

A Comparison of Unmanned Aerial Vehicle Regulations in the United States and Europe

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Unmanned aerial vehicles (UAVs) have the potential to enhance the construction industry in a variety of ways – they can be used for site layout, observation and inspection of construction, and monitoring productivity and safety conditions. In the United States, the Federal Aviation Administration (FAA) has authority over the airspace of the United States and was therefore charged with the responsibility of safely incorporating UAVs into the national airspace. While new regulations were being considered and enacted, from 2012 – 2016 there was uncertainty about the future of UAV regulation that may have hindered the widespread implementation of UAVs by the construction industry. These issues are not unique to the United States; in Europe the European Aviation Safety Agency (EASA) has issued proposed rules for implementing UAVs into European airspace, where regulations currently differ from country to country. Based on a comprehensive review of the former, proposed and enacted regulations at the federal and state level, as well as the current and proposed regulations in the European Union, this paper will discuss and compare the regulation of the use of UAVs in the United States and Europe, as they relate to the construction industry.

Key Words: Drone, Federal Aviation Administration, Unmanned aerial vehicle, Unmanned aircraft system

Introduction

Technological advances are continually changing the way construction projects are delivered worldwide; the use of unmanned aerial vehicles (UAVs) is one example of how technology has the potential to change the construction industry – if recently adopted regulations make it both possible and feasible. A UAV is a device with four to eight rotary blades – the higher the number of rotary blades, the greater the lift and payload ability of the UAV. The device can be equipped with a camera and operated with a handheld device such as a smart phone or tablet. It is anticipated that by the year 2018 the UAV industry will be a \$13.6 billion sector of the market (Hanna, 2014).

Although the terms UAV and drone are often used interchangeably, they are different systems. Because a UAV is commonly defined as a device that can be operated remotely, whereas a drone is typically defined as an autonomous system reserved for military applications, this paper will use the term UAV. The United States Federal Aviation Administration (FAA) refers to UAVs as Unmanned Aircraft Systems (UAS); for the purpose of this paper UAV and UAS will be used interchangeably.

In the construction industry, UAVs have the potential to facilitate construction in a wide variety of applications. Because UAVs can be flown in areas where humans and machinery cannot reach, UAVs can be used for activities such as jobsite surveys. The efficiency of an aerial survey of land to collect data to be used to map the site saves both time and money, especially in terrain that is difficult to access or traverse (Anderson, 2015). On some construction sites, UAVs are also being used for capturing daily photographs or videos of the site. Those videos can be used to create three-dimensional images of the site that can then be compared to BIM models and project schedules to assess progress and productivity. This process can lead to increased efficiency in the delivery of

construction projects (Knight, 2015). It is even feasible to conceive of UAVs being used to assist with the actual construction of a building. A team of roboticists from ETH Zurich's Institute for Dynamic Systems and Control have used a team of UAVs to assemble a tower of polystyrene bricks by programming the UAVs with flight paths derived from digital design data (Lavars, 2012). Although the current payload capacity of the individual UAVs is limited to approximately 13 to 35 pounds per UAV, the team is working to develop a way for a team of UAVs to effectively fly as one solid shape, thereby increasing the payload capacity (Lavars, 2012). This innovation has the possibility to allow for the use of UAVs to be used to physically construct components of a building, or to perform construction in places that are difficult or unsafe for humans to work.

Methodology

The following comparison of UAV regulations in the United States and the European Union was completed using conventional legal research methodologies. A comprehensive review of primary and secondary legal resources facilitated an analysis of how the regulations impact UAV use by the construction industry.

Unmanned Aerial Vehicle Regulation in the United States

Background

The United States Department of Transportation has delegated authority over the airspace of the United States to the Federal Aviation Agency (FAA), which defines an aircraft to be "a device that is invented, used, or designed to navigate, or fly in, the air" (Definitions, 2006), (General Definitions, 1999). Despite the inclusion of the term aircraft in the naming of Unmanned Aircraft Systems, in recent years many have argued that UAVs are not aircraft. In response, in 2007 and several times since, the FAA has explicitly stated that UAS fall within the definition of aircraft because they are "used or intended to be used for flight in the air with no onboard pilot" (72 Fed. Reg. 6689, 2007). The presence or absence of a pilot is not a determining characteristic of whether an object is an aircraft – the use of it to fly in the air is.

The United States Congress passed the Federal Aviation Administration Modernization and Reform Act (the Act) in 2012. Among other things, the Act required that the Secretary of Transportation, in consultation with the aviation industry, the UAV industry, and Federal agencies that use UAVs, must "develop a comprehensive plan to safely accelerate the integration of civil unmanned aircraft systems into the national airspace system" as soon as practicable, but no later than September 30, 2015 (49 U.S.C. 40101, §332, 2012). The Act also granted the Secretary of Transportation the authority to determine whether UAVs are required to have an airworthiness certificate (49 U.S.C. 40101, §333, 2012).

The FAA distinguishes between UAVs being used for recreational versus commercial purposes. Because there are no statutory definitions of recreational nor commercial use, the FAA has issued a Notice of Interpretation to clarify its interpretation of the meaning of both uses. Using the common meanings of recreation and hobby found in the dictionary, the FAA limits the recreational category of UAV use to involve pursuits unrelated to one's occupation. If the UAV use is for recreational purposes, such as flying a model airplane as a hobby, prior FAA approval is not required and the operator generally only needs to keep the UAV within sight, follow community-based safety guidelines, and not fly within five miles of an airport, and the UAV must weigh less than 55 pounds.

Once the UAV use is in furtherance of, or incidental to a person's business, regardless of whether or not compensation is received, the use is categorized as commercial. UAV use can be considered a commercial use if there is a relationship between the use of the UAV and the person's business. Several examples of commercial use provided by the FAA that are analogous to UAV use on construction sites include: a realtor taking aerial

photographs of a property when the photos will be used in the real estate listing and a UAV operator using a UAV to determine whether commercial farming crops need to be watered (14 C.F.R. Part 91, 2014). These examples are similar to using a UAV to take construction site photographs or monitor construction activity for scheduling purposes or the allocation of job site resources, therefore UAV use on construction sites is considered a commercial use and the remainder of the paper will focus on commercial uses only.

Regulations Prior to 2015

Prior to the Act, any aircraft being operated in national airspace had to be certified and registered, have a licensed pilot, and have operational approval. Unlike the limited recommendations for recreational UAV use, commercial use of a UAV required prior FAA approval. Approval could be obtained in one of several ways (Herrmann, 2016). The options most relevant to the construction industry were:

1. Apply for a Section 333 Grant of Exemption, named in reference to Section 333 of the Act, which allowed the Secretary of Transportation to waive the requirement of an airworthiness certificate. The Exemption contained a standard 200-foot nationwide Certificate of Waiver or Authorization (COA) with restrictions near airports, restricted airspace and densely populated areas. If granted, the Exemption would contain any additional applicable restrictions; examples of additional restrictions relevant to the use of UAVs on construction sites are listed below. The approval process took up to 120 days.

2. A similar yet potentially broader option than the Section 333 Grant of Exemption was to obtain a Certificate of Waiver or Authorization (COA), the scope of which was made on a case-by-case basis specific to the airspace required for a particular use of the UAV. This option potentially allowed the operator to fly the UAV beyond the 200-foot standard permitted in a Section 333 Grant of Exemption. The approval process took 60 to 90 days but the COA required the prior issuance of a Section 333 Grant of Exemption.

Both of the options listed above required the operator to have either an airline transport, commercial, private, recreational or sport pilot certificate (FAA, 2015), a process that can be both time consuming and expensive for many construction companies. Examples of additional restrictions for UAV use on construction sites typically included: (1) Not operating the UAV within 500 feet of nonparticipating persons, vehicles and structures unless barriers or structures are in place to sufficiently protect those persons in event of an accident, or the owner of those vehicles or structures has granted permission for the UAV to be operated closer to those objects, and (2) All operations were to be conducted over private or controlled-access property and permission had to be obtained from the property owner or an authorized representative for each flight to be conducted (FAA, 2016a). These additional restrictions were potentially insurmountable to achieve on many construction sites, especially in urban areas where it may not be possible to remain 500 feet away from nonparticipating persons, nor to sufficiently protect adjacent structures and passersby.

Regulations Proposed in 2015

Since passage of the Act in 2012, many states considered and/or enacted legislation while waiting for the FAA to propose its regulations. In 2013, 43 states introduced a total of 130 bills and resolutions related to UAV use (National Conference of State Legislatures, 2015a). Thirty-five states considered UAV bills and resolutions in 2014 (National Conference of State Legislatures, 2015b), and in 2015, 45 states considered 161 UAV-related bills (National Conference of State Legislatures, 2015c). The subject matter of the bills enacted nationwide varies however, many address privacy issues, agricultural operations (including hunting, fishing and trapping), law enforcement use of UAVs, and/or preemptive rights whereby a state reserves the right to regulate UAV use within its borders and does not allow county and municipal government to do so (National Conference of State Legislatures, 2015a,b,c).

On February 15, 2015 the FAA issued a Notice of Proposed Rulemaking for small UAVs being used for commercial purposes, with small UAVs defined as those weighing less than 55 pounds. The proposed rules stated that UAVs (1) may only be flown within the visual sight of the operator and only during daylight hours, (2) must fly lower than 500 feet and not exceed 100 miles per hour, (3) must be operated by a person who is at least 17 years of age who has also passed a FAA knowledge test (which needs to be passed every two years) and obtained an FAA UAS operator certificate, and (4) the UAV must be registered (National Conference of State Legislatures, 2015c). Additionally, the proposed rules prohibit dropping any object from the UAV and prohibit the operator from flying the UAV over anyone not directly involved in the operation of the UAV (FAA, 2015). The proposed regulation prohibiting the use of UAVs over anyone not directly involved in the operation of the UAV was potentially problematic for the construction industry. If that limitation was interpreted to mean that laborers on a construction site are not directly involved in the operation of the UAV, then a UAV could only be used on a construction site when it was unoccupied. While that may still allow for the gathering of data that may assist with scheduling, it would limit the ability of UAVs to be used for some productivity and safety-related uses (Herrmann, 2016). After the release of the proposed regulations, a 60-day public comment period followed.

Current Regulations – Enacted in 2016

Despite missing the 2015 deadline called for in the Act, the FAA's Small UAS Rule, formerly known as Part 107, went into effect on August 29, 2016 and is largely similar to the rules proposed in February 2015. The new UAS Rule still distinguishes between recreational and commercial uses (FAA, 2016c). As with the proposed rules, (1) UAVs must still be flown during daylight hours and within the visual sight of the operator, however a waiver can be obtained for these rules, (2) the UAV must be flown under 400 feet instead of the 500 feet in the proposed rules, however it must still not exceed 100 miles per hour. Again, a waiver can be obtained for those items, (3) although the proposed rules required an operator to be at least 17 years of age, the new rules only require the operator to be 16 years of age, as well as pass an Aeronautical Knowledge Test, have a Remote Pilot Airman Certificate and pass TSA vetting, and (4) the UAV must weigh less than 55 pounds, be registered, and undergo a pre-flight inspection. Although the new rules do not explicitly prohibit items from being dropped from the UAV as the proposed rules did, the new rules still prohibit the UAV from being flown over people. Additionally, the new rules prohibit the operator from flying the UAV from a moving vehicle however, a waiver can be obtained for both flying over people and operating the UAV from a moving vehicle (FAA, 2016b). The ability to obtain waiver for operating a UAV over people is of significant importance to the construction industry because it allows for a wider range of uses for the UAV, including but not limited to monitoring productivity and safety on an active construction site.

As mentioned above, waivers can be obtained for some of the rules, provided the operator can establish that use of the UAV will be safe. The majority of the waivers approved since the implementation of the new rule have been to allow use of the UAV at night (FAA, 2016c). For those operators who had obtained a COA under the former rules, they may continue to operate under the conditions and limitations in their exemption until it expires, which is usually two years after it was issued. Once an existing exemption expires, the operator must then comply with the new rules and seek a new waiver for any parts of the operation that do not comply with the requirements of the new rules (FAA, 2016d).

Unmanned Aerial Vehicle Regulation in Europe

In the European Union (EU), the term Remotely Piloted Aviation System (RPAS) is analogous to the term UAV used in the United States – an aircraft that is remotely controlled by a pilot. For the sake of simplicity, this paper will use the term UAV in this section even though the terms RPAS or drone may be used in the EU. UAVs are currently being used in the EU for similar purposes as in the United States, such as inspections of infrastructure and precision

farming. The UAV market in the EU is expected to grow exponentially in the next ten years, with predictions that it could be worth up to 15 billion euro per year (European Commission, 2014).

Current Regulations

The governing body regulating UAV use in the EU is the International Civil Aviation Organisation (ICAO), which regulates all civil aviation. ICAO has tasked the European Aviation Safety Agency (EASA) with developing uniform regulations for UAV use across the EU. UAVs weighing more than 150kg (approximately 330 pounds) are regulated in a similar way to manned aircraft. UAVs weighing less than 150 kg are regulated by each nation, called Member States (EASA, 2015). Many individual Member States have enacted legislation for UAV use however, legislation is not necessarily consistent from nation to nation and approval granted by one nation is not necessarily recognized in other nations – much like if each state in the United States had its own regulations in the absence of the FAA regulations. In recognition of the growing role of UAVs in a wide variety of applications, the EU is seeking to balance five primary objectives: (1) maintaining the safety of EU aviation, (2) respect the right for private and family life, and the protection of personal data, (3) ensure security, (4) ensure that insurance fees correspond to the risk, and (5) support the development of a competitive UAV market (European Commission, 2014).

Proposed Regulations

As was the case in the United States until the recent enactment of regulations, in the European Union new regulations have been proposed and are open for public comment, but have yet to be implemented. In July 2015, EASA introduced A-NPA, its proposal for creating common rules for UAV use in the EU. The period for public comment on the proposed regulations closed September 25, 2015. In contrast to the current EU regulations categorizing UAVs by weight, or the FAA regulations categorizing UAV use as either recreational or commercial, the EASA proposal is a risk-based approach. Rather than focusing on the size and type of UAV use, the proposal focuses more on how and under what conditions the UAV is used to determine the potential risks to third parties, including the risk to persons and property. In its entirety, the A-NPA contains 33 proposals and divides both commercial and non-commercial uses into three broad risk-based categories:

1. **Open Category:** As the lowest category of risk, this type has minimal regulations. The operator must maintain visual contact with the UAV and fly it below 150 meters (approximately 492 feet). The UAV must weigh less than 25 kg (approximately 55 pounds) and use the concept of geo-fencing wherein the UAV software and/or hardware is designed not to enter designated areas even if the pilot inadvertently attempts to direct it there. The UAV must also be operated a safe distance from people on the ground not involved with its use, and away from other airspace users.
2. **Specific Category:** Any use that exceeds the limitations of the open category would be subject to the requirements of the specific category. This medium risk category requires the operator to perform a risk assessment prior to obtaining authorization from a national aviation authority (NAA) in the country where the use will take place. The risk assessment must be documented by the operator in an Operations Manual that includes but is not limited to any temporary or permanent conditions and limitations for operation as well as the training and qualifications of any operators. After reviewing and approving the Operations Manual, the NAA would issue an Operation Authorisation (OA) (EASA, 2015).
3. **Certified Category:** This higher risk category would impose requirements similar to those required for manned aircraft, meaning the individual UAV would need to be certified for airworthiness and similar maintenance and operational requirements would be imposed. The operator would also need to be a licensed pilot. UAVs in this category would likely be larger UAVs, weighing more than 25 kg (approximately 55 pounds) (EASA, 2015).

On August 22, 2016, EASA released prototype regulation for the open and specific categories that will be subject to a period of public review and comment. The purpose of the prototype regulation was to establish a framework for

Member States to follow in developing and/or modifying regulations for UAV use within their borders. Among other things, the extensive prototype regulations offer Member States guidance on rules, administrative procedures, and requirements and conditions for both the UAV operator as well as the operation of the UAV (EASA, 2016). Following the review process, a Notice of Proposed Amendment should be issued by the end of 2016.

Discussion

Although categorized differently, with the exception of the geo-fencing requirement, the regulations of the proposed Open Category in the EU are similar to the regulations implemented by the FAA for small UAVs. Both limit the weight of the UAV to approximately 55 pounds and both prohibit the use of the UAV around people not involved in the operation of the UAV. Many UAVs used on construction sites could potentially fit into the requirements and limitations of the Open Category however, under no circumstances can the UAV be flown above a crowd, which is defined in the EU to be a group of more than 12 people (EASA, 2015). Although the FAA may grant a waiver from that limitation, it remains to be seen whether the EU Member States will allow exceptions to that rule. Potentially, a group of more than 12 laborers on a job site, even if they could arguably be considered to be involved with the use of the UAV, could constitute a crowd and therefore the use would not qualify for the Open Category. However, if the UAV were used during a time when the site was not occupied, the use could fit into this category. Because the Open Category is most analogous to the FAA's new Small UAV regulations, a comparison of those regulations is shown in Table 1, below.

Table 1

Comparison of UAV Regulations in the United States and European Union

Item Regulated	United States (Commercial Use)		European Union	
	2015 Proposed Regulations	Current Regulations – enacted in 2016	Current Regulations	Proposed Regulations (Open Category)
Distance	Within sight of operator during daylight hours	Within sight of operator during daylight hours (can be waived)	Varies by Member State	Within sight of operator
Maximum Height	500 feet	400 feet (can be waived)		150 meters (approximately 492 feet)
Maximum Speed	100 miles per hour	100 miles per hour (can be waived)		
Operator	17 years of age, pass FAA knowledge test, obtain UAS operator certificate	16 years of age, pass FAA knowledge test, obtain operator certificate, pass TSA vetting		
UAV	Less than 55 pounds and registered	Less than 55 pounds, be registered, undergo pre-flight inspection		Less than 25 kg (approximately 55 pounds)
Other	Prohibited from dropping items and from flying over people	Prohibited from flying over people and from operating from a moving vehicle (can be waived)		Use geo-fencing, operate a safe distance from people and other airspace users

With regard to the proposed Specific Category, because prior approval is required before this type of use, it sounds similar to the FAA Section 333 Grant of Exemption or Certificate of Authorization options previously available in the United States. One key distinction however is that in the U.S., the FAA will prescribe any restrictions and

limitations whereas in the EU, the operator self-imposes its own restrictions after completing its risk assessment. Under the new FAA rules, the Specific Category would be analogous to a use where an operator has obtained waivers from one or more of the new rules.

Because of the weight threshold of the Certified Category, UAVs in this category would be heavier than those regulated by the FAA's new Small UAV regulations. With respect to all categories, while the EU takes a risk-based approach that requires both a risk assessment and mitigation, operators in the United States should still perform a similar assessment in consultation with legal counsel and insurance representatives. An FAA waiver of one or more requirements or limitations of the rule is not the same as a waiver of legal liability. Although they are beyond the scope of this paper, some of those unresolved issues include but are not limited to legal liability, insurance coverage, and privacy issues (Herrmann, 2016).

Conclusion

With the UAV industry expected to become a \$13.6 billion industry in the United States by 2018, it is imperative that regulations allow for the safe implementation of UAVs into the airspace. Between the passage of the Act in 2012 and the implementation of the new rules in August of 2016, there was a great deal of uncertainty about the future of UAV use in the domestic construction industry, which left many companies waiting to determine whether to implement UAVs on their construction sites. Now that the FAA has implemented new rules, construction companies looking to implement UAVs on their construction sites should have more certainty with which to assess whether the technology is worthwhile for that particular job and company. The proposed regulations in the Open Category in the European Union are similar to the recently enacted FAA rules, and should provide a similar level of certainty to UAV operators there once implemented.

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