

Unmanned Aerial Vehicles: Legal Features of Aerial Video



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Abstract: *The purpose of the study is to systematize the requirements of regulatory documents of the United States of America, the countries of the European Union and the Russian Federation regulating the procedure for aerial video recording using UAVs. As a result of the study, information that allowed UAV owners to quickly resolve issues related to obtaining permission to fly, observing the established procedure for using airspace, fulfilling requirements to ensure data confidentiality and nondisclosure of state secrets, UAV registration and certification of an external pilot activity was presented. The efficiency of resolving issues is ensured by the fact that the main provisions of regulatory documents are supplemented by links to relevant resources, which allows obtaining more detailed information depending on the specific situation. The procedure for implementing practical actions to fulfill the requirements of legal acts is also set out. The novelty of the work lies in the way of presenting the requirements of regulatory documents, ensuring their familiarization by the UAV owners in a minimum time and in the amount determined by the specifics of performing aerial video recording in each specific case.*

Keywords *Aerial video, unmanned aerial vehicle, legal regulation of flights.*

I. INTRODUCTION

Unmanned aerial vehicles (UAVs) are widely used when performing aerial video recording, including the 360 degrees format. The number of UAVs in this sphere will only increase in the future [1-3]. When recording video, the owner of the UAV must solve the following issues [4-7]:

- develop the flight track considering the recording scenario, as well as the design features of the video camera system displacement on the UAV and its flight performance;
- obtain permission to perform a flight, taking into account airspace use restrictions and ensuring the safety of the flight;
- comply with legal standards for the protection of intellectual property, state secrets and privacy of citizens;
- register UAVs in the database, obtaining an account

number and applying it to structural elements.

Methodological approaches and recommendations for calculating UAV flight track parameters taking into account the “blind” zones of the video camera system are provided in [8]. Materials relating to the legal basis for the use of UAVs during video recording are given in various documents. Moreover, the list of regulatory documents of different states differs in composition and requirements. Therefore, the owner of the UAV is forced to find the latest versions of these regulatory documents, study them and determine the order of practical actions to fulfill these requirements prior to recording. The time spent on such actions will take more time than the procedure for their implementation.

The article presents the requirements of regulatory documents of the United States of America (USA), countries of the European Union (EU) and the Russian Federation on the use of UAVs during aerial video recording in a systematic way. A possible procedure for the practical actions of the UAV owner to fulfill these requirements was also considered.

II. PROPOSED METHODOLOGY

A. General description

The requirements of regulatory documents on the use of UAVs depend on the take-off mass of the aircraft in all states. The analysis of the review of modern UAVs for video shooting [9, 10] allows concluding that their mass is in the range from 300 grams to 10 kilograms. Based on these conditions, below are the results of the analysis of regulatory documents of various states.

B. Algorithm

The USA.

Legal regulation of UAV use is carried out by the United States Federal Aviation Administration (FAA) based on the Code of Federal Regulations (Title 14, Part 107) [11]. The text of this document is available at <https://www.law.cornell.edu/cfr/text/14/part-107>. An extract was made from this document [12], which the UAV owner can use as a memo in preparation for video recording. The operator controlling the UAV is called an external pilot. The extract defines the following basic rules for the use of UAVs:

- the UAV should be within the direct line of sight of the external pilot;
- the UAV should be at a distance that allows it to be visually observed by its external pilot without the aid of auxiliary optical devices;
- flying above people outside enclosed structures or vehicles is prohibited;

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- flight is allowed to be carried out only in the daytime or at dusk (30 minutes before sunrise or 30 minutes after sunset according to local time provided there are side lights);

- other aircraft must be let through;

- the maximum speed is 100 miles per hour (87 knots);

- the minimum flight altitude is 400 feet above ground level;

- the minimum visibility according to meteorological conditions is 3 miles relative to the position of the external pilot;

- flight in airspace of classes B (from the surface of the ground to an altitude of 10,000 feet above sea level in areas of the most busy airports), C (from the surface of the ground to an altitude of 4,000 feet above sea level in areas of airports equipped with radars), D (from the surface of the ground to an altitude of 2500 feet above sea level in areas of airports equipped with a control tower) and E (air traffic controlled by controllers, not belonging to classes B, C, D) ([https://wiki2.org/en/Airspace_class_\(United_States\)](https://wiki2.org/en/Airspace_class_(United_States))) is allowed with permission of air traffic management (ATM);

- flying in Class G airspace (uncontrolled airspace below 14,500 feet above sea level) is performed without permission from ATM;

- simultaneous control of more than one UAV by one external pilot is not allowed;

- UAV control from a moving aircraft is not allowed;

- UAV control from a moving vehicle is not allowed, with the exception of sparsely populated areas;

- it is necessary to conduct a pre-flight UAV check before the flight;

- UAV control in a physical or mental state that does not ensure safe operation of UAVs is prohibited;

- the person controlling the UAV during the commercial video recording must have an external pilot certificate or be under the direct supervision of a person who has an external pilot certificate;

- before performing the flight, the external pilot must make sure that the UAV meets the FAA registration requirements, it is always necessary to have documents confirming registration;

- do not fly near emergency zones (fires, hurricanes);

- take into account the presence of airspace restriction zones when flying;

- comply with the information confidentiality rules.

One of the important aspects when performing a UAV flight is compliance with the requirements for the use of airspace, taking into account current restrictions. The following restrictions are applied in the United States:

- 1) The territory of the stadiums and venues of sports events (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/sports_stadiums).

UAV flights in and around stadiums are prohibited, starting from one hour before and ending one hour after the end of any of the following events:

- Major League Baseball;

- National Football League;

- The first football division of the national college sports association;

- NASCAR Sprint Cup, Indy Car and Champ Series races.

In particular, UAV flights are prohibited within a radius of three nautical miles from a stadium or venue for sporting events.

- 2) Aerodrome areas (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/flying_near_airports).

If there is an external pilot certificate, permission to fly in the area of the aerodrome may be provided by the air traffic management authority (ATM).

- 3) Objects that determine national security (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/security_sensitive).

Such objects include:

- military bases designated as objects of the Ministry of Defense;

- national attractions – the Statue of Liberty, Hoover Dam, Mount Rushmore;

- hazardous infrastructure, such as, for example, nuclear power plants.

- 4) Airspace of limited or special purpose (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/tfr).

The following types of restrictions are provided:

- restricted areas;

- flight restriction zones;

- temporary modes (map of temporary flight restrictions in the areas of aerodromes https://tfr.faa.gov/tfr_map_ims/html/map_airport.html).

- 5) Washington city airspace (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/airspace_restrictions/dc).

Flights are regulated within a radius of 30 miles of the Ronald Reagan National Airport in Washington. The airspace is divided into an “inner ring” with a radius of 15 miles and an “outer ring” with a radius of 30 miles.

It is forbidden to control UAVs within the inner ring with a radius of 15 miles without special permission from the FAA. UAV flight in the area of 15-30 miles is allowed under the operating conditions described in [6].

Areas where UAVs are prohibited are indicated by a prohibition sign (Figure 1).



Fig. 1: The sign prohibiting UAV flights

To quickly obtain information about current restrictions, there is the B4UFLY mobile application (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/b4ufly), developed for the Android and iOS operating systems.

It provides real-time information about airspace restrictions and other flight requirements based on a GPS location. There are interactive maps with filtering options. The external pilot is provided with information on controlled airspace, special-purpose airspace, critical infrastructure, airports, national parks, military maneuver routes and flight time limits.

In addition to the prohibition on flying, there are limitations associated with video recording. This is due to the requirements of maintaining state secrets, the confidentiality of information, and the right to private property.

In the interests of maintaining state secrets and the confidentiality of information, video recording is prohibited:

- of objects owned by the federal government (federal buildings, public parks, squares, airports, train stations, police stations, courthouses);
- of motorways, tunnels and bridges;
- of individual buildings that make up America's cultural heritage (filming requires special permission).

The right to private property provides for the prohibition of video recording of real estate without obtaining permission from the owner of this property. In addition, the right to real estate consists of the right to land and everything that is on the surface of the ground and above the ground, including airspace (with a restriction on flights).

In order to control the UAV during video recording for commercial purposes in accordance with the established rules, the external pilot must obtain an external pilot certificate from the FAA (https://www.faa.gov/uas/commercial_operators/become_a_drone_pilot). To obtain a certificate for an external pilot, the following requirements apply:

- age over 16 years old;
 - ability to read, speak, write and understand English;
 - be in a physical and mental state that ensures safe flight;
 - passing of the initial aviation knowledge exam.
- The test contains questions on knowledge of:
- current rules regarding privileges, restrictions and flight conditions of UAVs;
 - airspace classification and UAV operational requirements;
 - sources of data on weather and the influence of weather conditions on UAV characteristics;
 - issues of preparation and operation of UAVs;
 - order of action in extreme conditions;
 - UAV control issues;
 - radio communication procedures;
 - issues of UAV characteristics assessment;
 - physiological effects of drugs and alcohol;
 - air navigation issues;
 - the order of the flight in the aerodrome area.

The certificate is valid for 2 years, after which it is necessary to take a second test. The initial and subsequent tests are passed in the Knowledge Testing Center (the addresses of the centers can be found at <http://candidate.catstest.com/sitesearch.php>). Testing is carried out online on the website of the selected center.

It is necessary to register a UAV if its weight is in the range from 0.55 pounds (250 g) to 55 pounds (25 kg) before flying (https://www.faa.gov/uas/getting_started/register_drone).

An application for registration can be submitted in paper form or online at <https://faadronezone.faa.gov/#>. After the UAV registration process is completed, it will be assigned a unique registration number, which must be applied in any way to the UAV fuselage (Figure 2). Registration costs \$5 for one UAV and is valid for 3 years. To register, one must provide the following information:

- email address;
- credit or debit card details;
- physical and mailing address;
- brand and model of the UAV.



Fig. 2: UAV with registration number FA12345678 on the fuselage

Registration terms:

- age not younger than 13 years (if the owner of a UAV is younger than 13 years old, then registration must be performed by a person older than 13 years old);
- the person must be a citizen or permanent resident of the United States (foreign citizens visiting the United States must register UAVs upon arrival, while online registration serves as the UAV certificate of ownership).

EU countries.

In the countries of the EU, the legal regulation of UAV use is carried out by the European Aviation Safety Agency (EASA). The main provisions of the regulatory framework are presented at <https://www.easa.europa.eu/easa-and-you/civil-drones-rpas/drones-regulatory-framework-background>. In accordance with them, UAV flights are divided into two categories:

- "open" – for which the prior permission of the competent authority or the declaration of the UAV operator is not required before the flight;
- "specific" – for which permission of the competent authority is required prior to the start of the UAV flight, except in certain situations in which the statement of the operator is sufficient or when the operator has a simplified certificate of an external pilot with the appropriate privileges.

The procedure for using UAVs for these flight categories is described in two parts of the "Introduction of a regulatory framework for the operation of drones" [13, 14] and is updated by the document "Introduction of a regulatory framework for the operation of unmanned aircraft systems in the 'open' and 'specific' categories" [15]. Regulatory acts are developed based on the risks for people on the ground and for other aircraft, as well as the problems of confidentiality, security and data protection created by UAVs.

The open category provides for the following requirements:

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- the maximum take-off weight of UAVs – 25 kg;
- the maximum flight altitude – 120 m;
- line of sight between the UAV and the external pilot.

The open category is divided into three subcategories:

- A1: flying over people, but not over open crowds;
- A2: flying close to people while maintaining a safe distance to them (at least 5 m);
- A3: flying away from people (at a distance greater than the line of sight).

UAVs are divided into C0, C1, C2, C3, C4 classes depending on technical characteristics. The corresponding class is assigned by the UAV manufacturer and is indicated in the technical documentation included in the delivery package. The instructions indicate the list of permitted and prohibited actions in accordance with the UAV class.

The following requirements are imposed on UAVs of class C0:

- the maximum take-off weight, including payload – 250 g;
- safe control by an external pilot in compliance with the manufacturer's instructions;
- availability of an instruction manual with warnings of possible risks, taking into account the age of the user;
- the range of the “follow me” function should not exceed 50 m from the external pilot and should allow controlling the UAV or crashing the flight;
- availability of an information sheet with all the information necessary for the use of UAVs in accordance with the rules of flight safety, aviation security, confidentiality and data protection, liability and insurance;
- must be designed and manufactured for safe flight;
- must be designed to operate below 50 m or have an active system limiting the attainable height to no more than 50 m above the take-off level;
- must have a construction without sharp edges, which can be dangerous for people on the ground;
- if there are propellers, they must be designed in such a way as to limit any injury that may be caused by blades;
- must have a DC supply voltage or an equivalent AC voltage of not more than 24 V unless electric shock is guaranteed if the UAV is damaged.

Class C1 UAVs have the following requirements:

- must be designed and manufactured for safe flight;
- impact energy should not exceed 80 J or the maximum take-off weight, taking into account the payload, should be no more than 900 g, the maximum cruising speed – 18 m/s;
- the maximum flight altitude is 120 m or the UAV must be equipped with a height limiting system set from the control panel;
- must be equipped with an electronic identification system if there is a microphone or camera with a resolution of more than 5 megapixels and a real-time video transmission line, or any other type of sensor capable of recording personal data;
- safe control by an external pilot in compliance with the manufacturer's instructions;
- must not have sharp edges that are dangerous to people on the ground;
- if there are propellers, then their design should exclude the possibility of injury by the blades;

- the sound power level at a distance of 3 m should not exceed 80 dB;
- must have a DC supply voltage or an equivalent AC voltage of not more than 24 V unless electric shock is guaranteed if the UAV is damaged.

– the range of the “follow me” function should not exceed 50 m from the external pilot and should allow controlling the UAV or crashing the flight;

– the control panel must provide the external pilot with data on the status of the battery and controls;

– must have the necessary mechanical strength, excluding its breakage or deformation during flight;

– must be equipped with side lights;

– availability of operating instructions indicating operational restrictions and warnings of possible risks;

– availability of an information sheet with all the information necessary for the use of UAVs in accordance with the rules of flight safety, aviation security, confidentiality and data protection, liability and insurance.

Class C2 UAVs have the following requirements:

– must be designed and manufactured for safe flight;

– maximum take-off weight, taking into account the payload – 4 kg;

– the maximum flight altitude is 120 m or the UAV must be equipped with a height limiting system set from the control panel;

– must be equipped with a navigation system and an electronic identification system;

– safe control by an external pilot in compliance with the manufacturer's instructions;

– the control panel must provide the external pilot with data on the status of the battery and controls;

– must have a DC supply voltage or an equivalent AC voltage of not more than 48 V unless electric shock is guaranteed if the UAV is damaged.

– must have the necessary mechanical strength, excluding its breakage or deformation during flight;

– must have a reliable way to terminate a flight or restore a data channel in the case of loss of control;

– must be equipped with side lights;

– availability of operating instructions indicating operational restrictions and warnings of possible risks;

– availability of an information sheet with all the information necessary for the use of UAVs in accordance with the rules of flight safety, aviation security, confidentiality and data protection, liability and insurance.

Class C3 UAVs have the following requirements:

– must be designed and manufactured for safe flight;

– the maximum take-off weight, taking into account the payload – 25 kg;

– the maximum flight altitude is 120 m or the UAV must be equipped with a height limiting system set from the control panel;

– safe control of an external pilot in compliance with the manufacturer's instructions;

– the control panel must provide the external pilot with data on the status of the battery and controls;

- must have a reliable way to terminate a flight or restore a data channel in the case of loss of control;
- must have a DC supply voltage or an equivalent AC voltage of not more than 48 V if electric shock is not guaranteed if the UAV is damaged;
- availability of operating instructions indicating operational restrictions and warnings of possible risks;
- availability of an information sheet with all the information necessary for the use of UAVs in accordance with the rules of flight safety, aviation security, confidentiality and data protection, liability and insurance.

- Class C4 UAVs have the following requirements:
- must be designed and manufactured for safe flight;
 - the maximum take-off weight, taking into account the payload – 25 kg;
 - availability of operating instructions;
 - availability of an information sheet with all the information necessary for the use of UAVs in accordance with the rules of flight safety, aviation security, confidentiality and data protection, liability and insurance.
- A mark corresponding to its class should be applied to the UAV case (Figure 3).



Fig. 3: Tags indicating the UAV class

In accordance with the subcategory and class of UAVs, the requirements for the competence of an external pilot, technical characteristics,

identification/geolocation and the need for registration are listed in Table 1.

Table 1: UAVs use rules requirements

Subcategory	External pilot competency	UAV			Registration
		Class	Technical requirements	Electronic Identification/Geolocation	
A1	Read consumers information	individually built	not applicable	no	no
		C0	consumer information <19 m/s, without sharp edges, selectable height limit		
A2	- consumer information - online training - online test	C1	consumer information <19 m/s, without sharp edges, selectable height limit	yes + unique serial number for identification	yes
		C2	consumer information, mechanical strength, no sharp edges, selectable height limit, low-speed mode		
A3	- consumer information - online training - online test	C3	consumer information selectable height limit, strength	if required by flight space	
		C4	consumer information no automatic flight		
		individually built	not applicable		

The requirements for the “specific” UAV category are the same as for the “open” category, with the addition of the need to obtain permission to fly from ATM authorities. The procedure for obtaining such permission is determined by national rules, which can be found at <https://drone.rules.eu/en/recreational/regulations>. The <https://drone.rules.eu> website also contains information on the regulatory framework for the use of UAVs, including the procedure and the need to register UAVs, obtain an external pilot certificate, and the responsibilities of the external pilot to comply with safety rules and information confidentiality.

- Information is provided for various European countries.
- In order to ensure the safety of the flight, the external pilot must:
- know and abide by the rules of flight operations;
 - maintain eye contact and UAV control;
 - do not fly in prohibited airspace;
 - keep a safe distance from people and objects that UAVs may encounter;

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- do not fly near airports and flight routes of manned aircraft;
- plan a safe flight, taking into account their experience in UAV control;
- know and follow the UAV manufacturer's instructions;
- check the UAV before each flight in accordance with the operating instructions;
- obtain permission from the competent authorities in the case of the commercial use of UAVs;
- register UAVs in local authorities if necessary.

In addition to complying with safety regulations, an external pilot is also required to comply with the requirements of privacy laws. Title documents in this area are:

- Article 7 (respect for private and family life), Article 8 (data protection – personal and confidential personal information) of the EU Charter of Fundamental Rights [16];
- Article 8 (right to respect for private life) of the European Convention on Human Rights [17].

In accordance with these documents, the external pilot must:

- inform others about the use of UAVs during video recording;
- request permission from these persons to perform video recording, especially if the flight is done above their personal space;
- respect the requests of these persons not to be included in the footage or be captured in photographs, to delete personal data at their request.

An external pilot is prohibited from:

- using UAVs to take pictures of people in private space without their permission;
- using UAVs to detect, track, monitor or watch people;
- using UAVs in such a way that a person feels compelled to limit his or her movements or change behavior due to the presence of UAVs;
- intentionally take pictures of objects by which people can be recognized or identified without their permission (faces, license plates, etc.);
- publish videos that lead to direct or indirect identification of a person to an unlimited number of people, for example, through an open blog entry/social network on the Internet.

UAV registration is carried out in accordance with the national rules of various states, listed on the <https://dronerules.eu/en/recreational/regulations> webpage. After receiving the registration number, the owner of the UAV must put it on the body so that the information is readable without the use of special optical devices when the UAV is on the ground. If it is not possible to put a readable number on the UAV body, then marking is allowed inside the battery compartment, if it is available for opening. The number can be applied in any way: with marker, with label sticker, by engraving.

The Russian Federation.

The legal regulation of UAV use is carried out by the Federal Air Transport Agency. The procedure for using the airspace of the Russian Federation, including by the unmanned aerial vehicles, is established by the Federal Rules for the Use of Airspace of the Russian Federation [18].

A permissive procedure of airspace use has been established for performing flights, regardless of the class of airspace in which the flight is performed. Permission to

perform a flight is carried out in the following order:

1) In the case of a flight within the boundaries of the settlement the permission is obtained from the local government. When launching a UAV in the airspace over Moscow, it is necessary to obtain permission from the Department of Regional Security and Anti-Corruption of Moscow by submitting an application in person or by mail. In cities of federal significance (St. Petersburg, Sevastopol), permission of the executive authorities is required. The statement shall indicate:

- surname, name, patronymic;
- individual insurance account number;
- place of residence and passport data;
- contact phone number and email address;
- date, time and place of launch, altitude and duration of the flight.

2) If the flight is performed in the military airfield operating area, coordinate it with the senior navigator of the airfield.

3) Conduct initial approval of the flight with the regional center (RC) of the Unified Air Traffic Management System (UATMS) (Area Control Center) or the zonal center (ZC) of the UATMS (Zonal ATM Center), obtain information on the flight conditions (the need to establish a local or temporary regimen). The contact details of the officials of the Area Control Center and the Zonal ATM Center are available at <https://www.favt.ru/o-rosaviacii-territorialnye-organy>.

4) Make a submission in accordance with [19] for the establishment of a local or temporary regimen, send it and coordinate it with the head of the Area Control Center or the Zonal ATM Center.

5) Obtain the local or temporary regimen number in the Area Control Center or the Zonal ATM Center.

6) Send the UAV flight plan at least one day prior to flight commencement. Submission of the flight plan is carried out online using the “System for submitting flight plans via the Internet and the telephone network of the Head Area Control Center”, located at <https://www.ivprf.ru>.

When developing the route and UAV flight plan, it is necessary to exclude the entry into the airspace restriction zones. Information about restrictions on the territory of the Russian Federation is available on the electronic map <https://fpln.ru>. The map of restricted areas for UAV flights is also displayed on the PilotHub website (<https://pilothub.ru/airmap>).

If it is necessary to use the airspace of restricted areas and restricted flight areas, the UAV owner is required to obtain permission from the persons in whose interests such zones are established. The contact details of such persons are available on the official website of the Federal Air Transport Agency <https://www.favt.ru>. It is additionally indicated on the above electronic map for each of the restrictions in the interests of which authority is this restriction established and the contact details of this authority.

7) At least 2 hours before the flight commencement, inform the official of the military aerodrome with whom the flights were previously agreed upon (in case flights are made in the military airfield operating area).

8) Not later than 2 hours before the flight commencement, inform the Area Control Center and the Zonal ATM Center of the period of activity (confirm the use of the established regimen or its dismissal).

9) At least 1 hour prior to the flight commencement, request permission for the use of airspace from the Area Control Center.

10) Report no later than five minutes after the scheduled start of the flight the actual time the flight started, the delay, rescheduling or cancellation of a flight to the Area Control Center.

11) Report the actual start time of the flight to the official of the military aerodrome with whom the flights had previously been agreed upon (if flights were made in the military airfield operating area).

12) Report the actual end of the flight and the interruptions in flights for more than an hour to the Area Control Center not later than ten minutes after the end of the flight.

13) Report the actual time of the end of the flight to the official of the military aerodrome with whom the flights had previously been agreed upon (if flights were made in the military airfield operating area).

14) Report the actual time of completion of activities to the Area Control Center and dismiss the local regimen (if the flight will not be commenced).

In order to comply with the law on state secrets, it is necessary to exclude shooting in the vicinity or over the following objects:

- any structures of the Ministry of Defense of the Russian Federation (buildings, military units, training grounds, etc.);
- cities with military infrastructure, military harbors, ships, any objects of military defense;
- factories and other defense industries, or other enterprises with a special regimen of visits;
- existing military and civil airfields;
- command structures of the Federal Security Service of the Russian Federation – FSB;
- places of imprisonment, correctional facilities.

Flights, video recording within the frontier should be carried out in coordination with the border service of the FSB of the Russian Federation. The frontier is a strip 25 kilometers wide, established along the entire border of the Russian Federation (with the exception of the Arctic Ocean).

In order to comply with the confidentiality requirements, it is prohibited to:

- publish photos and videos with the participation of a specific individual without his/her permission (Article 23 of the Constitution of the Russian Federation: every citizen of the Russian Federation has the right to preserve private (personal) life; Article 137 of the Criminal Code of the Russian Federation: violation of privacy) on the Internet or other media;
- perform video recording of a private house or apartment without the consent of its owner (Article 152.2 of the Civil Code of the Russian Federation: protection of a citizen's private life).

Prior to the flight, the owner of the UAV must register an unmanned civilian aircraft with a maximum take-off weight of 0.25 kilograms to 30 kilograms imported into the Russian Federation or produced in the Russian Federation. The registration procedure is described on the FAVT website page

<https://www.favt.ru/dejatelnost-ucet-bespilotnyh-grajdanskij-vozdyshnih-sudov/>.

To register a UAV, its owner submits a statement to the Federal Aviation Administration with a color photograph of the UAV attached. A link to the application form is available

at <https://www.favt.ru/dejatelnost-ucet-bespilotnyh-grajdanskij-vozdyshnih-sudov/>. The following information shall be indicated in the application:

- type of UAV (the name assigned by the manufacturer);
- serial (identification) number of the UAV (if available);
- the number of installed engines and their type (electric, gas turbine, internal combustion);
- the maximum take-off weight;
- the name of the manufacturer of the UAV (for a legal entity) or the surname, name, patronymic (for the individual who independently constructed the UAV));
- information about the owner of the UAV (phone number, email address, personal information of an individual or details of a legal entity).

In addition to the above documents, UAV owners need to issue a certificate of state registration of UAV, a civil liability policy, a certificate of the operator (when performing a commercial video recording), a certificate of airworthiness, a certificate of an external pilot, as well as permission to use the airspace. All this information will be stored in the database of the Federal Air Transport Agency for ten years after deregistration.

The application is submitted by mail to the following address: Leningradsky Prospekt, 37, bldg. 2, Moscow, 125993, marked "UAV registration". In the future, it is planned to submit an application online through the unmanned aircraft registration portal and the Unified portal of public services (from March 1, 2020).

The application is submitted within the following terms:

- Federation – within 10 working days from the date of acquisition;
- in the case of importing UAV into the Russian Federation – within 10 working days from the date of import;
- in the case of self-production – before the commencement of flight;
- for UAVs imported into the Russian Federation or manufactured in the Russian Federation before the entry of the registration decision (until September 27, 2019), – until October 27, 2019.

The following recommended requirements are presented for UAV photography.

The UAV photo should be in color with a light solid background. The size of the UAV shown in the photo should occupy at least 70% of the total image size and contain an image of all the UAV design elements. The shooting angle should provide a display of the entire visible area of the UAV, allowing for its identification.

The UAV registration number assigned in the manner prescribed by the UAV Registration Rules is subject to applying to UAV design elements before it commences operations. Recommendations for applying registration numbers to UAV design elements are as follows:

- 1) The following parts of the UAV are subject to marking with the registration number if they are present in a particular type of aircraft: upper and lower wing surfaces (both consoles), side surfaces of the fuselage, upper and lower surfaces of the stabilizer, keel, multicopter UAV engine mounting beam, fairings or other facing elements of the helicopter type UAV.

2) Regardless of the type and design of the UAV, the registration number must be duplicated on detachable structural elements not less than:

- 3 times for UAVs with a maximum take-off weight of up to 1.5 kg;
- 5 times for UAVs with a maximum take-off mass of more than 1.5 kg.

3) The UAV registration number can be applied by any of the methods that ensure that the number is preserved and is remains readable when exposed to water as well as in the event of UAV destruction. It includes applying with color that provides contrast with the background, and engraving number on small-sized structural elements.

4) The UAV registration number should be clearly distinguishable and readable without the use of special optical means; the font height should not be less than 5 millimeters. It is not allowed to use fonts with ornaments, italics, or with serifs that make it difficult to recognize the account number.

In the case of a commercial video recording, the UAV owner must obtain an aircraft operator certificate. This operation can be performed online on the <https://www.gosuslugi.ru/54500/4/info> webpage of the Russian Federation public services website. One needs the following in order to obtain the certificate:

- certificate of state registration of the UAVs;
- operations manual or flight organization information for the operator;
- liability insurance policy;
- certificate of airworthiness;
- certificate of qualification of an external pilot.

An application for registration as an aircraft operator is submitted to the territorial authority of the Federal Air Transport Agency. In addition, the conduct of the survey requires permission from the General Staff of Russia, the district headquarters, the FSB administration for aerial photography and control views. To obtain permits from these departments, licenses for geodetic and cartographic works and licenses for works related to the use of information constituting a state secret will be required.

III. RESULTS ANALYSIS

The following results have been obtained in the course of the research.

1. For various states that actively operate UAVs during aerial surveys, the requirements of regulatory documents governing UAV flight and requirements for the filming procedure are systematized. Regulation of requirements concerns the following rules of:

- external pilot certification;
- UAV registration;
- flight performance;
- video recording.

In all countries, the flight is organized based on the requirements of ensuring the safety of air traffic, persons and property located in the flight area. In the United States and EU countries restrictions are set on the maximum altitude and flight speed of UAVs. At the same time, UAV classes have been introduced for the EU countries, which are determined by the features of its design. In accordance with these classes, requirements are set for certification of the external pilot's activity, UAV registration and equipping with geolocation

and electronic identification tools. In the United States and EU countries, the permission of the ATC to perform a flight is only required if the UAV's flight will affect airspace restriction areas. The legislation of the Russian Federation provides for obtaining permission in all cases. If it is necessary to perform a flight in restricted areas, obtaining permission is required from the authorities in whose interests such restrictions are established. In order to help the external pilot, there are map servers that provide up-to-date information about current airspace restrictions. In the United States, a mobile application has also been developed for interactively supporting UAV flight organization and video recording.

The regulation of video recording is based on the requirements of maintaining the confidentiality of information and ensuring the protection of state secrets. All countries take into account the inviolability of personal life and private property of citizens. It is forbidden to publish videos relating to personal life on the Internet and other media without the permission of the person who became the subject of the recording. A ban was set on recording military and some public facilities. There is even a specific list of such objects in the US law.

In all countries, UAV registration is necessary if its weight exceeds 250 g. The registration procedure can be performed online on the websites of organizations maintaining UAV records. At the end of the UAV registration procedure, a unique identification number is assigned, which the owner must apply to the UAV body. The purpose of registration is to establish a responsible person in the case of damage to citizens or their property in cases involving UAVs.

Obtaining an external pilot certificate is not required to perform a flight for personal purposes in all countries. Such a certificate is required if a commercial survey is being conducted. Moreover, in the United States, the requirements for the age of an external pilot are clearly defined in both cases: 13 and 16 years.

2. An approximate procedure for the implementation of practical actions by the UAV owner to implement the requirements of regulatory documents is described. Links to pages of websites containing information on the following are provided:

- map servers that provide data on airspace restrictions;
- instructions to the UAV owner on ensuring safety during the flight, maintaining the confidentiality of information during video recording, on the procedure for registering UAVs and certification of the activity of an external pilot.

As a result of the study, the main requirements of the regulatory documents of different states regulating the procedure for aerial video recording using UAVs are systematically described. The material presented in the article describes the provisions relating to the following areas of activity of an external pilot in compliance with legal requirements:

- certification of an external pilot and registration of UAVs;

- obtaining permission to perform a flight;
- compliance with the established procedure for the use of airspace;
- compliance with requirements to ensure the confidentiality of data and nondisclosure of state secrets.

The information provided, accompanied by hyperlinks to relevant websites, will allow the external pilot to quickly and with the required completeness study the provisions of legal acts relating to the above areas of activities. In addition, the external pilot will have the necessary information about the practical implementation of the regulatory documents requirements.

Further research is supposed to be carried out in the direction of improving the mathematical and software tools described in [3] for constructing the UAV flight route during aerial video recording in the 360-degree format. The improvement resides in the fact that when constructing a flight route taking into account the “blind” areas of video recording, one can also use information from the Internet relating to the requirements of regulatory documents of the Russian Federation on the procedure for flying and video recording. That is, the development of a software product similar to the B4UFLY mobile application (https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/b4ufly), but taking into account the specifics of Russian legislation. The application under development should implement the following functional capabilities:

- in accordance with the flight operation area indicated by the owner of the UAV, determine the responsible air traffic control unit with which it is necessary to coordinate the flight and display its contact information. It should also provide links to websites with restrictions on the use of airspace and provide online submission of a flight plan;
- be connected with a map server that has data on airspace use restrictions, including those that display local or temporary regimen established by the air traffic control unit in the interests of the UAV owner;
- when performing a flight within the boundaries of a settlement, provide information about the executive authority issuing a flight permit, display its contact details and the procedure for applying for a flight;
- provide the opportunity to obtain information on the UAV registration procedure and certification of the external pilot’s activity, as well as display links to websites that provide online registration and certification;
- provide the ability to manually enter data on areas prohibited for aerial video recording (military facilities, private property, etc.).

Such a software product will allow UAV owners to quickly and efficiently resolve issues related to the preparation and implementation of video recording using UAVs.

IV. CONCLUSION

One of the aspects of UAV flight performance during aerial video recording is the need to comply with regulatory requirements. The list of regulatory documents and their contents vary for different states. In this case, the owner of the UAV, who is preparing to make the first flight or who has arrived in another state to perform video recording, is forced

to find all the documents governing both the flight rules and the video recording rules, study them and determine how to practically fulfill all the requirements of these documents. It is going to take a lot of time. In addition, the owner of the UAV may miss some legal acts or their individual provisions.

As a result of studies conducted for states in which UAVs are actively used in aerial video recordings, an analysis is made of the legal framework relating to safety issues, compliance with confidentiality information and state secrets, UAV registration and certification of an external pilot. Based on the analysis, the main information of a normative nature, which should guide the external pilot in the preparation and implementation of aerial video recordings, is described in a short and systematic way.

The novelty of the results is as follows:

- the provisions of various regulatory documents of each state are grouped in such a way that they cover all the practical issues that need to be addressed when performing aerial video recording;
- the main issues of legal regulation are accompanied by hyperlinks to Internet materials, which allows the UAV owner to quickly go to the information of interest for its more detailed study;
- the provisions of regulatory documents are accompanied by a description of the procedure for performing practical actions by the UAV owner to implement the requirements set forth in these documents.

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