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Mini Review

How to legally use drones for surveys?

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Abstract

Drones are very useful for civil engineering and environmental surveys because drones may increase productivity, allow more regular and comprehensive monitoring of construction progress, monitor the status of infrastructures (e.g. bridges), and anyway collect a vast amount of digital data, which can be easily stored, manipulated and shared.

However, while the benefits offered to end users by drones are becoming apparent to the entire professional community, possibly not anyone is yet aware of the conditions to fly drones legally in different jurisdictions.

The aim of this article is to respond to some of the most common questions on the regulation of drones, hoping that the answers might facilitate the development of business cases for organisations that have not yet decided to use drones, or which intend to expand their use.

In the USA Part 107 lists detailed limitations and conditions for the UA flight, but it does not have a clear list of responsibilities of the RPIC compared with the wider responsibilities of the UAS operator (e.g. the commercial company employing the pilot).

In the EU, USA, and other jurisdictions, the first obligation to legally fly a drone for professional purposes is registration; the drone (if MTOM 250 g or more) in the USA and the operator in the EU (even if the drone is below 250 g).

Virtual and 'face-to-face' courses on the regulation of non-military drones are available at the Joint Aviation Authorities – Training Organisation (JAA-TO).

Acronyms

AGL: Above Ground Level; BVLOS: Beyond Visual Line-of-Sight; CAA: Civil Aviation Authority; CAT: Commercial Air Transport; CONOPS: Concept of Operations; DGCA: Directorate General of Civil Aviation; EC: European Commission; EMSA: European Maritime Safety Agency; EU: European Union; EUROCAE: European Organisation for Civil Aviation Equipment; E-VLOS: Extended Visual Line-of-Sight; FAA: Federal Aviation Administration; FAR-Federal Aviation Rule; ICAO: International Civil Aviation Organisation; IFR: Instrument Flight Rules; ISO: International Standard Organisation; JAA TO: Joint Aviation Authorities – Training Organisation; JARUS: Joint Authorities for Rulemaking on Unmanned Systems; MTOM: Maximum Take-Off Mass; OHS: Occupational Health and Safety; RP: Remote Pilot; RPAS: Remotely Piloted Aircraft Systems; RPIC: Remote Pilot in Command; RTCA: Radio Technical Commission for Aeronautics; TC: Type Certificate; UA: Unmanned Aircraft; UAS: Unmanned Aircraft System; UAV: Unmanned Aerial Vehicle; UN: United Nations; USA: United States of America; VLOS-Visual Line-of-Sight

Introduction

It may be a common experience of several readers that drones are very useful for civil engineering and environmental surveys. This opinion is widely supported by technical literature [1] because in civil engineering drones may increase productivity, allow more regular and comprehensive monitoring of construction progress, monitor the status of infrastructures

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(e.g. bridges) and anyway collect a vast amount of digital data, which can be easily stored, manipulated and shared.

The same happens in drone applications used to monitor several environmental parameters, in the atmosphere, on the ground, or at sea. Among them, a noticeable example is the European Maritime Safety Agency (EMSA[1]) which uses drones to monitor pollution at sea [2].

So, while the benefits offered to end users by drones are becoming apparent to the entire professional community, possibly not anyone is yet aware of the conditions to fly drones legally in different jurisdictions.

The aim of this article is hence to respond to some of the most common questions on the regulation of drones, hoping that the answers might facilitate the development of business cases for organisations that have not yet decided to use drones, or which intend to expand their use.

Are drones considered aircraft?

According to Britannica[2], an Unmanned Aerial Vehicle (UAV) is a military aircraft that is guided autonomously, by remote control, or both and that carries sensors, target designators, offensive ordnance, or electronic transmitters designed to interfere with or destroy enemy targets. In fact, the acronym UAV is widely used by the armed services as well as by journalists and scholars.

This term was widely debated in civil aviation forums until the International Civil Aviation Organisation[3] (ICAO) decided in 2007 [3] to use, from then on, the term Unmanned Aircraft System (UAS). In fact, in the mentioned [3] the term UAV is labelled as 'obsolete'.

The change of terminology was motivated by the decision by several aviation authorities to consider drones not generically 'vehicles', but more specifically 'aircraft', hence subject to aviation. Regulations and procedures.

This understanding was enshrined in 2012 in Annex 7 [4] to the Chicago Convention:

Part 2.2: An aircraft that is intended to be operated with no pilot on board shall be further classified as unmanned.

Consequently, responsible organisations, when using drones for surveys in any jurisdiction, should comply with aviation regulations applicable in the involved jurisdiction. In particular, with the rules and procedures applicable to 'aerial work' [5]:

Aerial work: An aircraft operation in which an aircraft is used for specialised services such as agriculture, construction, photography, surveying, observation and patrol, search and rescue, aerial advertisement, etc.

Where drones are subject to aviation regulations?

There is nevertheless one exception. In fact, small drones may fly inside closed volumes, such as caves, sports halls, buildings whose statics may have been compromised by an earthquake, reservoirs possibly contaminated by toxic gases [6], etc.

In this case, the closed environment is not considered by most aviation authorities as 'airspace', because the risk of collision between the drone and aircraft in flight is non-existent. In this case, therefore, in most jurisdictions, aviation rules do not apply.

The result is however in practice not very different. In fact, being aviation rules not applicable indoors, the regulations on Occupational Health and Safety (OHS) would still apply. And in most cases, they would require safety assessment and mitigations before initiating the operation. Industry standards may support their development, such as [7].

Are drones always subject to ICAO provisions?

When one speaks about international standards for civil aviation, the instinct of all aviators around the globe is to refer to ICAO and in particular to the 19 Annexes[4] to the Chicago Convention. However, Art. 44 of said Convention mandates ICAO to standardise only what is relevant for international aviation on a global scale. Matters belonging to domestic aviation do not need to be subject to obligatory standards developed under the Convention.

Therefore, while on one side long range commercial air transport (CAT) is largely a global issue, in fact, standardised in all its necessary aspects by ICAO, there are several other domains of aviation, possibly less economically relevant, but still regulated only at regional (e.g. European Union - EU) or national, but not at ICAO level. Among them, one might recall airships, hot air balloons, gliders, light sport aircraft below 2,250 kg, aeroclubs, model aircraft, private-use aerodromes, and so on.

Notably, since 1965, aerial work using crewed (i.e. with pilot on board) aircraft is not covered by any Annex to the Chicago Convention, being considered a domestic and not international subject.

Turning to drones, ICAO has decided [8] to concentrate, until 2026, its efforts on standardisation of Remotely Piloted Aircraft Systems (RPAS, being autonomous UAS excluded) flying under Instrument Flight Rules (IFR) along international air routes in controlled airspace.

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[1]EMSA is an Agency of the European Union (EU) https://www.emsa.europa.eu/about.html

[2]https://www.britannica.com/technology/military-technology consulted on 16 July 2023

[3]Specialised Agency of the United Nations (UN).

[4] https://store.icao.int/en/annexes consulted on 17 July 2023.

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In conclusion, most drones flying today are out of the scope of the ICAO provisions because of their limited range and because most of the time they fly at heights below 500 ft Above Ground Level (AGL) at which ICAO standards do not necessarily apply (except take-off and landing at international aerodromes).

Do we need to register our drone?

Putting then aside the ICAO provisions which are not applicable, small drones[5] shall be registered in several States. For instance, in the USA [9] all drones must be registered through the FAA portal, except those that:

Weigh 0.55 pounds or less (less than 250 grams); or are model aircraft, flown exclusively for recreational purposes in the frame of Community-Based Organizations (CBO; i.e. model clubs) under the exception for limited recreational operations.

Drones registered under the exception cannot however be flown for professional purposes under Part 107 [10].

EU rules on the registration of small UA [11] are slightly different. In general, all civil drones, whether used for professional or recreational purposes or in the frame of a model club, shall be registered if the MTOM is 250 grams or more, but the EU rule requires that not the drone itself but the operator[6] is registered.

However, if the drone is equipped with a camera or other sensor, the operator shall register even if MTOM is below 250 g unless the drone is marketed as a 'toy' based on [12].

Furthermore, in the EU, for high-risk operations, the drone shall be accompanied by a Type Certificate (TC). In this case, the operator still needs to be registered, but in addition, even the drone shall be registered, according to national rules, in turn complying with [4].

Who is accountable for drone operations?

Most of the rules in [10] are addressed to the Remote Pilot in Command (RPIC) since in that country, for long cultural tradition, there is more reliance on individuals than on organizations. Even in the case of the smallest drones in the lowest risk category [12], the responsibilities of the RPIC are more limited than the responsibilities of the operator, as summarised in the Table 1.

In addition, in the EU the UAS operator is responsible to purchase insurance [13-40] to cover liability towards third parties, while this obligation does not exist in the USA under FAA Part 107.

Conclusion

In the USA Part 107 lists detailed limitations and conditions for the UA flight, but does not have a clear list of responsibilities of the RPIC compared with the wider responsibilities of the UAS operator (e.g. the commercial company employing the pilot).

In the EU, USA, and other jurisdictions, the first obligation to legally fly a drone for professional purposes related to surveys or environmental monitoring, is registration; the drone (if MTOM 250 g or more) in the USA and the operator in EU (even if the drone is below 250 g).

Virtual and 'face-to-face' courses[7] on the regulation of non-military drones are available at the Joint Aviation Authorities – Training Organisation (JAA-TO)[8].

[5]Small drones are commonly considered those with a Maximum Take-Off Mass (MTOM), including the payload, of 25 kg, 55 lbs).

[6]i.e. the legal person employing or contracting the remote pilot. In the simplest case the owner, the operator and the remote pilot are the same natural person.

[7]https://jaato.com/uas-diploma/ consulted on 22 July 2023.

[8]https://jaato.com/uas-diploma/

Table 1: The responsibilities for the RPIC are more limited than the responsibilities of the operator.

EU Rule UAS.OPEN.050 Responsibilities UAS operator	EU Rule UAS.OPEN.060 Responsibilities of RP
The UAS operator shall: (1) develop operational procedures adapted to the operation and risk involved; (2) ensure that all operations effectively use and support the efficient use of radio spectrum to avoid harmful interference; (3) designate a remote pilot for each flight; (4) ensure that remote pilots and all other personnel performing a task are familiar with the UAS manufacturer's instructions, have appropriate competency, are fully familiar with the operator's procedures, and are provided with information concerning any geographical zones limiting or prohibiting UAS flights. (5) update the information into the geo-awareness system, if applicable; (6) Verify that the UAS is accompanied by the EU declaration of conformity and that the related class identification label is affixed to the UA. (7) Ensure, for drones with MTOM higher than 900 g, that all involved persons present in the affected area have been informed of the risks and have explicitly agreed to participate.	(1) Before starting a UAS operation, RP shall have appropriate competency, carry proof of competency while operating the UAS, obtain updated information about any geographical zone, observe the operating environment, and check the presence of obstacles and of any uninvolved person. RP shall also ensure that the UAS is in a condition to safely fly. is equipped with required functions (e.g. direct remote identification) and that the UAS fitted with the payload does not exceed either the MTOM defined by the manufacturer or the MTOM limit of its class. (2) During the flight, RP shall not perform duties under the influence of psychoactive substances or alcohol or when it is unfit to perform its tasks due to injury, fatigue, medication, sickness, or other causes and respect the limitations and conditions applicable to the UA flight, while operating in accordance with manufacturer's instructions and with the operator's procedures. (3) During the flight, RP shall not fly close to or inside areas where an emergency response effort is ongoing unless they have permission to do so from the responsible emergency response services.

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