THE PROCEDURE OF USING AERIAL PHOTOGRAPHS TO CREATE THE GRAPHIC PART OF LAND MANAGEMENT DOCUMENTATION

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Abstract

The article is devoted to the use of aerial surveying issue to create a graphic part of land management documentation. For each type of land management documentation, the scale of graphic materials of land management documentation is determined, as the scale depends on the task and the required accuracy of the work. It has been established that aerial surveying is the most effective method for creating (updating) basic graphic materials of land management documentation at the scales of 1:5 000, 1:2 000, 1:1 000, space imagery is used to create of maps on a scale of 1:5 000 in plains and 1:10 000 in mountainous areas. It was determined that the use of aerial photographs in solving land management problems is possible only after passing all stages of their preliminary processing: post-processing, rectification and an orthophoto plan creation. General recommendations have been developed regarding the use of aerial photography to create the graphic part of land management documentation: aerial photographs or space images should be used for a large area; aerial photographs – for displaying land management objects within the boundaries of settlements; space images – outside of populated areas, or at the stage of designing land management documentation or performing planning works.

Methodology of research and materials

The graphic part of land management documentation is performed using topographic maps and plans of various scales. At the same time, the scale of the cartographic material depends on the task and the required accuracy of the works. Figure 1 shows various land management objects and the approximate scale of the image in the graphic part of the land management documentation.

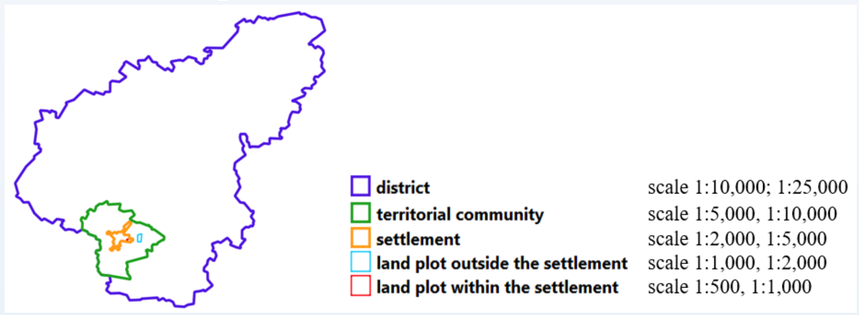

Fig 1. Land management objects and the approximate scale of the image in the graphic part of the land management documentation

The graphic part of the land management documentation (main drawings) can be on a scale from 1: 500 to 1: 25,000 depending on the type of documentation, location and area of the territory, and is compiled based on the results of cadastral surveys or available cartographic materials.

Aerospace imaging data can be divided into three groups according to the way of shooting:

- ✓ aerial photographs from digital cameras mounted on aircraft or helicopters;
- ✓ aerial photographs from digital cameras installed on unmanned aerial vehicles (UAVs);
- ✓ space pictures obtained from artificial satellites of the Earth.

To obtain images for end users (index block when using a stereo model or orthophotoplan), the original image necessarily undergoes photogrammetric processing using specialized software (Fig. 2).

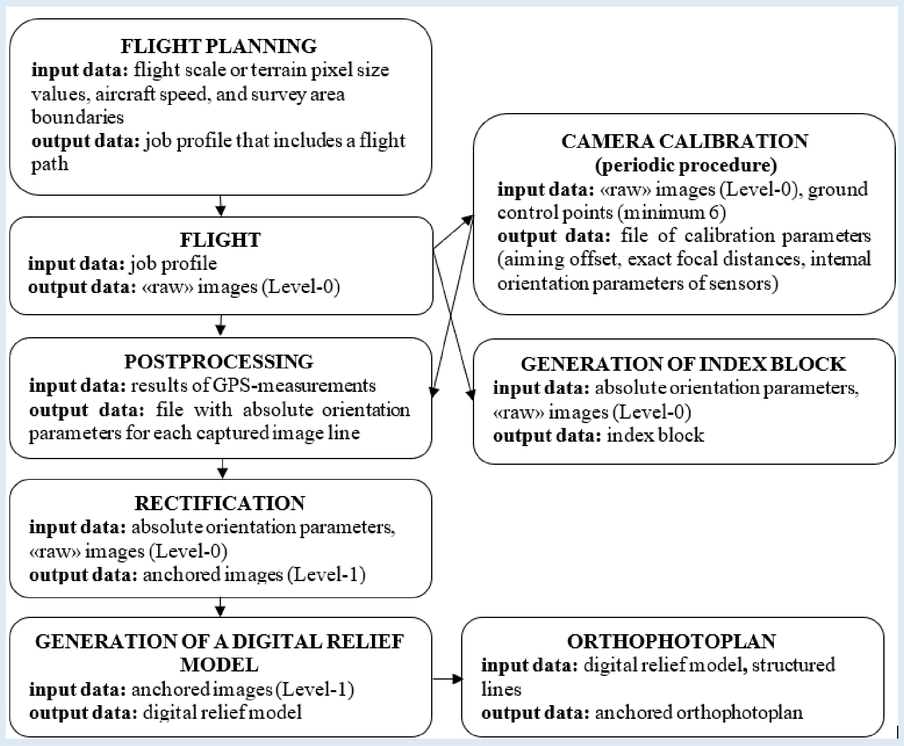

Fig. 2. Technological scheme of aerial photographs acquisition and photogrammetric processing

At the first stage of processing, flight GPS measurements are aligned together with measurements of base stations, at the second stage - automatic rectification of the original images using the data obtained at the first stage. The image obtained in this way is corrected for the angles of inclination and the trajectory of the aircraft and has a geodesic reference. At the third stage, stereo drawing of the situation (creation of a digital map) or creation of a digital relief model (DRM), orthophoto transformation and composition of mosaic orthophoto plans in a geodetic layout is performed.

At this stage the remote sensing methods, aerial surveying according to technical, economic and multifunctional characteristics development is still the most effective method of creating (updating) basic cartographic materials at the scales of 1:5,000, 1:2,000, 1:1,000 for solving problems cadastre and accounting of land resources, while ensuring a comprehensive approach to planning and functional organization of territories. Space images of high spatial capacity can be used to update only the contour part of maps at a scale of 1:5,000 in plains and 1:10,000 in mountainous terrain.

Discussions and results

So, let's assume that when using aerial photos, we receive graphic materials on a scale of 1:2,000, 1:1,000, and space photos on a scale of 1:5,000 and smaller, so the general recommendations for using data from aerospace photography are following:

1. aerial photos or space images are advisable to use when solving land management problems of a large territory;
2. aerial photographs are used to solve land management problems within settlements;
3. space images are used to solve land management problems outside settlements or at the stage of planning and designing land management documentation.

Recommendations for the use of aerial survey data during the development of the graphic part of specific land management documentation are given in the table 1.

Table 1

Recommendations on the use of aerial survey data for the development of the land management documentation graphic part

No.	Land management documentation	Recommended scale of the map (plan)	Aerospace survey data
1	2	3	4
1.	Land management schemes and technical and economic justifications for the use and protection of administrative-territorial units lands	1:10 000, 1:25 000	space images
2.	Land management projects regarding the establishment of territorial boundaries of territorial communities	not less than 1:10 000	space images / aerial photos
3.	Land management projects regarding the establishment (change) of administrative and territorial units borders	not less than 1:10 000	space images / aerial photos
4.	Urban planning documentation, which is also land management documentation (complex plans for the spatial development of territories of territorial communities, general plans of settlements, detailed plans of territories)	from 1:1 000 to 1:5 000	space images / aerial photos
5.	Land management projects regarding the organization and establishment of boundaries of the territories of the nature reserve fund and other nature conservation purposes, health, recreational, historical and cultural, forestry purposes, water fund lands and water protection zones, restrictions on the use of lands and their regime-forming objects	from 1:1 000 to 1:25 000	space images / aerial photos
6.	Land management projects regarding land privatization of state and communal agricultural enterprises, institutions and organizations	from 1:500 to 1:1 000	aerial photos
7.	Land management projects regarding the allocation of land plots	from 1:500 to 1:5 000	aerial photos
8.	Land management projects regarding the arrangement of the territory for urban planning needs	від 1:500 to 1:5 000	aerial photos
9.	Land management projects that provide ecological and economic substantiation of crop rotation and land management	not less than 1:10 000	space images
10.	Land management projects regarding the regulation of the settlements territory	from 1:500 to 1:5 000	space images / aerial photos
11.	Land management projects regarding the organization of the territory of land traces (shares)	from 1:5 000 to 1:10 000	space images / aerial photos
12.	Land management working projects	from 1:2000 to 1:25000	space images / aerial photos
13.	Technical documentation on land management regarding the establishment (restoration) of land plot boundaries naturally (on site)	from 1:500 to 1:5 000	aerial photos
14.	Technical documentation on land management regarding the establishment of the boundaries of the part of the land plot to which the rights of sublease, easement apply	from 1:500 to 1:5 000	aerial photos
15.	Technical documentation from the land surveying process and the association of land plots	from 1:500 to 1:5 000	aerial photos
16.	Technical documentation on land management regarding land inventory	from 1:1 000 to 1:25 000	space images / aerial photos
17.	Technical documentation on land management regarding the reservation of territories and objects valuable for inheritance	from 1:1 000 to 1:25 000	space images / aerial photos
18.	Technical documentation on regulatory monetary assessment of land plots	from 1:500 to 1:5 000	aerial photos

Conclusions and proposals

1. The successful solution of land management problems in the modern conditions of Ukraine requires constant updating and actualization of cartographic materials along with a reduction in the cost and labor intensity of works. The solution to the given problem requires the improvement of joint use areas at the stage of designing land management documentation of cadastral survey data, existing cartographic materials and aerospace survey data with the use of geoinformation systems.
2. The analysis of existing approaches to the use of aerospace survey data made it possible to establish that at this stage of the development of remote sensing methods, aerial surveying is the most effective method for creating (updating) basic cartographic materials at scales of 1 : 5,000, 1 : 2,000, 1 : 1,000 to solve cadastre problems and accounting for land resources while providing an integrated approach to planning and functional organization of territories. Space images can be used to update only the contour part of the 1 : 5,000 scale maps in plains and 1 : 10,000 in mountainous terrain.
3. The use of aerial photographs when creating the graphic part of land management documentation is possible only after passing all stages of preliminary processing: post-processing, rectification and creation of an orthophoto plan.
4. The approach of using aerial photographs during the formation of land management documentation graphic materials is based on general recommendations:

- − it is advisable to use aerial photographs or space photographs during the formation of graphic materials of land management documentation of a large territory;
- − aerial photographs are used during the formation of land management documentation graphic materials within settlements;
- − space images are used during the formation of land management documentation graphic materials outside of settlements, or at the stage of designing land management documentation or performing planned works.