Chapter 66
Delivery of Special Cargoes Using the Unmanned Aerial Vehicles

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ABSTRACT

This chapter presents the role, functions, and prospects of civil unmanned aerial vehicles development, as well as technical and regulatory barriers to the introduction of unmanned aircraft into special cargo transportation technology. The authors' main idea is that the degree of UAV involvement in freight traffic will continue to grow rapidly as the range of UAV flight and carrying capacity increases, and the air law is liberalized. It is proposed to evaluate the economic efficiency of UAV application and their share in the market for the transportation of urgent and perishable goods using the methodology based on the principles of logistics and mathematical modeling. In the formulated model, the process of special cargoes delivery by unmanned aerial vehicles is integrated into the supply chain by all modes of transport along the set route network, taking into account the requirements formulated by the freight forwarder, carrier, and logistics company.

INTRODUCTION

The world economy globalization and the processes connected with this phenomenon largely influenced the overall structure of the world markets of air transportation and freight forwarding, including those requiring special delivery and storage conditions. On the one hand, the Freight Forwarding Companies

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(FFC) have significantly expanded the range of services. On the other hand, the client's demands for the goods delivery have increased, in particular in terms of comprehensive services, the full responsibility of the FFC for delivery management, shipment processing, formalities, cargo collection and consolidation etc.

Special, perishable and dangerous goods delivery is a popular and interesting market segment for FFC. To ensure effective delivery of special cargo, it is required to consider the whole chain of cargo delivery and take steps to minimize the time of goods delivery. This requirement is particularly important for regions with poorly developed transport connections, where it is unfeasible to use the charter flights or aviation. However, as it often happens in business, the relevant solution to the problem was found in military aviation, which has been using unmanned aerial vehicles (UAVs) in its operations for a long time. The civil UAV test flights performed in some countries of Europe, Africa, and Asia with the aim of medicines delivery to inaccessible communities and food (pizza, beer) supply to the vicinity of the city were done with minimal costs and minimal risks (Domino's, 2016, Bryan, Char, 2014, Rosen, 2017).

The objectives of this chapter are to educate the reader with information concerning theoretical and methodological approaches and practical recommendations for managing the economic efficiency of multimodal delivery of special cargoes with an emphasis on the capabilities and prospects of using UAVs. To achieve this goal, the following sequence of studies is determined:

1. About the present and future of UAV.
2. Role of UAV in forwarding operations.
3. Special cargo delivery modeling.

The authors of this work are not deluded by numerous iridescent publications in the media about the fast and widespread use of UAVs in many spheres of our life and, first of all, in the goods transportation. There are many barriers, which should be overcome in this unquestionably innovative direction, namely the technical, organizational and economic ones. The most important barrier is the regulatory one. Carriers and FFCs, apparently, should not waste time in anticipation of the final version of the legislation on UAV flights regulation, but to prepare for such a desired invasion of drones in advance.

BACKGROUND

21st century aviation is the unmanned aviation era. The impetus to the intensive development of unmanned aviation, as well as many other high-tech branches of engineering science, was the widespread use of unmanned aerial vehicles in the armed forces of the United States, Israel and other countries. More than 100 years ago, Nikola Tesla developed and demonstrated a miniature radio-controlled vessel (Cheney, 2001). Since then, the theory and practice of unmanned aviation has made a huge leap from the unmanned aerial vehicle to the unmanned aerial system. For clarity, some core definitions are specified below.

According to the ICAO Doc 9854 (2005), unmanned aerial vehicle is a pilotless aircraft in the sense of Article 8 of the Convention on International Civil Aviation, which is flown without a pilot-in-command on-board and is either remotely and fully controlled from another place (ground, another aircraft, space) or programmed and fully autonomous. An unmanned aerial system (UAS) includes not only the UAV, but also additional components, such as an autonomous or human-operated control system, a command and control system, technical personnel, software, means of integration with other systems, technical and