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Mini Review

Analysis of Possible Risks in Aviation Safety Issues Associated with the Massive Introduction of Unmanned Aerial Systems

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Abstract

In the period of rapid development of modern technologies and Remotely Piloted Unmanned Aircraft (*RPUA*), that are swiftly entering into all areas of human activity, including aviation, we are confronted with the new risks that will increase in the future and have a major impact on the aviation safety. One of the measures that could help us to avoid them in the future is the implementation of automation in the safety management system.

Keywords: Flight safety; Risk assessment; Remotely Piloted unmanned aircraft; Safety management; Automation

Future Aviation

According to the JARUS (*Joint Authorities for Rulemaking of Unmanned Systems*) research, two types of aircraft will be used for air transport in the future: manned and remotely piloted aircrafts [1]. Due to the technological advances and increased reliability of the equipment, there will be a gradual transition to the most efficient system, which is RPUAS (*Unmanned Aerial Systems with Remote Control*).

Looking at the summary of the SESAR (Single European Sky ATM Research) study [2], we can conclude that RPUA (*Remotely Piloted Unmanned Aircraft*) will be actively used in both controlled and non-controlled airspace. The largest use of RPUA is expected in populated areas, which will pose a threat to residents and infrastructure. Besides the technological innovations in RPUAS the other factors will have an impact on the aviation safety:

- supersonic aircraft, operations above FL 600, and commercial space flights are going to be developed [3],
- the number and diversity of RPUA's users will increase,
- future airspace users will have access to huge amount of information that they will receive from an aircraft, airspace management equipment and they will not be able to process it independently,
- The safety of flight equipment and the airspace management model will also play an important role in ensuring flight safety, which by 2050 will be almost or completely switched to automation [4], where the human/operator will only perform control functions,
- work is underway on the U-space [5], an airspace management automation project at RPUAS.

Currently, there is no common RPUA classification, but to ensure a consistent approach across the studies, JARUS has developed a RPUA's classification based on the potential risks that RPUA may pose during its use [1]. Operational risks are classified on the basis of potential damages that may be caused by the use of RPUA and are divided into the following categories: low, medium and high risk.

In accordance with this classification, specialized procedures, restrictions, standardization in their manufacture, certification of aircraft and operators, and continuing airworthiness will be used to ensure operational risk mitigation. However, it will become difficult to control and manage such a system with today's accepted safety management methods in aviation. Taking in the account the future emphases on digitalization, would be good idea to design the classification based on level of automatization of the RPUAS.

Analysis of the Future Risks

Obviously, aviation will remain one of the safer transport providers because it is achieved through a great deal of work on safety issues. Operational risks of RPUA that are defined by JARUS [1], can be mitigated with the current system of safety management. However, in addition to the operational risks, we also have to consider other types of risk factors and some of them will be related with the implementation of automation.

According to the ICAO Safety Management Manual, today the maintenance of aviation safety is based on traditional and modern methods [6]. In assessing both approaches, it is necessary to add that both of them would continue to play an important role in the future. The number of risk factors affecting aviation safety will increase and automation will be required to successfully control them. Additionally, the likelihood of some risks is very low, and considering the future development of aviation with the integration of RPUAS, the potential level of threat and possible damage that they can cause, is very high.

EASA is recommending for RPUA to use a method for assessing and mitigating risks based on the probability of the risk and the extent of the damage. Given the assumptions discussed above, such a method will not provide a full analysis of all risks. Analyzing them, it would be necessary to look at the effectiveness of the complex system as a whole, considering a number of factors that we may not even know at the moment. The main task of the theory of system safety is to predict disasters that occur in structurally complex systems with a probability of "almost zero".

Moreover, it is important to remember that most of the aviation system will move to automation and the user will have a large amount of information, which will make it quite difficult to apprehend and process. The only way to solve this complex issue is to upgrade a proactive safety management system with automation, as there already are mathematical models that can assess risks.

Nonetheless, the human factor will be decisive in the future, as it is the person who will carry out the automation in practice, namely developing and building aircraft, equipment and software.

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Conflict of Interest

No conflict of interest.

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