Enhancing Safety Culture in Air Navigation Service Providers

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Abstract

Air Traffic Management (ATM) must be extremely reliable, especially in terms of safety. Because separating aircraft safely, in an orderly way and efficiently is the fundamental part of ATM, every Air Navigation Service Provider (ANSP) must have a strong safety culture. Safety culture is an embedded commitment to safety throughout an organization. It is also an unwillingness to let production pressures outweigh safety concerns — at the management, controller, supervisory and technical support levels.

However, there are many changes occurring in the world of ATM. The projected increase in worldwide air traffic requires changes to allow for greater capacity. The pressure to make these changes can lead to a degradation of safety unless a strong safety culture exists. In addition, an inadequate safety culture can contribute to fatal accidents, including the disastrous 2001 Milan Linate runway collision and the Überlingen mid-air collision in 2002.

Therefore, the Federal Aviation Administration (FAA), Eurocontrol and Civil Air Navigation Services Organisation (CANSO) members have begun safety culture enhancement programs. In many cases, these efforts are occurring in parallel with the establishment of Safety Management Systems (SMSs) which include safety promotion activities that should positively impact safety culture.

Introduction

Air Traffic Management (ATM) must be extremely reliable, especially in terms of safety. Because separating aircraft safely, in an orderly way and efficiently is the fundamental part of ATM, every Air Navigation Service Provider (ANSP) must have a strong safety culture. However, will the current safety culture permit ANSPs to maintain the high reliability required of ATM in the future?

Although there are many definitions of safety culture, in November 2008, the Civil Air Navigation Services Organisation (CANSO) Safety Standing Committee endorsed the following definition:

> Safety culture refers to the enduring value, priority and commitment placed on safety by every group at every level of the organization. Safety culture reflects the individual and organizational attitudes, norms and behaviors related to the safe provision of air navigation services. [1]

In this context, safety culture is a real commitment to safety, an unwillingness to let production and capacity pressures outweigh safety concerns — at the management, controller, supervisory and technical support levels.

Objectives

The main objective of this paper is to show that organizations are accepting the premise that improvements to, and the maintenance of, safety culture are the keys to maintaining a safe aviation industry. They are developing plans and performing activities to enhance existing safety culture and are already seeing benefits. Specifically, this paper addresses:

- Examples of safety culture efforts in Eurocontrol, European ANSPs, the Federal Aviation Administration (FAA), and CANSO;
- Safety culture resources for other organizations to use; and
- Challenges and issues facing organizations implementing safety culture efforts.

This paper also shows that current activities in Eurocontrol, CANSO and the FAA demonstrate a coordinated vision for safety culture transformation.

Background

The past five years have been the safest period in commercial aviation history. For example, there were no fatal commercial airline accidents in the United States in 2007 or 2008. However, there are many changes occurring in the world of ATM, particularly the pressures that result from the need for increased air traffic capacity. The pressure to make these changes can lead to a degradation of safety unless a strong safety culture exists. In addition, an inadequate safety culture can contribute to fatal accidents, such as two of the most disastrous catastrophes in recent history, the 2001 Milan Linate runway collision and the Überlingen mid-air collision in 2002.

Recent economic conditions have placed additional stress on airlines, which are struggling to stay in business, and on ANSPs, which may be losing revenue. Despite these challenges, the leaders of ANSPs are recognizing that the aviation industry must remain vigilant and not allow complacency about safety. They have already learned one important lesson from the ailing financial industry; banks and insurance companies grew blind to the risks they were absorbing. Based on the historically low instances of defaults, financial computer models predicted extremely low risk, which in turn warranted an increase in the types of transactions that ultimately led to the worldwide financial crisis. Likewise, the aviation industry must not become complacent based on current safety statistics, such as the accident per departure rate, which reflects a remarkably safe industry.

"*We already have an SMS — why do we need safety culture, too?*"

Given the recent emphasis on Safety Management Systems (SMSs), this may be a fair question to ask. An SMS is a systematic and integrated method for managing the safety of navigation services. An SMS represents an organization's competence in the area of safety, and it is important to have an SMS and competent safety staff to execute it. However, the rules and processes contained in the SMS may not always be followed if people in the organization prioritize efficiency or equipment availability over safety. Such an attitude invites taking occasional risks and the underreporting of mistakes and potential safety concerns. Where would people get such an idea? The answer, ultimately, from their peers, but more so from their superiors. To ensure the necessary commitment to safety, organizational leaders must show that safety is their priority.

To achieve this, ANSPs need both an SMS and a healthy safety culture to maintain safe operations. Since accidents occur very rarely, almost all organizations assume they are already safe. However, accidents are usually complex and have multiple causes, so it is not always easy to see them coming. Even harder to see are contributing situations which affect an organization's 'forward vision' in safety, such as:

- Underreporting of incidents due to pressures to meet performance metrics;
- Fears of recrimination or prosecution;
- Personnel taking risks because they believe that is what they are supposed to do; and
- Different subgroups not sharing information due to a lack of mutual trust.

If you want to remain safe, you have to know the realities of safety in your organization.

Before the current global economic downturn, the United States and Europe began the gradual transformation of their aviation systems to meet expected future traffic demands, which have been projected at twice and even three times current levels. Although aviation has recently experienced a decrease in demand, this is expected to be only temporary. Just as air traffic steadily increased after the sharp decline after September 11, 2001, traffic will swell to meet future demand. This requires a drastic change to the air transportation system.

The realization that safety must improve commensurately with the increase in traffic and capacity has led to a global recognition of the need for SMSs. This recognition has been accompanied by the understanding that an SMS will not be successful without the right

organizational environment. As discussed above, this environment is referred to as a positive safety culture.

What are the attributes of a positive safety culture, and how does an organization transform itself to achieve these attributes?

Literature provides a wealth of relevant insights concerning the characteristics of safety culture. James Reason [2], for example, asserts that safety culture encompasses the four following aspects or components:

1. A **reporting culture** that encourages employees to divulge information about all safety hazards that they encounter.

2. A **just culture** that holds employees accountable for deliberate violations of the rules but encourages and rewards them for providing essential safety-related information.

3. A **flexible culture** that adapts effectively to changing demands and allows quicker, smoother reactions to non-nominal events.

4. A **learning culture** that is willing to change based on safety indicators and hazards uncovered through assessments, audits and incident analyses.

The four components — reporting culture, just culture, flexible culture and learning culture — combine to form a safety-conscious, **informed culture** in which a safety system integrates data from incidents, accidents and near misses and combines them with information from proactive measures, such as safety audits and climate surveys. An informed culture has the following characteristics:

- Leadership commitment
- Open communication
- Just environment
- Involvement of everyone at all levels of the organization
- Learning throughout the organization
- Effective decision-making process
- Action/implementation
- Follow-up, feedback and reporting

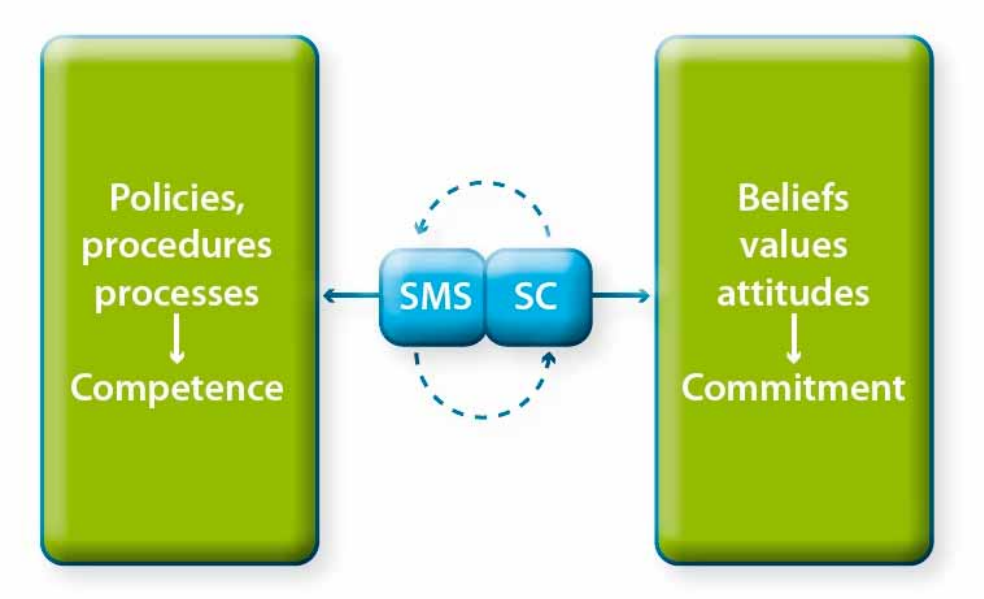
To these characteristics, we can add three further aspects. First, **risk perception** requires that individuals at all organizational levels have coherent perceptions and judgments of the seriousness of risks, as these perceptions affect risk-handling behavior and appropriate decisions with regard to safety issues. Second, **attitudes to safety** reflect a stronger weight given to safety in the balance between safety and capacity. Third, **safety-related behavior** concerns direct compliance with procedures and regulations but also aspects such as coaching, recognizing, communicating, demonstrating and actively caring about safety.

The Relationship Between Safety Culture and an SMS

A positive safety culture can be a strong enabler for an SMS; it can help ensure that the SMS works in practice. The reverse can also be true; implementing an effective SMS can enable a positive safety culture. Organizations are managed by organizational practices which affect both

the performance and reliability of safety systems. A well-developed SMS can therefore serve as an accelerator of safety culture [2, 3]. Therefore, SMS and safety culture are interdependent, as depicted in Figure 1, below. SMS embodies the competence to achieve safety, whereas safety culture represents the commitment to achieving the safest possible system. [4]

Figure 1: Interdependence Between SMS and Safety Culture



Standards developed to guide the implementation of an SMS include requirements to enhance and continuously improve the organizational safety culture. For example, in the United States, the Joint Planning and Development Office (JPDO) has developed an SMS standard [5] for use by the several government departments and agencies developing the Next Generation Air Transportation System (NextGen), the architecture that will allow the substantial increase in traffic in the next 25 years. The CANSO standard that was endorsed at the Safety Standing Committee meeting in November 2008 shows that safety culture is the enabling environment for an SMS.

As a result, Eurocontrol, the FAA and many other ANSPs have decided to launch programs to enhance their safety culture. In many cases, these efforts are occurring in parallel with the establishment of SMSs which include safety promotion activities that should positively impact safety culture. To quote David McMillan, Director General of Eurocontrol, in a recent message to Chief Executive Officers (CEOs) of ANSPs in Europe:

> It is widely recognized that the existence of an appropriate and comprehensive Safety Management System (SMS) is necessary for maintaining and improving the safety of Air Navigation Services. ANSPs across Europe have been striving to meet the EC requirements to implement a robust SMS. But having an SMS is not an end in itself. A Safety Management System will not assure safety if it is not used properly. Thus all staff involved in the provision of ATM services need to be properly aware of its existence, understand its basis and be motivated to use the SMS. Awareness, understanding and motivation don't just happen. They are products of the Organization's culture — something that is often taken for granted, but that has an implicit and very strong influence on the safe behavior of employees. Safety Culture is a sub-dimension of the organizational culture — it refers to the level of commitment of the organization to safety — and is a key driver of safety performance in the industry. ... Safety should not be seen as a cost, but as an opportunity to achieve superior business performance. Good safety also drives good business outcomes. [6]

Specific Examples

Eurocontrol Safety Culture Program

The Eurocontrol program began in 2004 with the adaptation of safety culture measurement tools (or safety climate tools) from more established fields, such as the chemical, nuclear and offshore oil and gas industries. These tools were placed in an ATM context via a detailed analysis of the safety culture of four ANSPs located in different corners of Europe (in order to account for different European regional cultural variability).

This early phase led to the development of an anonymous safety culture measurement questionnaire, which was applied to five additional ANSPs in 2006 and 2007. The evolving methodology included focus groups with ANSP personnel which included personnel at different levels in the organization, from system technicians to Chief Executive Officers. The questionnaire findings were used to guide the focus groups, and the result was a prioritization of safety culture strengths and vulnerabilities in each organization.

The final report for each organization suggested improvement measures, a number of which have either been implemented or are under investigation by the organizations concerned. In 2008, three more ANSPs completed the safety culture survey, and four more will do so in 2009. The questionnaire approach is passing through its second phase of scientific validation.

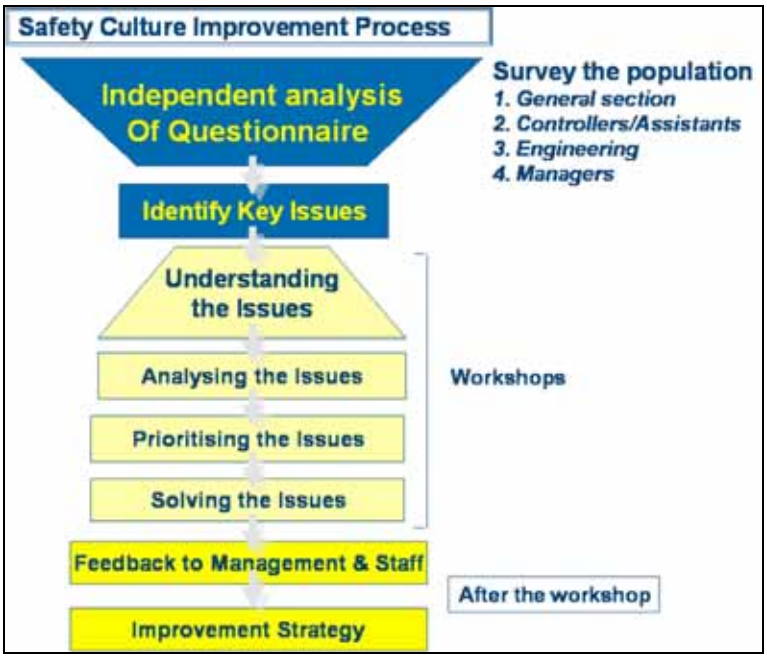
The overall process adopted by Eurocontrol is shown in Figure 2, below. Prior to the distribution of the questionnaire, meetings and visits at the ANSP are held to determine the scope of the survey, such as whether to include all staff or only operational staff, engineers and management; whether to consider regional differences; and whether to consider other factors, such as age.

These visits are also aimed at gathering an initial impression of the culture of the ANSP, and there may be interviews with key personnel, such as the Chief Investigator, Head of Operations or Head of Training, as well as informal discussions with operational and engineering staff. Any recent events or conditions, such as a recent serious incident or industrial action which can influence responses to a questionnaire, are also noted.

The safety culture survey is the launch, and it is important in securing a good response rate. Launches may occur at different regional locations. The important messages are:

- The safety culture survey approach is trustworthy and confidential.
- It is a mature process already used by many ANSPs.
- It can help improve safety and safety culture.
- It is a real chance for individuals to shape the future of safety within the organization.

- **Figure 2: Eurocontrol Safety Culture Survey Process**



Ideally, the response rate exceeds 30 percent of the target population; if it is less than 20 percent, the sample population may not be representative of the intended population. (In one case, an insufficient response led to the destruction of questionnaires and the re-launch of the survey at a later date.)

After a collection period of six weeks, all questionnaires are analyzed. The statistical analysis and the search for key issues takes approximately one month, and these issues are used to steer the focus groups which consist of four to six personnel, plus a facilitator, a note taker and an operational expert, if warranted. The focus groups enable deeper diagnoses of the issues, as well as ensure a precise understanding of the issues. They can even lead to the generation of improvement measures.

Following the workshops, a final (confidential) report is produced, and the main results are then presented to organizational management and all staff. The ANSP management board then determines which measures to incorporate into a strategic safety action plan. The final stage is to repeat the entire cycle two to three years after the first (baseline) survey and determine whether safety culture has improved. Safety culture improvement is therefore a continuous improvement cycle. The process, over time, is represented in Figure 3, below.

At present, eight ANSPs are currently engaged in the initial round, and two ANSPs are about to carry out their second surveys, in 2009. Another three or four ANSPs will begin the process in 2009. In addition to the Eurocontrol survey, ANSPs can carry out safety culture surveys using their own resources and utilize university psychology departments or consultants. Thus far, another four European ANSPs have gone this route. In practice, most safety culture surveys are similar, using similar questions and questionnaire/focus group approaches.

Figure 3: Safety Culture Survey Timing

CEO Conference

The quote from David McMillan, cited earlier, is from the program for a conference titled "Demystifying Safety Culture," sponsored by Eurocontrol. His message also included,

> All Safety Culture pundits say that Safety Culture works best top-down. This conference will bring together CEOs of ANSPs from across Europe to discuss Safety Culture best practices, and to demonstrate leadership and commitment in this key area.

As the title indicates, the objective of this conference on safety culture was to explain what it is and why it is important, as well as how to get started. ANSPs that are now in a position to lead by example supported the workshop at the CEO level. In addition, a well-recognized researcher in the field of organizational psychology in the oil and gas industry, Professor Rhona Flin of Aberdeen University, presented historical parallels in safety culture between industries. David Pryor, who leads a safety culture and SMS working group with the European Civil Aviation Safety Team, which is sponsored by the European Aviation Safety Agency, shared his experience on achieving a strong safety culture from the perspective of a low-cost airline, easyJet.

The success of this conference, as demonstrated by attendance alone (the 95 attendees came from 32 countries and included Eurocontrol's Director General, 22 CEOs, 30 Chief Operating Officers, the FAA's Vice President of Safety and CANSO's Safety Standing Committee Chairperson) illustrates the consensus among ANSP leadership that SMS and regulatory compliance are not enough. Management needs to understand the real risks to safety and instill a strong safety culture. Safety culture improvement efforts may also provide some protection in the event of legal action following an accident or incident. As a result of the conference, seven

additional ANSPs are now considering starting the journey towards establishing and maintaining a strong safety culture.

By 2013, the goal is to have all Eurocontrol member states understand their own safety culture strengths and weaknesses and put in place appropriate improvement actions.

A future aim is to begin learning across organizations via the sharing of best practices in safety culture. These lessons will come from areas such as just culture, incident learning and prioritization of safety. This work, which is scheduled to start in 2009, will examine how different ANSPs address and resolve safety culture problem areas. This will allow cross-industry learning on safety culture enhancement.

An example of cross-organizational learning is the Memorandum of Cooperation (MOC) between Eurocontrol and the FAA. The MOC established several working groups on ATM topics. One of these workgroups, Action Plan 15 on Safety, has published a detailed white paper on safety culture [4]. The white paper was distributed to attendees at the CEO conference and is available from Eurocontrol.

Other resources are available from SKYbrary [7], a wiki created by Eurocontrol, the International Civil Aviation Organization and the Flight Safety Foundation to create a comprehensive source of free aviation safety information available online. The Flight Safety Foundation defines SKYbrary's goal as "capturing authoritative aviation industry information and creating cumulative knowledge, especially with regard to critical safety issues."

Federal Aviation Administration

The FAA's Air Traffic Organization (ATO) began its safety culture enhancement activities in 2005 with the development of management briefings, posters (such as Heinrich's Triangle) and videos portraying the Challenger and Überlingen accidents, which were distributed throughout the organization. These were followed by a series of interviews at all levels, from upper management to frontline controllers, which were used to develop a questionnaire program.

In 2006, over 600 managers participated in an initial safety culture questionnaire. This was followed in 2007 by a survey at 12 air traffic control facilities. A pilot safety culture survey program was also conducted for the maintenance organization of the ATO. As a result of these early attempts to establish a safety culture baseline, employee reporting systems for both maintenance and air traffic personnel have been developed. These systems are modelled after the Aviation Safety Action Programs that have been successful at many airlines in the United States. Demonstration programs have been conducted and are currently being evaluated before moving to national implementation.

In 2008, safety culture surveys were administered at the previously-surveyed 12 facilities for a comparative analysis. In 2009, the ATO will work with the University of St. Louis, which received and analyzed the questionnaires, to develop strategies for improvement. Results are being used to address organizational attributes that may be acting as barriers to enhancing the safety culture and to determine areas of concentration for change. In addition, the ATO recently established a Safety Culture Manager position in the Office of Safety that will provide the leadership needed to continue further safety culture enhancement and monitoring activities.

The ATO also provides safety leadership to the JPDO, a multi-department United States government office established to plan NextGen. The Safety Working Group of the JPDO was tasked with creating a comprehensive national-level aviation safety management framework for NextGen. An important element of this framework is the establishment of standards and guidance. An SMS standard to be used by the JPDO agencies and other stakeholders was recently approved by the Senior Policy Committee. The SMS standard includes the requirement that organizations "promote the growth of a positive safety culture."

The Office of Safety within the ATO leads the Safety Culture Study Team of the JPDO Safety Working Group. The Study Team has engaged speakers from various fields, such as academia, military and industry, to present briefings related to safety culture and human factors to the Safety Working Group, conducted a safety culture workshop for JPDO working group leaders, and in 2008 published a Safety Culture Improvement Resource Guide [8] on the JPDO web site. Resource Guide is not an implementation plan but instead provides resources and guidance to assist stakeholders in strengthening their own safety cultures. Each JPDO agency is responsible for developing its own implementation plan, including the allocation of appropriate resources for safety culture improvement. The agencies will tailor the guide's tools to meet their needs. As the JPDO agencies develop lessons learned in enhancing safety culture, the guide will be updated to include best practices.

An example of measurement tools included in the guide is a list of objective criteria that can be used to assess safety culture. These objective measures check for the presence or absence of certain key elements of a positive safety culture. Criteria were selected by gathering characteristics of positive safety culture and processes of maintaining a healthy safety culture,

from agencies and companies that have had success in this area. The objective criteria are organized into five main areas:

1. **In-house Hazard Reporting —** how safety information is provided by employees and how the organization gathers, uses and disseminates safety data

2. **Safety Organization —** how safety fits into the company or agency structure

3. **Training —** the safety training and feedback that the organization provides to its human resources

4. **Senior Management Involvement —** the extent to which senior managers consider safety issues in decision making, finances and education

5. **Workshops —** the improved ability to identify weaknesses in communication, integrity and trust[1]

Civil Air Navigation Services Organisation (CANSO)

The CANSO Safety Standing Committee (SSC) supports a Safety Culture Working Group as part of its safety activities for ANSPs. The working group is led by representatives from FAA and NavCanada and includes representation from several other ANSPs (Austria, Sweden, Norway, Hungary, South Africa, Hungary and the Netherlands).

In 2008, the group conducted research on safety culture barriers and enablers, resulting in a paper that was presented at the Eurocontrol Safety Research and Development Conference in October of that year. A survey asking responders to rank several examples of organizational

attributes as enablers or barriers to safety culture was sent to the Safety Directors of all member ANSPs. Over 50 percent of the members replied. The survey also determined that 16 of the 26 ANSPs were already conducting safety climate surveys. The results will be used to inform the development of questionnaires for ANSPs to measure their safety cultures. The goal of the working group is for all members to be measuring and improving their safety cultures by 2012. In 2009, the group plans to complete a database of survey questions, a guidance document on conducting safety climate surveys and a safety culture transformation guide for the CANSO ANSP members.

The driver for continuing this safety culture work in CANSO is the SMS standard drafted by an SMS workgroup and recently endorsed by the SSC. The SMS standard states, "This standard provides a framework through which the safety culture of each organization can be improved. An SMS provides a strong organizational culture that prioritises safety." Safety culture is considered a vital enabler for SMS. Thus, the interdependent relationship between SMS and safety culture is addressed.

Next Steps

As ANSPs complete safety climate assessment activities, they must be prepared to address safety culture transformation. This is where the real benefits of safety culture activities will be realized. Through the information-sharing activities and conferences mentioned above, ANSPs are currently undertaking the following activities, among others, to improve their safety cultures and to enhance the safety of their operations:

[1] Guidelines for conducting workshops are included in an appendix to the guide.

- Crew Resource Management/Team Resource Management (TRM): This training provides a human factors workshop for all operational air traffic control personnel, from field managers to controllers, to improve teamwork, individual performance, and managing threats and errors. In several ANSPs, the use of TRM had fallen into disuse, and controllers mentioned that this was a loss in safety culture, team-building and awareness. In several ANSPs, TRM is now being re-instated.

- Regional safety culture workshops: These workshops bring together safety practitioners and operational personnel for training, sharing best practices and talking about lessons learned.

- Day-to-day Safety Measures [9]: Trained observers monitor controllers to document best practices. The results are used to drive improvements in safety performance through a better understanding of the techniques and behaviors used in the day-to-day operation.

- 360-degree safety leadership assessment [9]: Upper management receives feedback from superiors, peers and subordinates using a survey of safety-related behavior.

- Streamlining incident reporting processes: Streamlining allows reporters to gain faster feedback, whether individually or through "lessons sheets." If controllers or engineers have to wait for a significant period of time to learn the organizational factors that contributed to the incident, there is little motivation to report in the first place. Several organizations have made both the reporting and learning processes more efficient. In addition, in several cases, the whole process is being made more transparent, particularly with respect to just culture issues.

- Achieving consistency (a “level playing field”) with respect to disciplinary practices of different supervisors: One survey noted that controllers or engineers who suffer a “mistake” may get a varied response in terms of “discipline” depending who is his or her supervisor. This is being rectified at the supervisory level.

- Ensuring “personal relevance” of the SMS and safety responsibilities: In one ANSP in particular, some people felt distanced from the formal SMS. They were then asked to define their safety responsibilities in their own language, which then became the documented form of the local SMS. This clarified their safety roles, energized them towards safety, and made it easier to communicate safety roles and responsibilities to their subordinates.

- Identifying the need to carry out a periodic safety culture survey in the SMS: One ANSP in particular has done this, providing a concrete link between SMS and safety culture. This ANSP, as per its SMS, is about to carry out its second safety culture survey.

- Giving engineers an equal voice in safety: This helps to ensure that their safety concerns are treated similarly to those of controllers. For example, in one ANSP, certain engineers did not have the same access rights to key safety committees and felt their concerns were not getting an adequate level of attention.

Issues and Concerns

- Several issues that might impede safety culture improvement must be addressed. These include:

- The inherent resistance to change, especially culture change.
- Fear of loss of control among some managers.
- Legal issues concerning the protection of safety information.

Summary and Conclusions

ATM has always had a strong emphasis on safety, and has therefore always had a strong implicit safety culture, accounting for its strong track record in safety compared to most other industries. Nevertheless, given the challenges now facing ATM, a safety culture approach must be taken to gain a sharper picture of safety risks facing ANSPs. This approach will reveal the strengths and weaknesses in the safety culture of each ANSP.

In the United States via the FAA, in Europe via Eurocontrol and globally via CANSO, there is now a concerted effort to raise the bar in safety culture across all ANSPs, and ANSPs are increasingly implementing the safety culture philosophy. This is a timely focus given the parallel efforts toward improving SMSs across ANSPs. These two interrelated labors mean that ATM will have both the necessary ingredients — competence and commitment to safety — to ensure that the aviation industry continues to enjoy its hard-earned safety record well into the future and the next generation of ATM.

Recommendations

- Top management must champion safety and safety culture.
- ANSPs should invest in measuring safety culture (via surveys and workshops).

- ANSPs engaged in safety culture improvement efforts should share information on best practices and lessons learned.

About the Authors

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