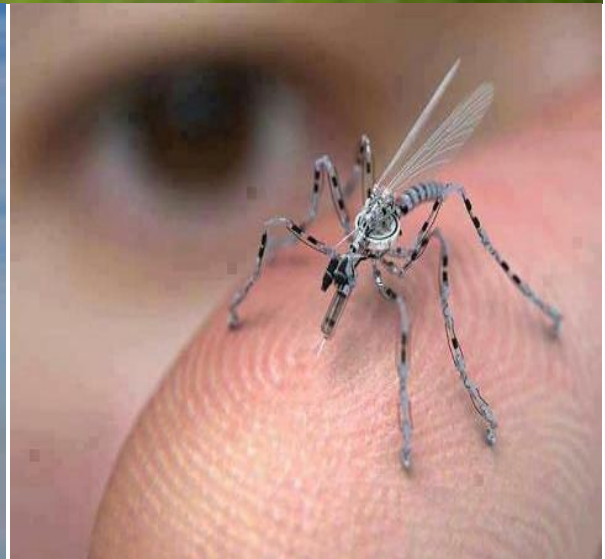


DRONE USAGE



TECHNOLOGY AWAKENING

Drone Usage –
Managing this Technology Awakening

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Abstract

Drones have been in existence for more than 150 years. What makes these aircraft special is that they operate with no pilot onboard and their flight is controlled outside the device. There are many beneficial uses of drones from recreational to agriculture to government to military uses. However, there are concerns about drones and the unintended use of the technology as well. Some areas of concern include: safety issues, privacy issues, illegal issues, security issues, public arena and gathering issues, and freedom of speech issues. The Federal Aviation Administration is the primary decision-making authority regarding aircraft, including drones, and has jurisdiction to control the nation's airspace. The FAA desires a national navigable airspace that is free from inconsistent state and local restrictions. The State of Iowa has reached a juncture where it is recommended the Iowa Legislature enact necessary legislation consistent with FAA guidelines to solve and prevent problems while, at the same time, encouraging the legal and appropriate use of the advancing technology to the benefit of the State of Iowa and all citizens.

Keywords: Drones, UAS, UAV, Federal Aviation Administration, right to privacy, Fourth Amendment, freedom of speech, First Amendment

DRONE USAGE – MANAGING THIS TECHNOLOGY AWAKENING

While many people believe drones are a relatively new phenomenon, they have a long and interesting international history. The drones popular today with the public are mostly recreational, radio-controlled flying machines often equipped with small cameras. They are frequently operated using a cell phone or tablet, and they enjoy mass appeal with all ages. As the costs of drones continue to decrease, their popularity soars. Although they are most commonly called drones, these aerial vehicles fall into a category defined by the Federal Aviation Administration as unmanned aerial systems (UAS), unmanned aircraft systems (UAS), radio controlled aircraft (RC), and unmanned aerial vehicles (UAV). The common factor connecting all these aircraft is they are created to operate with no pilot onboard, and their flight is controlled outside of the flying device. UAVs vary greatly in size. They can be as large as a full sized plane or helicopter, or they can be as small as an insect. Their uses vary greatly from pleasure flying to agricultural field surveying to creating images for marketing to surveillance for military reconnaissance and attack. The aerial technology is awakening continually every day. It is advancing at an unprecedented technological rate bringing benefits to many, but introducing many challenges as well.

The First Drones

Unmanned aerial vehicles were first used on August 22, 1849, when Austria attacked the Italian city of Venice with five balloons loaded with explosives (Remote Piloted, 2016). These balloons were to be launched with favorable winds to drift them over Venice. Once in

position, the explosives were dropped by an electro-magnetism triggering mechanism by means of a long isolated copper wire with a large battery placed on a building. Although this first attempt at unmanned vehicle does not meet today's definition of a UAV, it started the evolution and development of them.

The early version of UAVs relied on the wind to move the vehicle. In 1898, at Madison Square Garden, Nikola Tesla demonstrated the first remote-controlled vehicle. It was a pair of radio-controlled boats (Shaw, 2012). This was an important first step in developing remote radio-controlled vehicles. Tesla was able to steer the boat and control on-board gadgets, such as lights, on a moving vehicle from a short distance away. This presentation astounded those in attendance. As word spread, interest from military leaders peaked for its potential military capabilities. Over the next few years, advances were made in radio-control techniques proving someone could control these devices remotely with electromagnetic waves to execute various commands (RCFlightline, 2016).

Quadcopters, today's most popular amateur model of UAV, were first tested in 1907, as full-sized vehicles that flew only a few feet off the ground (Young, 1982). Improvements were made through the next several decades, but they had minimal success through the 1950s. Quadcopters demonstrated feasibility for use but were complex, difficult to fly, and susceptible to reliability problems. The pilot's workload proved exhausting, and the vehicles appealed to a small market only. Recreational remote-control vehicles were created in the 1960s after transistors became widely used. They allow the control equipment to greatly shrink in size (RCFlightline, 2016).

Mass Produced Drones

In the late 2000s, advancements in electronics allowed for the production of inexpensive lightweight flight controllers, global positioning systems, and cameras capable of producing very detailed images. Only a few years earlier these types of capabilities would have been unattainable and even completely unimaginable. This resulted in the proliferation of small consumer quadcopters. The market and interest in this type of item soon began to grow. These small quadcopters currently have been built as small as an insect, able to rest on one's thumb print (see image below).



(Dronebuff.com)



(Techblog.com 2012)

Unmanned aerial vehicles come in many shapes and sizes for every level of pilot. As technology has improved, amateur UAV enthusiasts have been drawn to remote control airplanes and small quadcopters. Advanced aircraft such as model jets and helicopters are much more challenging to fly, and those tend to fall into the category more useful for commercial users. Commercial UAVs are more powerful quadcopters or fixed delta wing planes. These aircraft are controlled in various ways. Most are flown by sight keeping the UAV in close proximity to the pilot. Failsafe measures are built into the UAV to minimize loss or

damage to the UAV and property. If the UAV gets out of sight or out of radio range, most have the ability to return to the point where the flight started. Some have protective molding, which safeguards the drone and property from damage if it runs into something.

One way UAV pilots are able to control their aircraft is by using first-person view. By utilizing first-person view, one flies the plane via live video download from a front mounted camera which sends images to an LCD screen. In this system, the pilot sees the flight as if he or she is actually sitting in the UAV and not watching the aircraft from the ground. This allows for flights that can go far beyond the line of sight. This technology is limited only by the distance the pilot can remain in contact with the UAV. Programming routes into the UAV provides a specific pattern of flight whether it is gathering data over a field of crops, flying a route miles away and miles at a time, surveying land, or searching for a lost hiker or even a lost child.



(Drone Agricole)



(web photo/AGdrones.com)

FAA Jurisdiction

UAVs are considered aircraft by federal law. Due to that designation, they fall under the jurisdiction of the Federal Aviation Administration (FAA). The FAA has divided drone usage into three categories, each with their own distinct rules and responsibilities:

- Public Operations (Governmental)
- Civil Operations (Non-Governmental)
- Model Aircraft (Hobby or Recreation *only*)

As the use of drones grows in each category, the FAA has been tasked with keeping up with the advancing technology, requested uses, types of users, user conflicts, public concerns, privacy issues, lack of a consistent public policy, and more. While the FAA has taken the lead in developing policy, it is anticipated that states and local governments will have an ongoing and continuous need to work with the FAA, promote FAA rule and regulations, and assist in educating the public about risks inherent with drone use. There is much discussion surrounding the need to be proactive to avoid conflicts and potential tragedies.

Drones in Agriculture

Drone use in agriculture is advancing quickly and gaining momentum at an unprecedented pace. Drones allow a farmer to survey his or her field in a matter of minutes and at a fraction of the prior costs. While in the past, it would take an individual farmer hours of walking through his/her fields to determine an overall view of growth patterns and crop health, today the same job can be done utilizing UAS technology at an amazing pace. Different types of cameras can be mounted to the drone depending on the data desired. Video, still, infrared, and thermal imaging are just a few of the camera options. The outline of the field is programmed into the drone utilizing global positioning system technology. As the drone flies over the field, the pilot, or farmer, can view the images real-time or the images can be stored and processed on a computer to view and study later, or both. If there is an anomaly found, the pilot can zoom in on the area for further inspection. This data can also be shared with others such as

agronomist to study the problem areas or with those who will be applying fertilizer or chemicals to the field, focusing on the locations that need it the most.

Surveying crops is only one aspect for drone usage in agriculture. In fact, the uses are limited only by the farmer's imagination. Ranchers with large pastures of land can fly their fields to check on livestock, to locate missing cattle, or cattle who are close to having calves. Drones can be flown down waterways to perform tile and drainage inspections. They can be flown over barns and silos to inspect the roof and mechanical equipment. If adverse weather comes through, drones can be flown over the fields to survey and record the damage for crop insurance claims. What normally would take hours or days in the past can now be done in a fraction of the time. Some drones have the capability to fly and accurately scan a square mile field in 30 minutes or less.



(AFP/Getty 2015)



(Understandingempire.wordpress.com 2014)

Drones in the Military

The military is a large user of UAVs. In the early 1980s, engineer Abe Kareem started "Leading Systems Inc." to build an unmanned aerial vehicle that could fly for days at a time

without refueling. In 1984, the Defense Advanced Research Projects Agency (DARPA) took interest and saw the value of an aircraft that could stay aloft for days at a time. Karem's aircraft, named Albatross, was the predecessor to the modern day Predator and Reaper drones. In the year 2000, the U.S. military operated 50 UAVs. Current experts now estimate the United States now has over 6,000 UAVs in use. The Department of Defense will spend over \$40 billion by the year 2020 to increase their fleet of UAVs by 750, as well as 30 additional medium and large sized UAVs (Betz, 2016).

Of the more than 6,000 UAVs that the military flies, the majority are smaller vehicles used for short range reconnaissance. The medium and large unmanned aerial vehicles the military operates are typically flown remotely. Most flights start with a local pilot controlling the UAV for takeoff, and then control is transferred to another pilot. These pilots, who can be located in the United States, may be controlling a UAV flight more than 7,500 miles away. The largest surveillance UAV has a wingspan of 116 feet and is 44 feet long. Military drones have advanced to where some of the current fleet models have the ability to stay airborne for more than 35 hours, fly more than 13,000 miles, and some can climb to as high as 65,000 feet. The Navy has a UAV that can be catapulted off an aircraft carrier, fly its mission, and land safely back on the carrier for use later (Shaw, 2012).



(Michael Fabey 2012)

Law enforcement is integrating UAVs into their day-to-day work as well. The use of a UAV during a police operation allows officers the ability to stay out of harm's way while surveying a potentially dangerous situation from overhead. Another example of law enforcement agencies use of UAS technology is monitoring a criminal pursuit and using multiple UAVs to extend coverage of the pursuit over a large geographic area. Today, high speed pursuits create some of the most dangerous situations for not only law enforcement, but for the general public as well. By utilizing UAS technology, law enforcement officers are able to better make a decision to disengage from a high-speed pursuit for safety reasons while continuing to monitor the situation from overhead and track the subject's location as well.

UAS technology can be used in numerous other ways too. Sophisticated cameras mounted to UAS allow for emergency responders to use them for search and rescue operations. Speakers can be added to assist with crowd control announcing directions for citizens to follow. UAVs can provide real-time images transferred back to a traffic operations center allowing public safety officials to notify travelers of any issues that may exist. Border Patrol can fly the borders relaying directions to local enforcement of individuals or drug runners

crossing into the United States illegally. The law enforcement use of UAS technology is nearly limitless and innovation in this area has only begun.

The use of drones by law enforcement is not without its controversy. Organizations such as the American Civil Liberties Union and others are greatly concerned by the surveillance potential of drones in the public sector. In Iowa, there has started to be limited UAV use among municipalities. In a survey, conducted by the authors, of Iowa city administration and airport managers regarding the government use of UAV, Rhonda Chambers, Fort Dodge Regional Airport Manager, reported Fort Dodge Police used a drone to help find some lost children. “Last year, the Fort Dodge Police Department contacted me that they were using a drone to search for possible victims that were reported missing in the Des Moines River. The boys were later found at a residence and okay,” she wrote. It is increasingly likely this type of public safety use will increase across the country as technology advances and costs decline.



Michael Zhang 2015

There are numerous commercial uses of UAS technology as well. Television directors are using high quality cameras on UAVs to film from angles not previously available. Media coverage of sporting events using UAS is growing. Filming from UAS platforms during breaking

news events allows reporters to remain at a safe distance while still getting the story they desire. Real estate companies are using UAVs to fly over property, recording images to provide to potential clients a complete view of a property they have for sale. UAVs increase safety by replacing workers who previously had to climb towers to conduct inspections or by flying them over bodies of water to conduct bridge inspections. Many companies have proposed plans to use UAVs for package delivery. In December 2013, Deutsche Post DHL was the first company to successfully deliver a civilian shipment of medical supplies via drone-delivery (Bonn, 2014).

Soaring in Popularity

Recreational UAVs have gained in popularity in the past few years. For a few dollars to several thousand dollars, an individual can purchase a UAV to fly for personal enjoyment. While it is clear that UAV use can have many benefits in the military, agriculture, public safety, marketing, and for the recreation or hobbyist user, drone use is not without its concerns.

Drone Issues & Concerns

The proliferation of UAS among members of the public, whether they are for government, commercial, or recreation use, has been a source of controversy and conflict. While the FAA continues to update its rules and regulations, other jurisdictions have been monitoring the technology and its impact. UAS have a long history, but mass production and lower costs have made them much more common now than in the past. It is estimated that millions of drones were sold in the United States in 2015. Privacy complaints nationally regarding the use of UAVs also have climbed as the popularity of drones has increased.

Currently, it is not the drone itself that is typically the main concern. Radio controlled airplanes and helicopters have been around for decades. Equipping UAVs with small, high resolution video cameras has changed the industry dramatically. In an interview by TNW, Simon Rice, Technology Group Manager at the Information Commissioner's Office (ICO), said:

“A drone in itself is not processing any personal data until you strap a video camera to it... It’s only really when you start strapping on sensors, whether that’s cameras, thermal imaging, or whatever it might be, then the privacy implications start to arise. When you’ve got a camera involved it’s not a million miles away from where we are with CCTV... Obviously it’s a slightly larger problem because they’re mobile.”

With the ability to travel miles remotely by novice operators and equipped with high definition 4k cameras and other peripherals, the modern UAS environment creates concerns involving six primary categories. These areas include, but are not limited to, safety issues, privacy issues, illegal issues, security issues, public arena and gathering issues, and freedom of speech issues. This abridged list of issues is what has local and national policy makers scrambling to try and keep in step with the evolving abilities and possibilities of UAVs.

1. Safety Issues

The most publicized of all the issues are the reported observations of drones by manned aircraft pilots. The FAA began collecting data on incidents in February of 2014. According to FAA data that they released in March, 2016 there were 1,200 incidents reported in 2015, more than five times the amount reported during the same time period in 2014 (Figure, 1/FAA DATA, 2016).

As indicated in the chart, peak incident reports occur during the summer months when operating conditions for the UAS were optimal. Of the 1,200 reported incidents in 2015, no mid-air collisions occurred. Mid-air collisions are not the only safety issues of concern. Physical harm from out of control UAS crashing into individuals and/or property has been documented. Specific incidents include an event in 2013, when spectators at a motorsports stadium were injured after a UAS crashed into the stands. In April, 2014, a female triathlete sustained a head injury when a UAS used to film competitors crashed (Warwick, 2016).

There has been debate by researchers and much concern spread by mass media outlets regarding the actual risks of drones or UAS causing damage or a crash of a manned aircraft, but

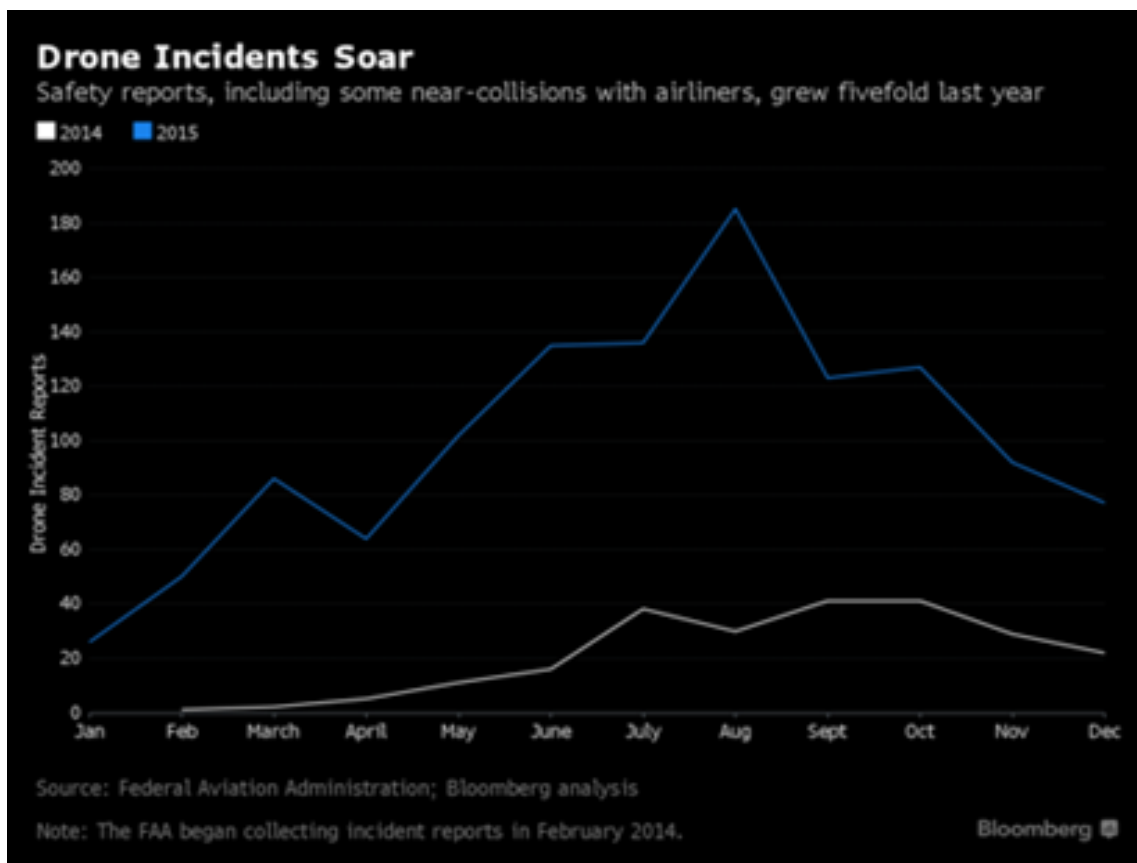


FIGURE 1 (Levin, 2016)

there have been no known incidents to date. According to researches ELI Dourado and Samuel Hammond, the risk for actual damage to manned aircraft is less likely to happen from a UAS than it is with a collision with live animals. Using Federal Aviation Administration data of actual collisions and the wildlife strike database by manned aircraft, Dourado and Hammond estimate that actual damage or injury from UAS usage would only occur once for every 1.87 million years of UAS flight time (Hammond & Dourado, 2016).

2. Privacy Issues

The Fourth Amendment of the U.S. Constitution includes “the right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no warrants shall issue, but upon probable cause, supported by oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized.” The ultimate goal of this provision is to protect a person’s right of privacy and freedom from government intrusions (Cornell University, 2016). With the Constitution specifically stating that citizens have the right to privacy, advocates of UAS privacy concerns have attempted to adapt the Fourth Amendment to correlate with UAS issues. This argument is effective with the use of UAS by government and law officials, but it is more challenging to adapt to the recreational operator. Citizens expect the right to be secure in their persons and houses from the government, but they also expect the same from other citizens.

The idea of citizens to be secure in their persons and homes directly correlates to the significant concerns people have regarding privacy, land use Issues, and the rights property owners have to be able to control the airspace directly above their property. A UAS mounted

with a camera now causes more concern than just an annoying flying object in the sky. A modern UAS has the ability to record and stream images of property owners and their houses without their consent. Currently, there is not a specific legal answer pertaining to what amount of airspace property owners are entitled to above their private property. In an article written by Michelle Bolos, she argues this issue needs to be addressed and specific land use regulations need to be set. Historically, the FAA has controlled airspace 500 feet and more in height, far above a landowner's property. New FAA regulations could give the FAA the right to control airspace from the ground up, leaving private citizens with no legal ownership or control directly above their property (Bolos, 2016). Without ownership or control being placed in a property owner's hands, private landowners are left with no way to ensure their own privacy until outside legal interventions are established.

3. Illegal Issues

Large companies, such as Amazon, have proposed and even tested the idea of using drones to remotely deliver items to consumers. With flight ranges of recreational drones being up to two miles, this has brought to light the issue of using UAVs for unlawful uses too. Drug delivery, weaponizing, and contraband delivery are three ways drones could be used unlawfully. In 2011, in Washington D.C., a "radicalized man was arrested for planning to fly a radio-control aircraft packed with C4 explosive into the Pentagon and Capitol" (Warwick, 2016). In July of 2015, Warwick also reported the Department of Homeland Security sent out an intelligence assessment to police regarding drones being used as weapons in terrorist and criminal activity. The threat of weaponizing UAS is extremely real, has already taken place, and

is a valid concern. UAS equipped with GPS and remote navigation systems, which are available at prices attainable for most people, can be retrofitted to deliver ordinances of destruction small and large.

Many incidents of attempted and successful delivery of illegal substances and contraband utilizing UAS technology have been documented in the recent years. In an article written by Graham Warwick, he reports that in North Carolina in July, 2014, a small UAS crashed outside a prison carrying tobacco, marijuana, and cell phones (Warwick, 2016). In January of 2015, in Tijuana, Mexico, a UAS crashed in a supermarket parking lot carrying six pounds of methamphetamine. In August of 2015, in Maryland, two individuals were arrested trying to use a UAS to smuggle drugs, tobacco, and pornography into a prison. Warwick also reports that in California in August of 2015, two men were convicted of attempting to fly 28 pounds of heroin over the U.S. border using a UAS. In October of 2015, in Oklahoma, a UAS crashed in the state prison yard carry hacksaw blades, cell phones, superglue, and drugs. Finally, in November of 2015, in Arizona, border patrol intercepted a UAS which dropped three 10-pound bundles of marijuana originating from Rio Colorado, Mexico (2016).

4. Security Issues

Security issues related to UAS are mostly in the form of unauthorized surveillance of restricted facilities. These typically occur in encroachments of areas which are highly restricted governmental institutions, facilities, or political gatherings. In several of these events, the UAS physically landed or crashed in the confine of the facility. In April of 2014, in the United Kingdom, an individual was fined for flying a UAS into restricted airspace near a nuclear

submarine facility in Barrow-in-Furness, England (Warwick, 2016). Warrick also reported several other recent incidents that have occurred as well. In October, 2014, in France, 16 flyovers of seven nuclear plants were reported. In February of 2015, UAS flights over the Eiffel tower and the U.S. Embassy were reported. In March of 2015, a UAS piloted by a National Geospatial Agency employee crashed into a tree on the White House lawn. And In May of 2015, a man was detained by the U.S. Secret Service for trying to fly a UAS over the White House fence. With the ability of capturing and streaming video, UAS pose a valid national and global security concern (2016).

5. Public Arena and Gathering Safety

With the ease of penetrating some of the most secure national and global facilities with UAS, it is not surprising that major sporting events, concerts, and other social gatherings have witnessed incidents involving UAS as well. In 2013, a UAS was reported at a motorsports stadium and in 2014, one was reported surveying the French soccer team during a world cup training session. In 2015, UAS were reported over the U.S. Open and inside the University of Kentucky football stadium (Warwick, 2016). Although no injuries were reported with these incidents, they pose an infringement on broadcasting rights of the event and the potential of harm if deliberately or inadvertently a UAS were to crash into spectators. UAS are often viewed as a curiosity by many people now. But in time, individuals may find them annoying or even threatening. Public perception of UAS in the future will be based on what happens to UAS usage in the present and what is done to encourage and promote proper, appropriate usage now.

6. Freedom of Speech

“The First Amendment guarantees freedoms concerning religion, expression, assembly, and the right to petition. It forbids Congress from both promoting one religion over others and also restricting an individual’s religious practices. It guarantees freedom of expression by prohibiting Congress from restricting the press or rights of individuals to speak freely. It also guarantees the right of citizens to assemble peaceably and to petition their government.” UAS are active in public and political rallies and are used by various political activists. There have also been reports of recreational pilots using UAS for surveillance in high crime areas, used by protestors, and curious citizens looking to peek into the lives of celebrities, all in the name of the first amendment, and the right to speak freely.

Political activist incidents have been reported as well. In September 2013, in Dresden Germany, a recreational pilot flew toward Chancellor Angela Merkel at a campaign event to protest UAV surveillance. In October of 2014, in Albania, activists flew a UAS carrying an Albanian flag over a soccer match with Serbia. In Tokyo in April, 2015, a UAS carrying radioactive sand landed on the roof of Prime Minister Shinzo Abe’s office protesting Japan’s nuclear policy. In June of 2015, in Poland, Women on Waves delivered pregnancy termination pills via a UAS from Germany to Poland to protest restrictive abortion laws (Warwick, 2016).

A natural dichotomy between the First and Fourth Amendment is present with both sides of the argument leaning on each of the amendments. Recreational pilots fly, record, deliver, and demonstrate under the belief that they are operating under the idea they have the

right to speak freely, and citizens whose belief of the right of privacy under the Fourth Amendment believe their right to privacy is being infringed upon.

Federal Aviation Administration

In February 2016, the FAA announced there are now more registered drone operators in the United States, 325,000 individuals, than there are registered manned aircraft, 320,000 (AP, 2016). It is also necessary to mention that these reported numbers do not include the number of owners of drones who have failed to register with the FAA. In response to many of the issues identified as concerns with drones, the FAA has enacted regulations that require UAS users that meet specific criteria to register with the FAA. This registry went into effect on December 21, 2015. The FAA timed the new registry to begin prior to the 2015 holiday season due to an estimated half-million drones be given as gifts during that period of time (Bryan, 2016). Recreational UAS operators who purchased their UAS prior to the registry were grandfathered in and had until February 19, 2016, to register. The new interim regulation by the FAA can be summarized into the following categories, who, what, when, where, why, cost, and enforcement.

Who

The new regulation focuses on the recreational users and “model aircraft” and is a different set of regulations than that of commercial users. The registered owner must be a person 13 years of age or older. If the owner is younger than 13, someone at least 13 years must register the drone. The registered user must also be a United States citizen or be a lawfully-admitted resident. “Model aircraft” must meet three use criteria. They must be

“capable of sustained flight, flown within visual sight of the operator, and flown for hobby or recreational purpose.

What

The new regulations are for “model aircraft” that are flown outdoors and weigh between .55 pounds and fifty-five pounds. The weight includes all items mounted or attached to the aircraft including batteries, cameras, or other devices. “Model aircraft” that are flown indoor are not required to register with the FAA. The regulations also state how the “model aircraft” can be operated. Five stipulations listed under the FAA Modernization and Reform Act of 2012 (P.L. 112-95, section 336(A)) include:

1. The aircraft is flown strictly for hobby or recreational use;
2. The aircraft is operated in accordance with a community-based set of safety guidelines and within the programming of a nationwide community-based organization;
3. The aircraft is limited to not more than 55 pounds unless otherwise certified through a design, construction, inspection, flight test, and operational safety program administered by a community-based organization;
4. The aircraft is operated in a manner that does not interfere with and gives way to any manned aircraft; and
5. When flown within five miles of an airport, the operator of the aircraft provides the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport) with prior notice of the operation (model aircraft

operators flying from a permanent location within five miles of an airport should establish a mutually-agreed upon operating procedure with the airport operator and the airport air traffic control tower (when an air traffic facility is located at the airport).

When

Any new “model aircraft” purchased since December 21, 2015, must be registered. Those purchased previously were grandfathered in until February 19, 2016.

Where

The FAA has developed a website, <http://www.faa.gov/uas/registration/>, to handle online registration of “model aircraft” that qualifies under the FAA. UAS that do not qualify must use a paper method for registration.

Why

“The FAA wants a means to locate the owner of a drone in the event of an accident or if the drone is lost or stolen. And, registration will aid the FAA in its drone-education programs.” (Bryan, 2016) “The new registration system is designed, in part, to allow the FAA direct access to drone owners for educational outreach and for legal enforcement” (Bryan, 2016).

Cost

The cost to register a drone is a minimum of \$5. The registration is valid for three years and covers all eligible drones owned by the operator. Once registered, a FAA registration card

and number is supplied to the operator. The operator is required to mark the UAS on a fixed area of the aircraft or within the battery compartment.

Enforcement and Reporting

Enforcement of recreational UAS is a maximum civil penalty up to \$27,500 and criminal penalties up to \$250,000, or three years in prison (Wagstaff, 2016). There are some concerns regarding the ability of the FAA to actually enforce these loosely detailed rules and penalties. Eli Dourado, director of the technology policy program at the Mercatus Center at George Mason University stated, "Whether the FAA will be able to enforce this rule is a genuinely open question" (2016). The \$27,500 amount is derived from existing FAA regulations for large manned aircraft. "The vast majority of drone owners won't get fined thousands of dollars for flying around their Christmas toys," said Michael Freudenberg, a partner at law firm Harrington, Ocko & Monk (2016). By putting a penalty to violating the registration of UAS, the FAA has created a situation in which large civil penalties could occur for misuse of recreational UAS.

The FAA relies on state, county, and local law enforcement agencies to report violations of the mandatory registry and for failing to abide by the current regulations and laws for operating a UAS. The FAA released a document titled Law Enforcement guidance for suspected unauthorized UAS operations. Under section two of this document the role of law enforcement is defined. The FAA states "State and local Law Enforcement Agencies (LEA) are often in the best position to deter, detect, immediately investigate, and, as appropriate, pursue enforcement actions to stop unauthorized UAS operations. Although the FAA retains the responsibility for enforcing FAA's regulations, FAA aviation safety inspectors, who are the

agency's principal field elements responsible for following up on these unauthorized and/or unsafe activities, will often be unable to immediately travel to the location of an incident." The FAA also created a Law Enforcement Assistance Program and provided contact information for state, county, and local law enforcement agencies to report problems to (United States Dept of Transportation, 2015).

This directive from the FAA says that state, county, and local law enforcement agencies typically operate as the "boots on the ground," but the FAA is available for follow up, education, and enforcement when necessary. This places a new set of responsibilities on law enforcement agencies in which they may or may not be ready to handle. Section two of this document gives six sections of procedures to assist local public safety officials with enforcement. These include:

1. Witness identification and interviews
2. Identification of operators
3. Viewing and recording the location of the event
4. Identifying sensitive locations, events, or activities
5. Notification
6. Evidence collection

Although guidance has been provided, local law enforcement agencies continue to not have the authority to enforce any of the regulations provided by the FAA. This appears to put state, county, and municipal law enforcement agencies in a precarious situation and they may be reluctant to respond adequately to a problem that very likely will become worse in the future.

Continued Policy and Direction

The FAA is expected to release more comprehensive regulations in the spring of 2016 (Wagstaff, 2016). FAA policy is continually evolving and racing to keep pace with the exponential growth of UAS use. The main focus at this point is education and not the enforcement of current rules and regulations. Apart from the countless electronic educational documents that have released to the public, the FAA has developed and published a mobile app for android and iPhone mobile device users named “B4UFLY”. This application is available for download free from the Google application store and the iPhone app store. The FAA has also attempted to work cooperatively with the nation’s Departments of Public Safety to issue press releases on rules that are new developments and of any changes being made to the rules and regulations. They are also relying on the states to keep law enforcement agencies in their state updated to better be able to respond and react to incidents when they occur.

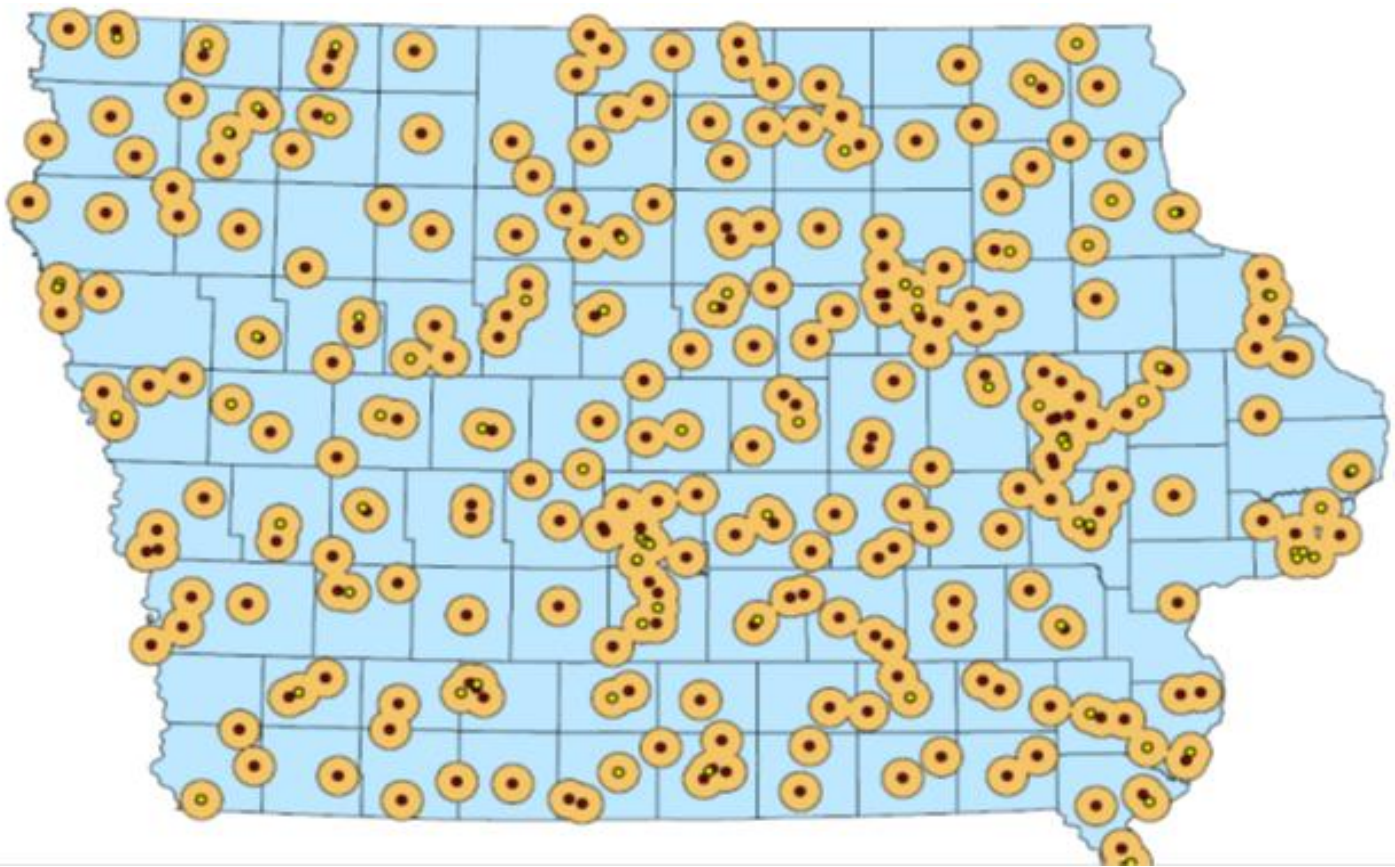
Drone Education

The “B4UFLY” application uses the phone’s location services to provide the user with five sets of information to safely operate their registered UAS. These include:

1. Is the user outside airspace restrictions?
2. Is the user further than five miles from airports? (See Map 1 for five-mile restricted airspace around airports and heliports for the state of Iowa.)
3. Are any upcoming flight restrictions are in place?
4. Is the operator is outside a national park?
5. Does the user need any general guidance?

When an operator is determined by the location of his or her phone to be in an area of concern, the mobile application warns the user that it may not be safe to operate their UAS. The application also provides a visual map, a flight planner, and additional educational resources.

The FAA has adopted a high-tech approach to educating the general hobbyist. To date, this new technology is being widely used and has been considered to be highly effective.



Map 1

(Jacob Sundholm, 2016)

Black dots are airports, White dots are Heliports

Iowa Communities UAS Usage Survey

In March, 2016 a short survey was sent via email to a dozen Iowa communities asking specific questions about each city's experiences with UAS. The questions focused on issues which included: if the communities had logged any complaints, had policies been put in place to handle any drone-related inquiries, and if the cities were using drones for any type of community work. (See Appendix A for respondents and survey questions.) Surveys were typically sent to city administrative staff, but were often forwarded to airport managers or police departments.

By early April, several surveys had been returned with a variety of responses. The answers showed that, in general, cities and airport managers were currently fielding few to no questions or concerns about unmanned aircraft. However, nearly all respondents mentioned they believed recreational and hobby users would be a concern in the future as UAS become more popular. The most common potential concern was privacy or using the aircraft in a way other than intended such as for surveillance or to cause vandalism/property destruction.

Lieutenant Chris Scott, Des Moines Police Department, explained, "Down the road – in five years or so as the price drops – there will be more of them. And with more volume, it can become more problematic. We could start seeing issues with hobbyists using them not in the manner intended. In fact, (UAS use) could evolve in ways we had not thought of before."

In Fort Dodge, Airport Director of Aviation Rhonda Chambers, responded that while commercial users of UAS are familiar with FAA rules because they require an operator with a pilot's license, hobbyists create challenges because they are loosely regulated and continue to

grow in size. Chambers believes a reoccurring problem will be educating recreational users “on how to operate safely and follow FAA regulations.”

Public Awareness

Most city administrators/airport managers/public safety officials who responded to the survey said they frequently deferred to the FAA for guidance, education, and policy, and they refer hobbyist UAS users to the FAA website for specific questions. The FAA has partnered with others to develop an educational campaign specifically targeting recreational users. The “Know Before You Fly” campaign was founded by the Association for Unmanned Vehicle Systems International (AUVSI) and the Academy of Model Aeronautics (AMA). The FAA partnered with these organizations to provide simple, proactive, effective messaging about safe and responsible flying (<http://knowbeforeyoufly.org/>). From the “Know Before You Fly” website, general advice to hobbyists includes this information:

“Currently, small unmanned aircraft systems (sUAS) may be operated for hobby and recreational purposes under specific safety guidelines as established by Congress. Small UAS flown for recreational purposes are typically known as model aircraft.

Under the Special Rule for Model Aircraft, recreational UAS must be operated in accordance with several requirements, including a community-based set of safety guidelines and within the programming of a nationwide community-based organization such as the Academy of Model Aeronautics (AMA). Operators not operating within the safety program of a community-based organization should follow the FAA’s guidance here.

As of December 21, 2015, the Federal Aviation Administration requires all owners of small unmanned aircraft, or drones, weighing between 0.55 and 55 pounds to register online before taking to the skies (<http://knowbeforeyoufly.org/for-recreational-users/>).

Of the cities responding to the survey, several officials believe many recreational users of UAS may not be aware of the registration requirement. They consider educating the public as an area where municipalities could assist the FAA. In fact, some cities are already helping. Iowa City Airport Operations Specialist Michael Tharp reported the City of Iowa City, Iowa, has been promoting UAS registration for hobbyists by sharing the FAA website and message. Also, Iowa City reinforces the FAA messages with its own media releases. For example, shortly after the holidays, Iowa City distributed this media release with reminders of new FAA rules

(<https://www.icgov.org/news/faa-now-requires-registration-drones-and-model-aircraft>):

Did Santa deliver a drone this year? If so, Iowa City Airport Operations Specialist Michael Tharp reminds you that the Federal Aviation Administration (FAA) requires that it be registered -- and if you do so by Jan. 20, you'll save a registration fee.

Small unmanned aircraft (UAS) enthusiasts are considered aviators by the FAA. Therefore, drones and model aircraft that weigh between 0.55 and 55 pounds must be registered to ensure safe and responsible operation that will protect the owner / operator, others on the ground, and manned aircraft. If you operated your UAS before Dec. 21, 2015, the deadline to register is Feb. 19, 2016. If your UAS was purchased after Dec. 21, you must register it before you operate it outdoors.

Owners may register through a user-friendly web-based system at www.faa.gov/uas/registration. The normal registration fee is \$5, but in an effort to encourage people to register quickly, the FAA is waiving this fee through Jan. 20, 2016.

Registrants must be at least 13 years old, and will need to provide their name, home address and e-mail address. Upon completion of the registration process, a Certificate of Aircraft Registration/Proof of Ownership will be generated that will include a unique identification number for the UAS owner, which must be marked on the aircraft. Owners using the model aircraft for hobby or recreation will only have to register once and may use the same identification number for all of their model UAS. The registration is valid for three years.

In Fort Dodge, Chambers noted she is involved in UAV outreach at a local level. She is planning a workshop with the Iowa Department of Transportation Office of Aviation, as well as plans to include information on the Fort Dodge Airport website. Another outreach effort is “including UAS subject matter in every airport presentation I give.”

The City of Ames has used drone footage to document several large building projects including providing updated visuals on the progress of the new Water Treatment Plant, a two-year building project. The City of Ames has also used a UAS to fly over the top of a water tower to monitor antennae at the top. While not owning any drones, the City of Ames partnered with commercial drone pilots for access to aerial video used in City of Ames educational and promotional programs.

The City of Perry utilized drones when performing a “smoke” test of their sanitary sewers. City officials were able inspect possible points of infiltration and illegal interconnections which would otherwise not have been possible. The City of Perry has also partnered with a local videographer and drone pilot to produce a public outreach video for the Public Works Department.

At the Des Moines International Airport, Airport Authority Communications Assistant Tara Ely responded that information regarding UAS use is included on the airport’s webpage at <http://www.dsmaairport.com/about-the-airport/airport-operations/drone-safety.aspx>. The page includes links to FAA pages including Frequently Asked Questions, Know Before You Fly campaign, registration information, law enforcement guidance, and provides other information helpful to commercial and recreational UAS operators.

City Drone Use

While several Iowa cities are using UAS for public benefit, only one community, the city of Dubuque, Iowa, has purchased a drone. Of the cities that are using UAS, the uses included searching a river for missing children, flying over city projects for status reports of progress, and gathering video and still photos for marketing and promotional purposes. Many cities expressed a desire to use the technology in the future and were optimistic and encouraged by the possibilities UAV offered. Chamber, of Fort Dodge, responded, "I believe that UAS has many applications that could assist our city government and we look forward to working on developing these opportunities."

Craig Nowack, Cable TV Coordinator for the City of Dubuque, responded, "We are slowly going through FAA requirements for obtaining public certificate of authority to use a drone for emergency response and geological resource management. Ultimately, we'd also like to use it for public informational purposes (for shooting video and stills for City publications and our online local government cable access channel.)"

Survey respondents were consistent in saying there were no current efforts to add a more defined policy at a local level. Most were comfortable using FAA policy as their guide to appropriate UAS usage. Police department representatives who responded to the survey noted that issues of privacy – a frequently noted concern with unmanned aircraft – can be addressed through current privacy laws already enacted in state and municipal code.

The City of Ames did not that a recent comment left on the City of Ames Police Department Facebook page suggested cities are only beginning the notice the increased usage

of UAS. A resident posed two questions about drones she discovered flying in the community in March:

“I saw a drone (!!) hovering over the underpass on Grand (under the train tracks) last evening while heading towards Lincoln Way around 630PM 03/18/2016. Is this legal? And what was it doing hovering over the underpass where the train tracks are!? Just [curious] ...and FYI. Thanks!” (Ames Police Facebook page, March 19, 2016)

For those who responded to the UAS survey, city administrators, police department representatives, and airport personnel seem satisfied with the current FAA guidance. However, there a sense among some respondents that if UAS usage continues to grow, there may be the need for additional policy making, and most certainly additional coordination and cooperation between local government and state and federal agencies.

The Evolving Public Policy Debate:

Any new rules or laws adopted regarding drone or UAS use throughout the United States should be uniform, clear, and as consistent as possible while being given the utmost scrutiny before being put into effect. As the public policy debate continues to grow and expand in regards to the use of drones and UAS technology, clear and universal public policy will become more important and essential. City Councils and legislative bodies everywhere are responding to complaints, discussing issues as they arise, and desire more clarification on what is and what is not allowed. Public entities are also discussing what they should and will be allowed to regulate in the future. Much conflict arises as policy-making bodies debate the

consequences of any new rules and regulations that may be adopted while attempting to be able to allow the use of the technology for appropriate and beneficial purposes.

Any state, county, or municipality considering adopting their own rules regarding UAS usage must consider existing federal laws. According to 49 United States Code, 40103, The United States Government has exclusive sovereignty of the airspace of the United States. This sovereignty not only includes the regulation of private and commercial aircraft, but it also includes the use of drones and other UAS technology. The Federal Aviation Administration has attempted to make it clear that they are the primary decision making authority and have jurisdiction to control the nation's airspace. This power has been granted by Congress to the Federal Aviation Administration and includes the authority to regulate the areas of airspace use, management and efficiency, air traffic control, safety, navigational facilities, and aircraft noise at its source (49 U.S.C, 40103, 44502, and 44701-44735). This federal framework has been established primarily to promote safety and prevent adverse events within the nation's airspace from occurring.

According the Federal Aviation Administration's Office of the Chief Counsel and as stated in the State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet, "A consistent regulatory system for aircraft and use of airspace has the broader effect of ensuring the highest level of safety for all aviation operation." The FAA has shown immense concern with state and local governments attempting to create rules which interfere with their jurisdictional boundaries. "Substantial air safety issues are raised when state and local governments attempt to regulate the operation of flight of aircraft. If one or two municipalities enacted ordinances

regulating UAS in the navigable airspace and a significant number of municipalities followed suit, fractionalized control of the navigable airspace would result” (Office of Chief Counsel, 2016). Congress and the FAA have attempted to work to address the many concerns that drones and UAS systems have created in recent years. This includes exercising the federal government’s authority to regulate UAS technology now and in the future.

In order to provide as much support as possible, the FAA provides guidance to state and local agencies on what they can and cannot do in regards to imposing additional requirements on UAS operators and they have regional contact centers that can be contacted for support (See Appendix E). The FAA has been clear and adamant to present its desire to provide a national navigable airspace that is free from inconsistent state and local restrictions. Their goal is to provide a more consistent and a safer environment in the national airspace. This has been the FAA’s mission from the start, beginning with the Federal Aviation Act of 1958. The intent of the Federal Aviation Act was and continues to be to make all aircraft, including drones and UAS, subject to the air traffic rules that exist under their jurisdiction. Thus, the whole tenor of the Act and its principal purpose is to create and enforce one unified system of flight rules. (419 F.2d 1401, 1969).

The December 17, 2015, State and Local Regulation of Unmanned Aircraft Systems (UAS) Fact Sheet issued by the United States Department of Transportation provides direction to state and local government bodies regarding potential legislation for which consultation with the FAA is recommended prior. Legislative rules that fall into this category include: operational UAS restrictions on flight altitude, flight paths; operational bans; any regulation of the navigable

airspace. This includes, for example, a city ordinance banning a drone user from flying their UAS within the city limits, within the airspace of the city, or within certain distances of a landmark. It also includes mandating equipment or training for UAS related to aviation safety such as geofencing. The Courts have found that state regulation pertaining to mandatory training and equipment requirements related to aviation safety is not consistent with the federal regulatory framework (Office of the Chief Counsel, 2015).

The FAA fact sheet also provides examples of state and local laws that fall within state and local government jurisdiction and normal police power authority. These include laws traditionally related to state and local police power and include land use, zoning, privacy, trespass, and law enforcement operations. Other examples include allowing state and local jurisdictions to place a requirement for police to obtain a warrant prior to using a UAS for surveillance, specifying that UAS may not be used for voyeurism, prohibitions on using UAS for hunting or fishing, or to interfere with or harass an individual who is hunting or fishing, and prohibitions on attaching firearms or other destructive weapons to UAS.

Through careful consideration and thorough research, the best course of action is for states to now adopt rules and regulations which are consistent with FAA recommendations. Throughout the United States, at least 41 states have considered legislation related to UAS during their 2016 legislative sessions. In 2015, 45 states considered 168 bills related to drone and UAS usage (National, 2016). Most of the legislation passed by states throughout the nation pertains to the government police powers the FAA allows state legislatures to consider and enact.

In Iowa, Iowa code current restricts drone / UAS technology in four ways that are consistent with the FAA's recommendations. In response to concerns that the new technology could be used improperly by law enforcement agencies, the Iowa Legislature passed House File 2289 in 2014. House File 2289 states that information obtained as a result of the use of an unmanned aerial vehicle is not admissible as evidence in a criminal or civil proceeding, unless the information is obtained pursuant to the authority of a search warrant, or unless the information is otherwise obtained in a manner consistent with state and federal law. It shall be stated that, "although the United States Supreme Court and the Iowa Supreme Court have, for decades, upheld warrantless searches by law enforcement outside of a home or curtilage to be constitutional, House File 2289 contemplates that a search warrant must be obtained, or that evidence that the government has gathered with an unmanned aircraft would be suppressed" (Iowa, 2014).

The second legislative restriction placed on government entities by House File 2289 prevents agencies of the State of Iowa or a political subdivision of the state from using an UAS for traffic law enforcement. This legislation was a direct response against the growing use of municipalities regulating the speed of vehicles traveling through their jurisdictional boundaries using fixed or remote cameras. In recent years, this practice has received increased scrutiny by the public. In 2014, interest groups and citizens in Iowa demanded the Legislature forbid the use of speed cameras utilizing UAS technology on the ground or in the sky. In response, the Legislature listened and passed House File 2289.

The third way that Iowa law currently restricts drone and UAS usage is for using the technology for the purpose of intentionally killing or wounding or pursuing any animal, fowl, or fish. Iowa code section 481A.120 states, “ A person, either singly or as one of a group of persons, shall not intentionally kill or wound, attempt to kill or wound, or pursue any animal, fowl, or fish from or with an aircraft in flight or from or with any self-propelled vehicles designed for travel on snow or ice which utilize sled type runners, or skis, or an endless belt tread, or wheel or any combination thereof and which are commonly known as snowmobiles.” While the Iowa Department of Natural Resources has received very few complaints on this issue, they have issued citations to violators using this existing Iowa Code section and other administrative rules adopted by the Iowa Department of Natural Resources.

The fourth and final way that Iowa Law currently restricts drone and UAS usage is when doing so carelessly or in a reckless manner, while under the influence of drugs or alcohol, or doing so as to endanger the life or property of another. FAA regulations and federal law also prohibit a person from operating an aircraft in a careless or reckless manner as to endanger the life or property of another under 49 U.S. Code, 46301(a)(1) and (d)(2). Utilizing current Iowa Code section 328.41, the Iowa Department of Transportation is prepared to cite those found to be operating UAS technology in violation of the law.

The Iowa Legislature also commissioned a report to be completed by the Iowa Department of Public Safety, in consultation with the Iowa Attorney General’s Office and other state and local agencies in 2014. This report was completed in December, 2014, and examined whether the Iowa Criminal Code should be modified to regulate the usage of unmanned aerial

vehicles and to develop model guidelines for their use. The consensus of the report was that the State of Iowa should adopt regulations that restrict or regulate the usage of UAS technology in a reactive way as regulations are needed, rather than in a preemptive manner. As the final sentence of the report states, “In the future, once more information is available; laws can be crafted in such a way as to directly address the shortcoming in the criminal laws while still protecting those who are using unmanned aircraft technology for positive purposes” (Iowa, 2014). When drafting new laws, it is critical to adopt a balanced approach that recognizes the inherent difficulty of predicting the future of any rapidly changing technology (Villasenor, 2013). It can be agreed upon by all that any changes made to the Code of Iowa shall provide improvements that adequately protect the public, while considering not only present, but also future concerns. While it was recommended the legislature not consider tighter restrictions on UAS usage in 2014, it is now time to act in response to recent events.

Next Steps

Based on the analysis of recent data and experiences nationally and globally, the State of Iowa has now reached a juncture where it would be appropriate for the Iowa Legislature to review and consider enacting necessary legislation while, at the same time, encouraging proper and appropriate use of the advancing technology to the benefit of the State of Iowa and all citizens. The recommended changes proposed fall under three main categories with one concluding recommendation.

1. The Iowa Legislature should adopt regulations consistent with current FAA guidelines and recommendations.

2. The Iowa Legislature should take into consideration issues which have become known in Iowa, and throughout the nation since 2014. It should enact new legislation that is proactive in nature to address problems that are destined to continue and worsen. The Iowa Legislature should also enact legislation to modify current Iowa code sections to better address UAS issues specifically.
3. In support of the FAA, the Iowa Legislature should restrict the ability of county and municipal governments from individually regulating the use of privately owned, unmanned aerial systems.
4. Finally, there are endless possibilities that UAS technology provides to individuals and businesses alike, especially within the agricultural economy of Iowa. Drone and UAS research and development should be encouraged at an advanced level here in Iowa to the benefit of all citizens of the state.

First, it is recommended that the Iowa Legislature consider and enact legislation that is consistent with the FAA's Office of the Chief Counsel recommendations. The need for statewide legislation culminates from the blurred jurisdictional lines that are involved from the usage of UAS technology without clear or consistent guidelines being in place and known by all users. A single set of distinct statewide rules and regulations will solve a multitude of problems. It will enhance the safe use of UAS technology across the state. It will also create one set of rules for state and local law enforcement agencies to enforce uniformly. While the FAA has provided to law enforcement agencies a guidance worksheet for one suspected of using a UAS in an unsafe or unauthorized manner (see Appendix D), law enforcement agencies are reluctant to act on behaviors in violation of existing federal statute when they cannot take action using

independent judgment in regards to their own state or local laws. Enacting statewide legislation will clear up many of these issues. Adopting a single set of statewide rules will also assist the FAA in preventing a ‘patchwork quilt’ of differing restrictions from becoming law in cities and counties across Iowa.

Adopting legislation using FAA recommendations will also allow UAS users to have better knowledge of the UAS laws existing in the State of Iowa and current federal rules as well. Typically most citizens, including UAS users, do not purposefully seek to violate the law and want to be good stewards of the technology they are using. The UAS industry has also attempted to encourage the proper use of UAS technology by adopting an Industry “code of conduct” for UAS users (see Appendix F). Despite the industry’s and the FAA’s greatest attempts, UAS users seek information regarding the legal use of UAS technology most often from their local officials. There is a natural expectation by citizens and UAS users that state and local officials will adopt laws regarding UAS use, enforce accountability for the failure of others to obey the law, and that appropriate fines and penalties will be levied to violators in ways that are fair and consistent. While the FAA has regional operation centers where individuals can call for assistance (see Appendix B), with no single set of enforceable UAS rules and penalties in existence statewide, the public’s expectations are not being fulfilled and maintaining credibility for the legal use of UAS technology statewide is at risk.

Second, it is recommended that the Iowa Legislature consider and enact legislation to be proactive in nature to the threat of real problems that exist. Current Iowa Code section 716.7, does not include any language regarding UAS technology. Without specific language

existing in the Iowa Code to address this issue, law enforcement officials are reluctant to consider charging someone with trespassing when suspected of doing so with a drone or UAS. Currently, no guidelines exist in Iowa Code concerning how low a drone can hover, film, or photograph above one's property. In 2015, California and Florida both passed legislation that prohibits one from entering the airspace of an individual in order to capture an image or recording of an individual engaging in private, personal, or familial activity without that person's permission. While no criminal case of this nature has been brought to the Iowa Supreme Court yet, it is only a matter of time that the judicial branch of the State of Iowa will be asked to intervene. It is now necessary for the legislature to debate solutions to address this current problem.

Closely affiliated with the crime of trespassing utilizing a UAS, current Iowa laws do not specifically address harassment, stalking, or voyeurism utilizing UAS technology either. While it could be argued that a person or persons could be charged with harassment or stalking using a UAS, it is again very unlikely to happen in Iowa, except in extreme circumstances. Law enforcement officers across the state of Iowa are taught to file criminal complaints using specific language found in the Code of Iowa. Without specific language existing, law enforcement officials are reluctant to act. A 2013 Congressional Research Service report titled, *Integration of Drones Into Domestic Airspace: Selected Legal Issues*, examined and explained the contentious issues regarding unmanned aircraft and stalking, harassment, and voyeurism. In part the report states, "Traditional crimes such as stalking, harassment, voyeurism, and wiretapping may all be committed through the operation of a drone". "As drones are further introduced into the national airspace, courts will have to work this new form of technology into

their jurisprudence, and legislatures might amend these various statutes to expressly include crimes committed with a drone” (Gallagher, 2013). The Code of Iowa needs to be updated to prevent and solve these types of problems from occurring and to prevent additional problems states throughout the nation have already found legislative solutions for.

There is growing public debate involving UAS technology, privacy issues, and the definition of what “privacy” is. It needs to be recognized that UAS can be and are being used in ways that do invade one’s privacy and which amount to trespassing, harassment, stalking, and voyeurism. While some may argue that UAS technology platforms provide the same level of observation that could have been achieved using other aviation and photography equipment, this is an unfair comparison. Today’s UAS systems are being operated at a fraction of the cost, are readily deployable by amateur pilots, and traditional aviation does not offer near the discreteness of the quickly evolving UAS technology that is available today. While there are many cases that have been argued in front on the nation’s courts concerning “privacy” and what “privacy” is, state and federal courts, including the Supreme Court of the United States has yet to tackle “privacy” as it involves the use of drones and other UAS technology.

It is also recommended that Iowa law be updated to specifically prohibit weaponizing a UAS for any and all purposes. After several instances occurred in Connecticut, the state legislature found it necessary to debate legislation pertaining to weaponizing UAS technology. In one case, a university student mounted a handgun that was able to be controlled remotely and shot from a UAS. After the incident was recorded and posted on Youtube, local police investigated the incident. However, they were unable to file charges since the student did not

break any existing Connecticut laws. In response to the incident police officials in Clinton, Connecticut stated, "It appears to be a case of technology surpassing current legislation,". In another Connecticut example, a university student mounted a flame-thrower to a UAS and tested the technology out on a holiday turkey. These two incidents and other concerns were enough to force the Connecticut State Legislature to consider a bill restricting the weaponizing of UAS technology earlier in 2016.

Currently, Iowa Laws do not restrict the use of UAS technology over critical infrastructure sites, including over detention centers. The FAA is a partner in the nation's Law Enforcement Assistance Program (LEAP) and is willing to assist jurisdictions who have complaints about suspected unauthorized UAS operations (see Appendix C). However, this program is unable to provide support to law enforcement officers who are actively engaged in a complaint and need immediate assistance. For example, in Maryland, two men attempted to drop a shipment of contraband including drugs, pornography, and a firearm into the Western Correctional Institution. Similar stories have happened at other correctional facilities across the country. In some cases, deliveries of contraband have been successful. In response, this year the State of Wisconsin passed legislation that prohibits the operation of UAS over correctional facilities and other states are considering similar legislation as well.

Correctional facilities are not the only facilities of concern. Other critical infrastructure facilities include property owned by the Department of Defense and Department of Energy, chemical plants, dams and hydroelectric power plants, other energy production/transmission facilities, ports and other major transportation facilities, and water treatment plants. In early

2016, Tennessee passed legislation which criminalizes flying a drone near critical infrastructure for purposes of surveillance or gathering information. Arkansas also passed legislation in 2015 pertaining to the use of UAS collecting information on critical infrastructure without consent. Placing reasonable limits of UAS usage around/over critical infrastructure facilities will protect these sites from potential harm being done to them and enhance the public's safety.

Third, it is recommended the Iowa Legislature restrict the ability of county and municipal governments from individually regulating the use of privately owned, unmanned aerial systems. As stated earlier, a "patchwork quilt" of differing restrictions could severely limit the flexibility of the FAA in controlling the airspace and flight patterns, and ensuring safety and an efficient air traffic flow (Office of Chief Counsel, 2016). Consistent with the concerns expressed by the FAA, Virginia passed legislation in 2016 and Maryland passed legislation in 2015 that specifies only the state legislature can enact legislation to prohibit, restrict, or regulate the usage of drones and UAS technology. This legislation specifically preempts county and municipal authority regarding UAS and encourages uniformity and consistency statewide across all jurisdictions.

Lastly, it is important for the State of Iowa to recognize the many possibilities that UAS technology provides to individuals and businesses alike. The State of Iowa should be encouraging the use of UAS technology across all business sectors for the benefit of all. It could be and should be a leader in UAS technology research and development. The State of Iowa should also be encouraging and promoting the high-tech jobs that are able to be created from the technology. As stated earlier, the agricultural industry has already begun to take full

advantage of this technology in many ways. Agricultural professionals can map the health of fields to calculate where and how much pesticide, herbicide, and/or fertilizer should be applied. It seems likely the future of UAS technology could include the ability to not only monitor crops, but apply pesticides, herbicides, and fertilizers in ways that are more efficient and more environmentally safe. Being open to new technology and welcoming its benefits should be encouraged and incentivized. The State of Iowa currently has an opportunity now to realize and take complete advantage of all known and future opportunities.

Looking Ahead

In conclusion, despite all that UAS technology currently has to offer, everyone must realize that this technology is in its infancy. This is only the beginning. The developing usage of drones and UAS technology in Iowa, throughout the United States, and around the world is evolving at an amazing pace. Drone research, development, and use in the United States and across the globe have a long and impressive history. However, the changes over the last 150 years cannot compare to the rapid advancements that have taken place in the last five to ten years. These technological UAS advancements have not come without their troubles. The State of Iowa has reached a juncture where it is recommended that the Iowa Legislature enact necessary legislation consistent with FAA guidelines to solve and prevent problems while, at the same time, encouraging the legal and appropriate use of the advancing technology to the benefit of the State of Iowa and all citizens.

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APPENDIX A**Iowa Communities UAS Usage Survey (2 PAGES)****Questions:**

1. Have you received complaints about UAS, and have you developed a formal/informal process for handling complaints?
2. Who is the designated staff person for any questions regarding UAS usages? (complaints or policy questions)
3. Is your city doing anything beyond the FAA requirements for UAS registration or monitoring for any category of UAS (commercial, hobbyist, etc.)?
4. Has your city implemented any type of education campaign for residents about UAS usage?
5. Is your city using UAS to perform any public functions?
 If yes, do you own the UAS or contract the work?
 If yes, what type of work are you performing?
6. What problems does your city foresee in the future in regards to UAS usage?

Survey Respondents:

Rhonda Chambers-Director of Aviation
Fort Dodge Regional Airport

Michael Tharp, C.M.
Airport Operations Specialist
Iowa City Municipal Airport

Police Chief Jeff Brinkley
Airport Manager Pam Osgood
Mason City, Iowa

Tara Ely, Des Moines International Airport
Lt. Chris Scott, Des Moines Police Department
Des Moines, Iowa

Damion Pregitzer, Airport Manager
Susan Gwiasda, Public Information Officer
Ames, Iowa

Chris Luhring, City Administrator
Parkersburg, Iowa

Sven Peterson, City Manager
Perry, Iowa

Randy Gehl, Public Information Officer
Craig Nowack, Cable TV Coordinator
City of Dubuque

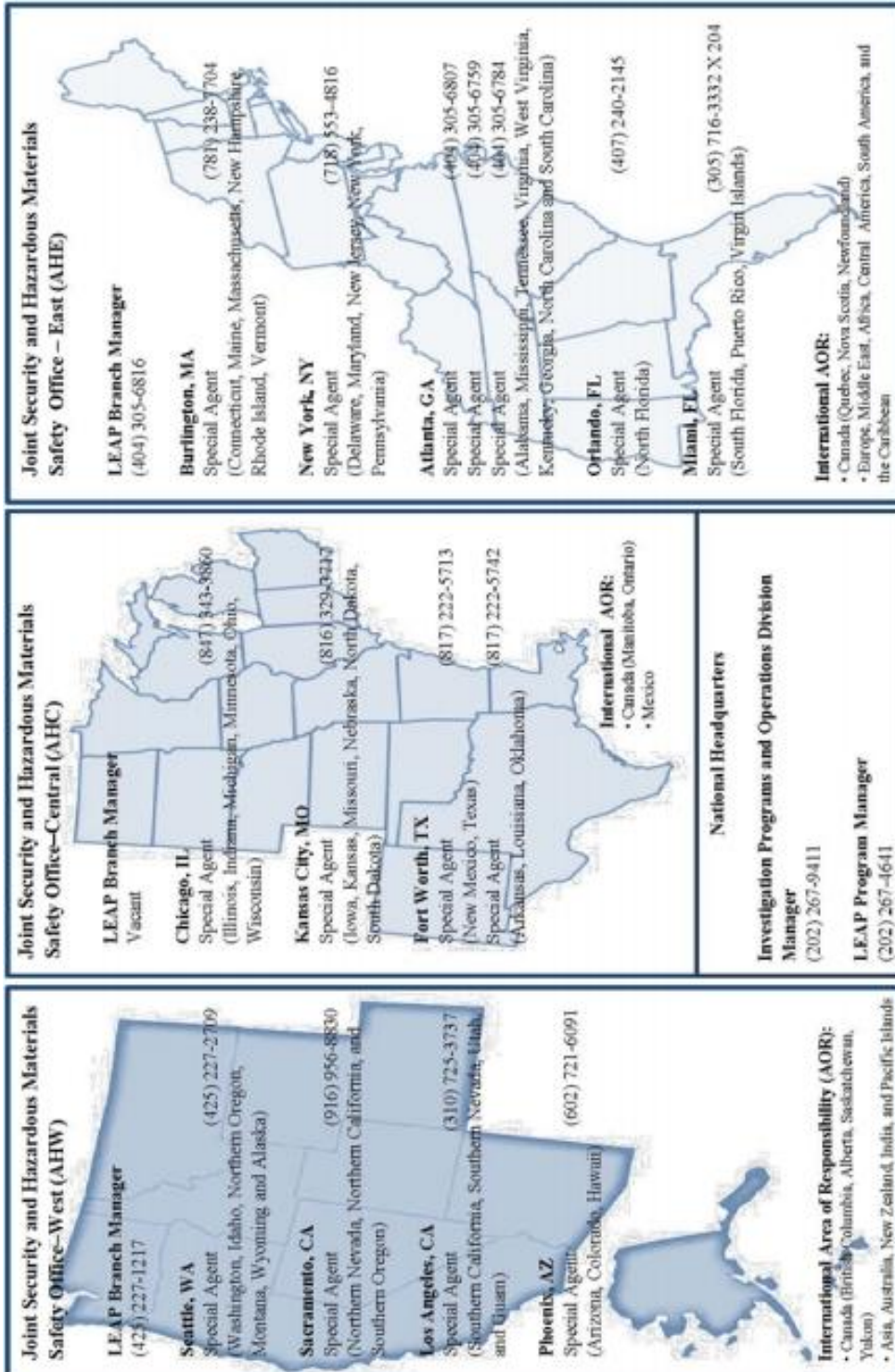
APPENDIX B

FEDERAL AVIATION ADMINISTRATION REGIONAL OPERATION CENTERS

Facility	States	Office	E-mail
Western ROC	AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, WA and WY	425-227-1999	9-WSA-OPSCTR@faa.gov
Central ROC	AR, IA, IL, IN, KS, LA, MI, MN, MO, ND, NE, NM, OH, OK, SD, TX and WI	817-222-5006	9-CSA-ROC@faa.gov
Southern / New England ROC	AL, CT, FL, GA, KY, MA, ME, MS, NC, NH, PR, RI, SC, TN, VI and VT	404-305-5156	9-ASO-ROC@faa.gov
Eastern ROC	DC, DE, MD, NJ, NY, PA, VA and WV	718-553-3100	7-AEA-ROC@faa.gov
Washington WOC		202-267-3333	9-awa-ash-woc@faa.gov

APPENDIX C

FEDERAL AVIATION ADMINISTRATION LAW ENFORCEMENT ASSISTANT PROGRAM (LEAP) CONTACT NUMBERS BY JURISDICTION FOR SUSPECTED UNAUTHORIZED UAS OPERATIONS



Law Enforcement Assistance Program

APPENDIX D

FEDERAL AVIATION ADMINISTRATION LAW ENFORCEMENT GUIDANCE FOR UNMANNED AIRCRAFT SYSTEMS (UAS) (2 PAGES)

LEO Guidance for Unmanned Aircraft Systems (UAS)



If you suspect a UAS operation is unsafe or unauthorized:

1. Locate the operator
2. Ask for registration and verify markings¹ on the UAS - Required for all UAS greater than 0.55 lbs
3. Ask operator for the type of operation and to present appropriate documentation (see reverse)
4. Interview operator and collect the following information:
 - Name, address, and positive ID of operator
 - Record Registration Number and the FAA Docket Number from Exemption or COA (see reverse)
 - Document time, place, and details of flight (take pictures and interview witnesses, etc)
5. Take action based on local Laws, Ordinances, Directives
6. Contact the FAA:
 - Safety concern or serious UAS incident – contact the Regional Operations Center (see below)
 - Investigation support – contact an FAA Law Enforcement Assistance Program (LEAP) Special Agent (business hours)

Local Protocol:

FAA REGIONAL OPERATIONS CENTERS:

Eastern	(404) 305-5150	DC, DE, MD, NJ, NY, PA, WV, VA	9-asso-roc@faa.gov
Southern / New England	(404) 305-5156	AL, CT, FL, GA, KY, MA, ME, MS, NC, NH, PR, RI, SC, TN, VI, VT	9-asso-roc@faa.gov
Western	(425) 227-1999	AK, AZ, CA, CO, HI, ID, MT, NV, OR, UT, WA, WY	9-wsa-opsctr@faa.gov
Central	(817) 222-5006	AR, IL, IN, KS, LA, MI, MN, MO, ND, NE, NM, OH, OK, SD, TX, WI	9-csa-roc@faa.gov
Washington	(202) 267-3333	National	9-awa-ash-woc@faa.gov

**** If you need immediate assistance from the FAA call (202) 267-3333 ****

Types of Authorized UAS Ops and Required Documentation:

Required documents must be in operator's possession and presented to law enforcement upon request per 49 U.S.C. 44103(d)

Model Aircraft	Non-Model / Commercial	Public / Government
<p>An unmanned aircraft that is 1) capable of sustained flight in the atmosphere, 2) flown within visual line of sight of the person operating the aircraft, and 3) flown for hobby or recreational purposes. Must be operated within ALL of the following parameters:</p> <ol style="list-style-type: none"> 1. Strictly for hobby or recreational use 2. Must give way to manned aircraft 3. Less than 55 pounds² 4. Operated in accordance with community based set of safety guidelines³ 5. If within 5 miles of airport, must notify airport operator and control tower (if tower) 6. Registration and Markings⁴ <p><i>Model aircraft operating standards are governed under P.L. 112-95 (Feb 14, 2012)</i></p>	<p>Any UAS operation conducted for non-hobby or commercial purpose <u>OR</u> any operation that does not meet the parameters for Model Aircraft. Operator must possess ALL of the following documents:</p> <ol style="list-style-type: none"> 1. Section 333 Exemption⁴ or Aircraft Certification 2. Certificate of Authorization (COA)⁵ 3. Aircraft Registration and Markings¹ 4. Pilot certificate⁶ 	<p>Public agencies or organizations that conduct UAS operations for a government function. Operator must possess ALL of the following documents:</p> <ol style="list-style-type: none"> 1. Certificate of Authorization (COA)⁵ 2. Aircraft Registration and Markings¹
<p>ALL UAS:</p> <ul style="list-style-type: none"> • Must have Registration and Markings¹ (required for all UAS greater than 0.55 lbs) • Must not endanger persons or property on the ground • Must give way to and not interfere with manned aircraft • Must comply with all flight restrictions and Temporary Flight restrictions⁷ • Are subject to legal enforcement for Careless or Reckless operation 		
<p>¹ Aircraft Registration and Markings: All UAS greater than 0.55 lbs are required to be registered, regardless of the type of operation. The operator must provide the registration certificate (paper or electronic) upon request and the UAS must be marked with the registration or serial number. To verify registration, contact a LEAP agent during normal business hours or the Regional Ops Center after hours.</p> <p>² Aircraft is limited to no more than 55 pounds unless certified through design, construction and inspection by community based organization.</p> <p>³ A membership based association that represents the modeling community and provides its members a comprehensive set of safety guidelines.</p> <p>⁴ 333 Exemption: FAA Letterhead dated and signed with an Exemption Number and Regulatory Docket Number. Includes conditions and limitations such as: (Not required for UAS with an FAA Aircraft/Wisness Certificate or Public/Government Operators)</p> <ul style="list-style-type: none"> > Line of Sight: The UAS must be visible at all times to the operator using his or her own natural vision. > Daytime only: Unless specifically authorized in the COA, UAS operations must be conducted during daytime only. <p>⁵ Certificate of Authorization (COA): FAA Form 7711-1 signed by UAS Tactical Operations Section and includes FAA Docket Number.</p> <p>Addresses specific restrictions such as:</p> <ul style="list-style-type: none"> > Altitude: As stipulated on cover page of COA. Generally 400' or 200' (but can be higher). > Proximity to Airports: As stipulated on COA. <p>⁶ Pilot certificate: All non-model/commercial operators must have an FAA pilot certificate. (Government agencies may self-certify pilots)</p> <p>⁷ Temporary Flight Restrictions (TFR) are common for Presidential movements, select sporting events, theme parks. Active TFRs are published here: www.faa.gov</p>		



APPENDIX E

**FEDERAL AVIATION ADMINISTRATION OFFICE OF THE CHIEF COUNSEL:
REGIONAL AND CENTER OFFICES**

FAA Office of the Chief Counsel
Regulations Division (AGC-200)
800 Independence Ave. SW
Washington, DC 20591
(202) 267-3073

Alaskan Region
Office of the Regional Counsel
222 West 7th Ave.
Anchorage, AK 99513
(909) 271-5269
(AK)

Central Region
Office of the Regional Counsel
901 Locust St., Room 506
Kansas City, MO 61406-2641
(816) 329-3760
(IA, KS, MO, NE)

Eastern Region
Office of the Regional Counsel
1 Aviation Plaza, Room 561
Jamaica, NY 11434-4848
(718) 553-3285
(DC, DE, MD, NJ, NY, PA, VA, WV)

Great Lakes Region
Office of the Regional Counsel
O'Hare Lake Office Center
2300 East Devon Ave.
Des Plaines, IL 60018
(847) 294-7313
(IL, IN, MI, MN, ND, OH, SD, WI)

New England Region
Office of the Regional Counsel
12 New England Executive Park
Burlington, MA 01803
(781) 238-7040
(CT, ME, MA, NH, RI, VT)

Northwest Mountain Region
Office of the Regional Counsel
1601 Lind Ave. SW
Renton, WA 98055-4056
(425) 227-2007
(CO, ID, MT, OR, UT, WA, WY)

Southern Region
Office of the Regional Counsel
1701 Columbia Ave., Suite 530
College Park, GA 30337
(404) 305-5200
(AL, FL, GA, KY, MS, NC, SC, TN)

Southwest Region
Office of the Regional Counsel, 6N-300
10101 Hillwood Parkway Dr.
Fort Worth, TX 76177
(817) 222-5099
(AR, LA, NM, OK, TX)

Western-Pacific Region
Office of the Regional Counsel
P.O. Box 92007
Los Angeles, CA 90009
(310) 725-7100
(AZ, CA, HI, NV)

APPENDIX F

AUVSI Code of Conduct

Unmanned Aircraft System Operations Industry “Code of Conduct”

The emergence of unmanned aircraft systems (UAS) as a resource for a wide variety of public and private applications quite possibly represents one of the most significant advancements to aviation, the scientific community, and public service since the beginning of flight. Rapid advancements in the technology have presented unique challenges and opportunities to the growing UAS industry and to those who support it. The nature of UAS and the environments which they operate, when not managed properly, can and will create issues that need to be addressed. The future of UAS will be linked to the responsible and safe use of these systems. Our industry has an obligation to conduct our operations in a safe manner that minimizes risk and instills confidence in our systems.

For this reason, the Association for Unmanned Vehicle Systems International (AUVSI), offers this Code of Conduct on behalf of the UAS industry for UAS operation. This code is intended to provide our members, and those who design, test, and operate UAS for public and civil use, a set of guidelines and recommendations for safe, non-intrusive operations. Acceptance and adherence to this code will contribute to safety and professionalism and will accelerate public confidence in these systems.

The code is built on three specific themes: Safety, Professionalism, and Respect. Each theme and its associated recommendations represent a “common sense” approach to UAS operations and address many of the concerns expressed by the public and regulators. This code is meant to provide UAS industry manufacturers and users a convenient checklist for operations and a means to demonstrate their obligation to supporting the growth of our industry in a safe and responsible manner. By adopting this Code, UAS industry manufacturers and users commit to the following:

Safety

- We will not operate UAS in a manner that presents undue risk to persons or property on the surface or in the air.
- We will ensure UAS will be piloted by individuals who are properly trained and competent to operate the vehicle or its systems.
- We will ensure UAS flights will be conducted only after a thorough assessment of risks associated with the activity. This risks assessment will include, but is not limited to:
 - Weather conditions relative to the performance capability of the system
 - Identification of normally anticipated failure modes (lost link, power plant failures, loss of control, etc) and consequences of the failures
 - Crew fitness for flight operations
 - Overlying airspace, compliance with aviation regulations as appropriate to the operation, and off-nominal procedures

- Communication, command, control, and payload frequency spectrum requirements
- Reliability, performance, and airworthiness to established standards

Professionalism

- We will comply with all federal, state, and local laws, ordinances, covenants, and restrictions as they relate to UAS operations.
- We will operate our systems as responsible members of the aviation community.
- We will be responsive to the needs of the public.
- We will cooperate fully with federal, state, and local authorities in response to emergency deployments, mishap investigations, and media relations.
- We will establish contingency plans for all anticipated off-nominal events and share them openly with all appropriate authorities.

Respect

- We will respect the rights of other users of the airspace.
- We will respect the privacy of individuals.
- We will respect the concerns of the public as they relate to unmanned aircraft operations.
- We will support improving public awareness and education on the operation of UAS.

As an industry, it is incumbent upon us to hold ourselves and each other to a high professional and ethical standard. As with any revolutionary technology, there will be mishaps and abuses; however, in order to operate safely and gain public acceptance and trust, we should all act in accordance with these guiding themes and do so in an open and transparent manner. We hope the entire UAS industry will join AUVSI in adopting this industry Code of Conduct.

APPENDIX G

LIST OF FEDERAL AUTHORITIES (3 pages)

(Office of the Chief Counsel, 2016)

Federal Statutes

- 49 U.S.C. §§ 40103, 44502, and 44701- 44735 (former Federal Aviation Act of 1958, as amended and recodified).
- FAA Modernization and Reform Act of 2012, Public Law No. 112-95 (Feb. 14, 2012), Subtitle B, "Unmanned Aircraft Systems."

Federal Regulations

- Title 14 of the Code of Federal Regulations, Chapter 1.

The U.S. Supreme Court

- "Congress has recognized the national responsibility for regulating air commerce. Federal control is intensive and exclusive. Planes do not wander about in the sky like vagrant clouds. They move only by federal permission, subject to federal inspection, in the hands of federally certified personnel and under an intricate system of federal commands. The moment a ship taxis onto a runway it is caught up in an elaborate and detailed system of controls. It takes off only by instruction from the control tower, it travels on prescribed beams, it may be diverted from its intended landing, and it obeys signals and orders. Its privileges, rights, and protection, so far as transit is concerned, it owes to the Federal Government alone and not to any state government." *Northwest Airlines v. State of Minnesota*, 322 U.S. 292, 303 (1944)(Jackson, R., concurring).

- "If we were to uphold the Burbank ordinance [which placed an 11 p.m. to 7 a.m. curfew on jet flights from the Burbank Airport] and a significant number of municipalities followed suit, it is obvious that fractionalized control of the timing of takeoffs and landings would severely limit the flexibility of FAA in controlling air traffic flow. The difficulties of scheduling flights to avoid congestion and the concomitant decrease in safety would be compounded." *Burbank v. Lockheed Air Terminal Inc.*, 411 U.S. 624, 639 (1973).

- "The Federal Aviation Act requires a delicate balance between safety and efficiency, and the protection of persons on the ground ... The interdependence of these factors requires a uniform and exclusive system of federal regulation if the congressional objectives underlying the Federal Aviation Act are to be fulfilled." *Burbank* at 638-639.

- "The paramount substantive concerns of Congress [in enacting the FAA Act] were to regulate federally all aspects of air safety ... and, once aircraft were in 'flight,' airspace management...." *Burbank* at 644 (Rehnquist, J. dissenting).

U.S. Courts of Appeals

- “Air traffic must be regulated at the national level. Without uniform equipment specifications, takeoff and landing rules, and safety standards, it would be impossible to operate a national air transportation system.” *Gustafson v. City of Lake Angeles*, 76 F.3d 778, 792-793 (6th Cir. 1996)(Jones, N., concurring).

- “The purpose, history, and language of the FAA [Act] lead us to conclude that Congress intended to have a single, uniform system for regulating aviation safety. The catalytic events leading to the enactment of the FAA [Act] helped generate this intent. The FAA [Act] was drafted in response to a series of fatal air crashes between civil and military aircraft operating under separate flight rules In discussing the impetus for the FAA [Act], the Supreme Court has also noted that regulating the aviation industry requires a delicate balance between safety and efficiency. It is precisely because of ‘the interdependence of these factors’ that Congress enacted ‘a uniform and exclusive system of federal regulation.’” *Montalvo v. Spirit Airlines*, 508 F.3d 464, 471 (9th Cir. 2007), citing *City of Burbank v. Lockheed Air Terminal Inc.*, 411 U.S. 624, 638-39 (1973).

- “[W]hen we look to the historical impetus for the FAA, its legislative history, and the language of the [FAA] Act, it is clear that Congress intended to invest the Administrator of the Federal Aviation Administration with the authority to enact exclusive air safety standards. Moreover, the Administrator has chosen to exercise this authority by issuing such pervasive regulations that we can infer a preemptive intent to displace all state law on the subject of air safety.” *Montalvo* at 472.

- “We similarly hold that federal law occupies the entire field of aviation safety. Congress' intent to displace state law is implicit in the pervasiveness of the federal regulations, the dominance of the federal interest in this area, and the legislative goal of establishing a single, uniform system of control over air safety. This holding is fully consistent with our decision in *Skysign International, Inc. v. Honolulu*, 276 F.3d 1109 (9th Cir. 2002), where we considered whether federal law preempted state regulation of aerial advertising that was distracting and potentially dangerous to persons on the ground. In upholding the state regulations, we held that federal law has not ‘preempt[ed] altogether any state regulation purporting to reach into the navigable airspace.’ *Skysign* at 1116. While Congress may not have acted to occupy exclusively all of air commerce, it has clearly indicated its intent to be the sole regulator of aviation safety. The FAA, together with federal air safety regulations, establish complete and thorough safety standards for interstate and international air transportation that are not subject to supplementation by, or variation among, states.” *Montalvo* at 473-474.

- “[W]e remark the Supreme Court's reasoning regarding the need for uniformity [concerning] the regulation of aviation noise, see *City of Burbank v. Lockheed Air Terminal*, 411 U.S. 624 (1973), and suggest that the same rationale applies here. In *Burbank*, the Court struck down a municipal anti-noise ordinance placing a curfew on jet flights from a regional airport. Citing the ‘pervasive nature of the scheme of federal 7 regulation,’ the majority ruled that

aircraft noise was wholly subject to federal hegemony, thereby preempting state or local enactments in the field. In our view, the pervasiveness of the federal web is as apparent in the matter of pilot qualification as in the matter of aircraft noise. If we upheld the Rhode Island statute as applied to airline pilots, 'and a significant number of [states] followed suit, it is obvious that fractionalized control ... would severely limit the flexibility of the F.A.A' [citing Burbank] Moreover, a patchwork of state laws in this airspace, some in conflict with each other, would create a crazy quilt effect ... The regulation of interstate flight-and flyers-must of necessity be monolithic. Its very nature permits no other conclusion. In the area of pilot fitness as in the area of aviation noise, the [FAA] Act as we read it 'leave[s] no room for ... local controls.' [citing Burbank]. *French v. Pan Am Express, Inc.*, 869 F.2d 1, 6 (1st Cir. 1989).