

SUMMARY

The subject of the research undertaken as part of this dissertation is the system of safe use of unmanned aerial vehicles, including the correct flow of traffic in the airspace, care for maintaining the uninterrupted operations of airport infrastructure systems, as well as systems installed on aircraft. The analysis of issues within the scope of the undertaken topic focuses on the assessment of the possibility of implementing appropriate remedial measures in order to maintain the required level of aviation safety in the conditions of UAVs operations. The undertaken research is intended to identify concepts for minimizing the risk of airspace security violations by UAVs.

In order to justify the undertaken research, the existence of current gaps in science: theoretical and utilitarian was indicated. In relation to the theoretical gap, it was stated that despite the increasing level of knowledge, the growing number of scientific studies and the evolution in literature in the context of opportunities and threats resulting from drone mobility, we still cannot learn much about a reliable solution that would allow us to control the intentions of UAVs operators, effectively draw consequences for their use incompatible with the regulations, limit access to technologically advanced and equipped with hazardous materials UAVs. The development of legislation in this matter still does not ensure an acceptable level of safety. We are not able to determine the algorithm of action of both professional and amateur operators at the sales stage. The ethical aspect was also emphasized as a motivational factor for undertaking research. In the area of the utilitarian gap, the lack of a tool, a scheme of action in the case of illegal UAVs usage was defined. In addition, the need to expand the powers in the area of dealing with sanctions in the event of incorrect use of a drone was indicated. It is necessary to provide methods of ensuring safety, mainly related to estimating and eliminating risks at an early stage.

The cognitive aim of the dissertation is to identify opportunities and threats resulting from the use of UAVs in the context of aviation safety. The utilitarian goal is to develop a concept for the use of UAVs in ensuring aviation safety.

The main research problem was defined as follows: How should unmanned aerial vehicles be used to ensure aviation safety? The formula of the research question poses the task of analyzing current branches of application and directions of evolution of unmanned devices.

The main hypothesis formulated on the basis of the above-mentioned research problem is: UAVs should be used to ensure the highest level of aviation safety, which mainly depends on the competence of the personnel and moreover on:

- the dynamics of the new unmanned technologies development against the background of the aviation safety concept,*
- monitoring the registration and use of UAVs in order to achieve an acceptable level of aviation safety,*
- the evolution of changes in the aviation safety system due to the multidirectional nature of the application branches,*
- the implementation of countermeasures to prevent dangerous activities.*

The detailed problems were defined as follows:

- 1. How do current aviation safety concepts take into account new technologies related to the use of UAVs?*
- 2. What are the consequences for aviation safety resulting from the dynamics of UAVs use?*
- 3. To what extent are modern aviation safety systems efficient in relation to the operability of UAVs in airspace?*
- 4. What changes should be introduced to maintain the desired level of civil aviation safety in the conditions of UAVs operability?*

Taking into consideration the above-mentioned problems, the following detailed hypotheses were formulated:

- 1. Currently used (national) aviation safety concepts do not sufficiently take into account new technologies related to the UAVs usage.*

2. *The dynamics of UAVs use including its multidirectionality generates a number of opportunities and threats to aviation safety.*
3. *Modern flight safety systems are not efficient in relation to the constantly expanding branches of UAVs use.*
4. *In order to maintain the desired level of civil aviation safety in the conditions of UAVs operational use it is necessary to strive the implementation of a system based on new technologies, countermeasures with a wider spectrum of action and conduct stricter rules for operators, regulated by law.*

In accordance with the adopted research methodology, in the course of this dissertation, the indicated dependent variable is: the impact of UAVs on aviation safety. The independent variable is specified as: the environment of UAVs use.

The following theoretical methods were used in the research process: analysis, SWOT analysis, risk analysis, synthesis, definition, analogy, induction and deduction. In terms of empirical methods, the following were carried out: observation, diagnostic survey - survey using an expert sample and individual in-depth interviews with experts.

The first chapter presents the conceptual outline of the dissertation. The selection of the undertaken research was justified, the subject and purpose of the research were discussed. Research problems, hypotheses and variables with their indicators were indicated. Research methods and techniques were specified. The course of the conducted research was described in detail.

The second chapter explains the theoretical aspects of aviation safety, including the origins and stages of development of the issue. An analysis of the current state of knowledge in the field of aviation and unmanned aircraft safety was carried out. The development of the aviation safety paradigm and the causal models of aviation accidents were presented. The chapter contains a list of applicable legal acts determining the rules for the safe use of unmanned technologies.

The third chapter concerns risk analysis related to the operability of unmanned aerial vehicles in airspace. The chapter presents the theoretical foundations of risk identification and assessment. Dedicated methodologies were presented, criteria for proper risk analysis related to the studied domain area were defined.

The content of the fourth chapter is the assessment of the current safety system for unmanned aircraft flights. The chapter analyzes current threats to aviation and indicates the results of observations relating to incidents involving UAVs. Statistical data in the area of accidents were compiled and conceptual conclusions were formulated. An algorithm for constructing an FPV (First Person View) drone ready for tactical operations was presented. An attempt was made to forecast new threats in relation to develop the implementation of unmanned technologies.

Chapter five is a summary of the undertaken scientific investigations. The results of the survey research and the effects of interviews with experts were presented. The utilitarian and conceptual conclusions obtained in the research allowed for the design of a sales application. Chapter five closes a series of research works by evaluating the undertaken research, concluding the topic with an indication of solutions in the form of concept.

The analysis of the research results made it possible to identify priorities in terms of remedial measures, the possibility of implementing restrictions for private users and the purposefulness of changes in the system. In relation to the aspect of originality and innovation in solving the scientific problem, a sales control tool was developed in the form of a mobile application. In light of the obtained effects, it was determined that the elements most difficult to verify are constantly the intentions of the operators' actions and the autonomy of the independent construction of devices. The need for continuous prevention in relation to the subject and the implementation of security system seals was indicated. Regarding to the research results, confirmation of the concept assumptions was obtained and elementary solutions in the matter of security protection were developed.