

# SAFETY CULTURE ASSESSMENT – OPTIMIZATION OF EXISTING PRACTICE

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**Abstract:** Improving aviation safety has always been a priority for the aviation industry. While in recent decades the reliability of machinery and computers dramatically improved the reliability of the people and the organizational aspect of safety did not change much. Many of air accident investigations have shown that one of the causal factors, which increase the probability and severity of accidents, is exactly poor safety culture. The purpose of this paper is to present the concept of safety culture assessment and the overview and review of different methods of measuring the safety culture in aviation. This research provides the suggestion that by use of different methods of assessment (evaluation) of the results, more credible insight into the level of safety culture in the organization can be obtained. It also provides an understanding of how measurement systems in order to guide future performance can be used proactively.

**Keywords:** safety culture, safety management system, survey, ICAO, EUROCONTROL, EASA.

## 1. Introduction

Various literatures (ICAO, 2013; Fernandez-Muniz et al., 2007; Čokorilo et al., 2010; Hudson, 2001) define the safety culture as the means for safety management as well as the means for benchmarking on how the safety is perceived within the organization. It reflects the views, beliefs, and perceptions and values that employees share in relation to safety at all levels. Positive safety culture is based on high level of trust and respect between employees and management of the organization.

All organizations, which operate in safety-critical industries, have safety culture (ICAO, 2013). The way of work mainly reflects whether the safety culture in an

organization is positive or negative. Poor safety culture is the main key element in creation of an environment in which the probability of accidents is greater than usual. Optimization and promotion of safety culture within the organization is therefore one of the best means to avoid improper behavior and bad practices that would otherwise be detected only after the accident.

The existence and understanding of safety culture is the prerequisite for successful implementation and sustained performance of safety management system (SMS). Assessing safety culture in aviation is always related to SMS, since it is the safety culture of the organization that will influence the deployment and effectiveness of the safety

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management policies, resources, practices and procedures (Gordon et al., 2007).

For the aviation industry SMS is required for quick identification of hazards and management of safety risks that individuals have to cope with in their daily routine. The effectiveness of such proactive approach to safety depends primarily on the level of presence of positive safety culture within the organization (Gill and Shergill, 2004). The SMS can also be introduced only by formal assurance that all the safety objectives can be achieved. This is a risk of the systems that exist only on paper and were never really transferred in practice. Their existence is merely of a bureaucratic nature, so the organizations only introduce them in order to meet the requirements of regulations. SMS does not reach its objective if it is carried out only mechanically, therefore, for the effective implementation of SMS in practice, particular safety culture that represents a commitment to the achievement of safety is required (Werfelman, 2008).

The aim of the safety culture evaluation and survey is mainly to identify what is the prevailing perception of safety within the organization and to implement effective measures to increase the safety culture, based on the results obtained. The purpose of this paper is to scrutinize the current method used to assess the safety culture, to present an overview of the different approaches to safety culture evaluation used in aviation and to determine the differences between the various methods (both in terms of content of the tools used, and the effectiveness of the data collection process) and whether it makes sense to use only one or maybe more methods of assessment in order to obtain realistic data. This study can also serve as a guideline and tool for understanding and

implementing the safety culture maturity concept in aviation organizations.

## 2. Safety Culture Features

Key elements i.e. factors of safety culture within the organization can be extracted from the previous studies, which took place from the 80s onwards. Reason (1998) defines the following key elements:

- Just culture - people are treated fairly when they make mistakes - even if these errors lead to negative results. However, it is necessary to clearly distinguish between acceptable and unacceptable behavior (e.g. Gross negligence and intent).
- Culture of reporting - reporting system within the organization can stay alive only in an environment where relations between employees are based on mutual trust. In such organization staff believes that they are treated fairly, even if they make mistakes, and therefore have no hesitation to report faults, which they make themselves in their daily routine.
- Culture of learning - management of the organization is responsible for fair analysis and processing of information obtained by reporting system and should be able to discern proper conclusions, give proper feedback to employees and show willingness to implement such changes that will enhance safety.
- Culture of flexibility - the ability to adapt, which is reflected in the ability to transform the structure of the organization in accordance with the up-to-date standards and recommendations and the social environment.
- Informed culture - management of the organization has the current knowledge about all the factors that determine the safety of a system.

Zohar (1980) did not explicitly identify the safety culture, but merely highlighted the factors that define the safety climate:

- Management commitment to safety;
- General environment control;
- Stable workforce and care for older employees;
- Emphasis on training;
- Good communication and frequent contact between employees and management;
- Safety promotion.

## 2.1. How to Recognize Positive and Negative Safety Culture

The definition of safety culture, given in the first chapter, seems quite abstract. In general, weakening of the safety culture happens when practice is different from theory and policy; when the safety is sacrificed, even though employees claim that safety is number one (Eurocontrol, 2008). Some simple examples of the statement above are:

- Where staff concerns about safety are not consistently addressed;
- Where staff does not learn from past events;
- Where safety cases indicate that the system is safe, but operational staff believes that the accident is inevitable or;
- Where there is a belief that safety is the responsibility of someone else.

Discrepancy in the safety culture, where managers and employees at the operational level do not share the same view about safety, or when the behavior of these groups of personnel are in contrast, can be found in many organizations. This pattern reflects the negative safety culture, which means that the safety of the organization is not addressed in a coordinated and effective way. However,

if the managers and staff at the operational level share the same views about safety and behave accordingly, this pattern reflects positive safety culture (Eurocontrol, 2008). Positive safety culture is when everyone knows their role in regard to safety and all in the organization are truly committed to safety.

## 2.2. The Concept and Stages of the Safety Culture

Systematic safety management, covering regulatory, technical, organizational and managerial aspects is crucial for achieving and maintaining sufficient level of aviation safety. When trying to find out what is the level of safety in the organization two concepts, namely safety culture and safety climate, are described in the literature. The general consensus is that culture mainly embodies values, beliefs and underlying assumptions, and climate is a descriptive measure reflecting the employee's perceptions of the organizational atmosphere and defines the current mood (O'Connor et al., 2011; Flin et al., 2000).

Hudson (2001) in his work states that the organization's safety culture is the result of an evolutionary process of the steps from dangerous to safe. Only after a certain defined point in this evolutionary process it can be considered that the organization has a mature (serious enough) safety culture. The author defines the development of safety culture through the five stages of development:

- Pathological stage: Who cares about safety if we are not "caught".
- Reactive phase: Safety is important; a lot is done every time a disaster occurs.
- Calculative phase: We have systems for risk management.

- Proactive phase: We are trying to predict safety problems before they happen.
- Generative phase: Safety is our business mission.

The safety culture can only truly be confirmed at the generative level when the beliefs that are associated with safety are fully internally adopted and when everything that the organization does is based on safety. Many attempts to improve the level of safety culture have also failed, the reason mainly being beliefs and practices that characterize (define) the organization and its members.

### 3. Current Safety Culture Evaluation Method

Measuring the levels of development and safety culture in Europe is to some extent laid down by law, by Performance Scheme regulations (EU) No. 691/2010 and 390/2013 (European commission, 2010; European commission, 2013) laying down performance scheme for air navigation services and network functions. The regulation applies to a specific area of air navigation services by defining key performance areas of safety, environment, capacity and cost effectiveness and their implementation during defined reference periods.

The performance scheme Regulation contains binding performance indicators that are monitored at European, national and/or FAB level and are used to assess safety (among other areas). For the purpose of this research, methodology for measurement and verification of the effectiveness of safety management (EoS<sub>M</sub>) is discussed.

Measurement of EoS<sub>M</sub> of air navigation services in Europe is carried out through

questionnaires both at the State level and at the level of providers of air navigation services (ANSPs). The foundation for this assessment is the ICAO's safety management framework; at the State level the ability to manage State Safety Program (SSP) is measured and at the ANSPs level the ability to manage an effective SMS is measured (EASA, 2014). To achieve the aim to assess the safety performance the questionnaire includes typical SMS elements: safety policy and objectives, safety risk management, safety assurance, promotion of safety and safety culture, as a "system enabler". The number of questions for each one of the five elements varies and for each question the respondents are required to select one level of maturity (from A to E, see chapter 4) that best represent the position of their company.

The evaluation methodology also requires verification responses for both performance indicators. Questionnaires replies at the state level are crosschecked with the results of standardization inspections done by EASA and/or with requests for additional clarifications requested by EASA.

Questionnaires replies at the level of ANSPs are verified by the Member States (national supervisory authorities). The purpose of verification of responses is to some extent based on trust; if EASA in their cross-examination finds out that the Member State has overrated the level of implementation, they can reduce it to the lower level of implementation. On the other hand, States are obliged to verify the responses of individual ANSP. Questionnaires are addressed at the management level; usually safety/quality managers carry this task, and the coordination of all activities between

EASA and States/national supervisory authorities is done via national coordinators.

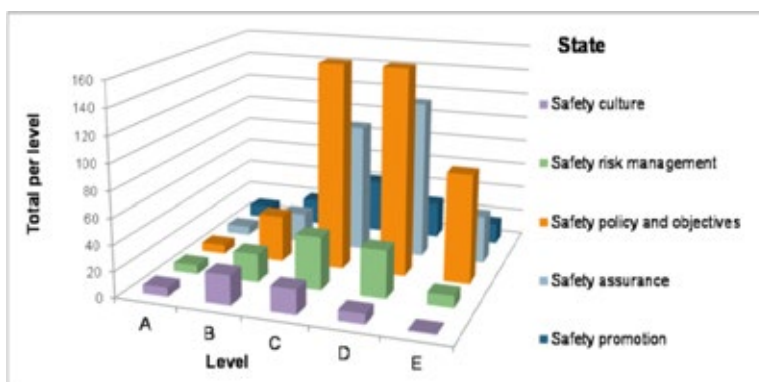
#### 4. Results and Discussion

Replies of the EoS M measurement show 5 levels of maturity of the EoS M achieved where states/organizations can progress sequentially by improving their strengths and removing their impediments. At the same time results indicate the level of safety performance:

- Level A - is defined as the “initial” - processes take place ad hoc and are chaotic;
- Level B - is defined as “planning / initial implementation” - activities, processes and services are managed;

- Level C - is defined as the “implementation level” - management uses defined and standard processes;
- Level D - is defined as “administrative and measurable level” - targets are used to manage the processes and performance is measured;
- Level E - is defined as “continuous improvement” - continuous improvement of processes and continuous improvement of the performance thereof.

Fig. 1 shows the considerable discrepancy in the level of maturity between different elements of EoS M; safety policy and objectives and safety assurance are the strongest components at State level.



**Fig. 1.**  
*The Level of Maturity Achieved at the Level of Member States*  
 Source: Performance Review Body (2014)

A similar picture is seen at the level of ANSPs (Fig. 2), where the most powerful area in addition to the two mentioned at the national level is also the safety promotion which suggests that creation of the formal policy and goals is not so much a problem as is the implementation and monitoring of these in practice.

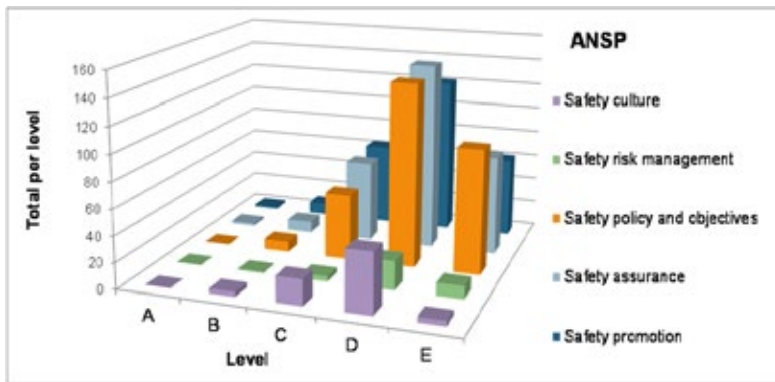
Performance of the SMS defines an important element that connects all the main phases; that is feedback. The management of the organization is, based on feedback, able to determine the performance related to safety. Feedback will also serve as a guide to decision-making and resource allocation. To the employees, feedback provides the

information on the safety achievements. This helps create the commitment and contributes to the promotion of a safety culture within the organization.

From Hudson (2001) generic model of the SMS, which defines the phases of SMS (Plan-Do-Check and Feedback), can be concluded that the phase of planning is the strongest, i.e. policy and strategic objectives, and assignment of responsibilities are starting elements for all activities related to safety.

Phases Do-Check (safety risk management, safety promotion) and flow of the feedback with a low level of maturity, suggest that policies and objectives are not effectively integrated into daily routine.

Results also show different levels of maturity of safety culture, which coincides with the concept of maturity of safety culture where safety culture is not developing as fast and in a steady manner in all organizations and in all elements (Fleming, 2000).



**Fig. 2.**  
*The Level of Maturity Achieved at the Level of ANSPs*  
Source: Performance Review Body (2014)

It is obvious that measurements should be reliable and valid, meaning that different persons performing a measurement should get the same results. This requirement sets the objectivity of measurement, which is very hard to reach.

Further it is required that the measuring method measures what it is supposed to measure, thus providing the validity of measurement. In order to efficiently measure the safety culture insiders or outsiders should make the assessments. Outsiders are being independent from the organization but this

might become unpractical if it is driven to absurdities. Insiders doing the assessment will easily understand organizational practices, but they may have the problem being neutral in their assessments. At the end a suitable combination of self-assessments and external review is recommended (Whalstrom and Rollenhagen, 2009).

In the methodology described, the reliability and validity of the method of measurement is not exactly achieved, for two reasons; the first reason being that questionnaires are designed for management personnel only,

allowing one-sided/biased view of the subject of evaluation. According to Zohar (2010) in many organizations discrepancy between the words and actions of managers at various levels of the organization can be noted. There could also be an inconsistency between organizational policies, procedures and practices (in other words, organizations can create rules and policies which appear to be logically inconsistent and/or mutually exclusive). The second reason is that national supervisory authorities, which in some cases, when making a self-assessment, have not produced realistic results, are validating the answers. Consequently, the question about the reliability of such checks arises.

Both factors strongly influence the perception of safety culture at all levels of the organization. From the aforementioned reasons, it would make sense to extend the survey questionnaires (with customized questions) to all levels of the organization thus acquiring a perception of safety culture from different points of view; from the staff (ATCOs, technicians) that carries out (or not) prescribed procedures and practices.

EASA approached to the evaluation with the so called pragmatic approach which is, according to the literature, only one of the possible approaches for safety culture assessment. Pragmatic approach, which assesses the level of maturity of safety culture, provides an insight into the future indicating what should still be done to achieve the next higher level of maturity. However, for a more objective and comprehensive insight into the safety culture, available literature recommends the use of different measurement methods, which are not mutually exclusive but complementary - the so called triangulation (Guldenmund, 2010; Whalstrom and Rollenhagen, 2009).

The concept of safety culture has been researched internationally by number of academics from different scientific fields (engineering, psychology, anthropology...). Guldenmund (2010) defines three different approaches to the safety culture assessment: academic, analytical and pragmatic approach. Each approach is based on specific methods and instruments of evaluation. Concise characteristics of each approach are shown in Table 1.

**Table 1**  
*Characteristic of Each Approach*

Main Approach	Properties of specific approach			
	Time focus	Information aimed to retrieve	Research Characteristics	Research characteristics
Pragmatic (experience based)	Future	Safety culture maturity (level)	Normative, prescriptive	Behaviourally Anchored Rating Scales
Analitical	Present	Quantitative information, on the safety climate/ culture	Descriptive	Questionnaires, survey
Academic	Past	Qualitative information	Descriptive	Document analysis, observations, workshops, interviews

Source: Guldenmund (2010)

The pragmatic approach as mentioned above is used to determine the current state of maturity of safety culture in order to assist the management of organizations to identify the actions needed (required) to improve their level of culture. It is not based on empirical research, but on experience and professional judgment. In practice, the pragmatic approach focuses on the structure and processes of the organization, which due to the dynamic interleaving, influence the culture of the organization. Pragmatic approach is future-oriented and is a normative rather than a descriptive approach (Guldenmund, 2010).

On the other hand the analytical approach is the most popular and dominant approach in the evaluation of the safety culture. It focuses mainly on the organizational aspect of safety climate. The safety culture is assessed through questionnaires with numerical results on all levels of organization of the establishment. Surveys are based on standardized questionnaires that ask employees about their opinion regarding specific safety elements. Data obtained from the survey are processed and analyzed in such a way to provide a snapshot of the current state of the safety climate in the organization. The approach with the questionnaires also provides comparison with the past results in order to quantify change processes or to assess the effects of interventions. It should be noted that it is necessary to define groups at different but meaningful organizational levels that have identifiable ways and means to interact, for example whole organization, sector or department, or simply a working group (Guldenmund, 2010; Zohar, 2010). When using questionnaires, it is first necessary to identify the potential concept or aspect of the study (these are the most commonly company policies towards safety,

group attitudes towards safety, and the level of safety perceived on the job (Guldenmund, 2010). This determines the parameters by which questions are formulated. Data analysis should show whether all concepts are present.

Last one, the academic approach, on the other hand aims to describe and understand the safety culture in the organization rather to evaluate it. Primary research methodology of this approach is of qualitative nature (Guldenmund, 2010). Academic approach explores the history of the organization, since the current state of the safety culture in an organization is primarily the result of what has happened in the past. Therefore the academic approach focuses primarily on accident statistics, statements of safety policy, etc. This is a descriptive approach, which means that the purpose of the research is to describe and understand the safety culture, with the aim to promote and improve the level of safety culture in the organization. The techniques of data collection include interviews, observation, and examination of documents, literature research, and anything else, which indicates the underlying assumptions of the organization. Most important in this approach is that the data collected are meaningful and sufficient to enable accurate interpretation of the results obtained. EASA methodology does contain some elements of the academic approach (verification of the responses at Member State level), but the sample is too small and inconsistent (not involving checks at all levels of the organization).

Common to all techniques is that they should be carried out by a person who has the expertise and the neutrality needed to evaluate and interpret the results.



Different approaches of safety culture measurement give different insights into the safety culture. Leadership however, can use them as an effective analytical tool with which specific organizational characteristics (weaknesses) can be fairly easily identified.

This can be done by the gap analysis, analyzing the gaps between the responses at the strategic level of the organization (leadership) and at the operational level of the organization (employees). The organization's management can systematically determine which elements (areas) should be improved. The analysis includes determination and approval of the differences between the business requirements and current capabilities. The results obtained by the employees are indispensable, as the leadership in order to identify appropriate measures also needs a vision and opinion of the staff that will implement those measures in their daily work. Such an approach makes it easier to identify and implement the appropriate measures that will really contribute to safety culture enhancement.

The assumption in safety culture assessment using the capability maturity model (pragmatic approach) is that the organizations must satisfy a number of specific criteria. These are as follows:

- Adequate SMS,
- Technical error does not cause the majority of accidents,
- The organization is in line with the safety legislation, and
- Safety should not be assured just in order to evade prosecution but due to a strong commitment to avoid an accident (Fleming, 2000).

These are important factors that in the EASA methodology cannot be fully

confirmed especially at the level of Member States, where no evidence exist that SSP is implemented and in place.

## 5. Conclusion

Effective implementation of SMS and the presence of a safety culture are inherent characteristics that can increase aviation safety. Effective implementation of SMS is enabled only in the presence of a positive safety culture, which affects the deployment and effectiveness of the SMS. When measuring the presence of a safety culture in the aviation it therefore makes sense to use different methods of measurement, in order to obtain the most credible results, which will foster the improvements. To acquire reliable data it is also meaningful to extend the research to all levels of the organization; it is necessary to define groups at different but meaningful organizational levels that have identifiable ways and means to interact, for example whole organization, sector or department, or simply a working group (Guldenmund, 2010; Zohar, 2010). In this way it is easier to detect any inconsistencies or tolerances in respect to the implementation of SMS and the presence of safety culture within the organization.

Current EASA methodology gives some results, but does not permit comprehensive insight into the safety culture elements, which in turn does not allow for identifying weak areas. By extending the methodology to operational levels of the organization would allow consistent gap analysis, through which it is possible to effectively introduce improvements in the organizations processes. With careful adaptation the approach of assessment of safety culture can also be used in other areas of aviation.

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