SAFETY AS A CORE PROCESS OF SUCCESSFUL COMPANY

Peter Vittek – Eva Straková – Vladimír Němec - Lukáš Krula

There is a revision in understood of safety in recent years; concept of safety has changed from mere authority requirements to vital business process of company. Safety as business process considers that failure is caused by combination of different factors, thus it is essential to implement safety management system into a whole company structure. Such a system involves preventive and reactive measures, which are specified by risk assessment. Final goal of these measures is not to remove safety risks, but manage them under organizational control. This work was supported by the Grant Agency of the Czech Technical University in Prague, grant No. SGS10/221/OHK2/2T/16.

K e y w o r d s: concept of safety, safety management, hazard identification, consequences of hazard, safety risk management, likelihood and severity of safety risks

1 INTRODUCTION

Concept of safety as an expression is dependent on perspective of aviation stakeholders (passengers' perspective, airline staff perspective, maintenance organization perspective etc.) and it may have different semantic content. A common feature of all concepts of safety is a safety management acting through preventive measures and reactive interventions. But in dynamic nature of aviation, there is impossible to consider about ideal functionality of safety management. Hazards are an integral component all systems. Any human activity or any system is not able to be free from hazards. Safety risks arising from the consequences of hazards in operational contexts must be managed to acceptable level for system (ALARP - as low as reasonably practicable).

Safety is considered as a result of management in order to maintain the safety risks under operational control. Security is therefore considered as a state when the possibility of personal injury or destruction of property is reduced and maintained at an acceptable level. To achieve safety objectives, it is necessary to ensure a continuous ongoing process of hazard identification and safety risk management.

2 THE EVOLUTION OF SAFETY THINKING

The gradual evolution of safety thinking began during the era of technical factors at the time when the beginnings of aviation were characterized by a high frequency of accidents. Huge extent of technical, technological and infrastructural improvements allowed massive expansion of aviation.

Ever since, a deeply ingrained belief in regulatory compliance as a guarantee of safety installed itself in aviation. There is a notion that safety can be guaranteed as long as rules are followed, and deviation from rules necessarily leads to safety breakdowns. Increasing the amount of activity and enforcement itself during the development of aviation was not sufficient. It is not difficult to make advanced safety regulations to ensure all existing operational processes, but in the dynamic system of air transport it is impossible to describe all the alternating behavior. Investigation of aviation incidents and accidents was based on searching for technical failures and defects, later started to point out observing safety regulations and influence of the special observation authority. Looking for cause of incident led to definition of probability of technical failure. If technical failure was not visible, investigation turned to possibility of personnel failure not observing the terms. Later, looking for weak points in processes or continuation of cause of incident started to be used, as well as employees came to point of interest - possibility of skipping task, or change of process. Attention was payed to dangerous conditions, which was not direct cause, but were preceding the failure. A failure in aviation is caused by combination of different factors.

Early 70's are characterized by major improvements - beginning of using turbojets, radars, and autopilots, improvement of navigation and communication appliances. Interest in

researching human mistakes announced beginning of the era of considering human factor. In period from 70s - 90s, there was a lot of investment to research of human factor and human performance. It was discovered, that work environment has a big influence to human performance, and its properties can increase as well as decrease quality of work. This knowledge started era of organization factors.

A safety effort was divided into **system point of view**, which included **organizational**, **human** and **technical** factors.

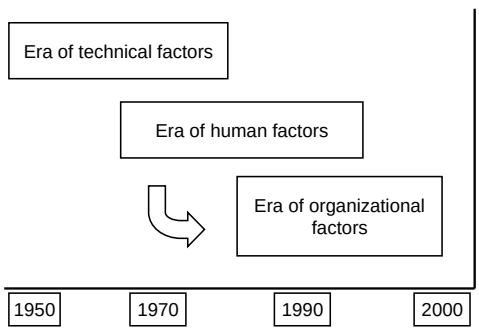


Fig. 1 The development of thinking abou safety

On the present, well known Reason model and SHEL model are used in safety management. In 2009 ICAO published doc. 8958 – Safety Management Manual that includes theoretical safety knowledge. The second important document is Safety Management Course Handout which includes practical examples based on practical situations in operation.

3 HAZARDS AND CONSEQUENCES OF HAZARD

Hazard identification and safety risks management are the core processes of safety management and main components of system approach to ensure safety of aviation system. Safety management is subsidized by theory of human factor and human performance.

For perception of safety management it is necessary to understand the differentiation between hazards and safety risks. Hazard consists of hazard itself and consequences of identified hazard.

A consequence is defined as the potential outcome (or outcomes) of a hazard. The damaging potential of a hazard materializes through one or many consequences. During hazard analysis it is inevitable to determinate all possible consequences. Proper determination of consequences is a part of risk assessment. Risk assessment enables the organization to make decisions and based on this idea it is possible to keep safety risks under organizational control. Following fundamentals are used for safety management at present time:

- Understanding hazards
- Hazard identification
- Hazard analysis
- Documentation of hazards

4 SAFETY MANAGEMENT

Safety is considered the highest priority in aviation but there is no aviation organization but ICAO created to deliver only safety. Nowadays it is common to reflect safety as an outcome of organizational processes management with the objective of keeping safety risks under organizational control. New approach to aviation safety is based on safety as a process that has the same importance as any other process in aviation organization, for example financial management, management of human resources, environmental management etc. Safety management is one of the core objectives of organizations in aviation.

Safety management is based on hazard identification and safety risk management. It is impossible to consider safety as natural part of aviation system alone without managing it. It is necessary to create appropriate conditions to achieve the objectives of safety. Safety is behavior required by every system. Safety helps significantly to achieve operational objectives associated with provision of services by all aviation stakeholders. Theory of safety management system is well founded. Application of this theory helps aviation organizations in process of continual improvement.

Duties of organization related with safety:

a) Definition of policy considering safety. Senior management using regulations provides employees with information about system operations.
b) Allocation of resources for activities related with safety management. Safety management requires resources. Management of organization has responsibility for all resources allocation and safety risks decreasing.
c) Accepting the best safety procedures. This leads to improve of safety processes in organization. Aviation has rich tradition in information exchange.
d) Incorporating Rules of civil aviation. A need for regulation in safety will be present at all the time. Delicate safety management is evolving by sensitive rules.

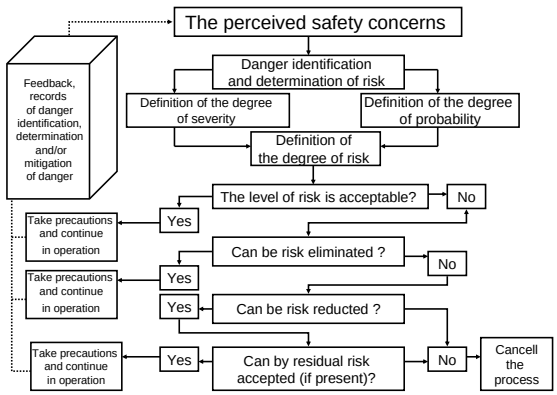
5 SAFETY RISKS

Safety risk management is the second core process that supports functionality of safety management. Safety is defined as outcome of safety management activities. Safety management is considered as a sequence of steps. Hazard identification is the first step. Risk assessment and risk control and mitigation follow after identification of hazards and finding consequences. Risk assessment helps to address the relevance for risk mitigation and risk control strategies and safety risk management as a whole. Risk assessment enables to manage safety, because one of management dogma says that one cannot manage what one cannot measure. Safety risk concludes base trilogy of safety management – hazards – consequences of hazards – safety risks.

Hazards and consequences are physical components of the natural world. Safety risks are not tangible or visible components of any physical or natural environment. Safety risk is defined as the assessment, expressed in terms of predicted probability and severity, of the consequence(s) of a hazard undertaking as reference the worst foreseeable situation. The notion of safety risk is what is known as a construct - an artificial convention created by humans. Safety risks are designated through an alpha-numeric convention that allows for their measurement.

Five principles of safety risk management:

a) Safety Risk Management - consideration of risk and its mitigation. Risk mitigation is executable up to ALRP level - As Low as Reasonably Practicable. The aim of Safety Risk Management is to provide support for balanced allocation of resources among all the risks in terms of its analyses. The safety risk is classified into tolerable, acceptable and unacceptable area, which determines following procedures.
b) The likelihood of safety risks - The process of decreasing safety risks and their further maintenance under the control of the organization begins with determining likelihood of the consequences of hazards. The likelihood of the safety risk is defined as the probability of presence of hazardous event. Safety risks are validated in degrees of importance and rated in probabilistic table.
c) The severity of safety risks - is defined as the severity of potential consequences of unsafe conditions and events, which are related to the worst, possible, and expectable situations. Consequences are determined by degrees of severity from catastrophic to negligible and measure of consequences tolerance is set.
d) Safety risk tolerability – Includes two steps. At first, it is necessary to obtain an overall assessment by combining the safety risk probability and safety risk severity values into a safety risk assessment matrix. Second step consists in definition of boundary-line which divide risk matrix into regions of tolerability (intolerable region, tolerable region, acceptable region).
e) Safety risk control or mitigation – it is process that brings safety risks under organizational control deploying one of control or mitigation strategies (avoidance, reduction, segregation of exposure). It is recommended to evaluate the effectivness of each specific alternative and examine it from various prespectives.



Obr. 2 Process of safety risk management

BIBLIOGRAPHY

[1] INTERNATIONAL CIVIL AVIATION ORGANIZATION: Doc 9859 – Safety Management Manual. Second Edition. 2008

[2] KRAUSE, SHARI S.: Aircraft Safety – Accident Investigations, Analyses, and Applications. Second Edition. Blacklick, OH, USA: McGraw-Hill Professional Publishing, 2003

[3] SHEEHAN, JOHN J.: Business and Corporate Aviation Management: On-Demand Air Travel, McGraw-Hill Professional Publishing, 2003

[4] WELLS, A.: Commercial Aviation Safety, McGraw-Hill Professional, 2001

[5] PŘIBYL, P. – JANOTA, A. – SPALEK, J.: Analýza řízení rizik v dopravě, BEN – technická literatura, Praha 2008

AUTHORS ADDRESSES

Ing. Peter VITTEK, Department of Air Transport, Faculty of Transportation Sciences, Czech Technical University, Horská 3, Praha 2, 128 03, Czech Republic, e-mail: xvittek@fd.cvut.cz

Ing. Eva STRAKOVÁ, Department of Aviation Engineering, Faculty of Aeronautics of Technical University Košice, Rampová 7, 041 21 Košice, Slovak Republic, e-mail: eva.strakova@tuke.sk

Ing. Vladimír NĚMEC, Ph.D., Department of Air Transport, Faculty of Transportation Sciences, Czech Technical University, Horská 3, Praha 2, 128 03, Czech Republic, e-mail: nemec@fd.cvut.cz

Ing. Lukáš KRULA, Department of Air Transport, Faculty of Transportation Sciences, Czech Technical University, Horská 3, Praha 2, 128 03, Czech Republic, e-mail: xkrula@fd.cvut.cz