

THE USE OF UNMANNED AERIAL VEHICLES (UAV) FOR LAND MANAGEMENT

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Abstract. *The article is devoted to a comparative analysis of the use of unmanned aerial vehicles for solving problems of land management. Scientific work highlights the prospects for the use of unmanned aerial systems in the implementation of local monitoring and the need to take into account the possibility of using unmanned aerial systems of various types in making management decisions to ensure their maximum efficiency in the shortest possible time. Given problem is not sufficiently substantiated in the Ukrainian law and this can lead to the complication of the use of unmanned aerial vehicles, due to bureaucratic and corruption schemes as well as the negative impact on objects of special use regime.*

Keywords: *unmanned aerial vehicles, a temporary order of use of the airspace of Ukraine, Earth remote sensing, land management*

The relevance of the article.

Efficiency in obtaining reliable information is an important component in making timely and effective management decisions to ensure an adequate response in critical situations and support the sustainable development of the economy. The use of modern means of scientific and technological progress allows us to achieve the desired results with minimal time and human labor.

Effective use of land resources is impossible without taking into account the specific properties of the land, directly or indirectly reflected in the structure of the qualitative and quantitative com-

position of land resources, which are in constant change.

The above suggests that the effective use of land resources largely depends on the effectiveness of monitoring land resources as a source of information about the current status of natural resources and dynamic changes in their structure.

Taking into account ease of use, efficiency, and reliability in collecting the necessary information about objects using unmanned aerial vehicles, the characteristics of the structures and the prospects for using them, as well as describing the possibility of their place in the coordinates of the legal field, requires detailed study and analysis.

Analysis of recent research and publications.

Actual information on the introduction of certain unmanned aerial systems is provided on official electronic resources of manufacturing companies and companies distributing UAV such as DJI, Smart Drones, People's Drone, etc.

At the same time, considering the UAV in the context of land management, it is impossible not to single out the role of scientists like Dorosh Y.M. and Butenko E.V. in the study of problems of monitoring land resources; Martyn A.G. and Tretyak A.M. in matters of legislative framework for the effectiveness of management decisions; Kokhan S.S. and Vostokov A.V. whose works are devoted to the specifics of geoinformatics and remote sensing of the Earth.

The aim of the article is to compare the characteristics of the currently existing models of unmanned aerial vehicles and the legal regulation of their use and also determine the use of the achievements of scientific and technological progress for the needs of the management of sustainable development of territories in the legal field.

Basic material.

The rapid development of scientific and technological progress, financial, economic and legal relations in society leads to constant rapid changes in the location of urban infrastructure, the structure and configuration of agricultural landscapes, agricultural and forestry lands, natural resources consumption areas. The efficiency and accuracy of managerial decision make directly depend on the information sensitivity to changes in the spatial location of objects which are sources or places of concen-

tration of material goods, cultural, spiritual and aesthetic values.

That's why the task is to timely meet the needs of various consumer groups with current information about the objects of the surroundings that can be expressed as a set of geospatial and attribute data about the objects of the potential query of users of geographic information systems.

For a long time, the solution of the set goals is achieved by land monitoring systems, remote sensing of the Earth and means of aerial photo-geodetic survey. The data collection process required careful preparation, time and cost and it was possible only in large areas.

The Antonov AN-30 aircraft served as a carrier of aerophoto mais equipment during medium and smaller scale surveys with an upper limit of flight altitude of 8 km and an average speed of 440 km/h.

For aerial surveys on a medium scale, the Ilyushin IL-14 FK was used, the flight altitude of which reaches 6 km and the average cruising speed is 300 km/h.

The Antonov An-2 was designed for photographing on a large scale. Its altitude is 5 km, the average speed is 180 km/h. The Kamov Ka-26 helicopter was used for photographing small areas of the land surface on the same scale. Its height reached 3 km and the average speed was 140 km/h.

Nowadays, obtaining high-quality aerial photographs has become possible because of the use of UAV which greatly simplified the process of aerial photography and made it possible to take photos even of insignificant areas or individual objects.

The use of unmanned aerial systems allows:

- Solve topographic and geodetic engineering tasks;
- Build 3D terrain models;

Comparison of multicopter and aircraft platforms

Comparison options	Multicopter	Aircraft
Maneuverability	Higher	Lower
Price	Cheaper	More expensive
Portability	Compact, conveniently fold	Larger, often need additional launch catapults
Ease of use	Simpler	More difficult
Stability	Lower	Higher
Load capacity	Lower	Higher
The need for space for takeoff/ landing	Absent	Obligatory
Large Area Monitoring	On average 50 ha	On average 6000 ha

- Perform remote diagnostics of engineering structures;
- Use a thermal imaging survey.

Flying on a given route, it is possible to get accurate and reliable photos and videos about the features of the relief, the state of the situation and the natural resources of the area which requires research.

In accordance with the objectives of aerial photography, there are 2 types of unmanned aerial systems which are used: copter and aircraft type. From the table, it can be concluded that it is advisable to use the multicopter for photographing individual point objects or areas of up to 20 ha, and aircraft-type drones for photographing and shooting linear objects and territories with known areas of more than 20 ha.

Among the copter-type UAVs, recently DJI Phantom 4 Pro (Pic. 1) is in great demand. It guarantees 30 minutes of flight, covering up to 50 ha with images; it can reach a maximum speed of up to 72 km/h, with a signal range of up to 7000 m and maximum wind speed up to 10 m/s. Phantom 4 Pro is equipped with a 20 MP, 1" sensor camera with a mechanical shutter, dual navigation system, high-precision guidance system.



Pic. 1. DJI Phantom 4 Pro

In order to introduce the use of modern trends with the use of UAVs in the arsenal of future leaders of state institutions, the National University of Life and Environmental Sciences of Ukraine has been using drones in the educational process from 2018.

An example of an orthophotomap created by students on the basis of Phantom 4 Pro materials is shown in Picture 3. It demonstrates the ability to produce quickly high-quality and high-resolution images for land management needs.

The prominent representative of the aircraft type of UAV can serve People's Drone PD-1 (Pic. 2), that during a flight of 600 minutes it is capable of covering 6,000 ha with a maximum wind speed of up to 10 m/s and can carry up to 8 kg of payload. The launch can be carried out using a catapult or chassis.



Pic. 2. PD-1

The launch of UAVs on the territory of Ukraine is regulated by the “Temporary Order of Using the Airspace of Ukraine”, approved by the State Aviation Service of Ukraine (01.06.2018). This Order directly defines the conditions under which the use of drones is permitted.

Based on the procedure, a UAV, that together with a camera or special equipment weighs more than two kilograms, should be submitted an application for the use of airspace. And if necessary, also get permission from the Air Force

of the Armed Forces of Ukraine, the State Border Service of Ukraine, the bodies of the United JCMS of Ukraine, the air traffic control and air traffic control authorities, etc.

It is allowed to fly only within the line of sight, but not farther than 500 meters from the external pilot. The maximum height is not more than 50 meters above the level of the land (water) surface.

It is also prohibited to fly over:

1. roads of state importance along the central streets of cities, urban-type settlements and villages;
2. state and regional railways;
3. and along power lines, product pipelines, except for the cases when the flights are carried out in agreement with the owner of the object;
4. industrial zones, power stations, railway stations, seaports, storages of fuel, oil, gas, other hazardous substances and liquids, etc., except for



Pic. 3. Orthophotomap of the training ground of NUBiP (Boyarka, Kyiv region, Ukraine)

the cases when flights are performed in coordination with the owner of the object;

5. the places (areas) of accidents and catastrophes (except those that involved in the aftermath of their consequences and search and rescue operations);
6. the penitentiary institutions and pre-trial detention centers, except for the cases when flights are carried out in the interests of the administrations of these institutions and detention centers;
7. other important state and potentially dangerous objects, except for the cases of flights under the permission of the authorities;
8. objects that are defined by the Ministry of Defense of Ukraine, the Ministry of Internal Affairs of Ukraine, the State Border Service of Ukraine, the Security Service of Ukraine, the National Police of Ukraine, the NGU, the State Guard Department, other military formations and law enforcement agencies established in accordance with the laws Ukraine and in respect of which the protection is carried out, except for the cases of flights with the permission of the above bodies.

For violation of airspace a fine is from 1020 to 8500 hryvnia.

Conclusion.

The development of unmanned aircraft offers a wide range of opportunities for specialists in the field of GIS, remote sensing and land management, provides an opportunity to conduct local monitoring of natural resources with high frequency and minimal cost. But with the development of scientific and technological progress, there is an

urgent need to assess the achievements of science in the legal context and the perfect legislative regulation of processes related to the use of UAVs. It is necessary to create a legal framework that would ensure the unhindered implementation of monitoring and other activities related to the use of unmanned aerial vehicles without jeopardizing the security of the state, preserving state secrets and preventing threats to the life and health of citizens.

References

1. Kupriyanchyk, I. P., Butenko, E. V. (2013). Photogrammetriia ta dystantsiine zonduvannia [Photogrammetry and remote sensing]. Kyiv, Ukraine: Medinform, 392.
2. DJI Phantom 4 Pro. Dron.Ua. Available at: <http://drone.ua/dji/phantom/>.
3. People's Drone PD-1. Available at: <https://uk.wikipedia.org/wiki/PD-1>.
4. Temporary Order of Using the Airspace of Ukraine. Available at: <https://avia.gov.ua>.

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ЗАСТОСУВАННЯ БЕЗПІЛОТНИХ
ЛІТАЛЬНИХ СИСТЕМ ПІД ЧАС ВИРІШЕННЯ
ЗАДАЧ ЗЕМЛЕУСТРОЮ

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Анотація. Стаття присвячена порівняльному аналізу використання безпілотних літальних апаратів для вирішення задач землеустрою. Наукова праця висвітлює перспективи застосування безпілотних літальних систем під час здійснення локального моніторингу і необхідності врахування можливості використання безпілотних літальних систем різних типів у прийнятті управлінських рішень, для забезпечення їх максимальної ефективності в найкоротші терміни.

Окреслено проблему недостатньо обґрунтованого законодавчого базису, що може призвести до ускладнення використання безпілотних літальних апаратів через бюрократичні й корупційні схеми та негативний вплив на об'єкти особливого режиму використання.

Ключові слова: безпілотні літальні апарати, тимчасовий порядок використання повітряного простору України, землеустрої, дистанційне зондування Землі, управління земельними ресурсами

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**ПРИМЕНЕНИЕ БЕСПИЛОТНЫХ
ЛЕТАТЕЛЬНЫХ СИСТЕМ ПРИ РЕШЕНИИ
ЗАДАЧ ЗЕМЛЕУСТРОЙСТВА**

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Анотація. Стаття посвящена сравнительному анализу использования беспилотных летательных аппаратов для ре-

шения задач землеустройства. Научная работа освещает перспективы применения беспилотных летательных систем при осуществлении локального мониторинга и необходимости учета возможности использования беспилотных летательных систем различных типов в подготовке управленческих решений, для обеспечения их максимальной эффективности в кратчайшие сроки. Затронуты проблемы недостаточно обоснованного законодательного базиса, что может привести к усложнению использования беспилотных летательных аппаратов из-за бюрократических и коррупционных схем и негативного воздействия на объекты особого режима использования.

Ключевые слова: беспилотные летательные аппараты, временный порядок использования воздушного пространства Украины, землеустройство, дистанционное зондирование Земли, управление земельными ресурсами