OPERATIONAL RISK MANAGEMENT AS A KEY ELEMENT OF FLIGHT PLANNING AND MONITORING

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This article presents selected theoretical and practical aspects that are related to operational risk management during preparing and performing aviation tasks. The concept of operational risk has been defined in the article. The stages of risk management process have been described, along with the rules to follow by aircraft crews in everyday aviation practice. The authors also referred to a number of elements of operational risk assessment from the perspective of flight planning and monitoring. An example of what may result from neglecting the operational risk assessment by the aircraft crew is given.

K e y w o r d s: safety in aviation, operational risk management

1. INTRODUCTION

People often decide to take some risk in order to achieve a goal or obtain some benefits. It happens every now and then that we make a mistake in our calculations and pay a very high price as a result. But there are always people willing to take the risk. The facts that attest to this are plentiful in mass media. In aviation, ever since its inception, the risk taken by the man has always been very high. This resulted above all from the defects and imperfections in aviation equipment and constructions used by Icarus's followers in their quest to conquer the skies. The reason for the high risk was also the lack of proper experience. As technology progressed, the aircraft constructions were becoming better, more perfect and less unreliable. Improvements in the training of aviation personnel corresponded to the increase in piloting skills in aircraft crews. But the number of unwelcome incidents was still too big. Better equipment meant new possibilities, and these together with better skills of the pilots signified new challenges in the area of safety. Each new technical development, that presented new possibilities, caused crossing further limits, and this was often related to risk levels that were unacceptable. More and more voices were heard advocating for finding more effective ways to avoid existing threats or to neutralize them to an acceptable level, thus increasing safety in pursuing aviation tasks. The economic factor also played an important role in growing interest in risk analysis [4]. And it was not only related to the risk of losing (destroying) an aircraft which was worth quite a deal of money. In case of air operators it was connected with losing potential passengers, who would avoid flying with an unreliable airline. This has led to air operators starting developing effective ways to increase safety in aviation operations. One of the core ways is undoubtedly following efficient methods by aircraft crews in operational risk management during preparation of, and performing aviation tasks.

2. THE CONCEPT OF OPERATIONAL RISK MANAGEMENT IN AVIATION

Operational risk management is currently one of the key elements that affect the safety level in air operations. The operational risk is usually defined as the state, or an object, with the potential to bring about injuries to personnel or damage to the equipment/construction, or to cause losing the substance, or to reduce the capability to perform initially assigned tasks. The risk is regarded as a normal component of a sociotechnical system, the man – aircraft – environment – organization aviation system. As such, the risk is not a "bad" thing. It does not always have to be conceived as a negative, destructive element of the system. It is assumed that the risk may pose a threat while performing tasks when it gets into unwanted interactions. It is then, that the risk's destructive potential may become a hazard for the acceptable level of safety in air operations.

The process of risk management, which is interpreted and implemented correctly, usually helps towards avoiding, eliminating, or mitigating threats that arise in connection with air operations. At present, the situation is that risk management is gradually becoming a new science, which is closely related to safety in aviation. This approach let people develop specific rules and tools that are used to identify, determine the likelihood of risk and the threat potential, and mitigate a risk of a given level. Three basic levels of risk have been highlighted in the subject's literature:

1. Unacceptable risk Should unacceptable risk occur during preparing or conducting an air mission, the most frequent method of avoiding it is aborting the mission. If the circumstances permit (e.g. the crew has sufficient time and resources), it is advisable to make use of proper tools and methods in order to reduce the risk to an acceptable or tolerable level.

2. Tolerable risk. We talk about tolerable risk if the likelihood of occurrence and the severity of consequences that result from appearing of the threat are being monitored by the aircraft crew, that is, the risk is under constant observation by the crew, and it is possible, if necessary, to implement appropriate strategies and activities in order to reduce the risk to a desirable level.

3. Acceptable risk. In other words it is a satisfying risk from the perspective of safety and objective of the mission. It means that the likelihood of a specific threat or the severity of its consequences does not pose a threat to the safety and objective of the mission. It must be stressed that if the risk has previously been reduced to an acceptable level, it requires regular

supervision by the crew. Only this approach will allow to keep the risk at an acceptable level. [5]

3. THE STAGES IN OPERATIONAL RISK MANAGEMENT

The risk management models that are accepted and based on the theory of management in organizations, have formed a common model for managing risk in Polish Air Force (Fig. 1).

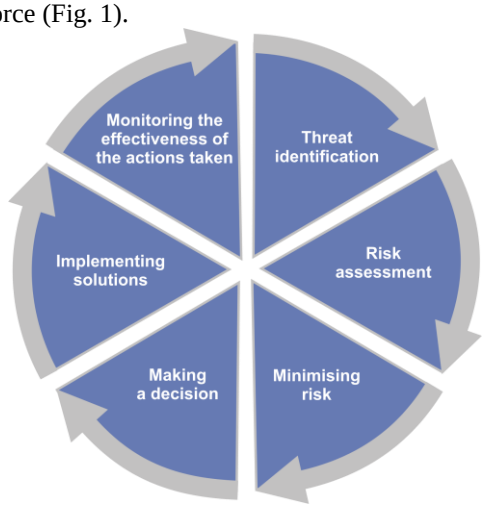

Fig. 1. Six stages in risk management. Authors´ own work on the basis of [5]

Based on these models, the sequence of cyclical stages has been singled out. Each of these stages is important for the whole of risk management process and therefore cannot be ignored. The frequency of the respective cycles is dependent on the dynamics of change in the environment of aviation tasks, that is, on the occurrence of factors that may result in the threat moving away from the acceptable or tolerable level.

Stage I. Threat identification – involves using the appropriate identification techniques used to determine threats that are related to performing aviation tasks. It comprises the task analysis and determining the list of threats and causes. The threat may be defined as any existing or potential factor that may cause difficulty in performing the task with regard to safety and the objection of the task. The basic factors to be considered while identifying threats include: the factors related to the construction of the aircraft, operating procedures and practices, aircraft communication, the human factor with its abilities and limitations, the psychophysical state of the crew, the organizational factors including those related to safety and quality policy, the physical factors related to working environment (noise, temperature, atmospheric pressure, lighting etc.), the factors related to following the policy, and the factors related to using appropriate detection and warning systems (e.g. malfunction of flight equipment and systems).

Stage II. Risk assessment – it consists in using quantitative and qualitative risk measures in order to determine the likelihood of risk, and the severity of adverse effects resulting from it, that may cause potential losses. This stage comprises four basic elements – the assessment of threats with regard to exposure, the assessment of the likelihood of a risk occurring, the assessment of the severity of a risk, and the total assessment of the risk.

Stage III. Minimising risk – it boils down to the assessment of possible ways to reduce the risk or to eliminate it. This stage comprises three basic elements: determining possible ways to resolve a problem that results from the risk level, determining the effects of implementing solutions, and the prioritisation of ways to reduce a risk. It is assumed that effective risk reduction helps towards minimising at least one basic factor that is used to describe the risk – the likelihood, the severity, or the exposure.

Stage IV. Making a decision – it consists in running a decision process on a suitable aviation task management level. This stage boils down to the selection of a method for controlling the risk and to making a decision. This process is based on a comprehensive analysis to choose the most effective solutions based on *four basic rules of risk management*. They are: do not accept unnecessary risk, accept the risk if benefits are greater than potential losses, make decisions related to a given risk on a suitable level, and finally integrate risk management together with the process of planning and performing aviation tasks.

Stage V. Implementing the decision – it consists in implementing the selected solutions (developed during decision-making process) in a consistent way. This stage comprises putting the accepted solutions into effect. The person who is responsible for implementing the decision is indicated. The resources and support measures for the accepted solution are determined.

Stage VI. Supervision and the monitoring of changes – this stage consists in making the assessment of the effectiveness of accepted solutions while taking into consideration the safety level and the objective of the task to be performed. A regular assessment of how the solutions work allows for effective verification and making corrections, if necessary, to the process of risk management.

It is worth mentioning that the risk management process may be characteristic of different levels of detail and scope:

- *complete risk management* – it is a time-consuming process and requires an appropriate set of measures that are available for use by the person responsible for minimizing the risk. It consists in making thorough research to collect data that is essential in making a decision. This research should also utilise the experience from previous operations, that is related to identified threats and actions taken to reduce the risk to an acceptable or tolerable level. This process is mostly used when doing long-term planning of tasks that are difficult

to perform, or when deploying new technologies, procedures or aircraft equipment etc.

- *extended risk management* – this process is done in a concurrent way with the one used in complete risk management. The basic difference is about the way of analysing threats and assessing risk. It is used when performing aviation tasks that are not complex. It is worth mentioning that extended risk management is implemented with the help of the 6-stage risk management model. This model is used for example when doing preparations for the flight or making the analysis of meteorological conditions present in the task area. It may also be used while making a decision regarding the way to perform an aviation task.
- *basic risk management* – this process is done within a time limit and is therefore used at individual stages of performing an aviation task. As a rule, it boils down to making analysis of the present situation, including making assessment of the threats and the risk level in changing conditions. It is applied when the crew plan to change the way of performing a task, within a time limit.

The authors have done some research and concluded that pilots use extended risk management as well as basic risk management in everyday practice.

4. PRACTICAL ASPECTS OF FLIGHT PLANNING AND MONITORING VS. RISK MANAGEMENT

While applying extended risk management, a pilot's responsibility during flight planning is to make an analysis of the task that is to be performed. Threat identification is the first stage of risk management. [2] This stage will be run in multiple threads and comprise, among other things, the assessment of anticipated meteorological conditions on planned flight routes or in the area of the task. In order to minimise the risk, the pilot should get acquainted with, and analyse the conditions on the starting airfield, on the route, on the destination airfield, and on the alternate airfields. In case of adverse atmospheric conditions, he or she will have to do risk assessment and make an analysis of the possibility to change the anticipated risk to an acceptable level. This can be done for example by changing the flight route or choosing and additional alternate airfield. The pilot's responsibility will also be to check the aircraft with regard to it being able to perform the task. The aircraft performance and its operating limitations must be taken into account. It may turn out that it is not possible to pursue the task using a particular type of aircraft, due to, for example, a limited aircraft operating range, or due to exceeding the limitations imposed on the aircraft weight during starting, taking into account the assumptions resulting from the nature of the task. To sum up, the first stage of risk management boils down, in essence, to:

- the selection of the flight route and alternate airfields – the pilot should collect essential information from the AIP (Aeronautical Information Publication), NOTAM (Notice To Airmen) , AUP (Airspace Use Plan) and UUP (. The objective is to reflect the airspace elements (that is the controlled, restrictive zone, all active and flexible elements of the airspace) that are used by others, in the flight route plan, in order to avoid potential collision situations.
- getting acquainted with the weather forecast for the planned flight route and for the selected airfields – making assessment of the meteorological situation is done on the basis of updated and available meteorological messages, such as SIGNIFICANT - TAF (Terminal Aerodrome Forecast), METAR (Meteorological Air Report)[1], SIGMET (Significant Meteorological Information) GAMET[2], SNOWTAM etc.
- sticking to the fuel policy by making calculations of the required amount of fuel that is needed for safely flying the distance – this is done by calculating the amount of fuel needed to reach the destination airfield. The amount of fuel to reach the alternate airfield and any required reserve fuel is also taken into account (final reserve fuel, contingency fuel, alternate fuel, additional fuel).
- the calculation of aircraft weight, its centre of gravity location and its performance at the time of the actual flight.
- the calculation of the safe altitude for the planned route.
- the preparation (completing) of the flight log – it must keep all information that is needed by the pilot to perform the task, that is, among other things, the course, distance and time at the individual sections of the flight route, the frequencies of the ATS service and the radio navigation service that are available on the route and on selected airfields.
- the preparation of the ATC flight plan etc.

After having planned and prepared the flight, the time comes for actually flying the aircraft. This stage will be based on the results of extended risk management. As part of flight monitoring, the risk management will now be done on the basic level. This means that while monitoring the flight, the pilot will have to make decisions in dynamically changing external conditions, often under time deficit. [3] Therefore so as to ensure the effectiveness of basic risk management, during flight planning the pilot must predict and consider as many factors as possible that may affect safety while performing the task. This knowledge will let develop possible action scenarios, that will improve the process of flight supervision and monitoring of changes, and will also shorten response times. If the process of risk

[1] METAR is a format for reporting weather information.

[2] GAMET area forecast. An area forecast in abbreviated plan language for low level flights a flight information region or sub-area thereof, prepared by the meteorological authority concerned and Exchange with meteorological Office in adjacent flight information regions, as agreed between meteorological authorities concerned. [6]

management is faulty during flight planning or actually flying the machine, the effects may be catastrophic for the pilot.

The accident that happened on 28 June 2009 to Cessna 172S is an example of mistakes in the process of risk management. The plane with passengers onboard was making a flight in order to participate in an aviation picnic. After the picnic had finished, the pilot filled up the fuel tanks but did not analyse the risk that emerged from the fact of exceeding the weight of the aircraft during starting. He did not take into consideration the length of the runway and disregarded some obstacles that were present. As a result of the accumulation of a number of adverse factors and not having diagnosed them at the flight planning stage, the plane crashed into trees and fell to the ground. In their report, the Committee of Accident Investigation pointed out that the reasons of the accident were: the lack of, or incorrect analysis of the aircraft performance and weight as well as making the first turn in the direction of a terrain slope, while flying at a very low altitude. [7]

5. CONCLUSION

Carrying out the process of risk management is of key importance for the safety of an aviation task and achieving its goals. The regular process of risk management done by the aircraft crews, while maintaining respect for its effective rules, is not an easy thing to do, especially when there is deficit of time and the pilot experiences high mental stress. The example given at the end of the article clearly indicates that if an attempt is made to disregard an element of risk management at the flight planning stage or during actually flying the machine, it may lead to tragic consequences.

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