UTILIZATION POSSIBILITIES OF UNMANNED AERIAL SYSTEMS IN POSTAL AND PARCEL SERVICES

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This article deals with the use of unmanned aerial systems in postal and delivery services. Unmanned systems are characterized by their classification and briefly closer to the possibility of using unmanned equipment are presented. An overview of the current state is created in the transport of mail and parcels and types of consignments. The achievements resulting from the choice of an appropriate UAV classification and financial analysis are applied in the design of the most appropriate options for the carriage of mail and mail systems.

K e y w o r d s: Unmanned Aerial Vehicle (UAV), Transport, Mail, Post

1 INTRODUCTION

Today's UAVs already comply with many of the specific tasks. From their use in the private sector, where they serve for military purposes, through fire and rescue component to scientific research or monitoring of poachers. Technological advances allow the UAV to compete with controlled aircraft.

The current air transport overinflation transport, particularly to end suffering, is the originator of the low capacity of some lines and airports, and on the other hand it is still constantly increasing volume of traffic. A solution could offer the use of UAVs in postal and delivery services.

The main objective is to propose the most suitable options for the use of UAVs in the international and regional transport for the carriage of postal and mail services.

2 CHARACTERISTICS OF THE UNMANNED TRANSPORT

UAV, the term originated in the USA in the 1970s was mainly used in robotics, photogrammetry, army, etc. The formal term for the unmanned aircraft is an English term Unmanned (or Uninhabited) Aerial Vehicle used under the abbreviation UAV. UAVs are in professional texts commonly also known as drone, RAC (Remotely Piloted Vehicle) or UAS (Unmanned Aerial System). **Chyba! Nenašiel sa žiaden zdroj odkazov.**

As the name indicates is a UAV aircraft without pilot. The word unmanned means a situation where the pilot is not on board the aircraft, but the aircraft is controlled from a remote station, either partially or fully automatically according to the defined route or by using a more complex dynamic of autonomous systems in advance. It is therefore imperative that the plane was managed by itself. There are a wide variety of UAV means in terms of shapes, sizes and characteristics.

2.1 The classification of UAV

In recent years, we can see real evidence of how the development of technology not only in the field of aerodynamics, but also of microelectronics, optics and navigation opened the way UAVs. Widely used is the concept from the aircraft lighter than air through the helicopters and the classic and the supporting surface. This also brings us to the division of UAV that can be classified in several ways. The most common classification belongs to the Division in accordance with the dimensions and the endurance UAV. [2]

Category	Weight (kg)	Flight Range (km)	Flight altitude (m)	Flight duration (hour)
Micro UAV	< 5	< 10	250	1
Mini UAV	<3 0	< 10	350	< 2
Close Range	25 - 150	10 – 30	3 000	2 – 4
Short Range	50 - 250	30 – 70	3 000	3 – 6
Medium Range	150 – 500	70 – 200	3 000 – 5 000	6 - 10
MR Endurance	500 – 1500	> 500	8000	10 – 18
Low Alt. Deep Penetration	250 – 2500	> 250	5000 – 9000	0,5 – 1
Low Alt. Long Penetration	12 – 25	> 500	3000	> 24
Medium Alt. Long Penetration	1500	500 – 750	5000 – 8000	24 – 48
High Alt. Long Penetration	2500 – 5000	> 250	20 000	24 – 48
Unm. Combat Aerial Vehicle	10 000	400	< 20 000	2

In addition, we can also be in contact with dividing the UAV based on weight, purpose, scope and propulsion and altitude, how to use, the mode of creation.

2.1 The use of UAV

The use of unmanned equipment offers wide options. Although the utilization possibilities of UAVs in the private sector are increasing, it seems that in a few decades the unmanned transport will be the main user of the airspace. Most UAVs are used for military purposes. They are especially useful in penetrating into areas that may be too dangerous for manned aircraft, in order to prevent their capture. It is also used to keep track of objects as static and moving targets, disposal. We can find them also in the police services. For example, in Canada

and the USA are being used in police work increasingly. Their use is questionable with regard to the possible abuse of personal data of air surveillance. Widespread deployment of UAVs will require legislative amendment. UAVs may be also applied to maritime search and rescue in hazardous areas, in dangerous conditions, or during natural disasters. It is used in the prevention and early detection of forest fires, and to monitor large-scale fires. The National Oceanic and Atmospheric Administration NOAA began using unmanned systems to observe hurricanes in 2006. Subsidiary in Australia designs and manufactures aircraft, which can fly to a hurricane and provide real time data directly to the national Hurricane Centre in Florida. British manufacturer also produced a variant of the UAV aircraft, which are designed specifically for scientific research in severe climatic conditions such as on Antarctica.

The potential use of the UAVs can be for example in archaeology. In Peru archaeologists use unmanned aircraft to speed up the surveying work and to protect the site from the illegal establishment of persons, builders and miners. It is interesting that in Japan and the Global Hawk unmanned aircraft-Hawk T used to obtain information about the damaged Fukushima No. 1 nuclear power plant in March 2011, which was destroyed by the tsunami. In Nepal and South Africa in 2012, the UAVs were used in the National Park for the tracking and to discourage poachers. Great application of UAV is also in the agricultural industry, where it is used for dusting and crop monitoring, monitoring of logging activities, inspection of the damage and the growth of the forest, finding the current status of biomass. The agricultural sector in the near future shows as one of the biggest customers. They can also be used to carry out geophysical surveys geomagnetic surveys, in particular, whether in the film industry. [3]

The Trend for the use of UAV technology is expanding rapidly due to increasing development.

3 CARRIAGE OF MAIL AND DELIVERIES

The importance of air transport in the mail today, whether from an economic perspective or the proportion of the total volume of traffic has declined significantly as compared to the early days of aviation. Of great significance from a technical point of view, and should be, because the capacity of the aircraft was very limited and a number of companies that have been in the 20 's and 30 's of the last century are specialized on the transport of mail. The advantage was that the carrier for such shipments had a relatively high turnover, which covers its operating and other costs. This new method of rapid transportation of mail has for its time rather great interest.

From an economic standpoint it is carried out on the basis of agreements with air carriers carriage of mail by postal services, which are awarded for compliance with the rules laid down by the air carriers and the world postal organisation between the UPU (Universal Postal Union) or between air carriers and the postal administrations of the country. Airlines are trying to ensure the agreed transport capacity to the erudite destinations in intervals. At present, the postal administrations offers a wide range of carriers from which you can choose the best combination of price, the highest reliability of service, or a lack of capacity.

All the procedures with regard to the transport and delivery of postal items, including items on agreed tariffs for the carriage of the carrier and takes the individual species (letter, parcel, express and others according to the specific situation) are precisely regulated. Upload the content of each individual letter is specified in the document titled Postal Bordeau.

The proportion of transport air mail and shipments in the total volume of air traffic is not negligible. The total volume of sales for the transport of mail and parcels with regular classic air carriers varies around 1 % of the total transport turnover. Low-cost carriers usually do not offer mail service. [4]

The use of air transport is definitely the fastest type of classic mail transport at a greater distance. Air transport is sometimes the only option seems to be the shipment to the destination, especially while it is a destination overseas. Numerous smaller companies provide national and international courier services. The largest shipping companies are Federal Express, DHL Express and UPS.

Postal item may take the form of:

- leaf consignments
- package,
- periodic consignments,
- postal-card.

Types of items:

- business consignment,
- official consignment,
- registered mail,
- letter,
- international shipment,
- braille shipment,
- registered mail. [5]

The difference between consignment and cash on delivery is that by receiving of the shipment must be the recipient`s identity proofed and the sender has a "paper" about the fact that the shipment was actually received. Postage for shipment or consignment pays sender. By cash on delivery pays the receiver price set by the sender.

Specific types of transport mail and shipments, according to the IATA Handbook – Goods Regulations (DGR) Dangerous include:

- shipments with extreme weight and large shipment (to be judged according to whether they fit into the cargo hold of the aircraft. The shipment may be handled only up to the maximum load of the aircraft. IATA has set the formula for calculating shipping by weight:

$$\frac{lenght[cm]xwidth[cm]xheight[cm]}{6000}$$

- valuable items,
- shipments of perishable shipments of flowers and plants,
- fragile and easily breakable items.

In the classic shipments of costly air transport for one piece is considered to be one package, box, boxes, etc. Usually, the maximum weight of the classic consignment is up to 50 kg. The calculation of that amount is then 2 x + 2 x width + length < 3 m. [6]

4 THE USE OF UAV IN THE TRANSPORT OF MAIL AND PARCELS

Before proposing the most appropriate options for the use of UAVS in the international and regional transport, we need to take account of the criteria for the selection of appropriate means and in particular:

- the requirement for speed of delivery of mail or parcels,
- risk of damage to the consignment,
- the regularity,
- the cost of delivery,
- the quantity and size of the consignments transported and the associated handling,
- packaging,
- the properties of the substrate,
- shipping distance and the direction of traffic,
- climatic conditions,
- technical parameters-performance,
- legislative requirements,
- the environmental impact,
- any additional requirements.

4.1 Financial analysis of UAV

At present, there is a question whether the UASs are more cost effective than often aircraft with the crew. Compare the hourly cost of airfreight with the cost of unmanned aircraft, the classic is not easy, because there is no standardized and recognized protocol for calculating the costs of the flight hour. However, there are a number of ways such as cost per flight hour may be calculated due to changing metrics that can be included in this calculation.

This issue is also important because more and more are used in some countries in domestic traffic UAS. Price per hour can dramatically drop in support of future customers. In addition, it is likely that customers may be more interested in hiring by the hour and not by the purchase of a separate platform.

However the comparison of the cost of an hour is very difficult. There are a number of reasons why the UAVs are hardly comparable with the human crew as for example:

- different altitude/distance – aircraft with crew are usually required to fly at higher altitudes due to security and legal factors, such as whether, from an economic point of view,
- UAS can fly only in the currently logistics – national space while manned space aircraft also carry out the international carriage,
- maintenance-need to UAS is generally much smaller than aircraft with crew,
- operator/pilot options, and the risks to pilots in the air are greater and other than options for UAS pilots,
- processing – pilot in the air can visually process information, therefore, as he sees it, while the necessary data must be processed by a variety of means of communication and the UAS sensors,
- weather and traffic, weather and time limitations may restrict the sensor as well as unmanned aircraft piloted,
- impact on the data from the aircraft's ability to fly at night and the sound – and under different weather conditions, changing the quality of the recorded data. Quantification of this difference can be very difficult.

The main advantage of unmanned assets compared with the human crew is that unmanned aircraft can be used in risk situations, without endangering human life in inaccessible areas. Most of the non-commercial available UAV market focuses on low price because the main advantage of using a UAV is a factor of cost and operating costs, which are much cheaper than the use of piloted aircraft. Savings starts already in the training of the operator even if some do not need this, since it can fly quite separately after a pre-set route in advance and fulfil the intended task. If you have some type of operator can control multiple machines at the same time is required.

Other advantages are:

- easy handling and mobility,
- high flexibility in terms of their use,
- the possible use in the hard to reach places (from the take-off and landing point of view),
- low noise operation ,
- high resolution images and videos,
- other potential benefits of the acquisition of data,
- the ability to use resources in inaccessible places,
- lower air pollution compared to the classic cargo shipment, ,
- some UAV miniaturisation saw less load-sensors, computers, communications,
- smaller UAVs are capable of performing the same functions as most of the UAV.

4.1 The application of the most appropriate options for the use of UAV

Looking at the different categories of UAVs and their representatives it is probably that not all UAVs can be used for the carriage of mail and parcels. If we focus on the nano UAVs it is clearly seen, that their use for the

transport of consignments and mail is unrealistic due to their minimal to no load. Also, their hours of operation and the impact are very small. It would be very inefficient to such transports one or two sheets of 5 g of the UAV.

The use of micro and mini UAV transport is the most difficult to complete. It's not because of technical limitations as some micro and mini UAVs are able to fly up to two hours with a load capacity of 2 kg, but this is mainly a problem for finding the identity of the addressee, signing transposed mail, registered letters and the like. AeroSight company in the UK came last year with the idea of using UAVs to deliver pizza. On the Internet a video was published in which pilotless delivery was realised at a great distance. Such use is currently unrealistic owing to the FAA rules and still continuing classification of airspace for UAVS. FAA rules pertaining to unmanned means clearly indicate that at the moment there are no available funds, which would be able to obtain permission for commercial use of UAVs in the NAS (National Airspace System) however is the ability to ask for "experimental" certificate for the purposes of research and the development of the UAV. In addition to the previous application possibility the AeroSight company came with the idea to use UAVS to transport foodstuffs and society of Minnesota. Its genius lies in the delivery of beer supply in the frozen ponds to fishermen. A week after the publication of the video on the Internet, the FAA announced that the company has violated all kinds of codes, and the operation of the equipment is prohibited. In the London sushi restaurant delivers food from the kitchen to the table a new method tried using unmanned UAV. [7]

If we focus on the MALE and HALE UAV we can split them up into two parts. The first is the use of UAVS as an alternative to the current aviation. These would include international shipping, transport over longer distances, a greater volume of shipments, taking advantage of the large UAVS. It is, therefore, a need to have available, schedule stopovers at airports to prevent a conflict with the aircraft and re-fuelling infringements. All of this would be possible gradually to implement well the primary task is already several times mentioned the need for the integration of UAVs in the airspace.

The second is the use of UAVs in the regional transport. These would include national transport operations where the use of smaller UAV resources, which are not on the take-off and landing, and there is no need for an airport here. Transportation could also take place among different warehouses the shipping companies or between the post offices in the region.

However the utilization of UAVs is now limited not only by the lack of rules and legislation, but also by the technical limitations, which include reliable navigation systems, sense and avoid systems, communication systems, failure detection and monitoring systems [8] and also safety and rescue systems [9], which should be integrated in the UAV construction.

5 CONCLUSION

UAVs are nothing new, but their use is nowadays limited mainly to military purposes. Their massive use in civil applications restricted mainly by the lack of rules and legislation.

The aim of this article was to determine the possibility of using unmanned systems in postal and delivery services. On the basis of the available information it was found that the use of UAVs in the transport of mail and parcels is now unrealistic but in the future there will be a need to make few steps to ensure that their operation will be legal and also safe without the risk of for example communication lost, hijacks or on-board system failure.

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