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# NEW CHALLENGES IN THE OPERATION OF UNMANNED AERIAL VEHICLES. CHANGES IN LEGAL REGULATIONS REGARDING THE SAFETY OF UNMANNED AVIATION

## Abstract

The extremely dynamic development of civil aviation in recent years has simultaneously contributed to the growing popularity of unmanned aerial vehicles (UAVs), which have taken over air traffic in the areas of protection and security of the population and, since the armed conflict in Ukraine, have also been put to use as dual-use products in military operations. However, one must bear in mind also users who fly drones for private and recreational purposes. Such a rapid growth in interest caused the necessity of introducing regulations that would enable their safe design, production, maintenance and operation in the EU. Thanks to these requirements, the civil aviation authorities in the EU have made every effort to create a solid legal framework for the operations of UAVs, keeping up with their rapid technological development, minimizing accidents that involve flight participants and reducing the risk of material damage or safety of bystanders present on the surface.

The authors adopted the assumption that aviation safety regulations are excessively conservative. The first part of this hypothesis is not a revelation, the rule being that legal regulations are delayed in relation to the dynamics of technological progress in this field. The second is an open question regarding the need for greater liberalization in the field of unmanned flights.

**Keywords:** unmanned aerial vehicles (UAV), legal conditions for the operation of UAV, implementing regulation, delegated regulation, Civil Aviation Authority (CAA/ULC)

## 1. Introduction

In the 1990s, the issues concerning the use of unmanned aerial vehicles were mentioned mainly in the context of military applications of this type of equipment (Blom, 2010).

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The US and Israeli Armed Forces used UAV systems for large-scale reconnaissance activities during the so-called war against terrorism, however, when the United States limited its involvement in Afghanistan and Iraq, many controversies, including legal ones, were caused by use of UAVs against enemy combatants and for the so-called targeted killing of terrorists. These attacks were, unfortunately, not without civilian casualties. However, in the light of the losses that the American armed forces suffered in these operations, UAVs have proven to be a safe, relatively cheap and low-risk method of combating wanted terrorists (Kopeć, 2015).

In any case, the use of new technology has changed not only the modern battlefield, but also the doctrine of warfare ([www.nato.int](http://www.nato.int), 2017). The new technology allows carrying out combat operations with a minimal risk of losses, and as an effect allows lowering the politically acceptable threshold for the use of force (Kreps, 2019).

Before the above-mentioned new legal regulations came into effect, EU countries used internal regulations, for example regarding differentiated flight permits, stemming from different technological and technical levels in individual countries. Therefore, the regulations regarding the entire spectrum of UAV operations kept constantly changing, starting from the terminology in the regulations (e.g. different nomenclature of the device in question was used), and therefore in the new regulations and in this article, for the sake of uniformity, use is being made of the term Unmanned Aerial Vehicle (UAV) or drone, which refers to aircraft that were designed to operate without human pilot on board – as defined by International Civil Aviation Organization (ICAO, 2011).

UAVs became essential in various areas of our lives, especially in scientific and commercial applications. Market forecasts for the value and growth of the commercial small drone sector over the next few years have shown a slight increase in predicted annual compound annual growth (CAGR) rates between 2022 and 2030 – up from 23.3% in 2021 to 24% during 2022 – according to the latest forecasts-of-forecasts for the drone industry by Unmanned Airspace. But these high-level figures conceal the market uncertainty for more complex operations, such as BVLOS missions, flights over people and more autonomous operations.

As the regulations ease to allow more BVLOS operations, the demand for more commercial small UAS services should soar. But the more conservative forecasters during 2022 lowered their expectations of growth in this sector. For example, in its 2022 survey the Teal Group predicted that non-military drone production would leap from USD7.2 billion a year to USD19.8 billion by 2031, a 9.1% compound annual growth rate in constant dollars. This is down from its 14.1% CAGR 2021/2022 forecast. And in its Drone Market Analysis 2022-2030 from Drone Industry Insights, the company forecast a CAGR of 7.8% until 2030, down from a CAGR of 9.4% in its 2021 forecast. Even the US Federal Aviation Administration (FAA) – which admitted its predictions for 2020-2021 growth rates for the commercial sector of 21% CAGR was 5% lower than expected – is

now predicting growth rates of between just 7% and 9% between 2026 and 2026 (unmannedairspace.info, 2022).

The use of drones in various branches of the economy, thanks to the dynamic development of technology, allows using this device as a platform for carrying, among others, sensors, thermal imaging cameras, mapping and photogrammetry software and mini-laboratories for measuring air pollution. Such diversified application options present the main challenge for achieving safe UAV navigation, which should allow minimizing the risk of collisions and damage to equipment for other airspace users, as well as for people and property on the ground. Obtaining the desired safety level in navigation can be achieved through certification of the device issued by the EU Notified Body. The legalization of drones should solve typical problems appearing in the guidelines for UAVs, such as air traffic management in or outside rush hour (Rango, Laliberte, 2010), the basic safety precautions that hinder the desired flexibility in the implementation of administrative processes and impede a widespread application of drone technologies (Stoecker, Bennett, Nex, Gerke, Zevenbergen, 2017).

The authors of the article were motivated by the desire to help understand the recently issued UAV regulations and to support users in navigating the administrative and legal processes for the effective implementation and legal use of UAVs in the new legal environment.

In regard of unmanned aerial systems and operators of unmanned aerial systems from third countries, on July 1, 2019 the European Commission Delegated Regulation No. 2019/945 came into force. This regulation introduced the essential technical requirements applicable to unmanned aerial systems operated in accordance with the principles set out in the European Commission Implementing Regulation No. 2019/947 of 24 May 2019 on the rules and procedures for the operation of unmanned aerial vehicles. As with the other New Approach directives, this delegated regulation regulates the design, production and placing on the EU internal market of Unmanned Aerial Vehicles operating in the so-called open category, i.e. performing operations with the lowest degree of risk.

The 'open' category addresses the lower-risk civil drone operations [...] where safety is ensured provided the civil drone operator complies with the relevant requirements for its intended operation. This category is subdivided into three subcategories, namely A1, A2 and A3. Operational risks in the 'open' category are considered to be low and, therefore, no operational authorisation is required before starting a flight (easa.europa.eu).

In accordance with the implementing regulation (2019/947), some Unmanned Aerial Vehicles introduced to the market before July 1st, 2022, which are not compliant with the delegated regulation, will still be able to be operated under the special rules set out in article 20 of this implementing regulation.

The delegated regulation (2019/945) in turn sets out the rules for placing on the internal market of the European Union and free movement in the EU of unmanned aerial systems intended for operation under the open category.

These rules apply to, among others: the obligation for the manufacturer to carry out a product assessment of conformity (i.e. UAV conformity) with the requirements set out in detail in the Annex to the Delegated Regulation and the relevant harmonized standards. Therefore, UAVs operated in the open category must have:

- technical documentation,
- manufacturer's declaration of conformity (issued on the basis of conformity assessment),
- product marking (CE).

As in the case of other EU directives, some of the procedures, based on which the manufacturer will be able to assess the conformity of the product before placing it on the market, will include certification in accordance with Regulation 2019/945, that being the conformity assessment by a third party (notified body).

The transitional provisions of the aforementioned drone law were in force from December 31, 2020 to January 1, 2023. In accordance with the EU Commission Implementing Regulations 2019/945 and 2019/947, drones distributed in the EU must meet specified standards (assigning a class) and be assigned with CE marking. Moreover, EASA (European Union Aviation Safety Agency) allowed the certification of drones introduced to the market before January 1, 2023 in the so-called transition period.

The purpose of this article is to provide an overview of the latest regulatory challenges regarding the planning, operation and servicing of UAVs. The article presented basic information on the importance of drone regulations as a necessary prerequisite that determines when, where and in what conditions UAVs can be used. The following section discusses the status of drone regulations starting from 2018. The final section describes the impact of the new regulations on the use of drones and its economic potential.

## **2. Development of aviation and the case of UAVs**

The civil aviation is one of the most growing branches of the economy; there is a continuous increase in interest in this type of transport, and the number of passengers traveling by air has steadily increased from 2.3 billion (2005) to 3.5 billion in 2015, an increase of 53% (ICAO 2015). In contrast, in the last year before the pandemic of 2019, the total number of passengers carried by airlines increased to 4.5 billion, an increase of 3.6% as compared to the previous year. Unfortunately, 2020 turned out to be the year in which, due to the COVID-19 pandemic, the world airlines served 3.36 billion passengers and transported 109 million tons of cargo, passenger aircraft performed 58 million take-offs and landings. Compared to 2019, air traffic decreased by -63%, -8.9% and -43%, respectively (Military Research and Analysis Team – Zbiam, 2023).

The dynamics of UAV technology development are well projected by forecasts. It is estimated that the global value of the drone market in the segment of civil

applications in the period 2017-2026 will amount to nearly USD 73.5 billion, including the Polish share of USD 3.3 billion (Biała Księga Rynku Bezzałogowych Statków Powietrznych, 2019).

It is, however, quite difficult to rely on forecasts alone, as they have been changing over the last few years. As an example, in 2016, according to forecasts commissioned by the EC, it was estimated that by 2050, ca. 7 million consumer drones and 400,000 drones would be in use in EU countries (European Drones Study, 2017).

According to more recent forecasts published by the European Commission in the year 2019 (World ATM Conference, Madrid 2019), the total number of consumer drones worldwide will reach approximately 35 million in 2022, more than 25% of which will be in EU countries. What is more, it is estimated that in 2022 the number of specialized drones (used in out-of-sight operations) would reach 9 million worldwide. In a report by one of the consulting companies, it was estimated that in 2020 over 500,000 UAVs would be sold worldwide, which would mean a 50% increase in sales as compared to 2019. (Gartner. Com, 2019). A March 2022 market study published by Global Industry Analysts (GIA) titled "UAV Drones – Global Market Trajectory & Analytics" says the global market for drones is estimated at USD33.6 billion in the year 2022 and is projected to reach USD 58.5 billion by 2026, growing at a CAGR of 13.9% over the analysis period. Multirotor, one of the segments analysed in the report, is projected to grow at a 15.2% CAGR to reach USD 32.3 billion by the end of the analysed period. After a review of business implications of the pandemic and the economic crisis induced by it, growth in the fixed-wing segment is readjusted to a revised 14.1% CAGR for the next 7-year period. This segment currently accounts for a 27.3% share of the global drones market. Globally, the market for multirotor drones is being driven by their increasing use in a number of non-military applications, specifically by law enforcement agencies. Demand for multirotor UAV drones is also being fostered by continuous advances in commercial and military technologies (Philip Butterworth-Hayes, 2023).

In 2023, the number of UAVs delivered is to reach 1.3 million. However, a fairly rapid increase in UAV applications in the coming years is to take place in the construction sector. It is estimated that the number of sold drones for monitoring construction works would increase from 141,000 in 2019 to over 510,000 units sold in 2023. It is further expected that purchases of UAVs will increase more for purposes related to fire protection, public safety (police services) or for damage estimation in winding-up proceedings and in logistics. Estimates of the number of UAVs in use are more reliable than forecasts. According to prudent estimation from 2016, it was extrapolated that about 1-1.5 million consumer drones and about 10,000 specialized drones were used in EU countries (European Drones Study, 2016).

It should also be taken into account that as of coming into force of new EU regulations requiring the registration of drone operators (December 31, 2020),

estimates for the number of drones used in individual EU Member States would be verified and the total number of UAV operators and their devices used will be known.

On March 14, 2022, Executive Order No. 2022/425 was issued amending Regulation 2019/947 on the applicable duration of the transition period, which ended on December 31, 2022. The new regulations assume the following time frames:

- In the A1 subcategory, until January 1, 2024, drones with a maximum take-off weight (MTOM) of up to 250 g may be used.
- In the A3 subcategory until January 1, 2024, drones weighing up to 25 kg may be used.

During the transitional period until December 31, 2023, it is allowed to use drones that do not meet the criteria of Regulation 2019/945 (classification):

- in A1 drones weighing up to 500 g,
- flights within 50 m of people for drones weighing up to 2 kg,
- in A3 weighing up to 25 kg.

As of January 1, 2024, operators will be able to submit declarations of flight compliance with the standard scenario (STS). Night flight operators must ensure that the drone is illuminated with a flashing green light for Open and Special category flights from July 1, 2022, but the remote identification system will be mandatory from January 1, 2024 (Dronem w Prawo).

As an example: in the USA at the end of 2018 over 900,000 owners of the so-called models (radio controlled model aircraft), i.e. drones, were registered weighing up to 25 kg used for recreational purposes or as a hobby, estimating the number of such drones at over 1.25 million devices. In addition, more than 277,000 drones weighing up to 25 kg used for commercial purposes were also registered (FAA, the Federal Aviation Administration, 2023).

Based, among others, on the dynamics of UAV registrations in the US, the FAA forecasts regarding the development of the UAV market assume that by 2023 the number of models would increase only slightly, reaching approx. 1.4 million devices. It is expected that the number of devices (up to 25 kg) used commercially will more than triple, and the number of this type of UAVs is estimated to reach as many as 835,000 by 2023 (from current 277,000) (FAA, the Federal Aviation Administration, 2023).

UAV technology has been developing very dynamically in recent years. Therefore, only based on the number of UAVs currently in use, as well as estimates regarding the development of the industry in the coming years, it can be reasonably argued that a new type of aviation activity has been established, requiring decisive regulatory action. A change in the approach to UAVs is also observed in Poland. One of the first reports focused exclusively on military applications of this type of devices (Gontarz, 2013).

Only subsequent studies analysed the possibilities of using this technology in civilian applications (Mikromakro report, 2018).

The change in approach is also visible in national legislation. The first regulations concerning UAVs were introduced to the Aviation Act (2002) in 2011, based on,

among others, the need of ensuring the use of UAVs in the operations of the armed forces. In 2013, the first UAV implementing rules were adopted. Simultaneously a report of the Civil Aviation Authority (Urząd Lotnictwa Cywilnego ULC) was published describing the legal status of UAVs at that time, the so-called opening report (ULC report, 2013).

It indicated that the lack of legal regulations did not prevent the early development of this industry in Poland. It was estimated that in 2013 about 60 companies dealt with various aspects of unmanned aviation, including around 40 companies providing services involving UAVs. However, according to studies from 2018, drones were already a significant source of income for over 280 companies in Poland, and the number of drones alone was estimated at approx. 100,000 (Biała Księga Rynku BSP, 2019).

Even more impressive are the figures for UAV pilots. In 2014, there were ca. 300 UAV pilots with the so-called qualification certificates issued by ULC, while at the end of 2019 this number came up to almost 15,000 (ULC, 2020).

The data on the value of market also project the dynamics of the development of this sector.

Although the value of the Polish market for 2018 was estimated between 150 and 450 million PLN (depending on the methodology), the forecast for 2026 estimates the value of the market will reach over 3.3 billion PLN (Biała Księga Rynku BSP, 2019).

Therefore only national statistics justify taking up the topic of UAV safety regulations. However, national regulations should be aligned with international regulations, as is the case in civil aviation and aviation law. This is for quite obvious reasons, such as the fact that the competence to regulate civil aviation safety in Europe is reserved to the EU legislator. This is also because safety standards in civil aviation are largely unified at the international level, constituting the starting point for the EU legislator.

The development of aviation does not only consist of the number of passengers carried and tonnes of cargo that express its progress, today's aviation is also the successive implementation of new technologies, the symbol of which in recent years are Unmanned Aerial Vehicles. The growing popularity of drones, which are machines capable of flying without the participation of a pilot, has resulted in an urgent need to adopt new regulations and procedures for the operation of unmanned aerial vehicles (EC Implementing Regulation (EU) 2019/947 of 24 May 2019).

Given the technologies used in UAVs, their use may allow a wide range of possible tasks. Airworthiness requirements, organization of people using the drones and UAV operations should be defined to ensure the safety of persons on the ground and other airspace users during operations involving these devices.

Given the economic impact of the growth of the drone sector, the European Commission estimates that within a decade this sector will generate over 10 billion € in revenues and will employ over 100,000 new employees (EC, 2018).

The development of the drone market made it necessary to adapt the EU legislation to its current realities; therefore, at the initiative of the European Commission, steps were taken to achieve a radical change. The result of this work was the adoption of Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.

The European Union Aviation Safety Agency (EASA) is an agency of the European Union established in 2002 by Regulation (EC) No 216/2008 of the European Parliament and the Council in order to ensure a high and uniform level of safety in civil aviation by implementing common safety rules and measures. EASA has taken over the responsibilities of the former Joint Aviation Authorities (JAA) system which ceased on 30 June 2009. However, it is not a successor agency in legal terms since it is operating directly under the EU statute. The main difference between EASA and the JAA is that EASA is the Regulatory Authority that uses NAAs to implement its Regulations, whereas the JAA relied upon the participating NAAs to apply its harmonised codes without having any force of law at source. Since it is self-evidently impossible to create a new Regulatory System ‘overnight’ EASA has had to accept large parts of the JAA system as its own while it develops the new harmonised system required under EU statute.

### 3. UAV – concept analysis

The study of the drone sector should begin with providing and defining the very concept of the word “drone” in everyday language, which, however, is defined in the professional literature as “Unmanned aerial vehicle”. When analysing the individual parts of this term, “aircraft” includes any device that can fly in the atmosphere as a result of force of the air reflected from the earth’s surface (Żylicz, 2011).

However, for an aircraft to be “unmanned”, it should be able to perform flights in the airspace without the presence of a pilot on board (Finn, Wright, 2012).

The expression *unmanned aircraft (unmanned aerial vehicle)*, used in English-language scientific literature, is also used in international organizations, such as the International Civil Aviation Organization (ICAO 328, 2011).

In the new regulation 2018/1139 of July 4, 2018, the previous nomenclature “pilotless aerial vehicle” was abandoned and the term “unmanned aerial vehicle” was adopted, which has been defined in art. 3 point 30, as “any aircraft performing an operation or intended to be operated independently or remotely piloted without a pilot on board” (Regulation (EU) 2018/1139 of the European Parliament and of the Council, 2018).

Henceforth, in this publication, the terms “drone” and “unmanned aerial vehicle” will be treated equivalently (synonymously).



#### 4. Adopted legal solutions in EU countries

The main legislative document relating to civil aviation security in the EU is Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018, the main objective of which is to ensure a uniform and high standard of civil aviation safety throughout the entire EU area (while maintaining the free movement of people, goods and services). Furthermore, the European Union Aviation Safety Agency was established to supervise:

- 1) airworthiness;
- 2) environmental protection;
- 3) validity of flight crew licenses;
- 4) technical condition of airports and air traffic control;
- 5) competences of aviation safety institutions;
- 6) other arising ongoing issues.

A whole range of solutions contained in the regulation of 2018 was based on the previous regulation, i.e. 216/2008, primarily pertaining to security. The analysis of statistics for aviation accidents and incidents in the EU in recent years clearly shows that the solutions adopted in 2008 contributed to better aviation safety (Eurostat, Air safety statistic in the EU, 2018).

Notwithstanding the increased level of safety in aviation, the regulation of 2008 did not address the topic of unmanned aerial vehicles. This could be due to little interest: drones were just gaining popularity among private users, and remained the domain of the armed forces of the world's prominent armies.

In the cited Regulation 216/2008, only one provision was dedicated to drones, which specified in article 4 that any Union legislation relating to certification, safety or air traffic only applied to unmanned aerial vehicles heavier than 150 kg. The regulatory obligation for other types of drones was the responsibility of EU Member States (Regulation (EC) No. 216/2008 of the European Parliament and of the Council).

Experts and professional UAV user milieus have been suggested an update to EU legislation (Ostrihansky M, Szmigiero M, 2020), because with the current popularity of drones, their owners are looking forward to standardised regulations according to which they can operate drones not only in their country, but also in other EU countries - this is due to open borders and the freedom to travel and use drones for recreational and exploratory purposes throughout the EU. Therefore, the need to adopt new regulations and rules regulating this segment of the aviation market has become extremely urgent and sought for (Regulation of the European Parliament and of the Council, 2018/1139).

#### 5. New guidelines for the needs of the drone market

With regard to the expectations presented in the previous chapter, the EU parliament took steps to amend and harmonize legal provisions related to the drone market

in the EU. In 2019, the European Commission issued a communication entitled “Aviation Strategy for Europe”, in which the importance of the aviation sector for the European economy was thoroughly described and the challenges, which the aviation market will face in the following years, were outlined, taking into account the immense growth in their popularity and the advancing technological progress in this area (ULC Lotnicza Strategia dla Europy, 2018).

The imperative goal of this strategy was the draft regulation on common rules in the field of civil aviation and the establishment of an EU aviation safety agency. In June 2018, Members of the European Parliament (MEPs) adopted a new regulation which entered into force on 11 September 2018 (Drones: reform of EU aviation safety, 2018).

Regulation 2018/1139 contains the following 6 chapters:

- 1) general rules of civil aviation;
- 2) aviation safety management;
- 3) significant requirements in the field of environmental protection, airworthiness, air operations, airports and unmanned aerial vehicles;
- 4) common certification, oversight and enforcement system;
- 5) European Union Aviation Safety Agency (hereinafter: the Agency);
- 6) changes in current regulations.

The separate section VII in Chapter III is devoted to unmanned aerial vehicles. Article 55 in this section contains a reference to Annex IX, which defines the essential requirements for the design, production, maintenance and operation necessary to ensure the safety standards of drones placed on the market (Regulation of the European Parliament, 2018, Article 57).

As a result of the adopted regulation, the area of competence in the matter of ensuring compliance with drone safety requirements was shifted onto the European Commission. Based on Article 57 it may issue delegated acts concerning the following areas (Górka, 2012):

- 1) issuing, suspending and revoking certificates for design, production, deployment and maintenance of drones and their components;
- 2) the conditions and procedures under which the operator of the unmanned aircraft will comply with issued certificates;
- 3) responsibilities and privileges of certificate holders and operators;
- 4) marking and identification of drones;
- 5) introducing bans or restrictions on the use of drones on grounds of public safety.

In addition, the European Commission has been empowered to issue delegated acts amending the provisions of Annex IX (see above) and Annex III (regarding environmental protection requirements), whenever it would be necessary to achieve the goal of ensuring a high level of aviation safety in the EU.

The provisions of article 57 are referred directly by article 56, which imposes the requirement of the certification and declaration stemming from delegated acts issued by the EC, more precisely on the basis of art. 57. Certification and declaration

would be required for the design, production, maintenance and operation of drones. Certifications are issued at the request of the relevant authority, and the declaration is issued by the person concerned under his responsibility (e.g. drone manufacturer or service provider). The intention of issuing both documents is to ensure appropriate levels of safety in the use of drones (Regulation of the European Parliament and of the Council, 2018/1139, art. 58).

The provision also establishes the non-application of the provisions of chapters IV and V, which deal with joint certification and prerogatives of the Agency, respectively, to the necessary requirements as long as it is specified in delegated acts issued on the basis of article 57 (Regulation of the European Parliament and of the Council of 9 July 2008).

Unmanned aerial vehicles are recognized as an innovative technology with a huge economic potential, and surely if improperly designed, maintained or deployed they may pose a serious threat to people and property on the earth surface (as is the case with any other aircraft). In the case of a drone colliding with a manned aircraft, the safety of people on board such aircraft (passengers, crew members) may be endangered.

The EU legislator therefore introduces certain standards (set out in Annex IX to the new regulation), which, if followed, should ensure the safe deployment of drones. The standards included in this legal act are set to ultimately apply to the territory of all EU countries, and as an effect users will be able to expect that, regardless by which Member State the device was designed, or put on the market in, it will be characterized by a high level of safety when used accordingly to its purpose.

With this in mind, Regulation 2018/1139 singles out the diligence required with the need to obtain the appropriate certificate or issuance of a declaration depending on how much danger is associated with the design, production, technical service or ultimately navigation of drones. Ultimately, the type of threat we will face will be decided by the European Commission when it publishes these delegated acts, such as Commission Delegated Regulation (EU) 2019/945 of 12 March 2019 on unmanned aerial systems and operators of unmanned aerial systems from third countries.

However, in some cases it is anticipated that these acts may even completely exclude the application of complex certification procedures set out in chapters IV and V, for example for mass-produced unsophisticated drones used as gadgets. Different degrees of risk are therefore the most optimal action on the part of the EU legislator.

Furthermore, the above-mentioned Regulation 2018/1139 does not account for the provisions of Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation which repeals Directive 94/56/EC with regard to small unmanned aerial vehicles (hereinafter: Regulation No. 996/2010), (Regulation of the European Parliament and of the Council, 2018/1139, Article 135).

Taking into account article 135 of Regulation 2018/1139, the designated safety investigation authority may decide not to proceed with an investigation procedure in the event of an incident involving an UAV without certification or an appropriate declaration. It appears to be the right decision and there is no need for the provisions of Regulation 996/2010 to apply to incidents in which unskilled operator crashed a drone onto and damaged another flying craft, or if due to loss of radio control the drone departed and went missing.

The next important provision contained in Regulation 2018/1139 is Article 136, which improves aviation safety, in this case by establishing an obligation to report occurrences that may jeopardize aviation safety. The new regulation introduced a change in that the scope of Regulation No. 376/2014 will exclude events involving unmanned aerial vehicles that do not require certification or declaration in accordance with Art. 56 sec. 1 and 5 of Regulation (EU) 2018/1139, unless such an event resulted in fatal or serious injury to a natural person. Each individual Member State can decide on the interpretation of this regulation in such a way that an event involving a drone will be mandatory to report (Regulation of the EP and of the Council, 2018/1139, Article 136).

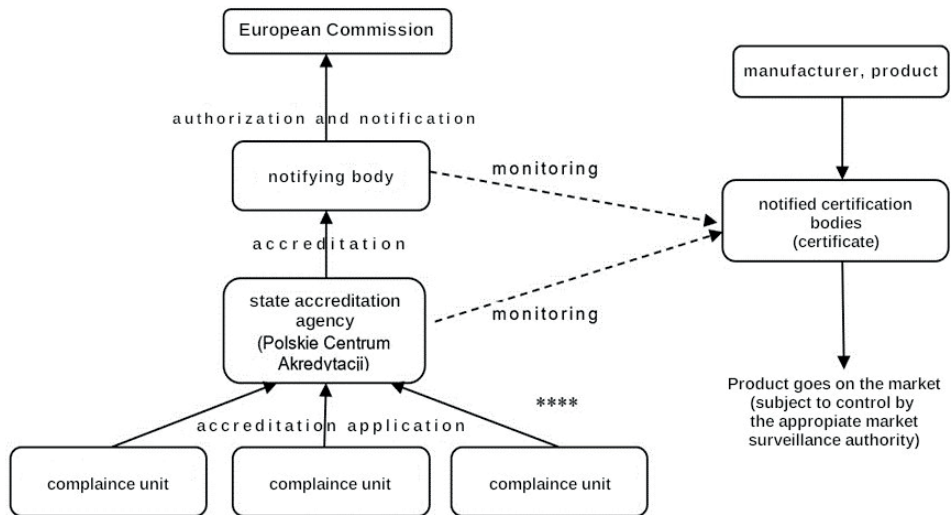
It is not easy to unequivocally assess whether Art. 136 contributes to the improvement to aviation safety in the Member States' territories. The principal ruling imposing the obligation to report events involving unmanned aerial vehicles that may pose a threat to aviation safety deserves a positive assessment, as it will make it possible to evaluate currently and in the future whether the number of accidents is actually decreasing, and consequently whether the certification and declaration system is also working. The ultimate exclusion of less serious events in which there was no damage to the health of a natural person from the category of mandatory reporting may however cause that incomplete safety data would be compiled.

## **6. Mandatory certification of drones**

In accordance with the EU Commission Implementing Regulations 2019/945 and 2019/947, drones distributed in the EU must meet certain standards (assigned classes) and have the CE marking. In accordance with the decision of EASA (European Union Aviation Safety Agency), it was possible to certify drones introduced to the market before January 1, 2023 (i.e. before the entry into force of the target regulations on January 1, 2023).

Accreditation is a procedure in which an authorized body issues a statement that a specific entity (e.g. a company) is competent to perform specific activities (Latam-dronem.pl). The accreditation body (i.e. one that grants accreditation) inspects the work and quality of services of the accredited entity (i.e. the one that applies for accreditation).

In the context of drones, in accordance with EC Delegated Regulation 2019/945, suppliers and manufacturers of drones are subject to the certification process for the drones they put on the market. In order to obtain the appropriate certificate, they must, in turn, submit an appropriate application to a body that is accredited to carry out certification (Figure 1). Certification, in turn, is nothing more than testing the UAV's compliance with the technical requirements of the EU Commission Regulation.

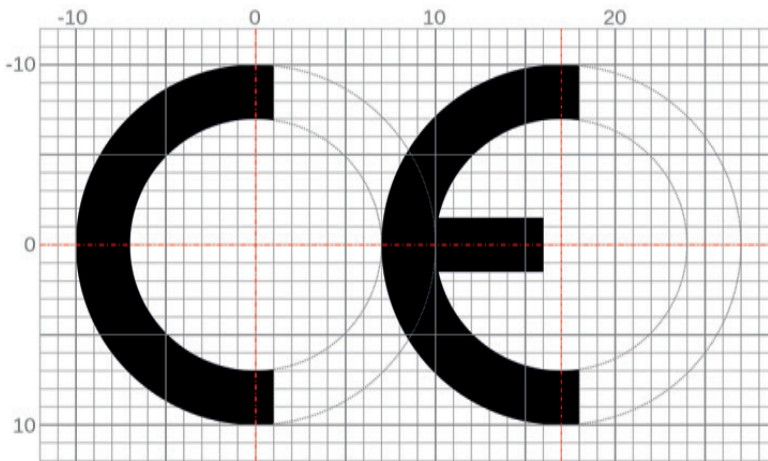


**Figure 1.** The process of granting accreditation to entities authorized to issue certification for drones (Civil Aviation Authority)

On the right side of the Figure 1 the UAV's path to market is shown. As an example, a company producing drones applies to a notified certification body for a certificate confirming the UAV's compliance with the technical requirements set out in the bill of law. After the certificate is issued, the drones are approved as airworthy and can enter the market.

The left side shows the process of granting accreditation to entities that want to become notified certification bodies (i.e. be authorized to issue certificates for drones). As one can see, the application for accreditation is submitted to the Polish Centre for Accreditation (Polskie Centrum Akredytacji, PCA), a nationwide body dealing with granting accreditation. Above the PCA there is also a notifying authority, i.e. a body responsible for authorizing entities applying for accreditation and informing (notifying) the European Commission about entities that are responsible for certifying drones. The CE marking indicates that the product has been examined by the manufacturer and found to meet EU health, safety and environmental requirements.

Additionally, in order to ensure the safety of operation of products available on the market for the customers and users starting from the purchase until disposal, the CE marking is the main reason for placing them on the devices (Figure 2) and the declaration of conformity issued by the manufacturer/importer, constituting a legally binding promise stating the product's compliance with the essential requirements of the relevant European Union directives.



**Figure 2.** The CE marking is the manufacturer's declaration as the conformity of the product with all the requirements of the relevant EU directives (Civil Aviation Authority)

The European Union Aviation Safety Agency (EASA) has presented two options for converting drones already present on the market to CE marked drones:

1. by the manufacturer, by recalling the products (returning the product by the user as part of the control procedure), updating the hardware or software as part of the production control procedure, assigning a new serial number, affixing the class identification label, issuing a new CE declaration,
2. by the user, by performing an in-place software update under the full control of the manufacturer, sending a new CE declaration, class identification label and new serial number plate by the manufacturer to the owner, and the owner placing the class identification label and new serial number plate on the drone.

The declaration of conformity is a confirmation of the manufacturer's assessment of the conformity of the product with the essential requirements of European Union directives and regulations. For many products, the declaration of conformity must be confirmed by a competent, independent body, the so-called notified body, and it is then used for compulsory certification. For other products, the certificate is a voluntary, additional, beneficial both for the manufacturer and the end user, confirmation of the product's properties ensuring its safe use and minimal impact on the environment.

The transitional provisions of the drone law were, as mentioned above, in force from December 31, 2020 to January 1, 2023. Pursuant to the EU Commission Implementing Regulations 2019/945 and 2019/947, drones distributed in the EU must meet certain standards (assigning a class) and have the CE marking. According to the decision of EASA (European Union Aviation Safety Agency), it was possible to certify drones introduced to the market before January 1, 2023.

The standards of the transitional provisions described by Delegated Regulation (EU) 2019/945 established, among other things, the requirement for a class identification label to give drones a class (C0, C1, C2, C3, C4), which specify the required equipment and performance of the drone.

This regulation did not set out the recertification of drones previously introduced to the market. It was only with Regulation 2019/947 that the Civil Aviation Authority introduced the possibility of granting a CE class and certificate, which is the manufacturer's declaration that the marked product meets the requirements of the so-called "New Approach" directives of the European Union, drones that were placed on the market before January 1, 2023.

Drones that do not have a class conforming to EU standards, introduced to the market during the period of transitional provisions, could be used until December 31, 2022 under certain rules in the open category:

- a drone with weight up to 500 g, in subcategory A1 by pilots with competences defined by a given Member State,
- a drone with weight up to 2 kg, at a horizontal distance of 50 metres from people, and the pilots with competences as for the A2 subcategory,
- a drone with weight up to 25 kg, in the A3 subcategory, and the pilots having competences as for the A1 subcategory.

Only drones with the following markings were included in the "open" category:

**0    1    2    3    4**

**Table 1.** Classification of drones in the "open" category (Polish) (Civil Aviation Authority)

| Open Category – Civil Drones                  |       |        |            |                             |                               |                          |
|---|-------|--------|------------|-----------------------------|-------------------------------|--------------------------|
| Classification of drones in the open category |       |        |            |                             |                               |                          |
| Subcategory                                   | Class | Symbol | Max weight | Drone operator registration | Remote pilot competence       | Remote pilot minimum age |
| A1  | C0    | 0      | <250 g     | No                          | knowledge of the drone manual | 14                       |
|   | C1    | 1      | <250 g     | Yes                         | online training and exam      | 14                       |

table 1 cont.

| Open Category – Civil Drones                  |       |        |            |                             |  |                          |
|---|-------|--------|------------|-----------------------------|--|--------------------------|
| Classification of drones in the open category |       |        |            |                             |  |                          |
| Subcategory                                   | Class | Symbol | Max weight | Drone operator registration | Remote pilot competence  | Remote pilot minimum age |
| A2  | C2    | 2      | <4 kg      | Yes                         | online training and exam, practical self-education, additional theoretical exam, | 14                       |
| A3  | C3    | 3      | < 25 kg    | Yes                         | online training and exam   | 14                       |
|   | C4    | 4      | < 25 kg    | Yes                         | online training and exam   | 14                       |

## 7. Final word

The article presents new solutions included in Regulation (EU) 2018/1139, Commission Delegated Regulation (EU) 2019/945 and Commission Implementing Regulation (EU) 2019/947, which should satisfy regulatory deficiencies in the constantly developing sector of unmanned aerial vehicles. Just a few years ago, this sector was occupied almost exclusively by uniformed services, i.e. the police, customs and tax services, border guards and, above all, the armed forces, while now it is gaining more and more popularity among private users.

The new regulations are meant to adapt the solutions already existing in civil aviation to the market of unmanned aerial vehicles. The certification obligation as well as the adaptation and implementation of high safety standards at the EU level are accepted standards that are used on a daily basis in most aircraft and including drones in that area meets the demands of experts, manufacturers and their users.

Due to a certain difference in this market segment, an additional positive opportunity for the EC is the right to issue commission delegated regulations (EU), for example 2019/945 of March 12, 2019 (Consilium.europa.eu, 2023).

This way, the committee can react quickly and flexibly, e.g. to regulatory requirements, using its technical knowledge; this may apply, among others, to the UAV sector. This possibility allows the Commission to react in a situation where a certain type of drone turns out to be technically unstable during use contrary to what it initially appeared. The legislative process in this case is not lengthy, unlike in the case of EU legislative acts (Barcz, 2012).

This work focused on legal regulations to ensure the safety of UAV operations, as their goal is to ensure the protection of supreme values: human life and health, which may be at risk as a result of a drone collision or accident.



## 8. Conclusion

The development of broadly understood UAV technology in recent years rightly warrants the opinion that we are dealing with a disruptive technology (Masutti, Tomasello, 2018).

The breakthrough of this technology should be however perceived in two aspects. Firstly, UAV systems create new possibilities stemming from their specificity as devices designed to perform operations (in most cases) at a very low altitude, in a completely different way from manned aviation operations. Secondly, the development of this technology is closely related to the need to integrate it with manned aviation, in particular with commercial transport aviation, which has the highest safety statistics. The development of the UAV sector is determined by the need for the drones to operate in airspace, without affecting the safety or efficiency of manned aviation (Communication of the European Parliament, 2014).

This article is devoted to the regulations in the field of safety of unmanned aerial vehicle operations, as well as the safety of manned aviation in the context of the integration of these two types of aviation.

## References

1. Barcz, J., Kawecka-Wyrzykowska, E., Michałowska-Gorywoda, K., (2012). *Integracja europejska w świetle Traktatu z Lizbony. Aspekty ekonomiczne*. Warsaw: Polski Instytut Ekonomiczny, pp. 23–24.
2. Biała Księga Rynku Bezzałogowych Statków Powietrznych (2019). Warsaw: Polski Instytut Ekonomiczny, Ministerstwo Infrastruktury.
3. Blom, J.D., (2010). *Unmanned Aerial Systems: A Historical Perspective Paperback – September*. Kansas: Combat Studies Institute Press US Army Combined Arms Center Fort Leavenworth, Occasional Paper 37, p. 139.
4. consilium.europa, <https://www.consilium.europa.eu/pl/council-eu/decision-making/implementingand-delegated-acts/> [24.03.2023].
5. <https://www.easa.europa.eu/en/domains/civil-drones#:~:text=It%20defines%20three%20categories%20of,requirements%20for%20its%20intended%20operation> [24.03.2023].
6. <https://www.skybrary.aero/articles/european-union-aviation-safety-agency-easa#:~:text=EASA%20became%20operational%20on%2028,permanent%20headquarters%20in%20Cologne%2C%20Germany> [24.03.2023].
7. European Drones Outlook Study, Unlocking the value for Europe (Apr.2017). SESAR Joint Undertaking.
8. European Drones Outlook Study Unlocking the value for Europe, (Nov. 2016). SESAR Joint Undertaking.
9. FAA Aerospace Forecast, Fiscal Years 2019–2039 (2023). [https://www.faa.gov/data\\_research/aviation/aerospace\\_forecasts/media/FAA\\_Aerospace\\_Forecasts\\_FY\\_2019-2039.pdf](https://www.faa.gov/data_research/aviation/aerospace_forecasts/media/FAA_Aerospace_Forecasts_FY_2019-2039.pdf).

10. Finn, R., Wright, D., (2012). Unmanned aircraft systems: Surveillance, ethics and privacy in civil applications. *Computer Law & Security Review*, Vol. 28, Issue 2, pp. 184–194. <https://doi.org/10.1016/j.clsr.2012.01.005>.
11. Butterworth-Hayes, P., (2023). *2022 drone market forecasts: optimism but uncertainty over demand for complex services*, <https://www.unmannedairspace.info/uncategorized/2022-drone-market-forecasts-more-optimism-but-uncertainties-re-main-over-demand-for-complex-services/>.
12. Gartner forecasts Global LoT Enterprise Drone Shipments to Grow 50% in 2020 (2019). <https://www.gartner.com/en/newsroom/press-releases/2019-12-04-gartner-forecasts-globaliot-enterprise-drone-shipment> [24.03.2023].
13. Gontarz, A, Kędzierska, E. Kosieliński, S., Rutkowski, P., (2013). *Człowiek, maszyna, bezpieczeństwo: systemy inteligentne w zarządzaniu kryzysowym i działaniach militarnych*. Warsaw: Fundacja “Instytut Mikromakro”.
14. Górka, M., (2012). Komisja Europejska ma prawo do wydawania aktów delegowanych z upoważnienia aktów ustawodawczych na mocy art. 290 TFUE. System Instytucjonalny Unii Europejskiej, Warsaw: Instytut Wydawniczy EuroPrawo, pp. 48–49.
15. ICAO Circular 328, 2011 Unmanned aircraft systems, Glossary.
16. International Civil Aviation Organisation, Annual Report of the ICAO Council. Appendix 1. Tables relating to the World of Air Transport in 2015, p. 2.) Accessed at: [https://www.icao.int/annualreport-2015/Documents/Appendix\\_1\\_en.pdf](https://www.icao.int/annualreport-2015/Documents/Appendix_1_en.pdf) [15.03.2023].
17. International Civil Aviation Organization (ICAO). Unmanned Aircraft Systems (UAS). 2011. Available online: [https://www.icao.int/meetings/uas/documents/circular%20328\\_en.pdf](https://www.icao.int/meetings/uas/documents/circular%20328_en.pdf) [04.04.2023].
18. Komisja Europejska, DG GROW, Unmanned aircrafts, accessed at: [http://ec.europa.eu/growth/sectors/aeronautics/rpas\\_en](http://ec.europa.eu/growth/sectors/aeronautics/rpas_en) [20. 04. 2018].
19. Komunikat Komisji do Parlamentu Europejskiego i Rady, Nowa era w dziejach lotnictwa. Otwarcie rynku lotniczego na cywilne wykorzystanie bezzałogowych statków powietrznych w bezpieczny i zrównoważony sposób, COM (2014) 207 final.
20. Kopeć, R., (2015). Dyplomacja dronów, *Kultura i Polityka*. ZN Wyższej Szkoły Europejskiej w Krakowie, Issue 17, pp. 65–83.
21. Kreps, S., (2019). Drony. *Wprowadzenie. Technologie. Zastosowania*. Warsaw: PWN.
22. [latam-dronem.pl/certyfikacja-dronow-zgodnie-z-nowymi-wymogami-ue/](http://latam-dronem.pl/certyfikacja-dronow-zgodnie-z-nowymi-wymogami-ue/) [19.02.2020].
23. Masutti, A. Tomasello, F., (2018). *International Regulation of Non-Military Drones*. Cheltenham UK: Edward Elgar, p. 7.
24. Ostrihansky, M., Szmigiero, M., (2020). *Prawo dronów. Bezzałogowe statki powietrzne w prawie Unii Europejskiej oraz krajowym*, Warsaw: Wolters Kluwer Polska, p. 255.
25. Rango, A., Laliberte, A., (2010). Impact of flight regulations on effective use of unmanned aircraft systems for natural resources applications. *J. Appl. Remote Sens.*, 4, 043539.
26. Raporty Instytutu Mikromakro za lata 2014–2018, ostatni raport za 2018 r., <https://www.5zywiolow.pl/dowyb/rynek-dronow-polsce-jutrzenka-edycja-2018/> [01.02.2021].

27. Raport ULC z 2013 r. o stanie prawnym odnoszącym się do bezzałogowych statków powietrznych, Bezzałogowe statki powietrzne w Polsce [https://www.ulc.gov.pl/\\_download/publikacje/\\_UAV\\_raport\\_ULC\\_2013.pdf](https://www.ulc.gov.pl/_download/publikacje/_UAV_raport_ULC_2013.pdf).
28. Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency. Aviation Safety and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 of the European Parliament and of the Council and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91 of the European Parliament and of the Council (OJ EU 2018 L 212/1), Article 3(30).
29. Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ 2008 L 79/1), Annex II, point (i) (repealed).
30. 30th European Council, Council of the European Union, Drones: reform of EU air safety. Accessed at: <http://www.consilium.europa.eu/pl/policies/drones/> [24.04.2022].
31. Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018, Article 57.
32. Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018, Article 58.
33. Regulation of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93 and Decision No 768/2008/EC of the European Parliament and of the Council of 9 July 2008 on a common framework for the marketing of products, and repealing Council Decision 93/465/EEC. For mass-produced unmanned aircraft (such as 'toy' drones), the application of a surveillance mechanism is foreseen.
34. Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018, art. 135.
35. Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018, art. 136.
36. Stoecker, C., Bennett, R., Nex, F., Gerke, M., Zevenbergen, J., (2017). Review of the Current State of UAV Regulations. *Remote Sens.*, 9, 459.
37. Urząd Lotnictwa Cywilnego, [ulc.gov.pl/pl/personel-lotniczy/rejestr-personelu-lotniczego/4365-statystykpersonelu-lotniczego](http://ulc.gov.pl/pl/personel-lotniczy/rejestr-personelu-lotniczego/4365-statystykpersonelu-lotniczego) [28.02.2022].
38. Urząd Lotnictwa Cywilnego, Lotnicza Strategia dla Europy. Obtained at: <http://www.ulc.gov.pl/pl/247-aktualnosci/3856-lotnicza-strategia-dla-europy> [24.04.2022].
39. Act of 3.7.2002 - the Aviation Law (i.e. Polish Journal of Laws/Dz.U. of 2020, item 1970 as amended).
40. Lage Dyndal, G. , Arne Berntsen, T., Redse-Johansen, S., (2017). *Autonomous military drones: no longer science fiction*, [www.nato.int/docu/review/pl/articles/2017.07.28/](http://www.nato.int/docu/review/pl/articles/2017.07.28/).

41. [www.unmannedairspace.info/uncategorized/2022-drone-market-forecasts-more-optimism-but-uncertainties-remain-over-demand-for-complex-services/](http://www.unmannedairspace.info/uncategorized/2022-drone-market-forecasts-more-optimism-but-uncertainties-remain-over-demand-for-complex-services/) [28.02.2022].
42. [www.dronemwprawo.pl/do-konca-2023-roku-nie-pojawia-sie-drony-z-klasyfikacja/](http://www.dronemwprawo.pl/do-konca-2023-roku-nie-pojawia-sie-drony-z-klasyfikacja/) [28.02.2022].
43. Speech by EC representative at the World ATM Conference, Madrid 2019, [https://issuu.com/airtrafficcontrolassociation/docs/watmc\\_2019\\_keynote\\_speech\\_henrik\\_ho](https://issuu.com/airtrafficcontrolassociation/docs/watmc_2019_keynote_speech_henrik_ho) [28.02.2022].
44. Zespół badań i analiz militarnych. Zbiam.pl. <https://zbiam.pl/artykuly/transport-lotniczy-naswiecie-w-2020-r/> [28.02.2022]
45. Żylicz, M., (2011). Prawo lotnicze międzynarodowe, europejskie i krajowe. Warsaw: Wolters Kluwer.

## NOWE WYZWANIA W EKSPLOATACJI BEZZAŁOGOWYCH STATKÓW POWIETRZNYCH. ZMIANY W REGULACJACH PRAWNYCH DOTYCZĄCYCH BEZPIECZEŃSTWA LOTNICTWA BEZZAŁOGOWEGO

### Abstrakt

Niezwykle dynamiczny rozwój lotnictwa cywilnego w ostatnich latach powoduje jednocześnie rosnącą popularność bezzałogowych statków powietrznych (BSP), które zawładnęły ruchem powietrznym w obszarach ochrony i bezpieczeństwa ludności oraz od czasu konfliktu zbrojnego na Ukrainie jako produkty podwójnego zastosowania są wykorzystywane w działaniach militarnych. Nie można jednocześnie zapominać o użytkownikach, którzy wykorzystują loty dronami do celów prywatnych i rekreacyjnych. Tak gwałtowny wzrost zainteresowania spowodował konieczność wprowadzenia regulacji, które umożliwią bezpieczne ich projektowanie, produkcję, obsługę techniczną oraz eksploatację na terytorium UE. Dzięki tym wymaganiom organy regulacyjne w UE dotyczące lotnictwa cywilnego dołożyły wszelkich starań, aby stworzyć solidne ramy prawne warunków funkcjonowania BSP, które nadążałyby w przyszłości z ich szybkim rozwojem technologicznym i minimalizowałyby nieszczęśliwe wypadki z udziałem uczestników lotów, zmniejszałyby ryzyko wyrządzenia szkód materialnych, przy czym zapewniałyby bezpieczeństwo osobom postronnym na powierzchni ziemi.

Autorzy przyjęli założenie, że regulacje z zakresu bezpieczeństwa lotniczego są zbyt zachowawcze. Pierwsza część tej hipotezy nie jest odkrywczą, regułą jest opóźnienie regulacji prawnych w stosunku do dynamiki postępu technologicznego w tej dziedzinie techniki.

Drugą jest pytaniem dotyczącym konieczności większej liberalizacji w sferze lotów bezzałogowych.

**Słowa kluczowe:** bezzałogowe statki powietrzne (BSP), prawne warunki funkcjonowania BSP, rozporządzenie wykonawcze, rozporządzenie delegowane, Urząd Lotnictwa Cywilnego (ULC)