

# New UAS Regulations in the EU and their Impact on Effective Usage of UAS

AHMED ALAMOURI<sup>1</sup>, ASTRID LAMPERT<sup>2</sup> & MARKUS GERKE<sup>1</sup>

*Abstract: A key hurdle in most UAS based applications is to conduct a safe UAS operation. To reach the highest safety level, minimizing risks to other airspace users, people & property is requested. Risk avoidance requests a clear presence of legislation for UAS operation. In this vein, UAS regulators in EU are making efforts towards enabling a reliable legal framework. The recent outcome of these efforts is that new EU drone regulations are into force since 1<sup>st</sup> Jan. 2021. Although the new regulations are seen as an essential step for harmonizing UAS rules in Europe, they may lead to new challenges that influence UAS operations. In this opinion paper, the authors will proceed with background information about the recent UAS rules in Europe and their impact on UAS operation and use.*

## 1 Introduction

Unmanned aircraft systems (UAS, also known as drones) are increasingly becoming popular and are used in many application and research fields such as topographic mapping, infrastructure maintenance, inspections, atmospheric research, etc. One key hurdle in most UAS-based applications is to operate flight missions with a high safety level. This is due to the fact that realizing a safe UAS operation is not always achievable or possible due to the urgent need for coordination between many factors such as the knowledge of all barriers and obstacles existing in the operation scenes. However, a safe UAS operation imposes minimizing the risks that may arise during the operation time and influence other airspace users, bystanders and property on the ground. In addition, avoiding or minimizing UAS risk needs a legal framework for UAS planning and operation. Such kind of a legalisation should provide rules with clear technical and operational definitions that can support overcoming common problems arising during flight missions; for instance the time of flight operation - e.g. within/outside the peak-hours (RANGO, ALBERT & LALIBERTE 2010), the complexity in the execution of administrative affairs that can hinder the desired operational flexibility (STÖCKER et al. 2017). Such high demand for a reliable legal framework for UAS operations is an important motivation that many national and international authorities and organizations in Europe started with tremendous efforts towards updating and modernizing the first wave of UAS regulations that have been adopted in 2017. The main aim of the update process and the modernization is to keep up with the fast and enormous developments of UAS technology in a way that respects the needs and laws of EU member states. The mentioned efforts have culminated in the adoption of new EU drone regulations that are into force since the beginning of 2021. In gen-

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<sup>1</sup> Technical University of Braunschweig, Institute of Geodesy and Photogrammetry, D-38106 Braunschweig, E-Mail: [a.alamouri, m.gerke]@tu-braunschweig.de

<sup>2</sup> Technical University of Braunschweig, Institute of Flight Guidance, D-38106 Braunschweig, E-Mail: astrid.lampert@tu-braunschweig.de

eral, the current EU drone rules are seen as a positive step towards harmonizing the drone regulations in Europe. From a practical point of view, implementing the new rules into national level may need more time, probably to the mid of 2022. This can be justified by the lack of adequate interpretation of some rules in terms of administrative and technical issues (AYAMGA et al. 2021). To this end, we aim in this opinion paper to provide a look back on the first wave of the regulations in 2017. Next, we address the recent developments of EU drone regulations with a focus on the most important amendments and changes in the regulations since 2017. Finally, we point at the impact of new rules on drone use i.e. how they may help or hinder the deployment of drone technology.

## 2 Briefly looking back on drone regulations (2017-2020)

In this section, we briefly introduce the status of the drone regulations in Europe within the past years, namely the last four years before adopting the new rules at the beginning of 2021. Basically, EU member states have started with the process for drafting or enacting drone legislation. JONES in 2017 reported about this process, and pointed out that it was somehow cumbersome and largely vague due to a lack of requirements or technical expertise. He provided a list of tables showing the requirements for UAS operations in different regions in the world. To give a close view about the regulation status at that time, we refer - for instance - to the first wide wave of drone regulations in Germany approved in spring 2017. In that year, the rules for UAS operation have been laid down with focus a.o. on air traffic management and navigation services (BGBL 2017). One distinctive issue to be noted is that the mentioned regulation wave considered the Maximum Take-Off Mass (MTOM) - allowed for UAS - as a key factor for UAS classification. For this reason, UAS were categorised in three systems: with MTOM less than 5kg, between 5-25kg and more than 25kg. The most important operational requirements for UAS categories are represented in Tab. 1 (CRAMER & WIELAND 2019).

Tab. 1: Important operational requirements of UAS according to their MTOM (German rules 2017-2020)

MTOM	<5KG	[5-25]kg	>25kg
Flight permission	Not necessary for each flight	requested	a fundamental operation is prohibited, although exceptions are possible
Labeling of UAS	Mandatory	Mandatory	
Maximum flight height	<100m	<100m	
Pilot certificate of knowledge	Requested	Requested	

In the end of 2017, MTOM was not considered anymore in UAS classification, where the European Council, European Commission and the European Parliament have proposed a new concept regulating all UAS regardless of their MTOM (EASA 2017-05). This concept was developed in the following year with focus on realizing a legal framework that enables a high uniform level of safety in the European civil aviation (EPC 2018/1139). For this aim, effective aviation policies in EU were achieved in 2019 (EASA/947 2019), and their main outcome was that new requirements for technology and personnel were included in the new EU rules for UAS operations adopted in the end of 2020 (EASA\_Rev. 2021). This will be highlighted in the next section.

### 3 New EU drone regulations

After a lot of efforts towards UAS rules harmonization, EU Aviation Safety Agency (EASA <https://www.easa.europa.eu/>) laid down the new UAS regulations in December 2020. Basically, the new rules have been developed based on the core notices of the amendment A-NPA proposed in 2015 (EASA\_NPA 2015). The new rules are structured in two main parts: the first one is Implementing Rules (IR) that cover issues related to operations of UAS. While the second part is Delegated Rules (DR), which deals with technical requirements for the design and manufacture of UAS (EASA\_Rev. 2021). In the following sections, IR and DR will be highlighted.

#### 3.1 Implementing rules (IR)

IR have been formulated through 23 articles that deliver comprehensive provisions for UAS operations. Key articles are those focusing on a safe UAS operation, personnel and organizations involved in UAS operations. In this context, IR classified UAS operations in three categories based on the operation risk that may be arisen or posted to third parties (EASA\_Rev. 2021); these categories are: open, specific and certified (Tab. 2).

Tab. 2: Categories of UAS operations

UAS operational categories		
Open	Specific	Certified
<ul style="list-style-type: none"> <li>• Low risk</li> <li>• No involvement of aviation authority</li> <li>• VLOS based operation</li> </ul>	<ul style="list-style-type: none"> <li>• Medium risk</li> <li>• SORA based approval</li> <li>• An operating permit is required</li> </ul>	<ul style="list-style-type: none"> <li>• High risk</li> <li>• Certified operator</li> <li>• Certified UAS</li> </ul>

One main issue in the open category is a low risk during UAS operations. Low risks are seen as an advantage in UAS operations, because it enables UAS pilots to fly without the need for an operation permission. For further characteristics of the open category, we can refer to the article 4 of IR (EASA\_Rev. 2021): “UAS operations are classified in the open category only where the following requirements are met:

- UAS has a class that is set out in DR EU 2019/945 (see 3.2)
- UAS MTOM should be less than 25kg
- UAS operation is conducted in the Visual Line of Sight VLOS and the UAS is kept at a safe distance of at least 1.5km from inhabited areas, airports and sensitive zones, and at least 100m from infrastructure like highways, hospitals, power plants, etc.
- During an operation, UAS do not carry dangerous goods and do not drop any material
- Flying height is limited to 120m above the surface of the Earth”.

If one or more of the abovementioned requirements of the open category cannot be complied within UAS operation, the specific category will be in force. The assumption here is that a higher operation risk can be expected. In this vein, UAS pilots need an operational permission issued by the competent authority pursuant to the risk assessment or the robustness of measures that keeps a high safety level during the operation - more details can be found in the article 12 of IR

(EASA\_Rev. 2021). Based on this, UAS pilots need to obtain an operation licence connected to a risk assessment for UAS activities in the specific category. According to the article 11 of IR (EASA\_Rev. 2021), “an operational risk assessment shall include, but not limited to:

- *A solid description of UAS operation*
- *propose comprehensive operational safety objectives*
- *identification of ground and air risks to, for instance uninvolved persons, objects, etc.*
- *measures for risk mitigation*
- *technical characteristics of the UAS and competencies of the personnel”*

IR proposed a methodology that can be applied to conduct the abovementioned risk assessment; this is known as the Specific Operation Risk Assessment (SORA). SORA has been developed by the Joint Authorities for Rulemaking on Unmanned Systems JARUS (<http://jarus-rpas.org/>). More details about this approach and its concept are available at the article 11 of IR (EASA\_Rev. 2021). Within the third operation category, UAS activities are regulated according to the article 6 of IR. Here UAS operations shall be classified in the certified category if only the following requirements are met (EASA\_Rev. 2021):

- *“if the UAS is certified pursuant to Article 40 of DR; here it deals with the design, production and maintenance of UAS*
- *if the operation is conducting over assemblies of people, involves the transport of people or involves the carriage of dangerous goods that may result in high risk to other parties*
- *if the competent authority may assess the operational risk such that the operation falls into the certified category”*

Beside the UAS certification according to the article 40 of DR, it is necessary to certify the entire operation, i.e. the company involved in the operation, pilots, the measures of UAS maintenance, the monitoring of the maintenance Continuing Airworthiness Management Organization (CAMO).

### **3.2 Delegated Rules (DR)**

The subject matter of DR is the design and manufacture of UAS to be operated with respect to the IR introduced in (3.1). In this paper, we focus on DR that define the type and class of UAS to be certified; which is - from our point of view - an important topic for UAS operation. In this context, and from operational aspects, the new EU regulations provided a class-identification of UAS that shows on one hand the technical properties of UAS for e.g. MTOM, and on the other hand the operational requirements to be respected during flight missions. As result, UAS are classified into seven classes C0 to C6. Most important characteristics of these classes are presented in Tab. 3. However, UAS regulators achieved a linkage between UAS classes and the operation distance to persons, which has an impact on the operation categories described in (3.1), namely on the open category. This led to the requirement that the open category got structured into three subcategories: A1, A2 and A3. For instance, when operating UAS with class C0 in A1, pilots do not need an operation license, but they have to be familiar with the UAS user manual guide. In contrast, flying in A1, but with UAS class C1 imposes that pilots should have a solid background about the UAS user manual guide and passed an online training course.

Tab. 3: UAS classes C0–C6, source (EASA\_Rev. 2021)

Subcategory	UAS Class	MTOM (kg)	Max. velocity (m/s)	Max. AGL (m)	Qualification
A1 Fly over people	C0	<0.25	19	120	Familiar with operation instructions
	C1	<0.9	19	120	Familiar with operation instructions Online training and test
A2 Fly close to people	C2	<4	-	120	Familiar with operation instructions Online training and test Certificate “proof of knowledge” (according to German rules)
A3 Fly far from people	C3	<25 < Diameter 3m	-	120	Familiar with operation instructions Online training and test
	C4	<25	-	-	
-	C5	Not defined	-	-	Online training and test
-	C6	Not defined	50	-	

## 4 Regulation impact on UAS Operation

Since the adoption of the new EU drone rules in early 2021, drone users and manufacturers have been following the repercussions that may result from applying these rules. Although the new regulations are seen as a positive step towards modernizing and harmonizing UAS rules in Europe, they will lead to some challenges that affect UAS operation and uses. More specifically, in the following subsections we discuss two challenges that may be crucial in the early phase of rules implementation, and these are: UAS user registration and visibility restriction.

### • UAS user registration

In order to realize a better accommodation of UAS operations, registration of UAS user (pilot or operator) within EU in the respective EU country is only required once. The UAS user’s ID assigned during the registration must then be visibly fixed to each drone. The registration process itself depends on UAS design, class (see Tab. 3) and on the operation category where the UAS should be operated. In this context and according to the article 14 of IR (EASA\_Rev. 2021), “UAS operators shall register themselves:

- a) when operating within the open category any of the following UAS:
  - i. MTOM is 250g or more
  - ii. UAS is integrated with a payload like for instance a sensor that could be used for personal data collection
- b) when operating within the specific category an unmanned aircraft of any mass”

To this end, we agree that the regulations addressed clearly who should register and when, but at the same time, having a competent registration system in a practical way is still a key challenge. This is because each EU country needs to create specific databases, and to create an online platform for the registration process, which requires skills for data managements and data provision. These requirements do not yet exist in many EU member states, and therefore the interoperability, mutual access and exchange of registration information might be affected. In addition, the need to indicate the operator information at each device physically might bring challenges in practice, e.g. when several people are using the same system.

- **Visibility restriction**

As previously mentioned in section (3.1), the open category is denoted as being low risk during UAS activities and imposes operating the UAS with VLOS conditions, which means that pilots must keep continuous visual contact with UAS. From an economic point of view, VLOS based operations may not be the best option for various UAS based applications; for instance, VLOS operations may not be the best scenario for monitoring issues in dense forest researches, where keeping a direct contact to UAS is not always possible (PANEQUE-GÁLVEZ et al. 2014; YAUN et al 2015; THIEL et al. 2020; DAINELLI et al. 2021). In contrast, Beyond Visual Line of Sight (BVLOS) based flight missions are a significant aspect for the drone operation (POLITI et al. 2021). This is due to the fact that in BVLOS based operations UAS can be operated away from the visual range. Therefore, it allows UAS covering long distances and large areas, which is interesting in terms of time and cost reduction. In this way, BVLOS opens chances for a large variety of services such infrastructure inspection, deliveries, etc. Nevertheless, BVLOS operations are still limited in current regulations, and regulators in EU are making efforts to develop and adopt clear rules for BVLOS operations (WACKWITZ & SCHROTH 2021). In this direction, we refer to the efforts towards developing the Standards and Recommended Practices (SARPs) for BVLOS operations that started in 2018 with adoption foreseen in 2020 – but not realized – and leading to operations from 2023 on (SESAR 2018). The mentioned developments are focusing on BVLOS main challenges such as security, safety and communications (POLITI et al. 2021), which are considered critical issues hindering the wide use of BVLOS operations.

From a practical point of view, and to understand the potential of VLOS or BVLOS based operations, we provide in Fig. 1 a comparison between typical applications. One can see that there is a tendency in the UAS markets to adopt BVLOS techniques for better UAS functionalities and therefore to open new commercial services such as for first responders, package delivery, etc.

However, the decision to conduct a VLOS or BVLOS operation depends on various factors such as safety, security, time, cost, etc.; and this will influence the selection of the operation category where UAS should be operated. In this context, UAS flights in the specific and certified categories are allowed with BVLOS conditions. This might be seen as a practical solution to get rid of VLOS confinements, but at the same time it requires additional processes that lead to more administrative and bureaucratic complexities that caused somehow a reluctance to conduct flights in these categories.

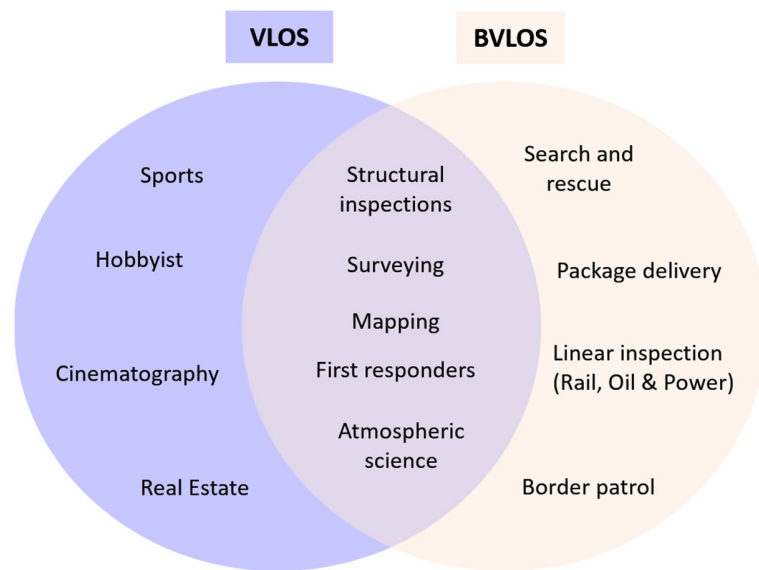


Fig. 1: VLOS- and BVLOS-based typical applications

## 5 Summary

Due to the rapid development of UAS technology and its usage, drone regulators in EU - and worldwide - are striving to integrate drones into their aviation regulation frameworks. In this paper, after a brief review of drone regulations from 2017 to 2020, we introduced the new EU drone regulations adopted in the beginning of 2021. The new rules are considered a positive step towards rules modernization and harmonization in Europe. They are structured into two parts: implementing and delegated rules, and detailed guidelines of how to define and conduct UAS operations with respect to critical factors such as safety, security, privacy, etc. The implementing rules deal with issues related to realizing safe UAS operations and avoiding risks to persons and organizations involved in UAS operations. While the delegated rules focus on issues related to UAS design and manufacture. Finally, we showed that the new regulations will lead to some challenges that may be faced in the early stage of rules implementation, here we discussed two aspects: UAS user registration and visibility restriction. However, there are other challenges that may be crucial like the risk assessment of UAS operations. In this context, a risk assessment should reflect the safety level expected during UAS operation, and this needs a collaborative effort from different responsibilities and processes that extend beyond a single agency or organization.

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