

USE OF UAVs IN MINING

Brukhatsky A.I., student
Scientific supervisor – Yalovik E.I., senior lecturer
English language department №1
Belarusian National University of Technology
Minsk, Republic of Belarus

UAVs are unmanned aerial vehicles, which are autonomous robotic systems. The most important task of these advanced devices is to perform a flight according to a given program in automatic or semi-automatic mode. UAVs and ground-based unmanned technologies are increasingly penetrating various manufacturing and mining industries.

Since many processes in mining endanger human life and health, this is the area where automation of various tasks such as object observation, building 3D space models, researching disaster sites, underground mines, etc. is needed. It is dangerous and time-consuming to perform these tasks by human forces.

But unmanned aerial vehicles can cope with some problems of mining and geological prospecting without personal human participation. Today UAVs allow solving very important tasks for mining, for example: geological exploration and mapping - accurate, up-to-date geometric data on the surface of an open pit, section, mine; 3D space modelling - surface model with spatial resolution of 1 cm; round-the-clock control and protection of objects due to thermal imaging, infrared cameras and additional lighting devices; control of tailings dumps; exploration of underground and abandoned mines; ensuring safety of mining and labour protection; improvement of mining operations; improvement of the quality of mining operations. Drones perform these tasks with better quality and speed than other known methods. The use of drones in surveying can reduce the time of data collection and processing from several days to one hour [1].

UAV models of the earth's subsurface are more accurate and detailed than those obtained by ground surveys. Thanks to unmanned aerial systems, it is possible to gain full control over a mineral deposit. The surveying of quarries is done in great detail. The result is a detailed grid in centimetre spatial resolution. 3D models are formed by combining the

aerial survey from a UAV and the total station survey of the quarry, which is carried out from the ground. Using this data, the programme automatically calculates the extraction volume and the amount of losses. The condition of the quarry terrain can also be obtained from UAVs.

For timely preparation of mining technical documentation and monitoring of the mining process in open-pit mining, UAVs can be used at the stage of early detection of deviations in operation and emerging threats. Having created a digital model that reflects the current status of work, mining technicians can improve safety and reduce costs on control processes. Early detection of abnormalities and correct assessment of the quarry will ensure rapid response and more effective planning works.

Using an unmanned complex, it is possible to solve a number of research problems, for example, studying the dynamics of ventilation of quarries after blasting works, remote mapping of crack systems on quarry benches for the purpose of analysis stability of its sides. In addition to shooting in the visual range, it is possible to use multispectral sensors to solve problems such as searching for minerals, analysis of the rock composition of already discovered deposits [2].

The use of UAVs allows you to quickly and accurately map and monitor the territory of enterprises, as well as solve a wide range of mining and geodetic tasks, including volume calculations mine workings, performing land management work, constructing sections, searching for fracture zones and tying wells, creating large-scale cadastral and topographic plans.

In recent years, there has been a rapid development of UAVs in the mining industry. With the release of new aircraft, they are equipped with advanced optical and geodetic technologies that improve the quality of aerial photography.

References

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