat to commercial security. In Tennessee Code "surreptitious commercial surveillance" occurs when a UAS operator captures an image with the intent of collecting data on a person or property.[108] Such unwanted surveillance is considered a Class B misdemeanor punishable by up to 6 months in jail and/or a $500 fine.[109] It is a further Class A misdemeanor offense to disclose, display, or distribute that data, which comes with a penalty of up to 12 months in jail and a $2500 fine.[110]

The Louisiana UAS law establishes a fine of up to $500 and 6 months in prison for using a UAS to conduct surveillance on specifically defined targeted facilities.[111] A second conviction raises the fine ceiling to $2000 and the potential prison term to one year.[112]

Idaho law establishes a civil penalty of $1000 for violation of its UAS use restrictions against unwarranted surveillance.[113] The Texas Privacy Act provides for a civil penalty of $5000 for UAS images captured in a single sweep without the express consent of the individual or property owner being photographed.[114] The Act also classifies this offense as a Class C misdemeanor.[115] The disclosure, display, or distribution of said images is also punishable in Texas by a fine of $10000 per episode and classified as a Class B misdemeanor.[116]

Oregon took a forward-thinking approach to restricting UAS activity by establishing explicit penalties for weaponizing or hacking UAS. Oregon legislators acknowledged the idea that UAS command and control systems are vulnerable to cyber-attack by establishing criminal penalties for intentionally interfering or gaining unauthorized control over drones licensed by the FAA, DOD or state and local agencies.[117] For example, interfering with or gaining control of a UAS licensed by the FAA or operated by a public entity in Oregon is considered a Class C felony.[118] The Oregon statute also created a Class A felony provision for persons firing bullets or projectiles from a UAS, using a UAS with laser directed at an aircraft, or crashing a UAS into an aircraft.[119] Wisconsin similarly criminalizes the use of a weaponized drone with the penalty of a Class H felony.[120] Possessing or using a UAS as a weapon in North Carolina is a Class E felony punishable by up to 5 years in prison.[121] While the severity of the penalties varies from state to state, each piece of legislation provides law enforcement with clear guidelines for identifying and citing UAS activity that might endanger the public or threaten infrastructure assets.

While 15 states have implemented UAS legislation, as of January 2015 only one municipality in the U.S. has implemented a local ordinance specifically restricting UAS use. On March 20, 2013 the city of St. Bonifacius, Minnesota (pop. 2,286) enacted a UAS ban over its airspace. Section 9-9.3 of St. Bonifacius City Ordinance 115 reads: "Prohibition. No person, entity, governmental unit or law enforcement agency may operate a Drone within the air space of the City."[122] St. Bonifacius defines "air space of the City" as airspace below 600 feet.[123] Section 9-9.5 of the ordinance establishes a penalty for violation whereby "Use or operation of a drone within the airspace of the City in violation of this Ordinance shall be a misdemeanor, punishable in accordance with State Law."

On May 21, 2013 the city of Evanston, Illinois (pop. 74,486), passed an "anti-drone" resolution although it does not carry the same weight as an ordinance. The Evanston City Council resolution declares a 2 year moratorium on the use of UAS in the city, however it contains exemptions for hobby and model aircraft.[124] The exemptions may serve to introduce confusion into the bill that a categorical ban on UAS use would avoid. The Evanston resolution only expresses City Council's support for the moratorium and does not outline penalties for non-compliance as an ordinance would. A handful of other cities have passed ordinances restricting UAS use by government agencies, however they stop short of creating "no-drone zones."[125]

Beyond categorical bans, local governments may incorporate UAS use restrictions into broader ordinances. In March 2013, the township of Conoy, Pennsylvania (pop. 3,248) enacted Ordinance 1-3-14 which defines and prohibits specific nuisances in the township.[126] The ordinance defines a nuisance as "the unreasonable, unwarrantable, or unlawful use of public or private property which causes injury, damage, hurt, inconvenience, annoyance or discomfort to any person or resident in the legitimate enjoyment of his reasonable rights of a person or property."[127] Among other activities such as storing garbage or junked vehicles and letting buildings fall into disrepair, the ordinance prohibits "the operation of remote controlled or other non-tethered aircraft over property not owned by the operator and without the permission of the property owner" on any public or private property in Conoy Township if that action is determined to constitute a nuisance.[128] The ordinance also outlines penalties for noncompliance, beginning with a written notice and escalating to a $300 fine for each violation. Unlike the St. Bonifacius example, the Conoy ordinance does not address airspace jurisdiction and therefore avoids any potential conflicts over FAA authority. As a result, the nuisance ordinance may prove to be more enforceable than a zone-based airspace restriction on UAS operations.

Due to the urban nexus of UAS activity evidenced in NCRIC reporting, enforcing UAS flight restrictions around areas of specific land use is perhaps easier than trying to create airspace regulations that respect FAA authority. The National Parks Service took this approach by enacting their "3-point system" in 2014 to prohibit UAS takeoff, landing, and operation from or on park-owned property.[129] The City of Los Angeles had a similar existing Municipal Code dating to 1979 that was invoked in August 2014 when Los Angeles Port Police cited Daniel Saulmon with a misdemeanor for flying his UAS over the San Pedro, CA harbor in violation of Los Angeles Municipal Code 63.44 (B)(8).[130] In California a misdemeanor is punishable by up to a $1,000 fine and/or 6 months in county jail.[131] Section 63.44 of the Municipal Code prohibits certain activities on property owned by the city or controlled by the Harbor Department specifying that "No person shall land, release, take off or fly any balloon, except children toy balloons not inflated with any flammable material, helicopter, parakite, hang glider, aircraft, or powered models thereof, except in areas specifically set aside therefor."[132] For the Saulmon incident the language of "aircraft, or powered models thereof" was interpreted to include UAS and could be used to restrict UAS activity on other city properties. This example demonstrates that local codes written well before the invention of UAS may include broad language that can still be used by law enforcement personnel to restrict their use. While such creative solutions can limit potentially dangerous UAS operations, clear and specific UAS laws are still imperative for improving the enforcement environment at the local level.

Moving Forward

There exists an immediate need to bridge the gap between policy and enforcement action for UAS operations that might endanger critical infrastructure or innocent bystanders. Passing local ordinances represents a key step towards mitigating these threats.

To begin from scratch, a local ordinance would include a pre-established scale for law enforcement officers to escalate a UAS incident. Consider the following scenario in the current policy environment: A security official at a high-rise in a major urban area reports to the police that a UAS is flying outside of the building. A local patrol officer is dispatched to investigate the incident by making consensual contact with the operator. If an operator refuses to answer questions or provide identification in this "walk-and-talk" encounter, the officer is not in a position to detain the subject or seize their UAS because they lack reasonable suspicion to do so.[133] Developing municipal or countywide ordinances would allow for more comprehensive reporting of incidents and increase local enforcement authority to restrict reckless or nefarious UAS operations. For example, if an individual hobbyist is cited twice for illegal overflights or reckless operation they

might be charged with a misdemeanor, required to pay a monetary penalty, and forfeit their device. This type of standard procedure would eliminate any "gray area" for enforcement at the local level.

In addition to establishing standards for officers dealing with UAS incidents, local ordinances would also include provisions for creating no-fly zones. As discussed earlier, Air Traffic Control is not responsible for airspace below 1200 ft. Only 5 buildings in the U.S. exceed this threshold, so in most cases cities would be within their rights to restrict operations in airspace around high-rises. A sample municipal code might also create no-fly zones in and around specific assets such as electrical substations, shopping centers, arenas, hotels, residential areas, or museums. Another avenue would be to create a categorical prohibition barring any UAS operations in a defined urban area while public parks and open space could be designated as "in-bounds." This might take the reverse form of Los Angeles Municipal Code 63.44 and is not unreasonable; especially considering the fact that conventional model airplane hobbyists are accustomed to flying their craft away from urban areas.

The intersection of interests among municipal governments, businesses, the public safety community, civil liberties groups, as well as model airplane and UAS hobbyists will facilitate the development of local ordinances to govern use. Legislators and law enforcement liaisons will be able to enlist the support of a broad coalition of groups. Making allies of these entities will facilitate efficient policymaking by hedging against dissent at city council meetings. For example, municipal governments would support no-fly zones for UAS in order to protect their constituents and tax base from physical threats. Commercial enterprises want to protect their facilities and equipment from unauthorized surveillance. The law enforcement and first responder communities would support local ordinances because creating no-fly areas will minimize public endangerment and increase the authority of officers to protect the population. Civil liberties groups that typically oppose UAS use for surveillance as a violation of privacy may actually lend their backing to an ordinance that limits UAS operations. While hobbyists might initially resist restrictions on their model aircraft or UAS flying, any concessions they make in accepting no-fly zones could be rewarded by expanding allowable operations in other parts of the city or county. In this way, stakeholders from all sides may ultimately become allies in establishing local ordinances to prevent potential damage and fatalities caused by UAS.

As with any piece of legislation, UAS ordinances will also encounter opposition. The most vocal opponents of no-fly zones might be commercial operators, or those flying UAS for a profit. Markets for services such as cinematography, real-estate photography, and shipping have already emerged in metropolitan areas. Businesses earn money by using UAS to achieve unique perspectives and faster delivery times so their effectiveness would be hindered by no-fly zones. One potential solution would be to charge a fee for registering a UAS and imposing fines for violating the licensing criteria or the no-fly zones. As a part of the licensing process, UAS owners would also be required to furnish proof of liability insurance. The FAA's practice of granting Section 333 airworthiness exemptions while still requiring pilot and medical certificates may represent the maximum reach of their regulatory power over civil UAS. Local jurisdictions will still be responsible for most face-to-face encounters with operators. In this way, a local UAS registration requirement could function similarly to a fishing license or permit.

A local registration program or ordinance might also reduce the demand for city and county resources from the current enforcement environment. For example, an officer confronting a dangerous UAS operator without appropriate authority to cite the subject wastes both time and money because there is rarely a definitive outcome, only an ongoing investigation.[134] That single encounter requires additional investigative and analytic resources to build a case against the subject whereas an ordinance would ultimately shift those costs over to clerks assigned to process the citations. These workers are often employed at lower

wages than sworn personnel.[135] A well-worded and specific UAS ordinance that minimizes ambiguity is also essential to minimize the reporting and administrative burden. Any kind of local UAS policy has the potential to increase the workload for city officials and administrators, however registration fees and fines could serve to offset costs and perhaps as sources of revenue for the municipality. Of course life-safety is the first priority of any public safety organization, and resource allocation for enforcing UAS statutes would compete with preventing more "traditional" criminal activity such as gangs, drugs, and homicide.

A local regulation against UAS flights around specifically prioritized assets or events and an accompanying registration program will serve to standardize reporting, citation procedures, and penalties. Enacting a local ordinance establishes a systematic approach by which law enforcement officers can make contact with UAS operators, and gives these officers the code they need to take appropriate enforcement action. Conducting more encounters will ultimately contribute to increasing homeland security by providing more accurate information to differentiate malicious UAS activity from harmless hobby flights. This data can then be used for crime analysis, resource allocation, and predictive policing. The action taken by local jurisdictions to protect critical infrastructure and preserve public safety addresses more nuanced UAS uses than state or federal legislation and may be achieved more quickly. While the FAA continues to send out cease and desist letters to problem UAS operators, local governments should seize this unique opportunity to claim their own enforcement authority.

About the Author

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Notes

1. For ease of reading, the term UAS will be used interchangeably with the term "unmanned aircraft." This paper uses the Federal Aviation Administration (FAA) definition of "unmanned aircraft" to refer to a "device used or intended to be used for flight in the air that has no onboard pilot. This device excludes missiles, weapons, or exploding warheads, but includes all classes of airplanes, helicopters, airships, and powered-lift aircraft without an onboard pilot." See FAA, "Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap," (Washington, DC: 2013), 49. http://www.faa.gov/uas/media/uas_roadmap_2013.pdf.

2. Federal Aviation Administration Modernization and Reform Act of 2012, Public Law 112-95 § 332, 126 Stat. 73 (2012), http://www.faa.gov/regulations_policies/reauthorization/media/PLAW-112publ95[1].pdf.

3. The FAA classifies unmanned aircraft into three operating categories: Public aircraft, civil aircraft, and model aircraft. A public aircraft is operated by a governmental user such as a federal, state, or local agency. A civil aircraft refers to an unmanned aerial system operated for any non-governmental purpose including private sector and commercial use. Model aircraft are operated exclusively by hobbyists. See FAA, "Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap," 2013, 47-48, http://www.faa.gov/uas/media/uas_roadmap_2013.pdf.

4. U.S. Department of Transportation, Federal Aviation Administration, "N JO 7210.83 Notice- Unmanned Aircraft Operations in the National Airspace System," July 11, 2014, 1, http://www.faa.gov/documentLibrary/media/Notice/N_JO_7210.873_Unmanned_Aircraft_Operations.pdf.

5. Federal Aviation Administration, "Special Airworthiness Certification: Certification For Civil Operated Unmanned Aircraft Systems (UAS) and Optionally Piloted Aircraft," Sept 12, 2014, https://www.faa.gov/aircraft/air_cert/airworthiness_certification/sp_awcert/experiment/sac/.

6. Federal Aviation Administration, "Docket No. FAA-2014-0396- Interpretation of the Special Rule for Model Aircraft," June 18, 2014, http://www.faa.gov/uas/publications/media/model_aircraft_spec_rule.pdf.

7. Federal Aviation Administration, "Fact Sheet – Unmanned Aircraft Systems (UAS)," Jan 6, 2014, http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14153.

8. (PL 112-95, February 14, 2012), "Public Unmanned Aircraft Systems," 49 U.S.C. 334(c)(2)(C), www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf.

9. Ibid.

10. Class G Airspace is designated uncontrolled airspace 1200 feet or less above the ground surface. Air Traffic Control has no authority or responsibility to control air traffic in Class G airspace. FAA Pilot Handbook 2014, "Chapter 14: Airspace," 2014, 14-3, https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2014.pdf.

11. FAA, "Fact Sheet – Unmanned Aircraft Systems (UAS)."

12. 14 CFR § 91.319(a)(2).

13. Electronic Frontier Foundation, "FAA List of Special Airworthiness Certificates-Experimental Category (SACs)," April 16, 2012, https://www.eff.org/files/filenode/20120416_FAA_Drones_SAC.pdf.

14. FAA, "Press Release – FAA Approves First Commercial UAS Flights Over Land," June 10, 2014, http://www.faa.gov/news/updates/?newsid=73118.

15. The 6 test range operators are the University of Alaska, State of Nevada, New York's Griffiss International Airport, North Dakota Dept. of Commerce, Texas A&M – Corpus Christi, and Virginia Tech. Some operators have ranges in other states as well. See FAA, "Test Sites," Last updated March 13, 2015, https://www.faa.gov/uas/legislative_programs/test_sites/.

16. FAA, Order 8000.372A-,"Unmanned Aircraft Systems (UAS) Designated Airworthiness Representatives (DAR) for UAS Certification at UAS Test Sites," Dec 12, 2014, 6, http://www.faa.gov/documentLibrary/media/Order/FAA_Order_8000_372.pdf.

17. (PL 112-95, February 14, 2012), "Special rules for certain unmanned aircraft systems," 49 U.S.C. § 333(b)(1), www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf.

18. (PL 112-95, February 14, 2012), "Special rules for certain unmanned aircraft systems," 49 U.S.C. § 333(b)(2), www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf.

19. Federal Aviation Administration, "Section 333," April 14, 2015, https://www.faa.gov/uas/legislative_programs/section_333/.

20. The companies are Astraeus Aerial, Aerial MOB, HeliVideo Productions, Pictorvision, RC Productions Consulting dba Vortex Aerial, and Snaproll Media. See FAA, "Section 333," Jan 6, 2015, http://www.faa.gov/uas/legislative_programs/section_333/.

21. The companies are Clayco Inc., Trimble Navigation Limited, VDOS Global LLC, Woolpert Inc., Tierra Antigua Realty, and Advanced Aviation Solutions. See FAA, "Section 333," Jan 6, 2015, http://www.faa.gov/uas/legislative_programs/section_333/.

22. (PL 112-95, February 14, 2012), "Special rules for certain unmanned aircraft systems," 49 U.S.C. § 333(a), www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf.

23. FAA, "Exemption No. 11138- Regulatory Docket No. FAA-2014-0481," Jan 5, 2015, http://www.faa.gov/uas/legislative_programs/section_333/media/Trudeau_Douglas-11138.pdf.

24. FAA, "Exemption No. 11111- Regulatory Docket No. FAA-2014-0506," 10 Dec, 2014, http://www.faa.gov/uas/legislative_programs/section_333/media/Woolpert_Inc_11111.pdf.

25. 49 U.S.C. § 44711(a)(2).

26. Federal Aviation Administration, "Section 333 Exemption/Rulemaking," Accessed March 25, 2015, http://www.regulations.gov/#!searchResults;rpp=50;so=ASC;sb=title;po=0;s=%2522section%252B333%2522%252BFAA;dct=O.

27. (PL 112-95, February 14, 2012), "Special rule for model aircraft," 49 U.S.C. § 336, www.gpo.gov/fdsys/pkg/CRPT-112hrpt381/pdf/CRPT-112hrpt381.pdf.

28. Douglas M. Marshall, "US Aviation Regulatory System," in *Introduction to Unmanned Aircraft Systems*, R.K. Barnhart, et al., eds., (Boca Raton: CRC Press, 2012), 48.

29. FAA, "Docket No. FAA-2014-0396- Interpretation of the Special Rule for Model Aircraft," June 18, 2014, https://www.faa.gov/uas/media/model_aircraft_spec_rule.pdf.

30. (PL 112-95, February 14, 2012), "Special rule for model aircraft," 49 U.S.C. § 336 (c).

31. (PL 112-95, February 14, 2012), "Special rule for model aircraft," 49 U.S.C. § 336 (b).

32. Operation and Certification of Small Unmanned Aircraft Systems, 80 Fed. Reg. 9545, Feb 23, 2015.

33. Operation and Certification of Small Unmanned Aircraft Systems, "Visual Observer," 80 Fed. Reg. 9587, Feb 23, 2015.

34. Federal Aviation Administration Modernization and Reform Act of 2012, Public Law 112-95 § 332, 126 Stat. 73, (2012), http://www.faa.gov/regulations_policies/reauthorization/media/PLAW-112publ95[1].pdf.

35. FAA, "Fact Sheet- Unmanned Aircraft Systems (UAS)."

36. Ibid.

37. Email with Scott Harris, FAA Special Agent, Law Enforcement Assistance Program (LEAP), July 31, 2014.

38. This strategy is similar to the position taken by the National Parks System prohibiting UAS takeoff, landing, or the operator standing on Park property. See National Parks Service Press Release, "Unmanned Aircraft to be Prohibited in America's National Parks," June 20, 2014, http://home.nps.gov/news/release.htm?id=1601.

39. The 15 states are Alaska, Illinois, Indiana, Iowa, Louisiana, Tennessee, Utah, Wisconsin, North Carolina, Florida, Idaho, Oregon, Montana, Texas, and Virginia.

40. See Virginia Uncodified Act Chapter 755, "An Act to place a moratorium on the use of unmanned aircraft systems," (2013), http://lis.virginia.gov/cgi-bin/legp604.exe?131+ful+CHAP0755 . See also N.C. Gen. Stat. § 14-7.16(e) (2014), http://www.ncleg.net/Sessions/2013/Bills/Senate/PDF/S744v9.pdf. This statute extends the moratorium established in N.C. Gen. Stat. S. § 14-7.16(e) (2013). http://www.ncga.state.nc.us/Sessions/2013/Bills/Senate/PDF/S402v7.pdf .

41. Restricted category SACs allow for commercial operations under 14 CFR § 91.319(a)(2). See FAA, "Press Release – FAA Approves First Commercial UAS Flights Over Land," June 10, 2014, http://www.faa.gov/news/press_releases/news_story.cfm?newsId=16354. The exemption protocol under Section 333 of the FAA Modernization and Reform Act was first implemented on September 25, 2014. See Federal Aviation Administration, "Press Release- U.S. Transportation Secretary Foxx Announces FAA Exemptions for Commercial UAS Movie and TV Production," Sept 25, 2014, http://www.faa.gov/news/press_releases/news_story.cfm?newsId=17194&cid=TW251.

42. Tenn. Ann. Code § 39-13 (2014), http://www.capitol.tn.gov/Bills/108/Bill/SB1892.pdf.

43. Tex. Gov. Code § 423-002 (2013), http://www.statutes.legis.state.tx.us/Docs/GV/htm/GV.423.htm.

44. Ibid.

45. Idaho Code § 21-213 (2013), http://www.legislature.idaho.gov/idstat/Title21/T21CH2SECT21-213.htm.

46. La. Rev. Stat. § 14-337(A) (2014), https://www.legis.la.gov/legis/law.aspx?d=919584.

47. La. Rev. Stat. § 14-337(B)(3) (2014).

48. Wis. Stat. § 114.04 (2014), http://docs.legis.wisconsin.gov/2013/related/acts/213.

49. Or. Rev. Stat. 837 § 360 (2013), https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2013ors837.html . See also N.C. Gen. Stat. § 14-401.24 (2014), http://www.ncleg.net/Sessions/2013/Bills/Senate/PDF/S744v9.pdf.

50. N.C. Gen. Stat. § 14-63-96(d) (2014), http://www.ncleg.net/Sessions/2013/Bills/Senate/PDF/S744v9.pdf.

51. 47 CFR § 90.257(c), http://www.law.cornell.edu/cfr/text/47/90.257.

52. Turbo Ace, "Infinity 9 Octocopter Features and Options," 2014, http://www.turboace.com/infinity_9_octocopter/bundle_gimbal.aspx .

53. U.S. District Court, District of Massachusetts, "Indictment: United States of America v. Rezwan Ferdaus," September 29, 2011, 2, http://www.investigativeproject.org/documents/case_docs/1702.pdf.

54. Paul Cruickshank, and Tim Lister, "Analysis: Model Planes as Weapons of Terror," CNN Security Clearance Blog, Sept 29, 2011, http://security.blogs.cnn.com/2011/09/29/analysis-model-planes-as-weapons-of-terror/.

55. Stephanie Condron and Christopher Leake, "Poison Drones Carrying Biological Weapon are New Olympic Threat Warns Colonel in Charge of Keeping London Calm," *UK Daily Mail Online*, May 5, 2012, http://www.dailymail.co.uk/news/article-2140173/Poison-drones-new-Olympic-threat-warns-Colonel-charge-keeping-London-calm.html#ixzz1u450JnEV.

56. Federal Bureau of Investigation, "Citizen of Morocco Admits Fabricating Refugee Application to Remain in U.S.," July 24, 2014, http://www.fbi.gov/newhaven/press-releases/2014/citizen-of-morocco-admits-fabricating-refugee-application-to-remain-in-u.s.

57. U.S. District Court of Connecticut, Fairfield County, "Affidavit of Anabela Sharp," April 4, 2014, 16, http://documents.latimes.com/fbi-immigration-arrest-unveils-bomb-plot/.

58. Ibid., 17.

59. Ibid., 16.

60. Federal Bureau of Investigation, "Press Release: Man Sentenced in Boston for Plotting Attack on Pentagon and U.S. Capitol and Attempting to Provide Detonation Devices to Terrorists," Nov 1, 2012, http://www.fbi.gov/boston/

press-releases/2012/man-sentenced-in-boston-for-plotting-attack-on-pentagon-and-u.s.-capitol-and-attempting-to-provide-detonation-devices-to-terrorists.

61. Ibid.

62. U.S. District Court, District of Massachusetts, "Indictment: United States of America v. Rezwan Ferdaus," Sept 29, 2011, 9, http://www.investigativeproject.org/documents/case_docs/1702.pdf.

63. Michael D Shear, and Michael S. Schmidt, "White House Drone Crash Described as a U.S. Worker's Drunken Lark," The New York Times, Jan 27, 2015, http://www.nytimes.com/2015/01/28/us/white-house-drone.html?_r=0.

64. Krishnadev Calamur, "No Charges for Operator of Drone that Crashed at White House," National Public Radio News, March 18, 2015, http://www.npr.org/blogs/thetwo-way/2015/03/18/393855332/no-charges-for-operator-of-drone-that-crashed-at-white-house.

65. Ibid.

66. Patrik Jonsson, "Whose drone is it? St. Louis high-rise crash heralds age of private drones," May 8, 2014, http://www.csmonitor.com/USA/2014/0508/Whose-drone-is-it-St.-Louis-high-rise-crash-heralds-age-of-private-drones.-video.

67. Joe Millitzer, "FAA-No criminal charges for man who crashed drone into a St. Louis building," June 4, 2014, http://fox2now.com/2014/06/04/faa-no-criminal-charges-for-man-who-crashed-drone-into-a-st-louis-building/comment-page-1/.

68. The FAA serves as a regulatory agency tasked to create and enforce the rules published in the Code of Federal Regulations (14 CFR Part 91). These regulations are commonly called FARs.

69. Jim Hoffer, "Brooklyn man arrested for flying drone over Manhattan," ABC 7 Eyewitness News, Oct 18, 2013, http://abclocal.go.com/wabc/story?section=news/investigators&id=9292217.

70. Ibid.

71. Dana Sauchelli, "Toy Chopper-Crash Pilot Snagged by His Own Video," *The New York Post,* Oct 18, 2013, http://nypost.com/2013/10/18/toy-chopper-crash-pilot-snagged-by-his-own-video/.

72. New York Penal Law § 70.15, http://law.onecle.com/new-york/penal/PEN070.15_70.15.html.

73. The FAA maintains that UAS operation without a certificate is not permitted in Class B airspace –generally located over urban areas–however this violation did not play into the NYPD arrest, http://www.suasnews.com/wp-content/uploads/2014/05/Zablidowsky-CP-ltr.pdf.

74. New York State Police, "SP Kingston – Unlawful Surveillance Arrest," July 15, 2014, https://www.nyspnews.com/article_display.cfm?article_id=39366.

75. Ibid.

76. N.Y. Pen. Law § 70.00, http://law.onecle.com/new-york/penal/PEN070.00_70.00.html.

77. The White House Office of the Press Secretary, "Presidential Policy Directive – Critical Infrastructure Security and Resilience," Feb 12, 2013, http://www.whitehouse.gov/the-press-office/2013/02/12/presidential-policy-directive-critical-infrastructure-security-and-resil.

78. Ibid.

79. "Drones, Horns, Injuries: UAS Tumbles into Virginia Bull Run Crowd," *RT*, Aug 26, 2013, http://rt.com/usa/virginia-bull-run-drone-002/.

80. Ibid.

81. U.S. Department of Homeland Security, "Commercial Facilities Sector," Aug 27, 2014, http://www.dhs.gov/commercial-facilities-sector.

82. See FAA Notice to Airmen (NOTAM) 4/3621, 27 Oct, 2014, http://tfr.faa.gov/save_pages/detail_4_3621.html.

83. Interview with David B. Morton, FAA UAS Integration Analyst, April 4, 2014.

84. FAA, "Special Notice 4/0811," June 30, 2009, https://www.faa.gov/air_traffic/publications/us_restrictions/fdc_notams/pdf/FDC%20NOTAMS%204-4386%20and%204-0811.pdf.

85. FAA, "Law Enforcement Guidance for Suspected Unauthorized UAS Operations," Jan 8, 2015, 9, http://www.faa.gov/uas/regulations_policies/media/FAA_UAS-PO_LEA_Guidance.pdf.

86. Ibid., 10.

87. Ibid., 6.

88. For the Seattle incident see Michael Konopasek, "Seattle Wants Drone Rules after Space Needle Buzzing," July 29, 2014, http://www.usatoday.com/story/news/nation-now/2014/07/29/drones-Seattle-Space-Needle-faa/13322795/;For the Charlotte incident see Mark Washburn, "Drone Buzzes Panthers-Chiefs Game and Police Pounce," http://www.charlotteobserver.com/2014/08/26/5130873/drone-buzzes-panthers-chiefs-game.html; For the Tampa incident seeChristopher Spata, "Drone Video of Downtown Tampa Goes viral," July 11, 2014, http://tbo.com/news/business/drone-video-of-downtown-tampa-goes-viral-20140711/.

89. FAA, "FAA Compliance and Enforcement Program Order 2150.3B," Oct 1, 2007, 2-2, http://www.faa.gov/documentLibrary/media/Order/2150.3%20B%20W-Chg%204.pdf.

90. FAA, "FAA Compliance and Enforcement Program Order 2150.3B," 3-1.

91. FAA, "FAA Compliance and Enforcement Program Order 2150.3B," 4-38.

92. Interview with David B. Morton, FAA UAS Integration Analyst, April 4, 2014.

93. Interview with Scott Harris, FAA Special Agent, March 20, 2014.

94. 49 U.S.C. § 46306(b)(6)(B).

95. Interview with Scott Harris, FAA Special Agent, March 20, 2014.

96. Interview with David B. Morton, FAA UAS Integration Analyst, April 8, 2014.

97. Federal Aviation Administration, "Chapter 14: Airspace," *Pilot Handbook,* 2014, 4-3, http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2014.pdf.

98. U.S. National Transportation Safety Board Office of Administrative Law Judges, "Decisional Order Docket CP-217," March 6, 2014, 2, http://www.ntsb.gov/legal/Pirker-CP-217.pdf.

99. Ibid.

100. Ibid.

101. U.S. National Transportation Safety Board, "Order No. EA-5730," Nov 18, 2014, 12, http://www.ntsb.gov/legal/alj/OnODocuments/Aviation/5730.pdf.

102. Ibid.

103. Jack Nicas, "U.S. Federal Aviation Administration Settles with Videographer Over Drones," Jan 22, 2015, http://www.wsj.com/articles/u-s-federal-aviation-administration-settles-with-videographer-over-drones-1421960972.

104. FAA, "Busting Myths about the FAA and Unmanned Aircraft," March 7, 2014, http://www.faa.gov/news/updates/?newsId=76240.

105. John Mariani, "Lakemaid Beer Delivery Drone Grounded by FAA," Jan 31, 2014, http://www.syracuse.com/news/index.ssf/2014/01/lakemaid_beer_delivery_drone_grounded_by_faa.html.

106. Patrick McKay, "FAA FOIA Response 2-4-14," http://www.dronejournalism.org/news/2014/2/faa-cease-and-desist-letters-show-agencys-attempts-to-control-drone-use-in-the-us.

107. Ibid.

108. Tenn. Ann. Code § 39-13(10)(c) (2014), http://state.tn.us/sos/acts/108/pub/pc0876.pdf.

109. Tenn. Ann. Code § 39-13(10)(e)(1) (2014).

110. Tenn. Ann. Code § 39-13(10)(e)(2) (2014).

111. La Rev. Stat. § 14337(E)(1) (2014), http://www.legis.la.gov/legis/law.aspx?d=919584.

112. La Rev. Stat. § 14-337(E)(2) (2014).

113. Idaho Code § 21-213 (2013), http://legislature.idaho.gov/legislation/2013/S1134.pdf.

114. Tex. Gov. Code § 423.006 (2013), http://www.statutes.legis.state.tx.us/Docs/GV/htm/GV.423.htm.

115. Tex. Gov. Code § 423.002 (2013).

116. Tex. Gov. Code § 423.004 (2013).

117. Ibid.

118. Or. Rev. Stat. § 837.995 (2013), https://www.oregonlegislature.gov/bills_laws/lawsstatutes/2013ors837.html.

119. Ibid.

120. Wis. Stat. § 941.292 (2014), http://docs.legis.wisconsin.gov/2013/related/acts/213.

121. North Carolina General Statute § 14.401.24(a) (2014), http://www.ncleg.net/Sessions/2013/Bills/Senate/PDF/S744v9.pdf.

122. St. Bonifacius, Minnesota, Municipal Code § 115, March 20, 2013, http://sunpatriot.com/2013/03/29/st-bonifacius-ordinance-no-115/.

123. Email correspondence with Rick Weible, Mayor of City of St. Bonifacius, MN, July 17, 2014.

124. City of Evanston, Illinois, "27-R-13: A Resolution Authorizing the City of Evanston to Establish a Moratorium on the Use of Unregulated Drone Technology," May 21, 2013, http://www.cityofevanston.org/assets/27-R-13%20Unregulated%20Drone%20Technology.pdf.

125. See Charlottesville, VA, Iowa City, IA, and Pierce County, WA.

126. Township of Conoy, Pennsylvania, "Nuisance Ordinance 1-3-14-2013," March 14, 2013, http://www.conoytownship.org/files/2013/12/1-3-14-2013_Nuisance_Ordinance.pdf.

127. Ibid.

128. Ibid.

129. National Parks Service, "Policy Memorandum 14-05," June 19, 2014, http://www.nps.gov/policy/PolMemos/PM_14-05.htm.

130. Andrew Meyer, "California Cops Confiscate Quadcopter from Activist at Photo Friendly Event," Aug 7, 2014, http://photographyisnotacrime.com/2014/08/07/california-cops-confiscate-quadcopter/.

131. California Penal Code § 2-24 (19), http://www.leginfo.ca.gov/cgi-bin/displaycode?section=pen&group=00001-01000&file=2-24.

132. Los Angeles Municipal Code § 63.44, "Regulations Affecting Park and Recreation Areas," Nov 16, 1979, http://www.laparks.org/venice/pdf/lamc63.pdf.

133. Interview with John Gordnier, Legal Advisor Emeritus to Law Enforcement Intelligence Units (LEIU), June 12, 2014.

134. Interview with San Francisco Police Department Sergeant, June 10, 2014.

135. City and County of San Francisco Department of Human Resources, "Classification and Compensation Database," Accessed Jan 7, 2015, http://www.sfdhr.org/index.aspx?page=32.