

Methodology for Risk-based Indicators Implementation

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Abstract- The article describes the principle of creating a risk-based indicators in companies operating in an air transport. The first part deals with the description of safety indicators and introduce the concept of risk-based indicators. The next section describes the procedure for creating the base of risk-based indicators and describes specific examples of developed indicators.

Keywords – safety, safety indicator; risk-based indicator; SMS; airline-operator; maintenance; airport

I. INTRODUCTION

Assessment of safety in recent years, undergoing significant change, forced by the change of the events nature and frequency that had a big impact on aviation - aviation accidents and serious incidents. At present, these events do not occur to such an extent that it is not possible to say whether the company is safe or not only on the basis of their occurrence frequency. This task currently takes implementation of safety indicators, which focuses on the beginnings of chain of events creation that could, under certain circumstances, lead to the top event. Given the well-formed system of defences in aviation, which are designed to eliminate the consequences of isolated phenomena and prevent their overgrowth in the realization of top events is the number of top events in the aviation so small, that monitoring just their numbers has no longer correct informative value. Therefore we introduced other tools that enable detailed monitoring. With this tool, the safety indicators, tracking just instances of "germs" of top events and are current the only instrument that can be based on numerical values to determine the value of the organization safety.

II. THE INTRODUCTION TO SAFETY INDICATORS

Safety indicators are basically the precursors for hazards and risks based on routine monitoring of operational processes according to the latest trends in building the SMS according to ICAO Doc. 9859. With the introduction of safety indicators in aviation is also linked to Regulation 376/2014 and 1092/2015, the European Commission, which regulates the system of notification and reporting requirements for the content, with an emphasis on a uniform, exactly defined form and its content has been encouraging to follow certain "precursors" that may occur in an aviation organization. In addition to the operational process, safety indicators also focus on monitoring the safety culture and safety climate in company, evaluation and compliance with the requirements of the relevant safety

regulations. Equally important part of safety indicators implementation is monitoring of management processes. Safety indicators, based on data collection, provide an immediate picture of the organization safety. Following the implementation of the safety intelligence into the entire system of SMS becomes possible to objectively addressing safety recommendations to the relevant part of the processes. Safety indicators are defined as the measurable process variables that can be used to describe the larger phenomenon or part of reality. They can appropriately be used for the correct management decisions and responsible employees. It is important that also serve as feedback. The basic features of safety indicators are:

- Providing numerical values
- Regular updates
- Each indicator covers specific part of safety

III. TYPES OF SAFETY INDICATORS

Safety indicators can be divided into several groups. The basic division is to leading and lagging indicators (proactive, reactive), when we are interested in the nature of the indicators in terms of tracking data - whether monitored events have already taken place, or whether we focus on the precursors of top events. If we want to monitor precursors we are focusing on such phenomena, when top event not happened, and for the positive development of safety in an organization is necessary to eliminate the possible development of events still at the beginning, because every event has multiple causes, when these causes occur in the system several times a long time ago thus, before a "meeting" with other circumstances that allow penetration of all layers of defences.

For the monitoring and evaluation of the risk of individual precursors can very well serve so called Risk-based indicators, which are based on a risk assessment of the overall risk of a precursor to the realization of top events. Thus primarily we evaluate the likelihood of peak event realization, whichever is the precursor and the consequences of the implementation of the event, in which occurred just monitored precursor.

IV. PROCESS OF RISK-BASED INDICATORS CREATING

If the operator company decides to implement risk-based indicators the first step is to map the processes that occur in the

workplace. For this, it is possible to use different modelling tools, which make it possible to capture all the processes, relations between them, the necessary conditions for the continuation of the process, decision-making terms etc. As an example the following figures shows the process of communication with airplane at different stages of flight at an uncontrolled airport with AFIS.

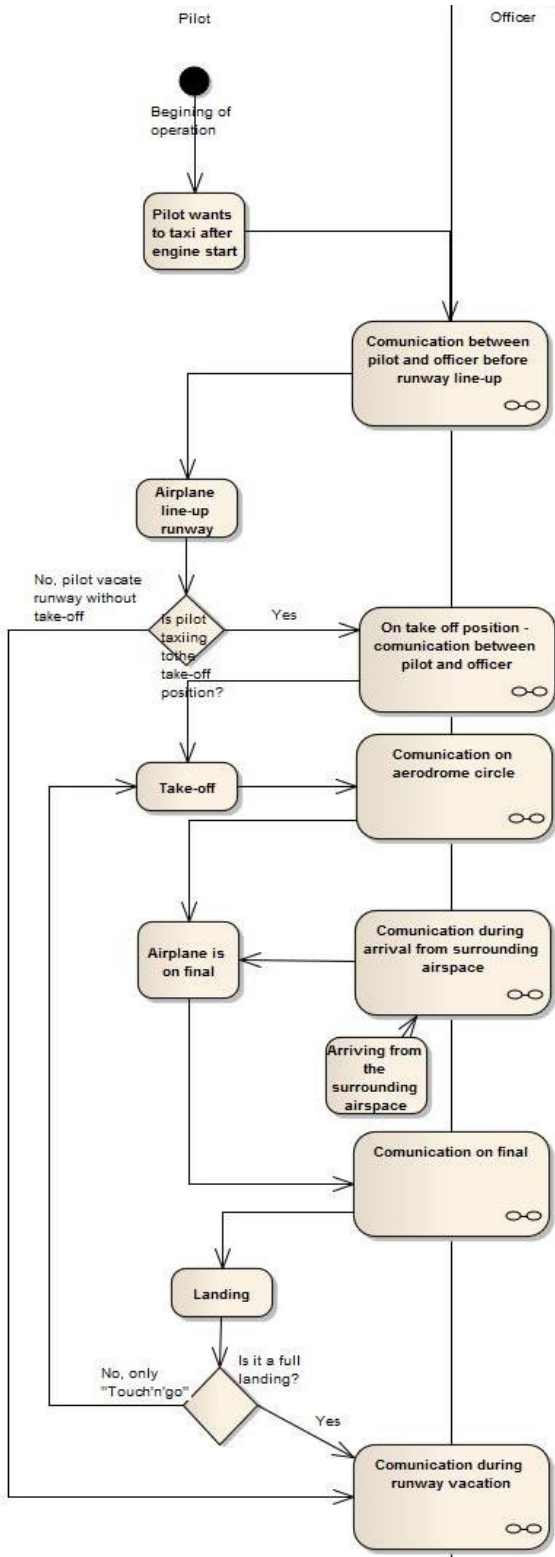


Figure 1. Process of departure and arrival at the aerodrome [10]

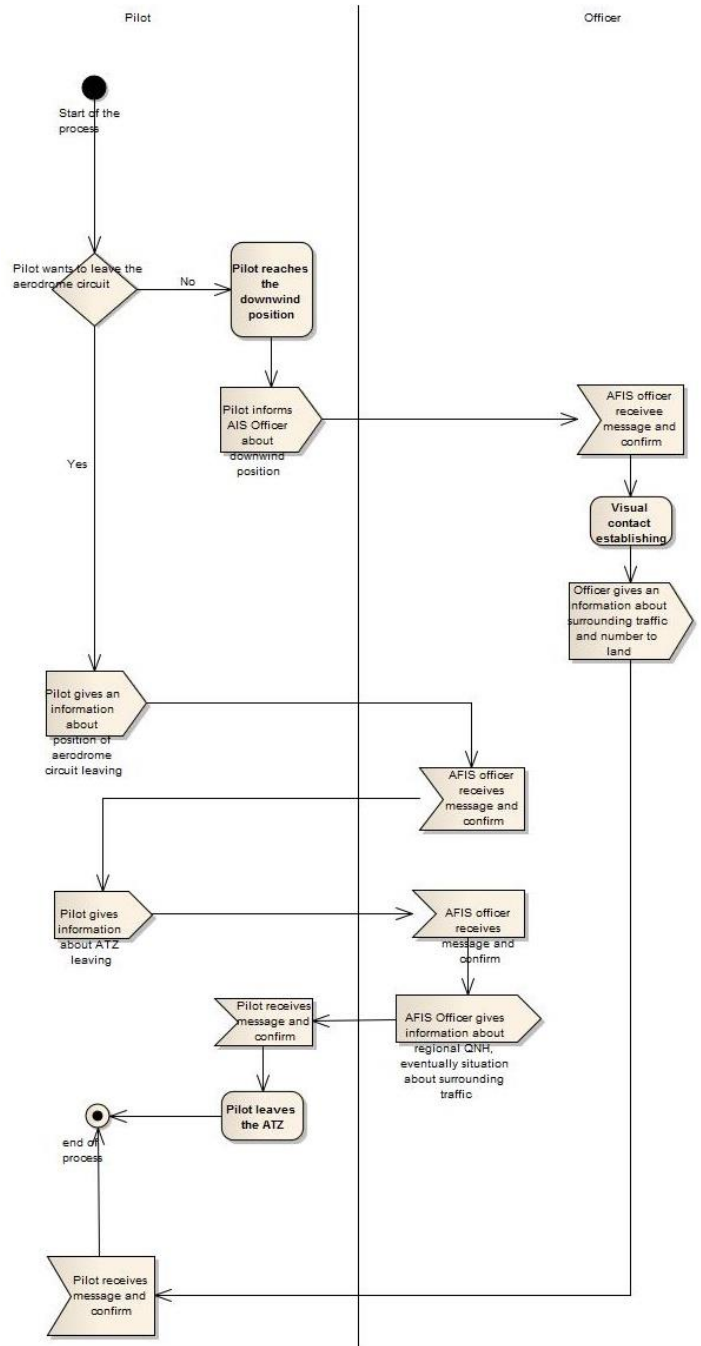


Figure 2. Process of the flying on aerodrome circuit [10]

After the model of processes which occur in normal operation is created, it is necessary to find crisis scenarios. Such crisis scenarios are based on the knowledge that we find in the safety library of the organization or from other sources that it is possible to use for the scenarios preparation - investigative reports, experience of operational staff, etc.

Such crisis scenarios can sometimes be very extensive. For each event in the crisis scenario, it is necessary to determine whether it is somehow measurable – whether it is possible to collect data on the occurrence of such events.

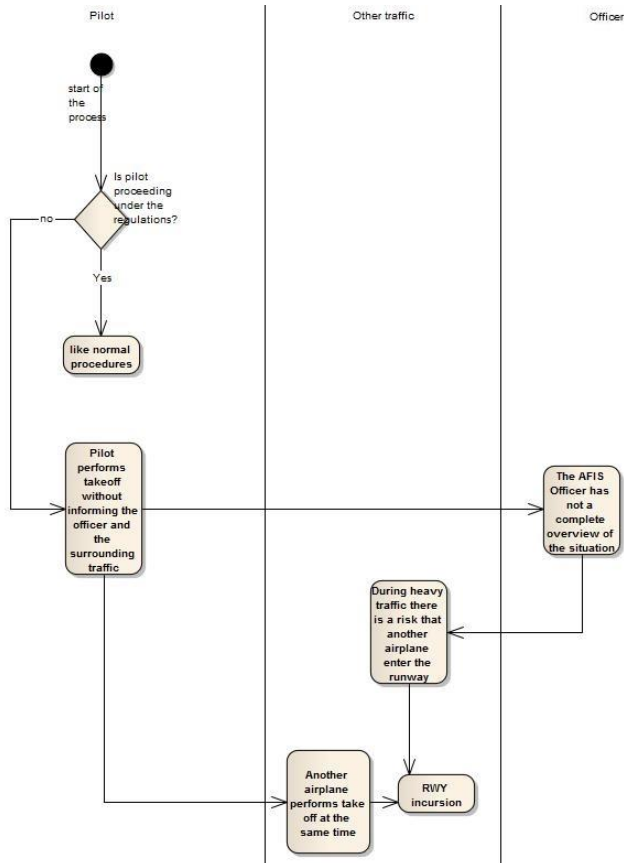


Figure 3. The process of take-off without informing the officer and the surrounding traffic [10]

Each event of a crisis scenario must be evaluated in terms of likelihood and severity in terms of contribution to the realization of the top events. In evaluating there is an importance to evaluate them on experience from actual operations, not only from its own resources, but it is necessary in many cases to inspire from external sources.

Risk assessment of each sub-event in relation to the change of risk top events satisfies the scheme on fig. 4.

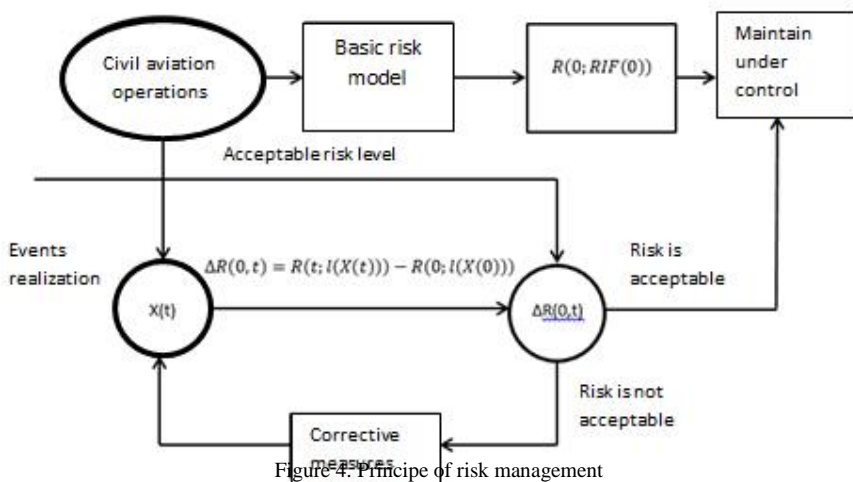


Figure 4. Principle of risk management

V. POSSIBLE SOURCES OF DATA FOR DETERMINING THE INITIAL SET OF INDICATORS

As was written in the previous paragraph, it is possible to use some external sources. These resources can be used for determining precursors in scenarios of crisis events. Typical examples are the taxonomy, which are used within the records of events. A typical example is the ICAO ADREP taxonomy, which provides a detailed list of events. If we add to taxonomies more knowledge in terms of linking individual events to crisis scenarios, these individual events (precursors) can be assessed in terms of likelihood and severity according to the conditions of the individual organization.

VI. EXAMPLES OF MONITORED INDICATORS RELATED TO THE TYPES OF CIVIL AVIATION ORGANISATIONS

As shown at pictures, risk-based indicators could be used even on uncontrolled aerodromes, where the operator of this aerodrome could assess their safety through usage of risk-based indicators through analysis of their processes.

In the case of air transport operators there could be monitored the occurrence of events like long landing behind the point of contact on the runway, landing higher than the specified speed, unstabilized approach, landing in the wrong configuration of the aircraft – all these “events” are indicators that can assess the risk process and means of monitoring them to assess the risk of such consequences, such as an event of "runway excursion to the side" and "runway overrun." By airliner operator there could be risk-based indicators used in operational activities, like, for example, flight planning department

Airport operator can again watch different types of events (precursors), leading to the realization of top events in the form of accident or serious incident. Examples of such events are typical examples of deviations from best practices on the apron. The monitored events are eg. insufficient staffing for individual tasks like towing of aircraft, as well as faulty communication between the crew and ground staff, improper deployment of ground clearance at the stand (carts, filling vehicles, various other equipment). All of these events can lead to top event of a crash of the airplane with ground-based resources that are often with damage with the high financial demands.

Another area where it is possible to use risk-based indicators is the maintenance of aircraft and aircraft components. In this area it is possible to use the classification of events, which was introduced by methodology of event in maintenance investigation - Maintenance Error Decision Aid (MEDA). This methodology specifies the factors that may lead to the top events. This methodology may serve as a good basis for determining the basis of risk-based indicators.

VII. ASSESSING OF RISK BASED ON INDICATORS

If we monitor the risk-based indicators and evaluate the data obtained through an effect on overall risk of operation we proceed as shown in Fig. 4. If the growing incidence of various types of events will be exceeded tolerable limits of the risk of the operation through indicators monitoring, it is necessary to take such corrective action, which will reduce the risk and returns the overall risk to an acceptable level.

Corrective measures can therefore be taken right to the activity for which (thanks indicators) we know that the overall risk has the greatest impact, eventually to the activity where is the biggest changes in risk over the observation period, and it is necessary to take measures to reverse the trend.

VIII. CONCLUSION

In this article mentioned methodology was created based on the grant SGS14/167/OHK2/2T/16 which has investigated the issue of risk-based indicators. Risk-based indicators can provide an additional tool for safety management, where there is a proactive approach to safety assessment. Risk-based indicators are the next step of nowadays introduced safety indicators and provide a higher level of safety evaluation.

The implementation of risk-based indicators also has its downsides, while during their implementation is necessary to build crisis scenarios and to find interconnection of factors in the sequence of crisis events.

IX. ACKNOWLEDGMENT

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