

**HISTORY, TYPES, APPLICATION AND
CONTROL OF DRONES****DRÓNOK FEJLŐDÉSE, CSOPORTOSÍTÁSA,
FELHASZNÁLÁSA ÉS ELLENŐRZÉSE**BÁLINT Márton¹**Abstract**

Nowadays thanks to the technical innovations drones play a very important role in many of the main areas, in public service, in agriculture, in international and domestic business as well as for the military and law enforcement units. Drones raised new legal questions that the old regulations could no longer answer. The presence of drones is now unavoidable, but this technology affects many areas of law, such as rights of personality, the right and conditions of drone usage. But drones also have a significant impact on national security and some public administration procedures. Drones mean a huge potential, but it is necessary to develop an appropriate regulatory safety framework. The technology of pilot-free aerial vehicles will definitely result in major changes and the legislation must react to these changes by creating a flexible legal framework. In this paper I would like to present the basic features of the drone technology and the drone development, and I also aim to analyze the legal environment of the usage of the drones. Our main purpose with this study is to identify and highlight the main emphasis of drone regulations.

Keywords

drone, development, application, technology, legislation

Absztrakt

A drónok műszaki fejlődéséből következően fontos szerepet játszanak életünk több területén is, úgy mint a közigazgatás, mezőgazdaság, nemzetközi és hazai kereskedelem valamint a honvédelem és rendvédelmi szervek életében. A drónok azonban új jogi kérdéseket is felvetettek, melyeket a régi szabályozások nem tudnak megfelelően megválaszolni. A drónok jelenléte már elkerülhetetlen, ez a technológia azonban több jogi területet is érint, például személyiségi jogokat és használati engedélyezési jogokat. Azonban a drónok jelentős szerepet játszanak a nemzetbiztonság és több állami közigazgatási szerv működésében is. A drónok jelentős felhasználási potenciált rejtnek magukban, mindemelllett a biztonságos használatához elengedhetetlen a megfelelő szabályozási keretek felállítása. Az pilóta nélküli légi járművek technológiája jelentős változásokat von maga után, és a jogalkotóknak ezeket a változásokat megfelelő flexibilis jogi keretek kialakításával szükséges lekövetni. Jelen cikkünkben bemutatjuk a drón technológia és drón fejlesztések alapvető elemeit, valamint elemezzük a drón használat jogi környezetét, fő célunk a drónszabályozás legfontosabb aspektusainak azonosítása és kiemelése.

Kulcsszavak

drónok, fejlődés, felhasználás, technológia, szabályozás

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INTRODUCTION

By preparing this paper I used different types of secondary data collection methods. In addition to the scientific articles available on the Internet, as well as authentic reports, published studies, and published interviews, the published literature and the published results of previous scientific research were also useful. In addition, the information leaflets and guiding advice published on the websites of the official bodies greatly contributed to the processing of the topic, and I was able to study the legal background of the examined topic firsthand through the published legislation, international treaties and other legal documents.

The paper is based on the material of various monographs, collections and articles in scientific journals. I would like to outline the legal background of the research area of the dissertation, relying on the relevant legislation in force and some sources in the legal literature.

HISTORICAL BACKGROUND

One would think that drones are the result of the technical developments of modern times. In reality, as many developments, it has a history of several decades. Moreover, its development is far from being finished, it is still ongoing in order to propose always better and more modern drones on the market, easily accessible to private consumers.

As for most of the technical findings, the drones are originating from the military industry. Back to the end of the 19th century, the need to developing a flying vehicle without pilot sitting in it has been risen. The first written note about it dates from 1849, but of course at that time it was about a very rudimentary version and changes in wind and weather conditions mostly deviated them from their original destination. In 1849, Austrian armies deployed against Venice unmanned aerial vehicles that are considered as predecessors of the drones. The vehicles were hot air balloons and were filled with explosives that were detonated by a timer. Following calibration settings based on preparatory calculations, the device was sent over the target area by wind force. These vehicles are not considered as UAV, because they did not meet the requirements of the modern drones, since although they were unmanned aircrafts, nobody could control them. [1]

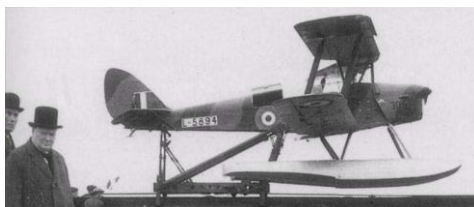
The next important tool was called the Kettering Bug, a development during World War I, but it was not actually deployed in the war. It looked like a two-deck plane, but it didn't have a wheel, it got off a four-wheeled car running on rails.



1. Picture: Kettering Bug.: https://www.daviddarling.info/encyclopedia/K/Kettering_Bug.html

He was unable to land, but was not needed as planned, as soon as he reached the designated target, the engine stopped, the wings detached from his fuselage, and the explosive-packed fuselage crashed into the ground like a torpedo. It was also impossible to control, but it contained important components that formed the basis of the structure of remotely controlled machines still in use today. The heading was controlled by a gyroscope, and the altitude was controlled by a barometer. [2]

The first real drone dates from 1935, was called DH 82B Queen Bee, and was used by the British Royal Navy for practice, target shooting. It was remotely controllable, able to land and take off, and was a reusable device as long as it was not damaged excessively during exercise. Moreover, the name drone used today is also related to this device: when Delmer Fahrney, commander of the U.S. Navy, was commissioned to develop a device similar to the British Queen Bee. Fahrney - out of respect for the name of the original device – named his own development as “drone”, meaning male bee, which has remained in popular use ever since. [3]



2. Picture: DH 82B Queen Bee. <https://hushkit.net/2013/10/01/ka-boom-a-gallery-of-target-drones/dehavilland-dh82b-queen-bee/>

Unmanned aerial vehicles were used for military purposes as early as the 20th century. They have been used since the beginning of the 20th century, in the 80s and 90s, although thousands of such devices were already in the possession of the army, with which they carried out reconnaissance and espionage tasks or mounted bombs and firearms on them for attacking purposes. [4]

The technology of unmanned aerial vehicles became essentially widespread in the 1950s, which in those times in the field of military aviation were primarily intended to help train air defense forces by using drones as moving targets. In order for the drones to be used for both direct tactical purposes and reconnaissance tasks, it was necessary to innovate in a direction that took place in the first decades of the millennium. For the first time in the US, the possibility of mass tactical use of drones has been on a more serious agenda under the Obama administration, and the development of automation, robotics, and machine-to-machine communication has greatly contributed to this new role of drones. By analyzing the development patterns of unmanned aerial vehicles so far, it can be concluded that the military and defense application of drones was fundamentally based on the following three goals.

- The drone as a mean of transport: That is, the drone is a device that can be used for transporting and deploying various weapons, thus paralyzing or destroying designated targets, forces, critical infrastructures of the enemy forces.

- Acquisition of Information: In order to properly prepare for military deployments, drones can also provide important information that can be used during training of air defense forces, in training simulations as well as directly on battlefields.
- Decision Support: An important military function of drones is that they can be equipped with a variety of sensors that enable drones to obtain information from the air and transmit it immediately, making information decision-makers in charge of the operation more informed. The decision support function of the defense application of drones allows for real and similar to on-field information to be used for by different decision-making levels. [5]

The commercial use of the unmanned vehicles had to wait until the early 2000s years, when the professionals and manufacturers began to discover that these devices could be used for multiple purposes. The breakthrough came in 2013 with the DJI Phantom series, as it already had the parameters and technology to be able to fly without any special training. The development of drones has continued at a steady pace ever since, with areas of use far beyond military applications, such as peaceful use for industrial purposes and more and more for hobby users as well.

The drone, also known as UAV (unmanned aerial vehicle) is a flying device that has no crew on board but can be remotely controlled by its pilot. It can also be equipped with a system of automated or pre-programmed control that can operate part or all of the route without a pilot.

Types of drones can also be grouped according to flight range as well as flight altitude. English designations, based on the above parameters and widely accepted in international practice, are used as follows:

HALE - the designation is used for high altitude, long endurance drones,

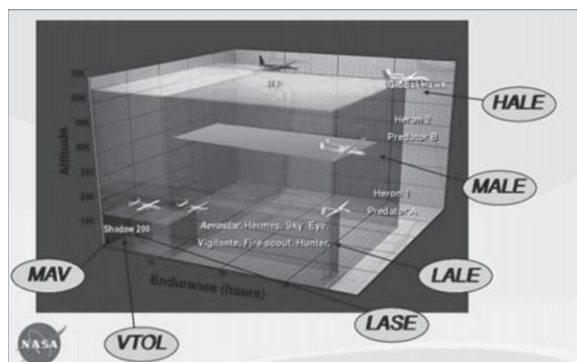
MALE - medium altitude, long endurance is used for medium-height but long-range drones,

LALE - used for low altitude but long range unmanned aerial vehicles (low altitude, long endurance),

LASE - the mark typifies low altitude and short endurance drones,

VTOL - designation according to flight functions, refers to drones used for vertical takeoff and landing machines,

MAV - Denotes very low weight (micro air vehicle) aircraft. [6]



3. Picture: Drawing showing the categories of pilot free aircrafts.

http://www.kozszov.org.hu/dokumentumok/UMK_2017/3/05_Dronok_a_kozszolgalatban.pdf

Types of drones can be distinguished according to their use, which can basically be either civil or military. Within the civil category it can be divided according to industrial or hobby use, within the military category reconnaissance or strike categorization is a possible division. In addition to these groups, of course, they can be diverse, can be differentiated according to control (autonomous, remote control, use of several remote controls), drive (electric, explosive motor) equipment level, number of sensors.

However, drones can be classified according to the design solutions as follows.

- **Rigid-wing drones:** The main feature of this type is that the position of the wings to the axles of the aircraft does not actually change. It is important to point out that this construction alone cannot take off from ground. The advantage of these types of drones is that they are capable of higher top speeds and relatively high peaks in height and high impact.
- **Multi-rotor drones:** The rotors are responsible for buoyancy and suspension during horizontal flight. With a classic ground takeoff construction, such drones are also differentiated from the pilot-operated aircrafts in number of rotors. Contrary to pilot-operated aircrafts having one or two rotors, Rotary-wing drones have mostly more than two rotors. Disadvantages are: high power consumption, reduced range and flight time. Although the number of rotors can be arbitrary, it is important to use an even number of rotors (rotating in opposite directions per pair) due to torque compensation. The four (quadro), six (hexa) and eight (octo) rotor versions are also common.
- **Lighter than air drones:** This class includes in effect airships where the buoyancy is provided by a gas lighter than a certain air.
- **Experimental and other drones:** This class usually includes solutions that do not spread more widely, such as flapping wings. [7]

APPLICATION OF THE DRONES

Drones can be used in many situations for a variety of reasons: cost reduction, no need to send people to hard-to-reach or dangerous places, faster and more efficient work.

Civil application

- **Transportation** - Unmanned aerial vehicles have many options for transporting small packages, but for the time being this industry is still quite young, many legal and technological barriers exist. We can use them only in connection to online consuming. However, it is worth working on this type of automation, since not only they allow a faster delivery service, but with a well-chosen central drone base the amount of greenhouse gases from transportation can be reduced, thus contributing to environment protection. [8]
- **Security service** - The use of drones can also be of great benefit in terms of surveillance and patrol. It is able to fly a pre-programmed route and repeat it many times a day, sensors can detect movements and send an alarm to the control center. Moreover, the recordings can be further analyzed to help identify intruders. They can be efficiently used for border surveillance or surveillance of large areas such as highway sections or railroad tracks.

- **Damage management** - Following natural disasters, damages usually occur over a large area the details inside which are difficult to approach quickly. For recovery teams UAV are useful since they can guide them from above, critical areas can be more easily identified without having to send people into unknown conditions. But a disaster doesn't necessarily have to happen to require an area survey. They make high-resolution images of drones or the topographic models they create, which can be used, for example, to survey plots for construction, for map design or for foresters for vegetation observation. [9]
- **Agriculture** - One of the largest and increasingly popular applications of drones is agriculture. The trend may be due to the fact that - similarly to the area survey - it is necessary to survey large, open plots in agriculture, which can often be very cumbersome on foot and not least time consuming. These activities can be performed easily and quickly from the air. Furthermore, there are a number of agricultural activities that can be done with drones, for which practicality and speed are also what advocates for unmanned aerial vehicles. For example, spray drones can be used to quickly and easily treat plants with nutrients and pesticides, and even preventive surveys can be carried out with drones, and based on the analysis of the data obtained, the development status of the plants and the level of infection can be determined that is used as a base for treatment and intervention. Assessing the current condition of plants is also important because it allows the programmed drone to emit extra material in areas where it is needed, so not only will plant care and plant protection be effective, but this method can also guarantee a uniform quality crop in the given cultivation period. [10]
- **Alpinism** - Climbers have to climb to dangerous places or hang from the sides of buildings for avoiding the construction of scaffolding, thus saving costs. However, in several cases, a flying device may be able to replace the role of climbers, further reducing costs and avoiding unnecessary risks. Such a situation could be inspections where human labor is avoidable, such as inspecting radio towers after a storm, inspecting roof tiles, inspecting lightning rods, chimneys, inspecting high-voltage wires.
- **Hobby** - In the last few years, drones for hobby use have started to explode. More and more models appeared in the lower price ranges, and this impressively complex technology has reached a wider range of users. Moreover, thanks to their efficient development, the tools are becoming safer and easier to use year after year. Operation is not more complicated today, than the use of a smartphone or a computer game; most machines are so intuitive that your operator can control them almost immediately after taking the remote unit in hand, no training course is required. In addition, they are equipped with various optical and ultrasonic sensors, using which the device can avoid collisions and accidents.

The knowledge of hobby drones is catching up with the knowledge of their industrial counterparts, and the technological leap between them is diminishing. More and more tasks can be performed by factory made hobby drones, which previously could only be done with a specially built device.

Public application

The increasing spread of drones may also have an impact on the performance of certain public service tasks and may be helpful for data collection and the rapid and efficient mapping of certain sites, thus contributing with high quality information in decision-making processes.

- **Municipals** - Local municipalities perform a wide range of tasks serving the local public interest and organizing public services. Many municipal tasks could be made simpler and more cost-effective using of the opportunities offered by drones. In this context it is enough to think about how much the local governments have been helped by the introduction of the various GIS systems, which are now used regularly with tangible results. The situation could be similar in the case of drones. Drones could be used in connection with essentially all tasks where some kind of imaging and long-term observation is required. In connection with the tasks of the municipality and the applicability of the overhead line electrical distribution the settlement planning should be emphasized, in the planning and implementation phase of which the drones could serve a huge service.

Through the drones, local municipals could also create databases that would lay the foundations for positive development in almost all public services affecting the population. Based on the accurate and objective information that municipalities can obtain through drone technology, public services could be improved, municipal asset management could be made more efficient, and public utility services and health programs could be optimized. Municipalities currently use drone technology only on a case-by-case basis but exploring the endless array of possibilities and developing methods will certainly receive increasing emphasis in the future. [11]

- **Environment Protection** - Drones may play an important role in organizing efficient environmental protection and monitoring in the near future. In the field of environmental protection, it is also key to assess a realistic picture of a given problem, which can be worked out either by personal experience, by means, by consistent use, or by a combination of these. There are often situations where environmental authorities and government organizations cannot access some delicate areas - because they are very difficult to reach, or precisely because it is dangerous to human life - thus it is difficult to assess the actual damages and determine the necessary recovery measures. In such cases, drones can provide a very useful service, as they can access areas whose condition can only be estimated by estimation or inference.
- **Military, police, disaster protection/management** - The work of the police can also be greatly aided by various drones. By monitoring an area with a higher crime rate, the number of cases that can occur can be greatly reduced, and it can also improve the sense of security of the civilian population in the area.

Drones are also a great help in assessing forest fires and various natural disasters. For example, we can get a picture of the area affected by a flood. We can track changes on a minute-by-minute basis, so we can react much faster to events and minimize additional losses and damages. UAVs make it easier to control various

wildlife damages, inland waters and other damage, following possibly a fully automated process.

The use of drones is also of great importance in the field of national security, especially in preventing attacks against individual states and in preparation for defense actions. Terrorism as an asymmetric warfare, and there seems to be a paradigm shift in defense views about the war, brought the use of drones in national security and defense. This is because it is one of the most widely used weapons by terrorist organizations, and in case of attacks by bombing with the hell machine, the drones can perform a special and grateful service in finding and neutralizing them. Considering that the decontamination and detection of explosives requires special expertise, and that the recordings made by drones can be transmitted even over long geographical distances, it is also feasible to be able to make an expert analysis of a hell machine in a different location in physical space. [12]

In general, drones can be used successfully in many areas of the public service, and essentially almost all tasks previously performed with a pilot-controlled aircraft will likely be able to be performed with drones in the near future.

THE REGULATION OF THE UAV

At first glance, drones may seem like harmless toys, but with the development of technology, more and more complicated tasks can be performed with them in many cases, already completely automatically, without human intervention. With the help of the image and sound recording devices that can be mounted on them, it is easy to collect data almost unnoticed, or in case of improper use, the device can be extremely dangerous.

Another problem is the restriction of airspace. It is not obvious to many people, but you can't fly a drone just anywhere. Also a few years ago, a drone strayed into the White House area, causing the entire building to be locked down for several hours until it was ascertained that the device is not a cause for alarm.

In addition to the incidents listed above, there are a number of other problems that can arise during the flight of a drone, so in order to avoid accidents and prevent illegal data collection, it is necessary to introduce regulations, bind flying to permit and registration, and inform pilots about the dangers of drones. Up to the last regulation, there was no uniform EU legislation on the use of unmanned aerial vehicles, so legislation varies from country to country.

The European Aviation Safety Agency (EASA) has a special role to play in developing the rules on drones, with the task of drawing up rules and drafting legislation on aviation safety.

The Agency has made the following recommendations:

- The drone should always be in our field of vision
- Check the device and plan the flight before each flight
- Always read the information about the device carefully
- Do not fly near airports or helicopter landings
- Do not fly while endangering others
- Do not fly over people, vehicles or private property
- Do not fly closer than 50m to people or private property

- Do not fly higher than 150m

In September 2015, the agency issued a framework of 27 actual proposals for drones. This was the first single draft regulation to divide the instruments into three categories: "open" (low risk), "specific" (medium risk) and "certified" (high risk). [13]

EASA has created the following categories:

- **"Open" category** - No prior permits are required to fly, and compliance with the rules is ensured by industry standards, some bylaws, and technological constraints. In case of violation, the police can intervene. This category includes devices with a maximum weight of 25 kg, such as civilian drones, which must always be kept in our field of vision during flight, must not fly above 150 m, or have a so-called "geofencing" mode, which prevents to fly to a restricted area with the device. [14]
- **"Specific" category** - A risk analysis issued by the operator or the competent authority is required. To facilitate the analysis, standards have been developed that include flights under certain conditions, such as farm work or infrastructure monitoring. This group includes devices that, due to their parameters, no longer fall into the "open" category.
- **"Certified" category** - Because drones in this group are already very similar to piloted aircraft due to their size and technical parameters, the requirements are similarly stringent. Many permits and trainings are required for use, and the operator has many responsibilities. This category includes, for example, drones used by the military. [15]

In developing the regulatory framework for drones, the U-SPACE framework is still worth describing. The recommendation was issued by an organization called SESAR in 2017, which aims to make EU regulation as appropriate as possible. U-space aims to create a framework that supports, on the one hand, routine drone flying and, on the other hand can provide an interface with the relevant authorities as well as with other aviation actors and stakeholders.

At the same time, it is important to clarify that U-space is not an airspace specifically dedicated to drones, not an airspace with pre-designed rigid boundaries, but a cohesive system that is connected at many points and compatible with other airspace users in aviation. with other actors involved.

The regulation demarcates the following three different areas of operation in connection with the operation of drones:

- Urban
- Suburban
- Rural

The U-Space framework was based on the following principles.

- The primary purpose of the regulation must be to ensure that the operation of the drones can be carried out without accident. The requirement for safe and accident-free operation must also cover the protection of persons and objects.
- The principle of equal access to airspace for all users should apply to the use of airspace.

- The framework should also include the necessary mechanisms to support the development of drone-related businesses through competitive and cost-effective service standards.
- During the creation of the framework, the aspect that the regulation must be adaptive and flexibly adaptable in order to meet the emerging needs has been given an important role. This principle is also particularly important because, as a dynamically evolving sector, there is a need for a framework that is appropriate for both technological innovation and business model innovation, that is able to react in a timely manner and that is flexible enough to handle change.
- It is important from the outset for the regulation that, in addition to emphasizing adaptive capabilities, the investment and operation of the system and the maintenance of the system associated costs should be kept to a minimum in order to make the system economically sustainable in the long term.
- A further principle is that, if possible, the new drone regulation can be properly integrated into the system of the already established and successfully functioning aviation and telecommunications networks,
- Carry out complex operations at high frequencies using automated drones under fleet supervision.
- In addition to the above, the regulation of drones must in all cases prioritize the highest possible level of safety and security requirements, which includes cyber protection, the protection of personal data and data protection in general. The protection of the environment is important, and the regulation must protect private property and the inviolability of privacy. [16]

THE HUNGARIAN REGULATION

In this section, I outline the main points of the Hungarian regulations on drones. In Hungary, in order to buy a drone or keep a drone, a separate permit is not required, however, the use of drones is already indirectly subject to a permit. More specifically, the above statement is intended that anyone wishing to enter the airspace with their drone needs an ad hoc airspace use permit. The permit itself is issued by the Ministry of Defense and applies only to the occasional use of airspace by drones. [17]

The current rules have abolished the previous rule that the drone users were required to report their activity, but the new rules do not require the use of drones for sports and private purposes to be reported separately, but occasional use of airspace is an activity subject to licensing.

The decree 392/2016 of the military aviation authority on the ad hoc airspace use license and the conditions for its issuance. (XII. 5.) of the Government defines the following criteria in connection with the permit application: [18]

- The applicant must submit an application for a permit at least thirty days before the drone is flown
- The applicant must indicate in his / her application the planned date and duration of the drone flying.
- The application for a permit must state the planned route of the flight, indicating its exact coordinates and the flight altitude.

- The application must also be accompanied by the permit of the operator of the overlapping airports.
- It is also a condition for accepting the application that the applicant has valid liability insurance.
- The result of the safety assessment related to the planned flight must also be attached to the permit application.
- Finally, the applicant must prove that he has duly paid the procedure fee, and a document certifying this must also be attached to the application. The fee for occasional airspace use according to the current rules is currently 3,000 HUF.

Pursuant to the ad hoc airspace use permit, the authority shall activate the airspace before the drone flight, based on the applicant's telephone call at least thirty minutes before the flight, a notification by telephone of flight ending is also required. The contact telephone number shall be recorded by the authority in the decision granting the permit. [19]

VIOLATIONS

The Cases of the violation of the rules of drones can be divided into several groups. In the following section I present these groups, which highlight the nature of drone regulation violation. The drone usage violation can involve civil or penal responsibilities. According to the rules of the civil law, the damage caused need to be compensated by the blameful. If the drone user during the flying caused a material damage in someone property, it will be refund. The most contentious civil law question is connected to the recordings by drones which is injury to various civil interests, first of all to the right for picture and voice recording.

Violation of the flight rules

The easiest way to violate the drone regulation is the breaching the rules of flight. The rules of the flight are the set of rules related to the use of airspace, for example the requirement of maximum flight altitude, the obligation to register, the training requirements. [20]

Picture and voice recording without authorization

To take a photo or video of someone, you need the verbal, written, or implied consent of that person. This is no different for images taken with a drone camera: we need to seek approval from the party concerned to take, use, and publish photographs. Although it is “only” an offense to take a picture of a person or their apartment in a recognizable way without permission, if the purpose of the observation is proven, for example, the activity is repeated regularly, a crime is already committed that can result in a much more severe punishment.

The authorization of the data subject is not required for the recording and use of the recording in the case of mass recordings and recordings of public performances.

The sanctions of the violations

According to the Hungarian drone regulation in the case the breach of the flight regulation will be fined by the law enforcement authority. The amount of the financial penalty depends on several circumstances. For example:

- The size of the range of the aggrieved parties
- The gravity of the injuring
- The mark of the caused danger and effects
- The duration of the injuring
- The repetition of the injuring conduct
- The extent of the damage
- The possibility of the recoverability
- In view of the extent of the undue advantage obtained by the violator

In all cases the real amount of the fine will be determined by the authority. According to the regulation the amount of the financial penalty reaches 20.000 to 100.000 HUF. [21]

SUMMARY

In this paper I clarified what does unmanned vehicles means and took a brief overview of the history and technical background of the drones. Also, I have briefly reviewed the grouping methods of drones and the main possibilities of the applications, explored the most important EU rules for drones and analyzed the domestic regulations too and analyzed the question of violations and sanctions to them. But, as in other fields of sanctions, one can say that a regulation is only as good as the respect of it is consequently observed. This is all the more difficult since the drone technology is in constant and rapid change, and the adaptation to them is a real challenge for the law making and law enforcement authorities. It seems that a flexible frame legal environment is the right answer to such challenges, and to make them respect is a perpetual task.

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