UNMANNED AERIAL VEHICLES AND LOGISTICS

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ABSTRACT

The possibilities of unmanned aerial vehicles (drones) in the future micrologistics are analyzed. The foreign experience in the use of copters in the delivery of small cargoes is considered. The vectors of development of a similar technology in Russia have been determined. According to the authors, the integration of this type of transportation of goods will undoubtedly reduce costs and increase the speed of transportation of goods, which meets the basic characteristics of logistics. Like any revolutionary technology, this one is also connected with a number of legislative, information, and financial barriers that are to be overcome very soon.

Keywords: logistics, light-weight cargo, drones, copters, unmanned aerial vehicles.

Background. *Logistics naturally combines the scientific and applied aspects of economic and business activity, the system organization of commodity circulation. The tasks associated with the subject of its study correspond to five basic principles: to deliver the goods at the right time, in the right place, in the required quantity, quality and at the lowest cost.*

In this case, these principles are localized at the private level – in the so-called «fast logistics», that is, in a segment of the logistics market where a lightweight cargo (up to 20 kg) is transported within a single city. And first of all we will talk about the use of quadrocopters.

Objective. *The objective of the authors is to consider unmanned aerial vehicles and logistics.*

Methods. *The authors use general scientific methods, comparative analysis, evaluation approach, scientific description.*

Results. *Quadrocopter or «drone» is a structure consisting of a frame on which control units with electronics are installed, propellers, external stands of the apparatus (fixed or folding), video equipment. All new generation quadrocopters, or rather their frames, are made of lightweight and at the same time very durable material that provides rigidity of the structure. The lighter is the frame, the higher is the maneuverability of the aircraft. As the starting materials plastic, reinforced with fiberglass, carbon, textolite or aluminum are used. As for the body of the drone, it is also made of high-strength and shock-resistant polymers (Pic. 1).*

Special attention should be paid to the propellers of the drone, which, in tandem with electric motors, provide the tractive effort required for flight and various maneuvers. They also require reliable materials, since the probability of their deformation and breakage during collisions during flights is very high. Most often, manufacturers equip the devices with an additional set of propellers in the event of their failure [2].

An important role is played by external racks, the main purpose of which is to give stability to the aircraft on a horizontal plane when landing or stationary «standing». In addition, the racks in many quadrocopter designs are designed to protect the camcorder from possible mechanical damage both during flights and on land.

Aerial autonomous vehicles capable of lifting and moving cargo must have a movable center of gravity in order to balance the load, and a very precise light mechanical arm for capturing the load.

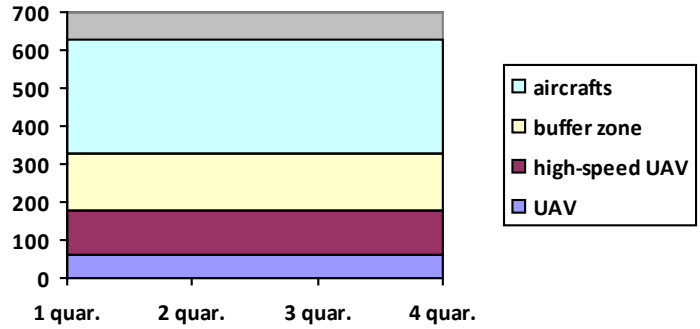
To date, the capabilities of flying drones can be realized in at least fifteen different fields of activity: transport, logistics, agro-industry, maintenance, construction, video control, security, information technology and so on.

The German company DHL in 2016 carried out pilot shipments of drones under the Parcelcopter SkyPort program, delivering packages from the German community of Reit im Winkl, located in the Bavarian Alps at an altitude of about 1200 meters above sea level. The delivery system was tested in real conditions, people brought their parcels to the automated postal station DHL Parcelcopter SkyPort. This facility with a small helipad at the top serves as a small post office. After installing the package, it is captured by Parcelcopter. Then the SkyPort's roof opens and the drones are sent with the cargo to their destination. The whole system works in automatic mode, without human intervention.

During the design of the drone, it was necessary to take into account the rapidly changing weather conditions in these parts of the Alps, so that the

Pic. 1. An example of a copter's structure.

Pic. 2. Delivery of goods by drones.



Pic. 3. Airspace sharing scheme.

Parcelcopter could resist them [1]. The DHL unmanned vehicle has the ability to climb vertically, like a helicopter, and then fly like an airplane. It is capable of supporting a speed of 70 km/h with a parcel weighing up to 2,2 kg, covering a distance of just over 8 km. This is almost twice as fast as the previous version of Parcelcopter, which reached a speed of 43 km/h (Pic. 2).

In the course of the tests it was established that the delivery of goods from the base station to the mountain plateau takes only eight minutes. A car ride on a mountain road takes 30 minutes. In the process of testing, 130 deliveries of packages were performed.

Russia, it should be noted, does not lag behind in terms of innovations in the sphere of UAV. According to the forecast of the expert group of the Agency for Strategic Initiatives, the global market of drones with the participation of our country will amount to more than $300 billion by 2035 [4].

A number of domestic companies in the sphere of information technologies actively disseminate the idea of using drones in the delivery of small parcels. In June 2015, one of the leading companies in the sphere of cellular communications delivered sim cards to about a thousand users in Moscow. In June 2014 in the city of Syktyvkar, the idea of delivering pizza by rones was realized. Today this company operates in 8 cities of Russia, the network's revenue is 180 million rubles a year.

The next step on the way to the introduction of a new technology for the delivery of goods by drones can be creation of a dedicated zone for them in the airspace, where drones must be dissected in speed and capabilities.

In today's busy airspace over airports and other complex areas, the advent of drones should be completely ruled out. At the same time, it is proposed to use high-speed routes for faster, long-range UAVs in a specially allocated space at an altitude of 60 to 120 meters, and leave a zone below 60 meters for relatively slow local-range devices (Pic. 3). It is proposed to make the zone from 120 to 150 meters as a buffer one, where there should not be any aircraft at all [3].

Conclusion. *Of course, the widespread introduction of such a technology is a laborious process. However, the development of UAV opens almost limitless possibilities for micro-logistics: it is easy to imagine how the road situation in the country will change if small-sized courier shipments (documentation, delivery of food, small goods) are taken over by autonomous aerial vehicles. As most recently, mobile phones were able to connect remote areas with traditional electronic communications infrastructure with the help of new electronic technologies, and drones are ready to lead to similar global positive consequences.*

Integration of this type of delivery of goods, of course, will reduce costs and increase the speed of delivery of goods, which meets the basic conceptual assumptions of logistics. Like any revolutionary technology, the system of drones-couriers will require the overcoming of many legislative, information, and financial barriers. However, advanced companies and the scientific community will surely overcome them in order to enrich the transport industry with a new and truly promising logistics tool.

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