

# **Concept of an IT system for strategic goods air transport management**

## **Abstract**

Air transport of arms and dual-use goods is a highly complex and important issue that has been poorly recognized so far, and thus inadequately supported by various scientific analysis methods and IT tools. While some applications exist that are (or potentially could be) used in this domain, these are fragmentary solutions that lack many key, necessary functionalities.

The lack of specialized, comprehensive software supporting companies in managing air transport of strategic goods creates a problematic situation that requires urgent attention. A similar problem affects the military sector, which currently has only partial IT support, unable to fully meet all the needs of the armed forces in terms of automation and appropriate decision-making and operational process support.

Research has shown that the commercial sector needs modern, advanced, comprehensive software that will streamline various aspects of activities in this area, while helping to meet the requirements of achieving increasingly higher levels of service quality and customer support. The target IT system should also contribute to minimizing the risk associated with non-compliance with regulations imposed by restrictive mechanisms established to exercise proper control over the flow of strategic goods. It is therefore necessary to develop an appropriate concept for a dedicated solution that can be implemented and deployed in the future. Moreover, considering that timely and effective execution of strategic goods air transport tasks by the Polish Armed Forces is essential for realizing national security interests, it is necessary to develop appropriate software functionalities that will optimize resource utilization and strengthen the operational capabilities of military stakeholders in this critical area.

The main objective of the dissertation was to identify needs in the field of IT support for managing air transport processes of strategic goods, and to formulate a concept

for a dedicated IT system that would improve the planning, organization, and control of the processes under consideration.

The introduction to the work includes a description of the problematic situation and justification for the topic selection, presents the research objective, research problems, and the adopted methodological approach, along with justification for the need for an interdisciplinary approach to solving the undertaken scientific problem.

The first chapter presents the theoretical foundations of management and its IT support. It outlines the genesis of management sciences, cites definitions of management and the management process considered on the grounds of cybernetics. It also explains the concepts of command, the *Command and Control* process, and points to the necessity of developing dedicated software.

The second chapter provides a comprehensive overview of the topics that introduce the undertaken research area. It describes what air transport is, what functions it fulfills, and characterizes the airspace it uses. It explains the specifics of strategic goods, presents the topic of trade in such goods, and established national and global control mechanisms to safeguard against their uncontrolled proliferation. This chapter concludes with a concise presentation of the process of air transport of strategic goods.

The third section of the dissertation presents a comprehensive review of existing software solutions that offer support in managing air cargo transport, with a particular emphasis on the transportation of goods of strategic importance. Both commercial solutions and military systems were analyzed. Their functionalities and applications were discussed, and the different specifics of tools dedicated to these sectors were shown. The in-depth presentation of selected applications aims to familiarize the reader with the complexity of the issues, as well as to show the practical application of these systems in the daily work of specialists using them.

The most important part of the dissertation is the fourth chapter. It contains a detailed concept of a dedicated IT system created based on conducted research. The proposed project is an original and comprehensive solution designed to assist civilian and military stakeholders in their daily work. Its functional scope concerns, among others, planning air routes, monitoring shipments and flights in real-time, or searching denial lists. Functionalities aimed at limiting the risk associated with participation in the trade of cargo of special importance and allowing better management of environmental requirements that the aviation sector

is strictly subject to were also proposed here. The final part of this chapter is devoted to system functionalities intended for strictly military applications. They take into account that the armed forces, in special situations, are forced to carry out tasks in an environment prone to deliberate destruction (both physical and informational) and perform specific types of transport missions, such as airdrop operations. Particularly noteworthy here is the design of a land and air situation visualization module, envisioned as an advanced data integrator from various sources, which can serve as a basis for providing situational awareness, which is extremely important in the military field.

The final chapter provides a synthetic summary of the achieved research results, indicates directions for future work, and outlines how to utilize the potential of artificial intelligence in the further development of the target software.

The research objective has been achieved. The presented work is of an applicative nature, combining theoretical foundations with specific implementation proposals. The presented, original and innovative solution can be implemented and put into use in real operational conditions in the future, contributing to improving the overall efficiency and safety of air transport of strategic goods.

The knowledge systematized in the dissertation and the proposed concept of a dedicated IT system can also become a starting point for further research, as well as inspire the development of similar systems in other branches of transport.