IMPLEMENTATION OF SAFETY INDICATORS FOR AVIATION SERVICES PROVIDERS

Roman Matyáš - Peter Vitter - Vladimír Plos - Andrej Lališ

This article describes the implementation process of safety indicators into aviation organizations. It provides brief step-by-step guide of evaluating organization's safety performance based on actual best practices in other industry areas, such as nuclear energy producing, petroleum mining etc.

K e y w o r d s: Safety, Safety Indicators, Imp, Safety Culture, Safety Performance

1 INTRODUCTION

There has always been the need to increase overall level of safety in aviation. Although it used to be satisfactory for decades, simple creating of safety recommendations on reactive basis is no longer effective in this area. Therefore, the industry must answer to the organizational factors affecting general operational safety level using modern methods. Moreover, for the aviation services providers there is a legislative requirement for an integrated management system and safety management system as a part of it. This system is described in ORO.GEN and consists of several activities and processes. One of the process is the evaluating the safety performance of organization.

Safety indicators are an effective tool not used just for measuring safety performance but serve as hazard identification assistance as well. Organizations with limited budget might find an easy to use implementation process in this article. The whole process is divided into four steps so the organizational load is distributed and should not be the limiting factor of successful implementation.

The whole process of implementation is based on research conducted in the field of safety assessment in several technical industries and tailor made for small commercial air services providers which need to comply with requirements of complex operators according to national authority resolution.

2 SAFETY INDICATORS

Firstly, brief introduction of safety indicator types and their possible means of use in aviation. Technical literature divides indicators by several specifics. Small organizations do not need to make complicated structure of indicators, therefore, any spread theoretical basis is not desirable in order to achieve simple comprehension.

For our purpose, we divide indicators to lagging and leading, basically by the time orientation – lagging are indicators of reactive method and focus on the past events whereas leading indicators monitor present and possible future events and actions. By adding one more group called early warning indicators we become more precise [1]. The idea is based on resilience engineering approach: despite high quality process of identifying hazards and managing risks, there is always a probability that something unexpected could occur [2]. The resilience approach stresses areas to concentrate on and it suggests which factors could assist to the successful prevention of unexpected crisis. Those unexpected events could be anticipated if we know to name them and where to search them.

In any case, for our purpose, we follow those golden rules of using indicators concerning all types – lagging, leading as well as early warning:

1. Indicators provide numerical value (number or ratio)
2. They are updated in regular intervals
3. They are targeted and their amount is manageable

After necessity of implementing quality management system into commercial aviation providers another system was introduces by EASA ORO.GEN – management system which integrate safety management and compliance monitoring. The AMC and GM to the ORO.GEN describe specifically individual means of compliance for organization, management and for assessment of safety performance.

Also state authorities of many countries maintain safety assessment on state level. Since 2006 several state safety plans has been introduced, followed by SMS integration in many proactively led organizations. In order to assess the overall state safety level, some states have used safety indicators, for instance Australia, Norway or Canada. The last named, Canada, developed directly a guide for assessing the design and performance of organization's safety management system in the form of audit. States choose different indicators; however, the process of assessing is based on similar idea and, therefore, could use similar principles which we reflect in further methodology as well.

Organizations should mainly assess safety performance by means of internal audits and safety performance indicators. As stated above, the guide published by Transport Canada [3] could be a good starting point for measuring the function of each SMS component.

On the other hand, safety performance and safety trends assessment needs to be covered by various kinds of indicators. This text further presents phased method of implementing all advisable sorts.

3 STRUCTURE OF SAFETY INDICATORS GROUP

As mentioned above, the most effective way is to combine all principles included in safety management. Using reactive method is helpful for measuring effectiveness of safety recommendations and the monitoring process of proactive means, proactive method focuses on current activities and predictive method deals with possible future issues and resilience ability of organization. On the top of those there is one more group – safety culture indicators – that reflects awareness and personnel feeling about safety within the firm. The evaluation of safety culture level as a corner stone is highly recommended and should precede any further effort. The process of building positive safety culture is not considered as part of this article, thus we mention just the principle idea. Safety is built collectively by all the employees and managers; stress is put on justness, effective communication and appropriate investing of resources by accountable managers. All of them should be implemented to give a complete picture of operational safety. The individual groups are implemented gradually; the process is described in the following paragraphs.

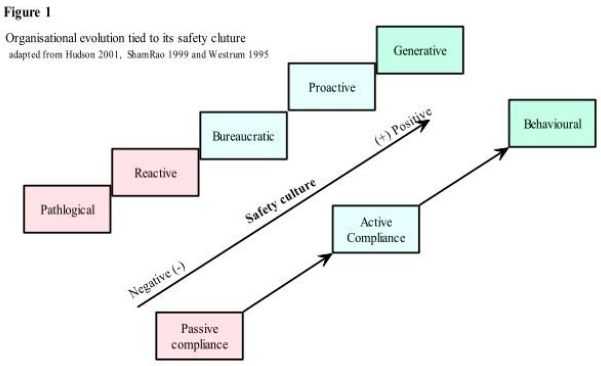

Figure 1. Building Positive Safety Culture [4]

4 IMPLEMENTATION PROCESS

Safety indicators implementation could create a great challenge for inexperienced personnel of organization. Besides implementing the whole organization structure of integrated management system the safety indicators represent something supplementary. The stepped approach offers an elegant solution preventing work overload.

In addition to golden rules, we set the common attributes for safety indicators as follows – sets of indicators ought to be:

1. Simply understandable
2. Logically structured
3. Systematic

Generally, the process starts with assessing safety culture level and according to its level continues from the easy to analyse indicators to more sophisticated ones.

4.1 Methodology

Methodology is quite straight. Firstly, the safety team should assess the main areas of operations and consider their impacts. Secondly, sufficient number of candidate indicators should be proposed and during workshop should be selected ten to twenty indicators. Then, they shall be described in details, including starting and desire levels. After that, implementation itself should take place and finally, evaluation and changes are realized on regular basis.

Implementation process divided to four phases is described in the following text.

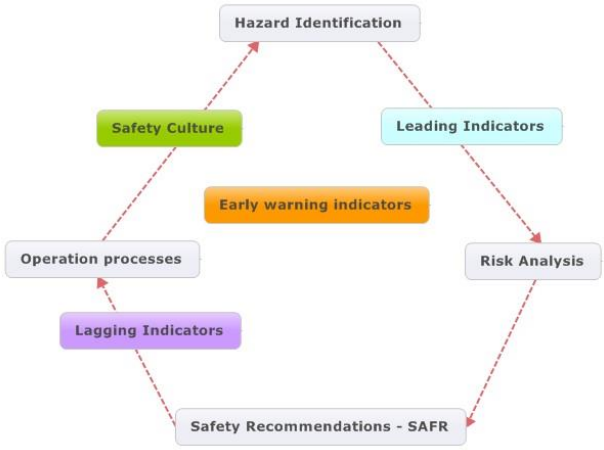

Figure 2. Indicators and Safety Management System Processes

4.2 First phase

Without positive safety culture cannot be achieved any satisfactory level of safety. Thus, the first step is assessment of safety culture. This could be done by means of questionnaires, interviews and/or operations observations. The result points weak areas with need of improvement as well as strong ones that could motivate employees through emphasising their best practices.

Organization's safety policy and aims stated in the operational manual or safety management manual of each organization are used as other simply managed indicators in the first phase.

4.3 Second phase

In the second phase, lagging indicators are added. They focus on accidents and incidents at the first stage, further they provide feedback on safety recommendation success and effectiveness. Long-term monitoring incident numbers gives basic safety trends. In the beginning, increasing number of incidents is desirable provided that those incidents are reported through voluntary and confidential reporting systems, thus, reflects the trust in those systems.

Safety aims could be more elaborated in this phase as the second step in their monitoring, eg for how much percent the aim is accomplished. They are targeted mainly on management issues and objectives, hence, stand as feedback of management process within an organization.

4.4. Third phase

In the third phase, we focus on monitoring of processes and activities through which is able to uncover issue way before it develops into a serious incident or even an accident. Leading indicators point to safety actions done by safety manager and his team in order to decrease the number of incidents. These include number of internal audits, analysed risks or issued safety recommendations.

4.5 Fourth phase

In this last phase of implementation, early warning indicators are added to the rest. These are focused on three areas – risk awareness, resilience of reaction to deviation and promotion. Those areas are further divided into eight factors contributing to successful diverting of crisis. Let us name some examples as risk understanding, anticipation, concentration, response, availability of sources in crisis, backup and others. Factors could be revised and customized to the needs of particular organization; named factors should be, therefore, considered as candidate factors.

4.6 Set of indicators for ATO

Finally, we suggest some examples of indicators for each individual phase customized to Approved training organizations (ATOs) that, according to EASA, are able to provide flight training in accordance with Part-FCL assuming the other requirements for integrated management system described in ORO.GEN are covered satisfactorily.

Table 1. Example of Indicators Sets

Approved Training Organization Implementation Process		
hase	***Area***	***Indicator***
First Phase	Safety Culture	Level of Commitment
		Level of Justness
		Level of Awareness
		Level of Information
		Level of Adaptability
		Level of Behaviour
	Safety Aims	Number of accomplished safety aims
Second Phase	Lagging Indicators	Number of incidents in 3 previous months
		Number of accidents in 3 previous months
	Safety Aims	Ratio of accomplished no not completed aims
Third Phase	Safety Promotion	Number of Safety Training Sessions
		Ratio of Trained to Non trained employees
		Number of safety themes published through promotion channel
	Risk Identification	Number of Identified Risks
		Number of issued safety recommendations
		Ratio of identified to analysed risks
	Reporting and Justness	Number of voluntary and confidential reports
	Operations Monitoring	Overall number of internal audits/surveys/interviews
	Management of Change	Ratio of changes in procedures to safety studies
		Ratio of changes in procedures to safety trainings
Fourth Phase	Risk Awareness	Average number of years of experience with operation
		Ratio of employees trained in risk managing process
		Number of risk analysis meetings in previous 3 months
	Anticipation	Cumulated number of years of experience with indicators of safety employees
		Number of violations in previous 3 months
	Attention	Ratio of identified hazards through reporting systems to all data sources
		Number of identified hazards through inner data sources
		Number of internal audits
	Response	Number of employees trained in ERP
		Average duration of ERP drill
		Number of ERP audits
	Robustness	Amount of free resources
		Ratio of functional to malfunctioning resources/tools
	Resourcefulness	Number of emergency decision-making process trainings and drills
		Ratio of managing employees trained

Approved Training Organization Implementation Process		
hase	***Area***	***Indicator***
		to non-trained in emergency decision-making processes
	Decision support	Number of safety stops of operations in 3 previous months
	Redundancy	Number of instructors momentarily not involved in training
		Average number of days Safety manager is available in the office

5 CONCLUSION

This text presented the methodology of implementing safety indicators as a mean of measuring the safety performance of organization. It emphasizes the significance of positive safety culture as a cornerstone for effective Safety management system including safety indicators. A phase implementing process in relation to level of safety culture is suggested as one of the optimal form providing full understanding of each step by relevant personnel. There is also stressed the importance of safety data collection and consequently promoting of company's reporting systems.

BIBLIOGRAPHY

[1] Øien, K., Utne, I. B. a Herrera, I. A. Building Safety indicators: Part 1 – Theoretical Foundation. Safety Science. 2011, 49, p. 148-161

[2] F. Størseth, R.K. Tinmannsvik a K. Øien. Building Safety by resilient organization – a case specific approach.

[3] TC. Safety Management System Assessment Guide. Ottawa, Kanada: 2005.

[4] Flannery, J. A. Safety culture and its measurement in aviation. The Australian Society of Air Safety Investigators.

[5] Poprenda, J., Socha, L.: Crew resource management as a factor of flight safety, Acta Avionica. Roč. 11, č. 17 (2009), s.160-163., ISSN 1335-9479.

[6] Nečas, P., Szabo, S., Bučka, P.: Crisis management and security in simulation environment, Science & Military. Roč. 1, č. 1 (2006), s. 33-37., ISSN 1336-8885.

[7] Soušek, R., Kelemen, M., Nečas, P., Križovský, S.: Safety Management in the Field of Transport? New Challenges for Science, Personal and Property Protection.MOSATT 2009, Zlatá Idka, s.136-139, ISBN 978-80-970202-0-0.

[8] Rozenberg, R., Szabo, S., Šebeščáková, I.: Safety management and formation flying of aerobatic team INDIAN JOURNAL OF APPLIED RESEARCH, Volume: 4, Issue 12, Dec 2013, India, Ahmedabad, ISSN 2249-555X.

[9] Reištetter, P., Stoláriková, K.: Eliminácia zlyhania ľudského faktora ako dôležitej súčasti zvyšovania bezpečnosti leteckej dopravy, Zborník príspevkov pri príležitosti Týždňa vedy a techniky, s. 10-13., ISBN: 978-80-553-1201-9.

[10] Schóber, T., Koblen, I., Szabo, S.: Present and potential security threats posed to civil aviation, Incas Bulletin. Vol. 4, no. 2 (2012), p. 169-175., ISSN 2066 – 8201.

AUTHORS´ ADDRESSES

Roman Matyáš, Ing.
Laboratory of Aviation Safety and Security
Department of Air Transport,
Faculty of Transportation Sciences,
Czech Technical University
Horská 3, Praha 2, 128 03, Czech Republic
E-mail: matyarom@fd.cvut.cz

Peter Vittek, Ing.
Laboratory of Aviation Safety and Security
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

Vladimír Plos, Ing.
Laboratory of Aviation Safety and Security
Department of Air Transport,
Faculty of Transportation Sciences,
Czech Technical University
Horská 3, Praha 2, 128 03, Czech Republic
E-mail: xplos@fd.cvut.cz

Andrej Lališ, Bc.
Laboratory of Aviation Safety and Security
Department of Air Transport,
Faculty of Transportation Sciences, Czech Technical University
Horská 3, Praha 2, 128 03, Czech Republic