



# AIRWORTHINESS GUIDANCE

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## SAFETY MANAGEMENT SYSTEM

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Pursuant to section 24O of the Civil Aviation Act 1969 [Act 3], the Chief Executive Officer (CEO) of the Civil Aviation Authority of Malaysia (CAAM) may, from time to time, issue Notices, circulars, requirements, Directives and information on any aspect of safety in civil aviation. This airworthiness guidance (AG) is issued pursuant to the section 24O and contains information about standards, practices and procedures acceptable to CAAM. This AG sets forth an acceptable means, but not the only means, of accomplishing or showing compliance with airworthiness requirements of CAAM.

This Airworthiness Guidance (AG) provides guidance for the Safety Management System of service providers pursuant to Notice 2101, *Safety Management System* and regulation 167 of the Civil Aviation Regulations (CAR) 2016.

Material in this AG is neither mandatory nor regulatory in nature and does not constitute a regulation.

A handwritten signature in blue ink, appearing to be 'Ahmad Nizar Zolfakar', is written over the typed name.

(Ahmad Nizar Zolfakar)  
Chief Executive Officer  
Civil Aviation Authority of Malaysia  
1<sup>st</sup> Nov 2019

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# CHAPTER 1. INTRODUCTION

## 1.1 Purpose

This Airworthiness Guidance (AG) issued to provide guidance to service providers in implementing effectiveness Safety Management System (SMS), in respect of compliance with Airworthiness Notice 2101.

## 1.2 Applicability

This AG is applicable to the Service provider's regulated by Airworthiness Notice 2101.

*Note 1.— In this AG, the term “organization” is used to refer to both State and service providers.*

*Note 2.— In this AG, the term “service provider” is used to refer to an aviation industry organization implementing SMS.*

## 1.3 Cancellation

This AG supersedes the Department Civil Aviation, Sector Airworthiness “SMS Handbook” rev 1, dated 1 Dec 2008

## 1.4 Background

ICAO Annex 19 – Safety Management defines SMS as “a systematic approach to managing safety, including the necessary organisational structures, accountability, responsibilities, policies and procedures”.

ICAO Doc 9859 – Safety Management Manual further elaborates that the SMS should assist the service provider's to continuously improve safety through identifying hazards, collecting and analysing data and assessing safety risks. This will enable the service provider to proactively contain or mitigate risks before they result in aviation accidents and incidents.

It is more than a manual and a set of procedures and requires safety management to be integrated into the day to day activities of the service provider. It requires the development of service provider culture that reflects the safety policy and objectives



At the core of the SMS is a formal risk management process that identifies hazards and assesses and mitigates risk. It is important to recognise that even with mitigations in place, some residual risk will remain and an effective SMS will enable organisations to manage this.

The scope of SMS applies to the activities of a service provider related to the safe operation of aircraft. Corporate activities such as finance, human resources and legal activities would have implications on SMS, and therefore should facilitate the effective.

## **1.5 Related Publications**

- (a) Malaysian Civil Aviation Regulations 2016.
- (b) Airworthiness Notice 2101, Safety Management System
- (c) ICAO Annex 19, Safety Management.
- (d) ICAO Safety Management Manual (Doc 9859).

## CHAPTER 2. SAFETY MANAGEMENT FUNDAMENTALS

### 2.1 The concept of safety and its evolution

2.1.1 This chapter provides an overview of fundamental safety management concepts and practices. It is important to understand these fundamentals before focusing on the specifics of safety management found in the subsequent chapters.

2.1.2 Within the context of aviation, safety is “the state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level”.

2.1.3 Aviation safety is dynamic. New safety hazards and risks continuously emerge and must be mitigated. As long as safety risks are kept under an appropriate level of control, a system as open and dynamic as aviation can still be kept safe. It is important to note that acceptable safety performance is often defined and influenced by domestic and international norms and culture.

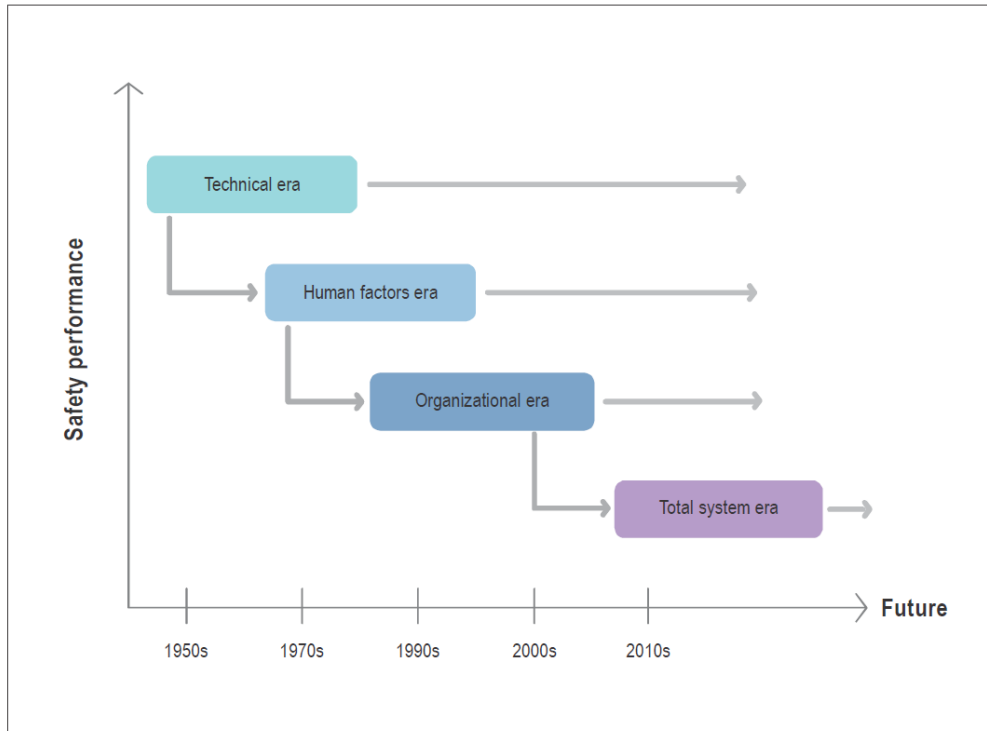
2.1.4 Progress in aviation safety can be described by four approaches, which roughly align with eras of activity. The approaches are listed below and are illustrated in Figure 2-1.

(a) *Technical* — From the early 1900s until the late 1960s, aviation emerged as a form of mass transportation in which identified safety deficiencies were initially related to technical factors and technological failures. The focus of safety endeavours was therefore placed on the investigation and improvement of technical factors (the aircraft, for example). By the 1950s, technological improvements led to a gradual decline in the frequency of accidents, and safety processes were broadened to encompass regulatory compliance and oversight.

(b) *Human factors* — By the early 1970s, the frequency of aviation accidents had significantly declined due to major technological advances and enhancements to safety regulations. Aviation became a safer mode of transportation, and the focus of safety endeavours was extended to include human factors, including such things as the “man/machine interface”. Despite the investment of resources in error mitigation, human factors continue to be cited as a recurring factor in accidents. Human factors tended to focus on the individual, without fully considering the operational and organizational context. It was not until the early 1990s that it was

acknowledged that individuals operate in a complex environment that included multiple factors which could affect behaviour.

- (c) *Organizational* — During the mid-1990s, safety began to be viewed from a systemic perspective and began encompassing organizational factors as well as human and technical factors. The notion of an “organizational accident” was introduced. This perspective considered the impact of such things as organizational culture and policies on the effectiveness of safety risk controls. Additionally, routine safety data collection and analysis using reactive and proactive methodologies enabled organizations to monitor known safety risks and detect emerging safety trends. These enhancements provided the learning and foundation which lead to the current safety management approach
- (d) *Total system* — From the beginning of the 21st century, many States and service providers had embraced the safety approaches of the past and evolved to a higher level of safety maturity. They have begun implementing SSP or SMSs and are reaping the safety benefits. However, safety systems to date have focused largely on individual safety performance and local control, with minimal regard for the wider context of the total aviation system. This has led to growing recognition of the complexity of the aviation system and the different organizations that all play a part in aviation safety. There are many examples of accidents and incidents showing that the interfaces between organizations have contributed to negative outcomes.



**Figure 2-1. The evolution of safety**

2.1.5 The steady, compounding evolution of safety has led States and service providers to a point where they are giving serious consideration to the interactions and interfaces between the components of the system: people, processes, and technologies. This has led to a greater appreciation for the positive role people play in the system. Safety benefits from collaboration between service providers, and between service providers and States. This perspective has nurtured multiple collaborative initiatives between service providers and an appreciation of the benefits of collaboration when addressing safety issues. The ICAO Runway Safety Programme is a good example.

2.1.6 For the collaborative total system approach to flourish, the interfaces and interactions between the organizations (including States) need to be well understood and managed. States are also beginning to recognize the role the total aviation system approach can play in their SSP development. For example, it helps to manage safety risks which cut across multiple aviation activities.

## **2.2 Humans in the system**

2.2.1 How people think about their responsibilities towards safety and how they interact with others to perform their tasks at work significantly affects their organization's

safety performance. Managing safety needs to address how people contribute, both positively and negatively, to organizational safety. Human factors is about: understanding the ways in which people interact with the world, their capabilities and limitations, and influencing human activity to improve the way people do their work. As a result, the consideration of human factors is an integral part of safety management, necessary to understand, identify and mitigate risks as well as to optimize the human contributions to organizational safety.

2.2.2 The following are key ways in which safety management processes consider human factors:

- (a) senior management commitment to creating a working environment that optimizes human performance and encourages personnel to actively engage in and contribute to the organization's safety management processes;
- (b) responsibilities of personnel with respect to safety management are clarified to ensure common understanding and expectations;
- (c) personnel are provided with information by the organization that:
  - (i) describes the expected behaviours in respect to the organizational processes and procedures;
  - (ii) describes what actions will be taken by the organization in response to individual behaviours;
- (d) human resourcing levels are monitored and adjusted to ensure there are enough individuals to meet operational demands;
- (e) policies, processes and procedures are established to encourage safety reporting;
- (f) safety data and safety information are analysed to allow consideration of those risks related to variable human performance and human limitations, with particular attention to any associated organizational and operational factors;
- (g) policies, processes and procedures are developed that are clear, concise and workable, with the aim of:
  - (i) optimizing human performance;

- (ii) preventing inadvertent errors;
  - (iii) reducing the unwanted consequences of variable human performance; the effectiveness of these are continually monitored during normal operations;
- (h) ongoing monitoring of normal operations includes assessment of whether processes and procedures are followed and, when they are not followed, investigations are carried out to determine the cause;
  - (i) safety investigations include the assessment of contributing human factors, examining not only behaviours but reasons for such behaviours (context), with the understanding that in most cases people are doing their best to get the job done;
  - (j) management of change process includes consideration of the evolving tasks and roles of the human in the system;
  - (k) personnel are trained to ensure they are competent to perform their duties, the effectiveness of training is reviewed and training programmes are adapted to meet changing needs.

2.2.3 The effectiveness of safety management depends largely on the degree of senior support and management commitment to create a working environment that optimizes human performance and encourages personnel to actively engage in and contribute to the organization's safety management processes.

2.2.4 To address the way that the organization influences human performance there must be senior level support to implement effective safety management. This includes management commitment to create the right working environment and the right safety culture to address human factors. This will also influence the attitudes and behaviours of everyone in the organization.

2.2.5 A number of models have been created to support the assessment of human factors on safety performance. The SHELL Model is well known and useful to illustrate the impact and interaction of the different system components on the human, and emphasizes the need to consider human factors as an integrated part of SRM.

2.2.6 Figure 2-2 illustrates the relationship between the human (at the centre of the model) and workplace components. The SHELL Model contains four satellite components:

- (a) Software (S): procedures, training, support, etc.;
- (b) Hardware (H): machines and equipment;
- (c) Environment (E): the working environment in which the rest of the L-H-S system must function; and
- (d) Liveware (L): other humans in the workplace.



**Figure 2-2. SHELL Model**

2.2.7 *Liveware.* The critical focus of the model is the humans at the front line of operations, and depicted in the centre of the model. However, of all the dimensions in the model, this is the one which is least predictable and most susceptible to the effects of internal (hunger, fatigue, motivation, etc.) and external (temperature, light, noise, etc.) influences. Although humans are remarkably adaptable, they are subject to considerable variations in performance. Humans are not standardized to the same degree as hardware, so the edges of this block are not simple and straight. The effects of irregularities at the interfaces between the various SHELL blocks and the central Liveware block should be understood to avoid tensions that may compromise human performance. The jagged edges of the modules represent the imperfect

coupling of each module. This is useful in visualizing the following interfaces between the various components of the aviation system:

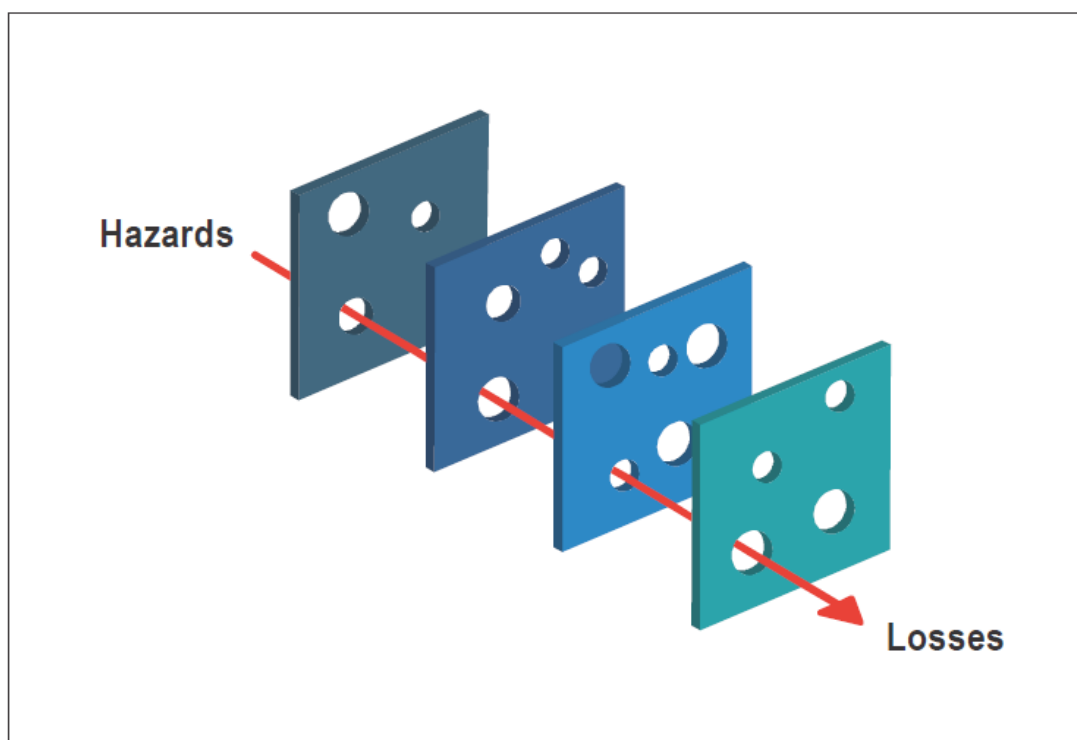
- (a) *Liveware-Hardware (L-H)*. The L-H interface refers to the relationship between the human and the physical attributes of equipment, machines and facilities. This considers the ergonomics of operating the equipment by personnel, how safety information is displayed and how switches and operating levers are labelled and operated so they are logical and intuitive to operate.
- (b) *Liveware-Software (L-S)*. The L-S interface is the relationship between the human and the supporting systems found in the workplace, e.g. regulations, manuals, checklists, publications, processes and procedures, and computer software. It includes such issues as the recency of experience, accuracy, format and presentation, vocabulary, clarity and the use of symbols. L-S considers the processes and procedures - how easy they are to follow and understand.
- (c) *Liveware-Liveware (L-L)*. The L-L interface is the relationship and interaction between people in their work environment. Some of these interactions are within the organization (colleagues, supervisors, managers), many are between individuals from different organizations with different roles (air traffic controllers with pilots, pilots with engineers etc.). It considers the importance of communication and interpersonal skills, as well as group dynamics, in determining human performance. The advent of crew resource management and its extension to air traffic services (ATS) and maintenance operations has enabled organizations to consider team performance in the management of errors. Also within the scope of this interface are staff/management relationships and organizational culture.
- (d) *Liveware-Environment (L-E)*. This interface involves the relationship between the human and the physical environment. This includes things such as temperature, ambient light, noise, vibration and air quality. It also considers the external environmental factors, such as weather, infrastructure and terrain.



## **2.3 Accident causation**

- 2.3.1 The “Swiss-Cheese” (or Reason) Model, developed by Professor James Reason and well known to the aviation industry, illustrates that accidents involve successive breaches of multiple defences. These breaches can be triggered by a number of enabling factors such as equipment failures or operational errors. The Swiss-Cheese Model contends that complex systems such as aviation are extremely well defended by layers of defences (otherwise known as “barriers”). A single-point failure is rarely consequential. Breaches in safety defences can be a delayed consequence of decisions made at the higher levels of the organization, which may remain dormant until their effects or damaging potential are activated by certain operating conditions (known as latent conditions). Under such specific circumstances, human failures (or “active failures”) at the operational level act to breach the final layers of safety defence. The Reason Model proposes that all accidents include a combination of both active failures and latent conditions.
- 2.3.2 Active failures are actions or inactions, including errors and rule-breaking, that have an immediate adverse effect. They are viewed, with the benefit of hindsight, as unsafe acts. Active failures are associated with front-line personnel (pilots, air traffic controllers, aircraft maintenance engineers, etc.) and may result in a harmful outcome.
- 2.3.3 Latent conditions can exist in the system well before a damaging outcome. The consequences of latent conditions may remain dormant for a long time. Initially, these latent conditions are not perceived as harmful, but under certain conditions may become clear when the operational level defences are breached. People far removed in time and space from the event can create these conditions. Latent conditions in the system may include those created by the safety culture; equipment choices or procedural design; conflicting organizational goals; defective organizational systems; or management decisions.
- 2.3.4 The “organizational accident” paradigm assists by identifying these latent conditions on a system-wide basis, rather than through localized efforts, to minimize active failures by individuals. Importantly, latent conditions, when created, had good intentions. Organizational decision makers are often balancing finite resources, and potentially conflicting priorities and costs. The decisions taken by decision makers, made on a daily basis in large organizations, might, in particular circumstances, unintentionally lead to a damaging outcome.

2.3.5 Figure 2-3 illustrates how the Swiss-Cheese Model assists in understanding the interplay of organizational and managerial factors in accident causation. Multiple defensive layers are built into the aviation system to protect against variations in human performance or decisions at all levels of the organization. But each layer typically has weaknesses, depicted by the holes in the slices of “Swiss cheese”. Sometimes all of the weaknesses align (represented by the aligned holes) leading to a breach that penetrates all defensive barriers and may result in a catastrophic outcome. The Swiss-Cheese Model represents how latent conditions are ever present within the system and can manifest through local trigger factors.



**Figure 2-3. Concept of accident causation**

2.3.6 It is important to recognize that some of the defences, or breaches, can be influenced by an interfacing organization. It is therefore vitally important that service providers assess and manage these interfaces.

2.3.7 ***“Swiss–Cheese” applications for safety management***

- (a) The “Swiss-Cheese” Model can be used as an analysis guide by both States and service providers by looking past the individuals involved in an incident or identified hazard, into the organizational circumstances which may have

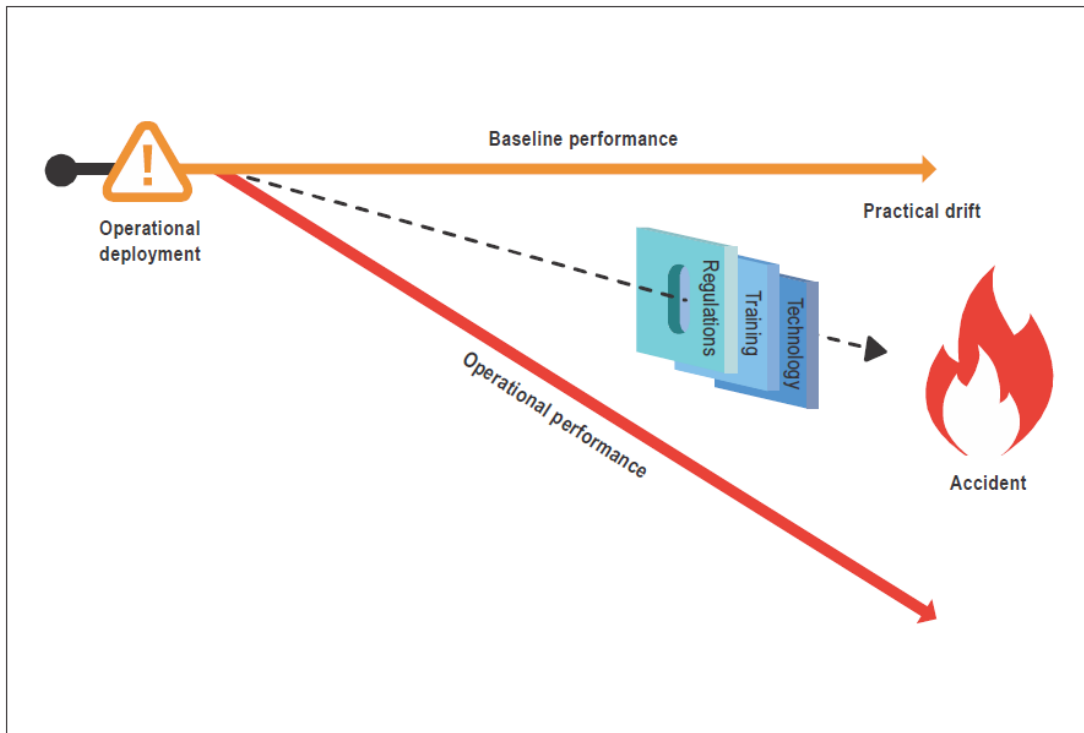
allowed the situation to manifest. It can be applied during SRM, safety surveillance, internal auditing, change management and safety investigation. In each case, the model can be used to consider which of the organization's defences are effective, which can or have been breached, and where the system could benefit from additional defences. Once identified, any weaknesses in the defences can be reinforced against future accidents and incidents.

- (b) In practice, the event will breach the defences in the direction of the arrow (hazards to losses) as displayed in the rendering of Figure 2-3. The assessments of the situation will be conducted in the opposite direction, in this case losses to hazard. Actual aviation accidents will usually include a degree of additional complexity. There are more sophisticated models which can help States and service providers to understand how and why accidents happen.

### 2.3.8 ***Practical drift***

- (a) Scott A. Snook's theory of practical drift is used to understand how performance of any system "drifts away" from its original design. Tasks, procedures, and equipment are often initially designed and planned in a theoretical environment, under ideal conditions, with an implicit assumption that nearly everything can be predicted and controlled, and where everything functions as expected. This is usually based on three fundamental assumptions that the:
  - (i) technology needed to achieve the system production goals is available;
  - (ii) personnel are trained, competent and motivated to properly operate the technology as intended; and
  - (iii) policy and procedures will dictate system and human behaviour.

These assumptions underlie the baseline (or ideal) system performance, which can be graphically presented as a straight line from the start of operational deployment as shown in Figure 2-4.



**Figure 2-4. Concept of practical drift**

- (b) Once operationally deployed, the system should ideally perform as designed, following baseline performance (orange line) most of the time. In reality, the operational performance often differs from the assumed baseline performance as a consequence of real-life operations in a complex, ever-changing and usually demanding environment (red line). Since the drift is a consequence of daily practice, it is referred to as a “practical drift”. The term “drift” is used in this context as the gradual departure from an intended course due to external influences.
- (c) Snook contends that practical drift is inevitable in any system, no matter how careful and well thought out its design. Some of the reasons for the practical drift include:
- (i) technology that does not operate as predicted;
  - (ii) procedures that cannot be executed as planned under certain operational conditions;
  - (iii) changes to the system, including the additional components;
  - (iv) interactions with other systems;

- (v) safety culture;
  - (vi) adequacy (or inadequacy) of resources (e.g. support equipment);
  - (vii) learning from successes and failures to improve operations, and so forth.
- (d) In reality people will generally make the system work on a daily basis despite the system's shortcomings, applying local adaptations (or workarounds) and personal strategies. These workarounds may bypass the protection of existing safety risk controls and defences.
- (e) Safety assurance activities such as audits, observations and monitoring of SPIs can help to expose activities that are "practically drifting". Analysing the safety information to find out why the drift is happening helps to mitigate the safety risks. The closer to the beginning of the operational deployment that practical drift is identified, the easier it is for the organization to intervene.

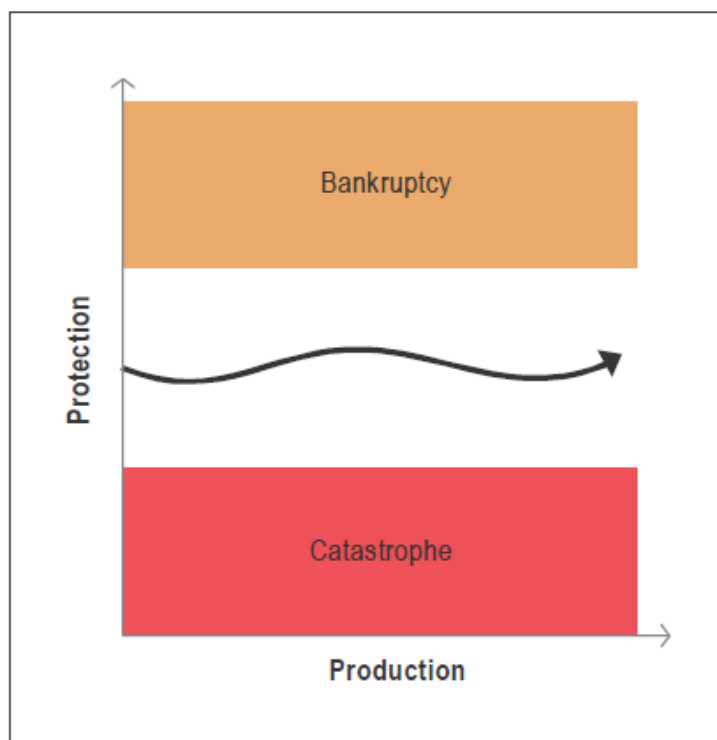
## **2.4 Management dilemma**

2.4.1 In any organization engaged in the delivery of services, production/profitability and safety risks are linked. An organization must maintain profitability to stay in business by balancing output with acceptable safety risks (and the costs involved in implementing safety risk controls). Typical safety risk controls include technology, training, processes and procedures. For the State, the safety risk controls are similar, i.e. training of personnel, the appropriate use of technology, effective oversight and the internal processes and procedures supporting oversight. Implementing safety risk controls comes at a price – money, time, resources – and the aim of safety risk controls is usually to improving safety performance, not production performance. However, some investments in "protection" can also improve "production" by reducing accidents and incidents and thereby their associated costs.

2.4.2 The safety space is a metaphor for the zone where an organization balances desired production/profitability while maintaining required safety protection through safety risk controls. For example, a service provider may wish to invest in new equipment. The new equipment may simultaneously provide the necessary efficiency improvements as well as improved reliability and safety performance. Such decision-making involves an assessment of both the benefits to the organization as well as the safety risks involved. The allocation of excessive resources to safety risk controls may result

in the activity becoming unprofitable, thus jeopardizing the viability of the organization.

2.4.3 On the other hand, excess allocation of resources for production at the expense of protection can have an impact on the product or service and can ultimately lead to an accident. It is therefore essential that a safety boundary be defined that provides early warning that an unbalanced allocation of resources exists, or is developing. Organizations use financial management systems to recognize when they are getting too close to bankruptcy and apply the same logic and tools used by safety management to monitor their safety performance. This enables the organization to operate profitably and safely within the safety space. Figure 2-5 illustrates the boundaries of an organization's safety space. Organizations need to continuously monitor and manage their safety space as safety risks and external influences change over time.



**Figure 2-5. Concept of a safety space**

2.4.4 The need to balance profitability and safety (or production and protection) has become a readily understood and accepted requirement from a service provider perspective. This balance is equally applicable to the State's management of safety, given the requirement to balance resources required for State protective functions that include certification and surveillance.

## **CHAPTER 3. SAFETY RISK MANAGEMENT**

### **3.1 Safety Risk Management (SRM)**

3.1.1 Safety Risk Management (SRM) is a key component of safety management and includes hazard identification, safety risk assessment, safety risk mitigation and risk acceptance. SRM is a continuous activity because the aviation system is constantly changing, new hazards can be introduced and some hazards and associated safety risks may change over time. In addition, the effectiveness of implemented safety risk mitigation strategies must be monitored to determine if further action is required.

### **3.2 Introduction to hazards**

3.2.1 In aviation, a hazard can be considered as a dormant potential for harm which is present in one form or another within the system or its environment. This potential for harm may appear in different forms, for example: as a natural condition (e.g. terrain) or technical status (e.g. runway markings).

3.2.2 Hazards are an inevitable part of aviation activities, however, their manifestation and possible adverse consequences can be addressed through mitigation strategies which aim to contain the potential for the hazard to result in an unsafe condition. Aviation can coexist with hazards so long as they are controlled. Hazard identification is the first step in the SRM process. It precedes a safety risk assessment and requires a clear understanding of hazards and their related consequences.

### **3.3 Understanding hazards and their consequences**

3.3.1 Hazard identification focuses on conditions or objects that could cause or contribute to the unsafe operation of aircraft or aviation safety-related equipment, products and services (guidance on distinguishing hazards that are directly pertinent to aviation safety from other general/industrial hazards is addressed in subsequent paragraphs).

3.3.2 Consider, for example, a fifteen-knot wind. Fifteen-knots of wind is not necessarily a hazardous condition. In fact, a fifteen-knot wind blowing directly down the runway improves aircraft take-off and landing performance. But if the fifteen-knot wind is blowing across the runway, a crosswind condition is created which may be hazardous to operations. This is due to its potential to contribute to aircraft instability. The reduction in control could lead to an occurrence, such as a lateral runway excursion.

- 3.3.3 It is not uncommon for people to confuse hazards with their consequences. A consequence is an outcome that can be triggered by a hazard. For example, a runway excursion (overrun) is a potential consequence related to the hazard of a contaminated runway. By clearly defining the hazard first, one can more readily identify possible consequences.
- 3.3.4 In the crosswind example above, an immediate outcome of the hazard could be loss of lateral control followed by a consequent runway excursion. The ultimate consequence could be an accident. The damaging potential of a hazard can materialize through one or many consequences. It is important that safety risk assessments identify all of the possible consequences. The most extreme consequence - loss of human life - should be differentiated from those that involve lesser consequences, such as: aircraft incidents; increased flight crew workload; or passenger discomfort. The description of the consequences will inform the risk assessment and subsequent development and implementation of mitigations through prioritization and allocation of resources. Detailed and thorough hazard identification will lead to more accurate assessment of safety risks.

### **3.4 Hazard identification and prioritization**

- 3.4.1 Hazards exist at all levels in the organization and are detectable through many sources including reporting systems, inspections, audits, brainstorming sessions and expert judgement. The goal is to proactively identify hazards before they lead to accidents, incidents or other safety-related occurrences. An important mechanism for proactive hazard identification is a voluntary safety reporting system.
- 3.4.2 Hazards can also be identified in the review or study of internal and external investigation reports. A consideration of hazards when reviewing accident or incident investigation reports is a good way to enhance the organization's hazard identification system. This is particularly important when the organization's safety culture is not yet mature enough to support effective voluntary safety reporting, or in small organizations with limited events or reports. An important source of specific hazards linked to operations and activities is from external sources such as ICAO, trade associations or other international bodies.
- 3.4.3 Hazard identification may also consider hazards that are generated outside of the organization and hazards that are outside the direct control of the organization, such as extreme weather or volcanic ash. Hazards related to emerging safety risks are



also an important way for organizations to prepare for situations that may eventually occur.

#### 3.4.4 The following should be considered when identifying hazards:

- (a) system description;
- (b) design factors, including equipment and task design;
- (c) human performance limitations (e.g. physiological, psychological, physical and cognitive);
- (d) procedures and operating practices, including documentation and checklists, and their validation under actual operating conditions;
- (e) communication factors, including media, terminology and language;
- (f) organizational factors, such as those related to the recruitment, training and retention of personnel, compatibility of production and safety goals, allocation of resources, operating pressures and corporate safety culture;
- (g) factors related to the operational environment (e.g. weather, ambient noise and vibration, temperature and lighting);
- (h) regulatory oversight factors, including the applicability and enforceability of regulations, and the certification of equipment, personnel and procedures;
- (i) performance monitoring systems that can detect practical drift, operational deviations or deterioration of product reliability;
- (j) human-machine interface factors; and
- (k) factors related to the SSP/SMS interfaces with other organizations.

### 3.5 Occupational safety health and environment hazards

3.5.1 Safety risks associated with compound hazards that simultaneously impact aviation safety as well as OSHE may be managed through separate (parallel) risk mitigation processes to address the separate aviation and OSHE consequences, respectively. Alternatively, an integrated aviation and OSHE risk mitigation system may be used to address compound hazards. An example of a compound hazard is a lightning strike on an aircraft at an airport transit gate. This hazard may be deemed by an OSHE

inspector to be a “workplace hazard” (ground personnel/workplace safety). To an aviation safety inspector, it is also an aviation hazard with risk of damage to the aircraft and a risk to passenger safety. It is important to consider both the OSHE and aviation safety consequences of such compound hazards, since they are not always the same. The purpose and focus of preventive controls for OSHE and aviation safety consequences may differ.

### **3.6 Hazard identification methodologies**

3.6.1 The two main methodologies for identifying hazards are:

- (a) *Reactive*. This methodology involves analysis of past outcomes or events. Hazards are identified through investigation of safety occurrences. Incidents and accidents are an indication of system deficiencies and therefore can be used to determine which hazard(s) contributed to the event.
- (b) *Proactive*. This methodology involves collecting safety data of lower consequence events or process performance and analysing the safety information or frequency of occurrence to determine if a hazard could lead to an accident or incident. The safety information for proactive hazard identification primarily comes from flight data analysis (FDA) programmes, safety reporting systems and the safety assurance function.

3.6.2 Hazards can also be identified through safety data analysis which identifies adverse trends and makes predictions about emerging hazards, etc.

### **3.7 Hazards related to SMS interfaces with external organizations**

3.7.1 Organizations should also identify hazards related to their safety management interfaces. This should, where possible, be carried out as a joint exercise with the interfacing organizations. The hazard identification should consider the operational environment and the various organizational capabilities (people, processes, technologies) which could contribute to the safe delivery of the service or product’s availability, functionality or performance.

3.7.2 As an example, an aircraft turnaround involves many organizations and operational personnel all working in and around the aircraft. There are likely to be hazards related to the interfaces between operational personnel, their equipment and the coordination of the turnaround activity.

### **3.8 Safety risk probability**

- 3.8.1 Safety risk probability is the likelihood that a safety consequence or outcome will occur. It is important to envisage a variety of scenarios so that all potential consequences can be considered. The following questions can assist in the determination of probability:
- (a) Is there a history of occurrences similar to the one under consideration, or is this an isolated occurrence?
  - (b) What other equipment or components of the same type might have similar issues?
  - (c) What is the number of personnel following, or subject to, the procedures in question?
  - (d) What is the exposure of the hazard under consideration? For example, during what percentage of the operation is the equipment or activity in use?
- 3.8.2 Taking into consideration any factors that might underlie these questions will help when assessing the probability of the hazard consequences in any foreseeable scenario.
- 3.8.3 An occurrence is considered foreseeable if any reasonable person could have expected the kind of occurrence to have happened under the same circumstances. Identification of every conceivable or theoretically possible hazard is not possible. Therefore, good judgment is required to determine an appropriate level of detail in hazard identification. Service providers should exercise due diligence when identifying significant and reasonably foreseeable hazards related to their product or service.
- 3.8.4 Table 1 presents a typical safety risk probability classification table. It includes five categories to denote the probability related to an unsafe event or condition, the description of each category, and an assignment of a value to each category. This example uses qualitative terms; quantitative terms could be defined to provide a more accurate assessment. This will depend on the availability of appropriate safety data and the sophistication of the organization and operation.

**Table 1: Safety Risk probability table**

Likelihood	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3
Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

*Note.— This is an example only. The level of detail and complexity of tables and matrices should be adapted to the particular needs and complexities of each organization. It should also be noted that organizations might include both qualitative and quantitative criteria.*

### 3.9 Safety risk severity

3.9.1 Once the probability assessment has been completed, the next step is to assess the severity, taking into account the potential consequences related to the hazard. Safety risk severity is defined as the extent of harm that might reasonably be expected to occur as a consequence or outcome of the identified hazard. The severity classification should consider:

- (a) fatalities or serious injury which would occur as a result of:
  - (i) being in the aircraft;
  - (ii) having direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or
  - (iii) having direct exposure to jet blast; and
- (b) damage or structural failure sustained by the aircraft which:

- (i) adversely affects the structural strength, performance or flight characteristics of the aircraft;
- (ii) would normally require major repair or replacement of the affected component;

3.9.2 The severity assessment should consider all possible consequences related to a hazard, taking into account the worst foreseeable situation. Table 2 presents a typical safety risk severity table. It includes five categories to denote the level of severity, the description of each category, and the assignment of a value to each category. As with the safety risk probability table, this table is an example only.

**Table 2. Example safety risk severity table**

Severity	Meaning	Value
Catastrophic	<ul style="list-style-type: none"> <li>• Aircraft / equipment destroyed</li> <li>• Multiple deaths</li> </ul>	A
Hazardous	<ul style="list-style-type: none"> <li>• A large reduction in safety margins, physical distress or a workload such that operational personnel cannot be relied upon to perform their tasks accurately or completely</li> <li>• Serious injury</li> <li>• Major equipment damage</li> </ul>	B
Major	<ul style="list-style-type: none"> <li>• A significant reduction in safety margins, a reduction in the ability of operational personnel to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency</li> <li>• Serious incident</li> </ul>	C
Minor	<ul style="list-style-type: none"> <li>• Nuisance</li> <li>• Operating limitations</li> <li>• Use of emergency procedures</li> <li>• Minor incident</li> </ul>	D
Negligible	<ul style="list-style-type: none"> <li>• Few consequences</li> </ul>	E

### 3.10 Safety risk tolerability

3.10.1 The safety risk index rating is created by combining the results of the probability and severity scores. In the example above, it is an alphanumeric designator. The respective severity/probability combinations are presented in the safety risk assessment matrix in Table 3. The safety risk assessment matrix is used to determine safety risk tolerability. Consider, for example, a situation where the safety risk probability has been assessed as Occasional (4), and the safety risk severity has been assessed as Hazardous (B), resulting in a safety risk index of (4B).

**Table 3: Example Safety Risk Matrix**

Safety Risk Probability	Safety Risk Severity				
	Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent (5)	5A	5B	5C	5D	5E
Occasional (4)	4A	4B	4C	4D	4E
Remote (3)	3A	3B	3C	3D	3E
Improbable (2)	2A	2B	2C	2D	2E
Extremely improbable (1)	1A	1B	1C	1D	1E

*Note.— In determining the safety risk tolerability, the quality and reliability of the data used for the hazard identification and safety risk probability should be taken into consideration.*

3.10.2 The index obtained from the safety risk assessment matrix should then be exported to a safety risk tolerability table that describes — in a narrative form — the tolerability criteria for the particular organization. Table 4 presents an example of a safety risk tolerability table. Using the example above, the criterion for safety risk assessed as 4B falls in the “intolerable” category. In this case, the safety risk index of the

consequence is unacceptable. The organization should therefore take risk control action to reduce:

- (a) the organization’s exposure to the particular risk, i.e., reduce the probability component of the risk to an acceptable level;
- (b) the severity of consequences related to the hazard, i.e., reduce the severity component of the risk to an acceptable level; or
- (c) both the severity and probability so that the risk is managed to an acceptable level.

3.10.3 Safety risks are conceptually assessed as acceptable, tolerable or intolerable. Safety risks assessed as initially falling in the intolerable region are unacceptable under any circumstances. The probability and/or severity of the consequences of the hazards are of such a magnitude, and the damaging potential of the hazard poses such a threat to safety, that mitigation action is required or activities are stopped.

**Table 4. Example of safety risk tolerability**

<b><i>Safety Risk Index Range</i></b>	<b><i>Safety Risk Description</i></b>	<b><i>Recommended Action</i></b>
5A, 5B, 5C, 4A, 4B, 3A	INTOLERABLE	Take immediate action to mitigate the risk or stop the activity. Perform priority safety risk mitigation to ensure additional or enhanced preventative controls are in place to bring down the safety risk index to tolerable.
5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C, 1A	TOLERABLE	Can be tolerated based on the safety risk mitigation. It may require management decision to accept the risk.
3E, 2D, 2E, 1B, 1C, 1D, 1E	ACCEPTABLE	Acceptable as is. No further safety risk mitigation required.

### **3.11 Assessing human factors related risks**

3.11.1 The consideration of human factors has particular importance in SRM as people can be both a source and a solution of safety risks by:

- (a) contributing to an accident or incident through variable performance due to human limitations;
- (b) anticipating and taking appropriate actions to avoid a hazardous situation:  
and
- (c) solving problems, making decisions and taking actions to mitigate risks.

3.11.2 It is therefore important to involve people with appropriate human factors expertise in the identification, assessment and mitigation of risks.

3.11.3 SRM requires all aspects of safety risk to be addressed, including those related to humans. Assessing the risks associated with human performance is more complex than risk factors associated with technology and environment since:

- (a) human performance is highly variable, with a wide range of interacting influences internal and external to the individual. Many of the effects of the interaction between these influences are difficult, or impossible to predict;  
and
- (b) the consequences of variable human performance will differ according to the task being performed and the context.

3.11.4 This complicates how the probability and the severity of the risk is determined. Therefore, human factors expertise is valuable in the identification and assessment of safety risks. (The management of fatigue using SMS processes is addressed in the *Manual for the Oversight of Fatigue Management Approaches* (Doc 9966)).

### **3.12 Safety risk mitigation strategies**

3.12.1 Safety risk mitigation is often referred to as a safety risk control. Safety risks should be managed to an acceptable level by mitigating the safety risk through the application of appropriate safety risk controls. This should be balanced against the time, cost and difficulty of taking action to reduce or eliminate the safety risk. The level of safety risk can be lowered by reducing the severity of the potential consequences, reducing the likelihood of occurrence or by reducing exposure to that



safety risk. It is easier and more common to reduce the likelihood than it is to reduce the severity.

3.12.2 Safety risk mitigations are actions that often result in changes to operating procedures, equipment or infrastructure. Safety risk mitigation strategies fall into three categories:

- (a) *Avoidance*: The operation or activity is cancelled or avoided because the safety risk exceeds the benefits of continuing the activity, thereby eliminating the safety risk entirely.
- (b) *Reduction*: The frequency of the operation or activity is reduced, or action is taken to reduce the magnitude of the consequences of the safety risk.
- (c) *Segregation*: Action is taken to isolate the effects of the consequences of the safety risk or build in redundancy to protect against them.

3.12.3 The consideration of human factors is an integral part of identifying effective mitigations because humans are required to apply, or contribute to, the mitigation or corrective actions. For example, mitigations may include the use of processes or procedures. Without input from those who will be using these in “real world” situations and/or individuals with human factors expertise, the processes or procedures developed may not be fit for their purpose and result in unintended consequences. Further, human performance limitations should be considered as part of any safety risk mitigation, building in error capturing strategies to address human performance variability. Ultimately, this important human factors perspective results in more comprehensive and effective mitigations.

3.12.4 A safety risk mitigation strategy may involve one of the approaches described above or may include multiple approaches. It is important to consider the full range of possible control measures to find an optimal solution. The effectiveness of each alternative strategy must be evaluated before a decision is made. Each proposed safety risk mitigation alternative should be examined from the following perspectives:

- (a) *Effectiveness*. The extent to which the alternatives reduce or eliminate the safety risks. Effectiveness can be determined in terms of the technical, training and regulatory defences that can reduce or eliminate safety risks.
- (b) *Cost/benefit*. The extent to which the perceived benefits of the mitigation outweighs the costs.

- (c) *Practicality*. The extent to which mitigation can be implemented and how appropriate it is in terms of available technology, financial and administrative resources, legislation, political will, operational realities, etc.
- (d) *Acceptability*. The extent to which the alternative is acceptable to those people that will be expected to apply it.
- (e) *Enforceability*. The extent to which compliance with new rules, regulations or operating procedures can be monitored.
- (f) *Durability*. The extent to which the mitigation will be sustainable and effective.
- (g) *Residual safety risks*. The degree of safety risk that remains subsequent to the implementation of the initial mitigation and which may necessitate additional safety risk control measures.
- (h) *Unintended consequences*. The introduction of new hazards and related safety risks associated with the implementation of any mitigation alternative.
- (i) *Time*. Time required for the implementation of the safety risk mitigation alternative.

3.12.5 Corrective action should take into account any existing defences and their (in)ability to achieve an acceptable level of safety risk. This may result in a review of previous safety risk assessments that may have been impacted by the corrective action. Safety risk mitigations and controls will need to be verified/audited to ensure that they are effective. Another way to monitor the effectiveness of mitigations is through the use of SPIs. See Chapter 4 for more information on safety performance management and SPIs.

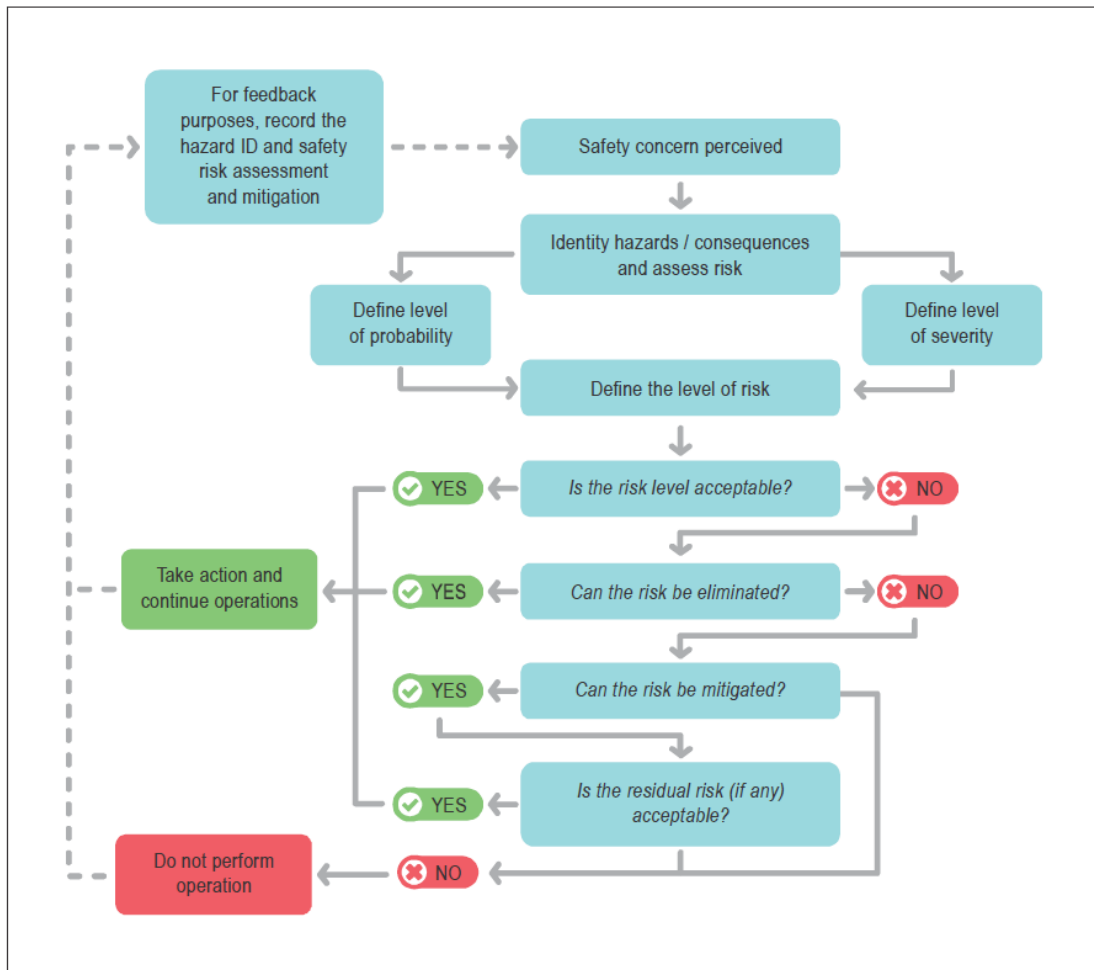
### **3.13 Safety risk management documentation**

3.13.1 Safety risk management activities should be documented, including any assumptions underlying the probability and severity assessment, decisions made, and any safety risk mitigation actions taken. This may be done using a spread sheet or table. Some organizations may use a database or other software where large amounts of safety data and safety information can be stored and analysed.

3.13.2 Maintaining a register of identified hazards minimizes the likelihood that the organization will lose sight of its known hazards. When hazards are identified, they

can be compared with the known hazards in the register to see if the hazard has already been registered, and what action(s) were taken to mitigate it. Hazard registers are usually in a table format and typically include: the hazard, potential consequences, assessment of associated risks, identification date, hazard category, short description, when or where it applies, who identified it and what measure have been put in place to mitigate the risks.

3.13.3 Safety risk decision-making tools and processes can be used to improve the repeatability and justification of decisions taken by organizational safety decision makers. An example of a safety risk decision aid is provided below in Figure 3-1.



**Figure 3-1. Safety risk management decision aid**

### **3.14 Cost-benefit analysis**

Cost-benefit or cost-effectiveness analysis is normally carried out during the safety risk mitigation activities. It is commonly associated with business management, such as a regulatory impact assessment or project management processes. However, there may be situations where a safety risk assessment may have a significant financial impact. In such situations, a supplementary cost-benefit analysis or cost-effectiveness process to support the safety risk assessment may be warranted. This will ensure cost-effectiveness analysis or justification of recommended safety risk control actions has been taken into consideration, with the associated financial implications.

## CHAPTER 4. SAFETY PERFORMANCE MANAGEMENT

### 4.1 Introduction

- 4.1.1 Safety performance management is central to the functioning of SSPs and SMSs. Properly implemented, it will provide an organization with the means to determine whether its activities and processes are working effectively to achieve its safety objectives. This is accomplished through the identification of safety performance indicators (SPIs), which are used to monitor and measure safety performance. Through the identification of SPIs, information obtained will allow senior management to be aware of the current situation and support decision-making, including determining whether actions are required to further mitigate safety risks to ensure the organization achieves its safety goals.
- 4.1.2 The generic safety performance management process and how it is linked with safety data collection and processing systems (SDCPS) and safety analysis, is shown in Figure 4-1 below. The link to safety promotion is shown to highlight the importance of communicating this information throughout the organization. More information on safety promotion, an important component of SSP and SMS.

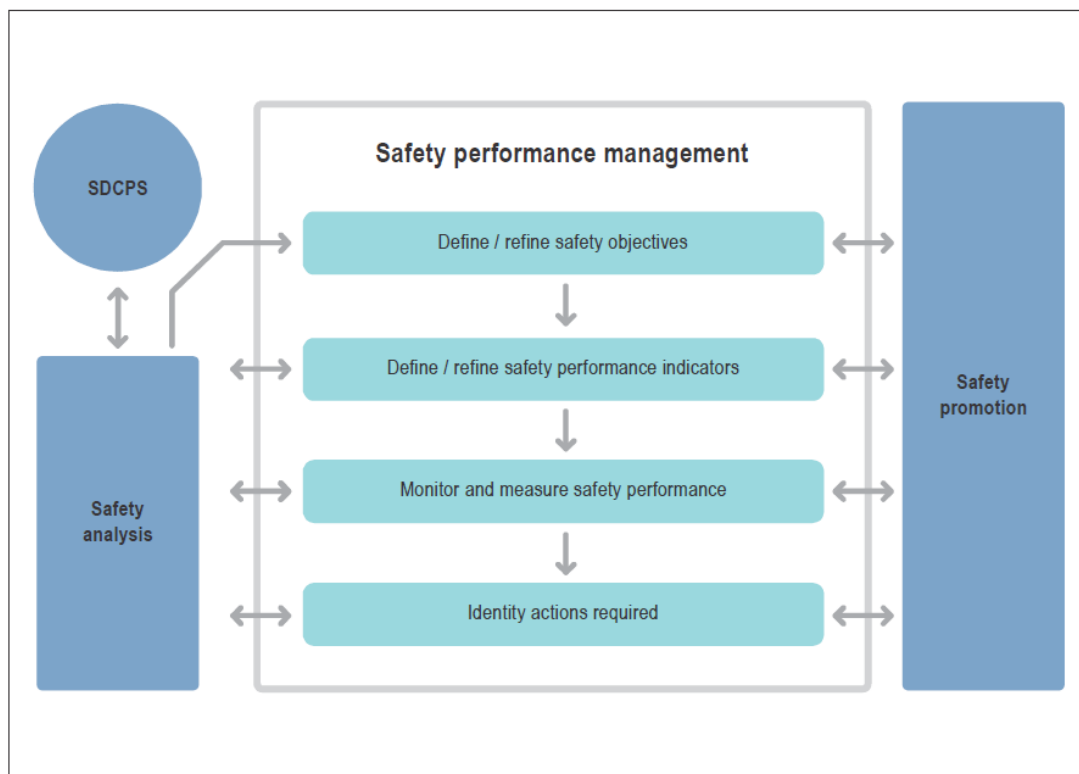


Figure 4-1. Safety Performance Management Process

4.1.3 Safety performance management helps the organization to ask and to answer the four most important questions regarding safety management:

- (a) What are the organization's top safety risks? Derived from a review of aviation accident and incident data as well as predictive analysis to identify and define emerging risks.
- (b) What does the organization want to achieve in terms of safety and what are the top safety risks that need to be addressed? The organization's safety objectives.
- (c) How will the organization know if it is making progress toward its safety objectives? Through SPIs, SPTs and, if practicable, safety triggers.
- (d) What safety data and safety information are needed to make informed safety decisions? Including the allocation of the organization's resources. Through an evolving SDCPS and safety data analysis.

4.1.4 The safety performance management process can also be used to establish an acceptable level of safety performance (ALoSP).

## **4.2 Relationship between States and service providers**

4.2.1 There are similarities between the State and service providers in the use and application of safety performance techniques.

4.2.2 The development of State safety performance should focus on what the State considers to be its most important aspects to managing safety. For the State, an effectively implemented SSP is used as a decision-making tool for the management of safety performance, which should include: the safety performance of its service providers; the State's oversight capability; and the support provided to service providers through the establishment of guidelines. States should consider measuring their ability to:

- (a) maintain their safety oversight system;
- (b) apply specific safety actions and introduce safety initiatives; and
- (c) adapt existing safety risk controls to ensure they remain effective.

- 4.2.3 For service providers, the primary function of safety performance management is to monitor and measure how well it is managing its safety risks. This is achieved through the effective implementation of an SMS that generates information that will be used to make decisions regarding the management of safety, including the implementation of safety risk controls and the allocation of resources.
- 4.2.4 The success of safety management depends on the commitment between the State and its service providers. There may be benefits in the State identifying suitable SPIs that could be monitored by service providers and then shared with the State, in particular for the establishment of the ALoSP. The information received from service providers will assist the State with its assessment of the safety performance of its aviation industry and its own ability to provide effective oversight and support to service providers. However, service providers should ensure their SPIs are appropriate to their operational context, performance history and expectations.

### **4.3 Safety performance management and interfaces**

- 4.3.1 When States and service providers are considering implementing safety management, it is important to consider the safety risks induced by interfacing entities. Interfaces can be internal (e.g. between operations and maintenance or finance, human resources or legal departments), or they can be external (e.g. other State, service providers or contracted services). Hazards and related risks at the interface points are among the most common contributors to safety occurrences. States and service providers have greater control over interface-related risks when their interfaces are identified and managed. Interfaces should be defined in the organization's system description.
- 4.3.2 States and service providers are responsible for ongoing monitoring and management of their interfaces to ensure safe outcomes. The safety risk posed by each interface should, ideally, be collaboratively assessed by the interfacing entities. Collaboration is highly desirable because the perception of safety risks and their tolerability may vary between the interfacing organizations. Sharing of interface risk management, through the establishment and monitoring of SPIs, encourages the mutual awareness of safety risks rather than ignorance or potentially one-sided risk management. It also creates an opportunity for transfer of knowledge and working practices that could improve the safety effectiveness of both organizations.

4.3.3 For this reason, SPIs should be agreed and established to monitor and measure the risks and the effectiveness of mitigating actions. A formal interface management agreement between interfacing organizations, with clearly defined monitoring and management responsibilities, is an example of an effective approach.

#### **4.4 Safety objectives**

4.4.1 Safety objectives are brief, high-level statements of safety achievements or desired outcomes to be accomplished. Safety objectives provide direction to the organization's activities and should therefore be consistent with the safety policy that sets out the organization's high-level safety commitment. They are also useful to communicate safety priorities to personnel and the aviation community as a whole. Establishing safety objectives provides strategic direction for the safety performance management process and provides a sound basis for safety related decision-making. The management of safety performance should be a primary consideration when amending policies or processes, or allocating the organization's resources in pursuit of improving safety performance.

4.4.2 Safety objectives may be:

- (a) *process-oriented*: stated in terms of safe behaviours expected from operational personnel or the performance of actions implemented by the organization to manage safety risk; or
- (b) *outcome-oriented*: encompass actions and trends regarding containment of accidents or operational losses.

4.4.3 The suite of safety objectives should include a mix of both process-oriented and outcome-oriented objectives to provide enough coverage and direction for the SPIs and SPTs. Safety objectives on their own do not have to be specific, measurable, achievable, relevant and timely (SMART) (George T. Doran, 1981), provided the safety objectives and accompanying SPIs and SPTs form a package that allows an organization to demonstrate whether it is maintaining or improving its safety performance.



**Table 5. Examples of safety objectives**

<b>Examples of safety objectives</b>		
process-oriented	State or service provider	Increase safety reporting levels.
outcome-oriented	service provider	Reduce rate of adverse apron safety events. (high-level) or Reduce the annual number of adverse apron safety events from the previous year.
outcome-oriented	State	Reduce the annual number of safety events in sector X.

4.4.4 An organization may also choose to identify safety objectives at the tactical or operational level or apply them to specific projects, products and processes. A safety objective may also be expressed by the use of other terms with a similar meaning (e.g. goal or target).

## **4.5 Safety performance indicators and safety performance targets**

### **Types Of Safety Performance Indicators**

#### **4.5.1 *Qualitative and quantitative indicators***

- (a) SPIs are used to help senior management know whether or not the organization is likely to achieve its safety objective; they can be qualitative or quantitative. Quantitative indicators relate to measuring by the quantity, rather than its quality, whereas qualitative indicators are descriptive and measure by quality. Quantitative indicators are preferred over qualitative indicators because they are more easily counted and compared. The choice of indicator depends on the availability of reliable data that can be measured quantitatively. Does the necessary evidence have to be in the form of comparable, generalizable data (quantitative), or a descriptive image of the safety situation (qualitative)? Each option, qualitative or quantitative, involves different kinds of SPIs, and requires a thoughtful SPI selection process. A combination of approaches is useful in many situations, and can solve many of the problems which may arise from adopting a single

approach. An example of a qualitative indicator for a State could be the maturity of their service providers' SMS in a particular sector, or for a service provider the assessment of the safety culture.

- (b) Quantitative indicators can be expressed as a number (x incursions) or as a rate (x incursions per n movements). In some cases, a numerical expression will be sufficient. However, just using numbers may create a distorted impression of the actual safety situation if the level of activity fluctuates. For example, if air traffic control records three altitude busts in July and six in August, there may be great concern about the significant deterioration in safety performance. But August may have seen double the movements of July meaning the altitude busts per movement, or the rate, has decreased, not increased. This may or may not change the level of scrutiny, but it does provide another valuable piece of information that may be vital to data-driven safety decision-making.
- (c) For this reason, where appropriate, SPIs should be reflected in terms of a relative rate to measure the performance level regardless of the level of activity. This provides a normalized measure of performance; whether the activity increases or decreases. As another example, an SPI could measure the number of runway incursions. But if there were fewer departures in the monitored period, the result could be misleading. A more accurate and valuable performance measure would be the number of runway incursions relative to the number of movements, e.g. x incursions per 1,000 movements.

#### 4.5.2 ***Lagging and leading indicators***

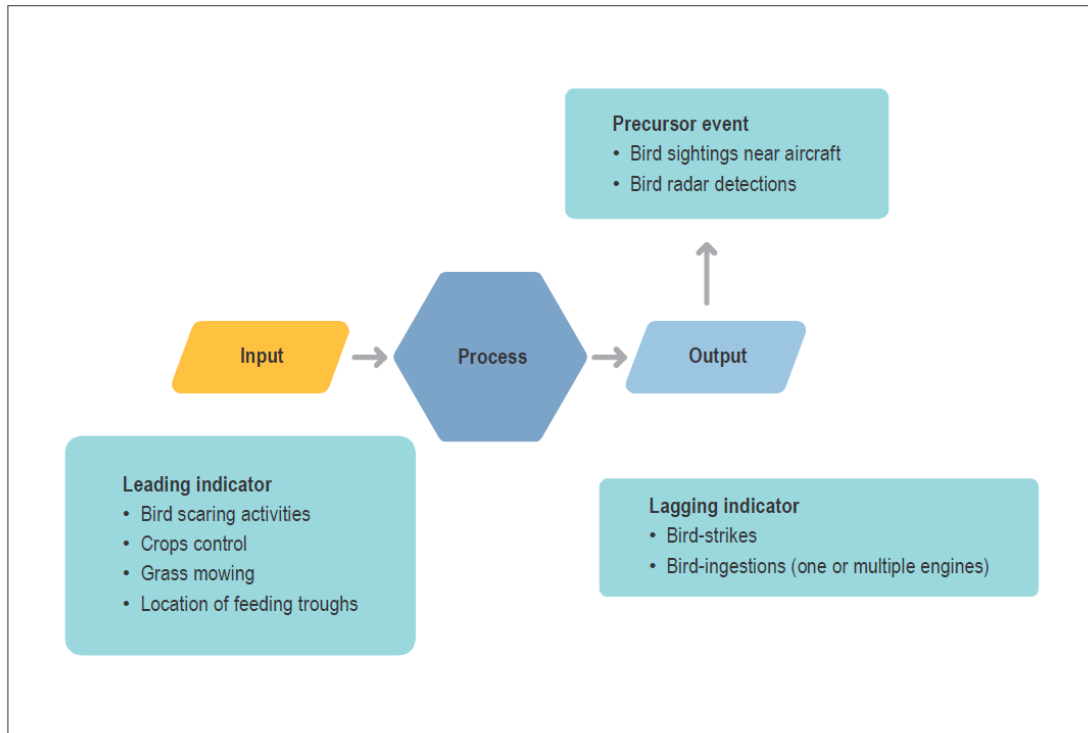
- (a) The two most common categories used by States and service providers to classify their SPIs are lagging and leading. Lagging SPIs measure events that have already occurred. They are also referred to as “outcome-based SPIs” and are normally (but not always) the negative outcomes the organization is aiming to avoid. Leading SPIs measure processes and inputs being implemented to improve or maintain safety. These are also known as “activity or process SPIs” as they monitor and measure conditions that have the potential to lead to or contribute to a specific outcome.
- (b) Lagging SPIs help the organization understand what has happened in the past and are useful for long-term trending. They can be used as a high-level

indicator or as an indication of specific occurrence types or locations, such as “types of accidents per aircraft type” or “specific incident types by region”. Because lagging SPIs measure safety outcomes, they can measure the effectiveness of safety mitigations. They are effective at validating the overall safety performance of the system. For example, monitoring the “number of ramp collisions per number of movements between vehicles following a redesign of ramp markings” provides a measure of the effectiveness of the new markings (assuming nothing else has changed). The reduction in collisions validates an improvement in the overall safety performance of the ramp system; which may be attributable to the change in question.

- (c) Trends in lagging SPIs can be analysed to determine conditions existing in the system that should be addressed. Using the previous example, an increasing trend in ramp collisions per number of movements may have been what led to the identification of sub-standard ramp markings as a mitigation.
- (d) Lagging SPIs are divided into two types:
  - (i) *low probability/high severity*: outcomes such as accidents or serious incidents. The low frequency of high severity outcomes means that aggregation of data (at industry segment level or regional level) may result in more meaningful analyses. An example of this type of lagging SPI would be “aircraft and/or engine damage due to bird strike”.
  - (ii) *high probability/low severity*: outcomes that did not necessarily manifest themselves in a serious accident or incident, these are sometimes also referred to as precursor indicators. SPIs for high probability/low severity outcomes are primarily used to monitor specific safety issues and measure the effectiveness of existing safety risk mitigations. An example of this type of precursor SPI would be “bird radar detections”, which indicates the level of bird activity rather than the amount of actual bird strikes.
- (e) Aviation safety measures have historically been biased towards SPIs that reflect “low probability/high severity” outcomes. This is understandable in that accidents and serious incidents are high profile events and are easy to count. However, from a safety performance management perspective, there

are drawbacks in an overreliance on accidents and serious incidents as a reliable indicator of safety performance. For instance, accidents and serious incidents are infrequent (there may be only one accident in a year, or none) making it difficult to perform statistical analysis to identify trends. This does not necessarily indicate that the system is safe. A consequence of a reliance on this sort of data is a potential false sense of confidence that an organization's or system's safety performance is effective, when it may in fact be perilously close to an accident.

- (f) Leading indicators are measures that focus on processes and inputs that are being implemented to improve or maintain safety. These are also known as “activity or process SPIs” as they monitor and measure conditions that have the potential to become or to contribute to a specific outcome.
- (g) Examples of leading SPIs driving the development of organizational capabilities for proactive safety performance management include such things as “percentage of staff who have successfully completed safety training on time” or “frequency of bird scaring activities”.
- (h) Leading SPIs may also inform the organization about how their operation copes with change, including changes in its operating environment. The focus will be either on anticipating weaknesses and vulnerabilities as a result of the change, or monitoring the performance after a change. An example of an SPI to monitor a change in operations would be “percentage of sites that have implemented procedure X”.
- (i) For a more accurate and useful indication of safety performance, lagging SPIs, measuring both “low probability/high severity” events and “high probability/low severity” events should be combined with leading SPIs. Figure 4-2 illustrates the concept of leading and lagging indicators that provide a more comprehensive and realistic picture of the organization's safety performance.



**Figure 4-2. Leading vs Lagging indicator concept phases**

## 4.6 Selecting and defining SPIs

4.6.1 SPIs are the parameters that provide the organization with a view of its safety performance: where it has been; where it is now; and where it is headed, in relation to safety. This picture acts as a solid and defensible foundation upon which the organization's data-driven safety decisions are made. These decisions, in turn, positively affect the organization's safety performance. The identification of SPIs should therefore be realistic, relevant, and linked to safety objectives, regardless of their simplicity or complexity.

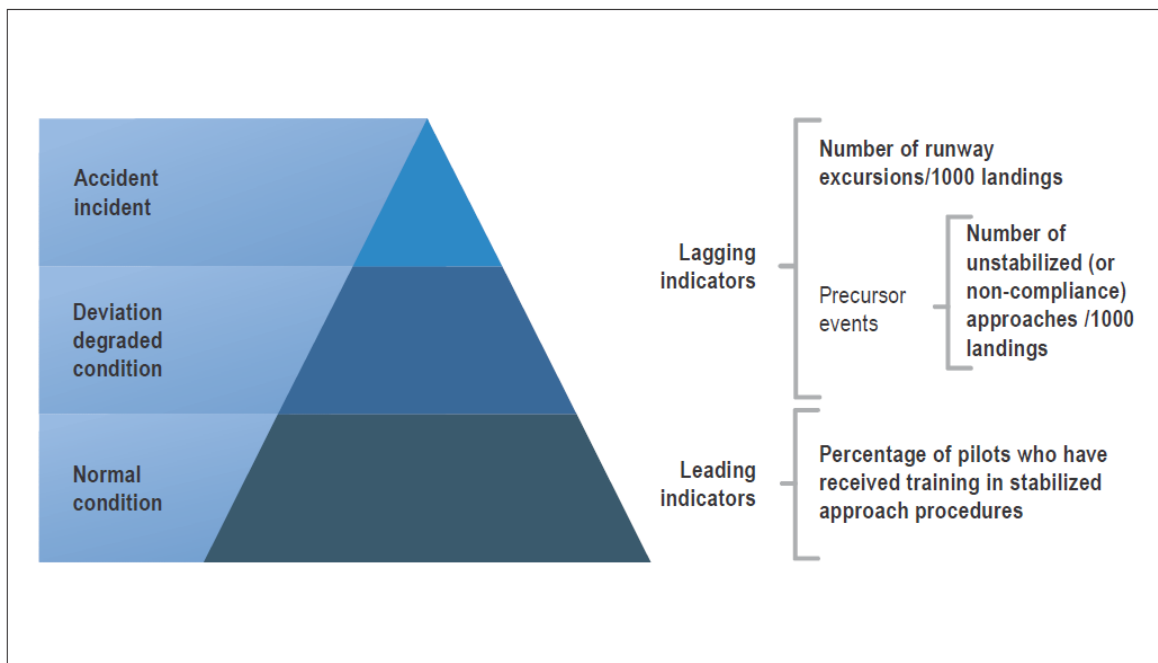
4.6.2 It is likely the initial selection of SPIs will be limited to the monitoring and measurement of parameters representing events or processes that are easy and/or convenient to capture (safety data that may be readily available). Ideally, SPIs should focus on parameters that are important indicators of safety performance, rather than on those that are easy to attain.

4.6.3 SPIs should be:

- (a) related to the safety objective they aim to indicate;
- (b) selected or developed based on available data and reliable measurement;

- (c) appropriately specific and quantifiable; and
- (d) realistic, by taking into account the possibilities and constraints of the organization.

4.6.4 A combination of SPIs is usually required to provide a clear indication of safety performance. There should be a clear link between lagging and leading SPIs. Ideally lagging SPIs should be defined before determining leading SPIs. Defining a precursor SPI linked to a more serious event or condition (the lagging SPI) ensures there is a clear correlation between the two. All of the SPIs, lagging and leading, are equally valid and valuable. An example of these linkages is illustrated in Figure 4-3.



**Figure 4-3. Examples of links between lagging and leading indicators**

4.6.5 It is important to select SPIs that relate to the organization’s safety objectives. Having SPIs that are well defined and aligned will make it easier to identify SPTs, which will show the progress being made towards the attainment of safety objectives. This allows the organization to assign resources for greatest safety effect by knowing precisely what is required, and when and how to act to achieve the planned safety performance. For example, a State has a safety objective of “reduce the number of runway excursions by 50 per cent in three years” and an associated, well-aligned SPI of “number of runway excursions per million departures across all aerodromes”. If the number of excursions drops initially when monitoring commences, but starts to

climb again after twelve months, the State could choose to reallocate resources away from an area where, according to the SPIs, the safety objective is being easily achieved and towards the reduction of runway excursions to alleviate the undesirable trend.

#### 4.6.6 ***Defining SPIs***

The contents of each SPI should include:

- (a) a description of what the SPI measures;
- (b) the purpose of the SPI (what it is intended to manage and who it is intended to inform);
- (c) the units of measurement and any requirements for its calculation;
- (d) who is responsible for collecting, validating, monitoring, reporting and acting on the SPI (these may be staff from different parts of the organization);
- (e) where or how the data should be collected; and
- (f) the frequency of reporting, collecting, monitoring and analysis of the SPI data.

#### 4.6.7 ***SPIs and safety reporting***

Changes in operational practices may lead to underreporting until their impact is fully accepted by potential reporters. This is known as “reporting bias”. Changes in the provisions related to the protection of safety information and related sources could also lead to over-reporting. In both cases, reporting bias may distort the intent and accuracy of the data used for the SPI. Employed judiciously, safety reporting may still provide valuable data for the management of safety performance.

### **4.7 Setting safety performance targets**

- 4.7.1 Safety performance targets (SPTs) define short-term and medium-term safety performance management desired achievements. They act as “milestones” that provide confidence that the organization is on track to achieving its safety objectives and provide a measurable way of verifying the effectiveness of safety performance management activities. SPT setting should take into consideration factors such as the prevailing level of safety risk, safety risk tolerability, as well as expectations

regarding the safety of the particular aviation sector. The setting of SPTs should be determined after considering what is realistically achievable for the associated aviation sector and recent performance of the particular SPI, where historical trend data is available.

4.7.2 If the combination of safety objectives, SPIs and SPTs working together are SMART, it allows the organization to more effectively demonstrate its safety performance. There are multiple approaches to achieving the goals of safety performance management, especially, setting SPTs. One approach involves establishing general highlevel safety objectives with aligned SPIs and then identifying reasonable levels of improvements after a baseline safety performance has been established. These levels of improvements may be based on specific targets (e.g. percentage decrease) or the achievement of a positive trend. Another approach which can be used when the safety objectives are SMART is to have the safety targets act as milestones to achieving the safety objectives. Either of these approaches are valid and there may be others that an organization finds effective at demonstrating their safety performance. Different approaches can be used in combination as appropriate to the specific circumstances.

#### 4.7.3 ***Setting targets with high-level safety objectives***

Targets are established with senior management agreeing on high-level safety objectives. The organization then identifies appropriate SPIs that will show improvement of safety performance towards the agreed safety objective(s). The SPIs will be measured using existing data sources, but may also require the collection of additional data. The organization then starts gathering, analysing and presenting the SPIs. Trends will start to emerge, which will provide an overview of the organization's safety performance and whether it is steering towards or away from its safety objectives. At this point the organization can identify reasonable and achievable SPTs for each SPI.

#### 4.7.4 ***Setting targets with SMART safety objectives***

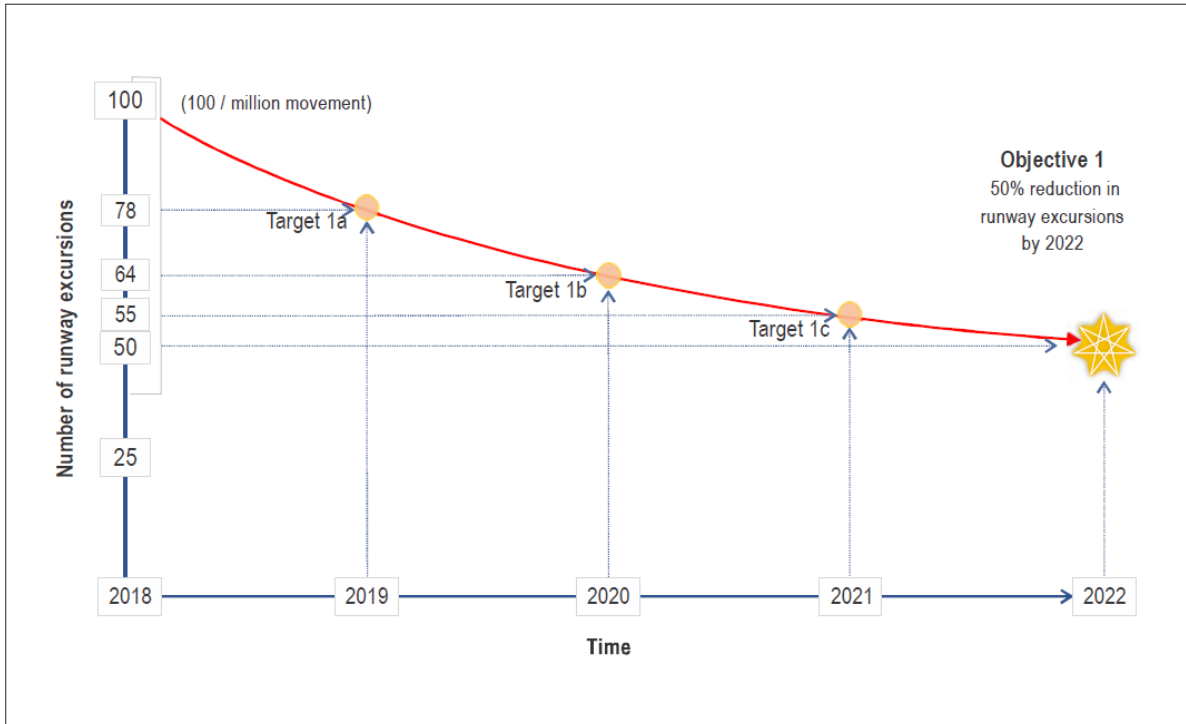
(a) Safety objectives can be difficult to communicate and may seem challenging to achieve; by breaking them down into smaller concrete safety targets, the process of delivering them is easier to manage. In this way, targets form a crucial link between strategy and day-to-day operations. Organizations should identify the key areas that drive the safety performance and establish a way to measure them. Once an organization has an idea what their current



level of performance is by establishing the baseline safety performance, they can start setting SPTs to give everyone in the State a clear sense of what they should be aiming to achieve. The organization may also use benchmarking to support setting performance targets. This involves using performance information from similar organizations that have already been measuring their performance to get a sense of how others in the community are doing.

- (b) An example of the relationship between safety objectives, SPIs and SPTs is illustrated in Figure 4-4. In this example, the organization recorded 100 runway excursions per million movements in 2018. It has been determined this is too many, and an objective to reduce the number of runway excursions by fifty per cent by 2022 has been set. Specific targeted actions and associated timelines have been defined to meet these targets. To monitor, measure and report their progress, the organization has chosen “RWY excursions per million movements per year” as the SPI. The organization is aware that progress will be more immediate and effective if specific targets are set which align with the safety objective. They have therefore set a safety target which equates to an average reduction of 12.5 per year over the reporting period (four years). As shown in the graphical representation, the progress is expected to be greater in the first years and less so in the later years. This is represented by the curved projection towards their objective. In the Figure 4-4:
- (i) the SMART safety objective is “50 per cent reduction in RWY excursions rate by 2022”;
  - (ii) the SPI selected is the “number runway excursions per million movements per year”; and
  - (iii) the safety targets related to this objective represent milestones for reaching the SMART safety objective and equate to a ~12 per cent reduction each year until 2022;

- SPT 1a is “less than 78 runway excursions per million movement in 2019”;
- SPT 1b is “less than 64 runway excursions per million movement in 2020”;
- SPT 1c is “less than 55 runway excursions per million movement in 2021”.



**Figure 4-4. Example SPTs with SMART safety objectives**

#### 4.7.5 **Additional considerations for SPI and SPT selection**

When selecting SPIs and SPTs, the following should also be considered:

- Workload management. Creating a workable amount of SPIs can help personnel manage their monitoring and reporting workload. The same is true of the SPIs complexity, or the availability of the necessary data. It is better to agree on what is feasible, and then prioritize the selection of SPIs on this basis. If an SPI is no longer informing safety performance, or been given a lower priority, consider discontinuing in favour of a more useful or higher priority indicator.

- (b) Optimal spread of SPIs. A combination of SPIs that encompass the focus areas will help gain an insight to the organization's overall safety performance and enable data-driven decision-making.
- (c) Clarity of SPIs. When selecting an SPI, it should be clear what is being measured and how often. SPIs with clear definitions aid understanding of results, avoid misinterpretation, and allow meaningful comparisons over time.
- (d) Encouraging desired behaviour. SPTs can change behaviours and contribute to desired outcomes. This is especially relevant if achievement of the target is linked to organizational rewards, such as management remuneration. SPTs should foster positive organizational and individual behaviours that deliberately result in defensible decisions and safety performance improvement. It is equally important to consider the potential unintended behaviours when selecting SPIs and SPTs.
- (e) Choosing valuable measures. It is imperative that useful SPIs are selected, not only ones which are easy to measure. It should be up to the organization to decide what the most useful safety parameters are; those that guide the organization to improve decision-making, safety performance management, and achievement of its safety objectives.
- (f) Achieving SPTs. This is a particularly important consideration, and linked to the desired safety behaviours. Achieving the agreed SPTs is not always indicative of safety performance improvement. The organization should distinguish between just meeting SPTs and actual, demonstrable organizational safety performance improvement. It is imperative that the organization consider the context within which the target was achieved, rather than looking at an SPT in isolation. Recognition for overall improvement in safety performance, rather than an individual SPT achievement, will foster desirable organizational behaviours and encourage exchange of safety information that lies at the heart of both SRM and safety assurance. This could also enhance the relationship between the State and the service provider and their willingness to share safety data and ideas.

#### 4.7.6 Caveats on setting SPTs

It is not always necessary or appropriate to define SPTs as there may be some SPIs that are better to monitor for trends rather than use to determine a target. Safety reporting is an example of when having a target could either discourage people not to report (if the target is not to exceed a number) or to report trivial matters to meet a target (if the target is to reach a certain number). There may also be SPIs better used to define a direction of travel to target continuous safety performance improvement (i.e. to reduce the number of events) rather than used to define an absolute target, as these may be difficult to determine. The following should also be considered in deciding appropriate SPTs:

- (a) Drive undesirable behaviours; if managers or organizations are too focused on achievement of the numbers as an indicator of success they may not achieve the intended improvement in safety performance.
- (b) Operational targets; too much focus on achieving operational targets (such as: on time departures, reduction in overhead costs, etc.) without a balance of SPTs can lead to “achieving the operational targets” while not necessarily improving safety performance.
- (c) Focus on quantity rather than quality; this can encourage personnel or departments to meet the target but in doing so deliver a poor product or service.
- (d) Cap innovation; although not intended, once a target is met this can lead to a relaxation and that no further improvements are needed and complacency can set in.
- (e) Organizational conflict; targets can create conflict between departments and organizations as they argue over who is responsible rather than focusing on trying to work together.

#### **4.8 Safety Performance Measurement**

Getting safety performance measurement right involves deciding how best to measure the achievement of the safety objectives. This will vary from State to State and from service provider to service provider. Organizations should take the time to develop their strategic awareness of what it is that drives safety improvement for their safety objectives.

## **4.9 Use of SPIs and SPTs**

SPIs and SPTs can be used in different ways to demonstrate safety performance. It is crucial that organizations tailor, select and apply various measurement tools and approaches depending on their specific circumstances and the nature of what is being measured. For instance, in some cases, organizations could adopt SPIs that all have specific associated SPTs. In another situation, it may be preferable to focus on achieving a positive trend in the SPIs, without specific target values. The package of selected performance metrics will usually employ a combination of these approaches.

## **4.10 Monitoring safety performance**

4.10.1 Once an organization has identified the targets based on the SPIs they believe will deliver the planned outcome, they must ensure the stakeholders follow through by assigning clear responsibility for delivery. Defining SPTs for each aviation authority, sector and service provider supports the achievement of the ALoSP for the State by assigning clear accountability.

4.10.2 Mechanisms for monitoring and measuring the organization's safety performance should be established to identify what changes may be needed if the progress made isn't as expected and reinforce the commitment of the organization to meet its safety objectives.

## **4.11 Baseline safety performance**

4.11.1 Understanding how the organization plans to progress towards its safety objectives requires that they know where they are, in relation to safety. Once the organization's safety performance structure (safety objectives, indicators, targets, triggers) has been established and is functioning, it is possible to learn their baseline safety performance through a period of monitoring. Baseline safety performance is the safety performance at the commencement of the safety performance measurement process, the datum point from which progress can be measured. In the example used in figures 4-3 and 4-4, the baseline safety performance for that particular safety objective was "100 runway excursions per million movements during the year (2018)". From this solid basis, accurate and meaningful indications and targets can be recorded.

## **4.12 Refinement of SPIs and SPTs**

4.12.1 SPIs and associated SPTs will have to be reviewed to determine if they are providing the information needed to track the progress being made toward the safety objectives and to ensure that the targets are realistic and achievable.

4.12.2 Safety performance management is an ongoing activity. Safety risks and/or availability of data change over time. Initial SPIs may be developed using limited resources of safety information. Later, more reporting channels may be established, more safety data may be available and the organization's safety analysis capabilities will likely mature. It may be appropriate for organizations to develop simple (broader) SPIs initially. As they gather more data and safety management capability, they can consider refining the scope of SPIs and SPTs to better align with the desired safety objectives. Small non-complex organizations may elect to refine their SPIs and SPTs and/or select generic (but specific) indicators which apply to most aviation systems. Some examples of generic indicators would be:

- (a) events including structural damage to equipment;
- (b) events indicating circumstances in which an accident nearly occurred;
- (c) events in which operational personnel or members of the aviation community were fatally or seriously injured;
- (d) events in which operational personnel became incapacitated or unable to perform their duties safely;
- (e) rate of voluntary occurrence reports; and
- (f) rate of mandatory occurrence reports.

4.12.3 Larger more complex organizations may elect to institute a broader and/or deeper range of SPIs and SPTs and to integrate generic indicators such as those listed above with activity-specific ones. A large airport, for example, providing services to major airlines and situated under complex airspace, might consider combining some of the generic SPIs with deeper-scope SPIs representing specific aspects of their operation. The monitoring of these may require greater effort but will likely produce superior safety results. There is a clear correlation between the relative complexity of SPIs and SPTs and the scale and complexity of the State's or service providers' operations. This relative complexity should be reflected in the indicator and target set.

Those responsible for establishing safety performance management should be conscious of this.

4.12.4 The set of SPIs and SPTs selected by an organization should be periodically reviewed to ensure their continued meaningfulness as indications of organizational safety performance. Some reasons to continue, discontinue or change SPIs and SPTs include:

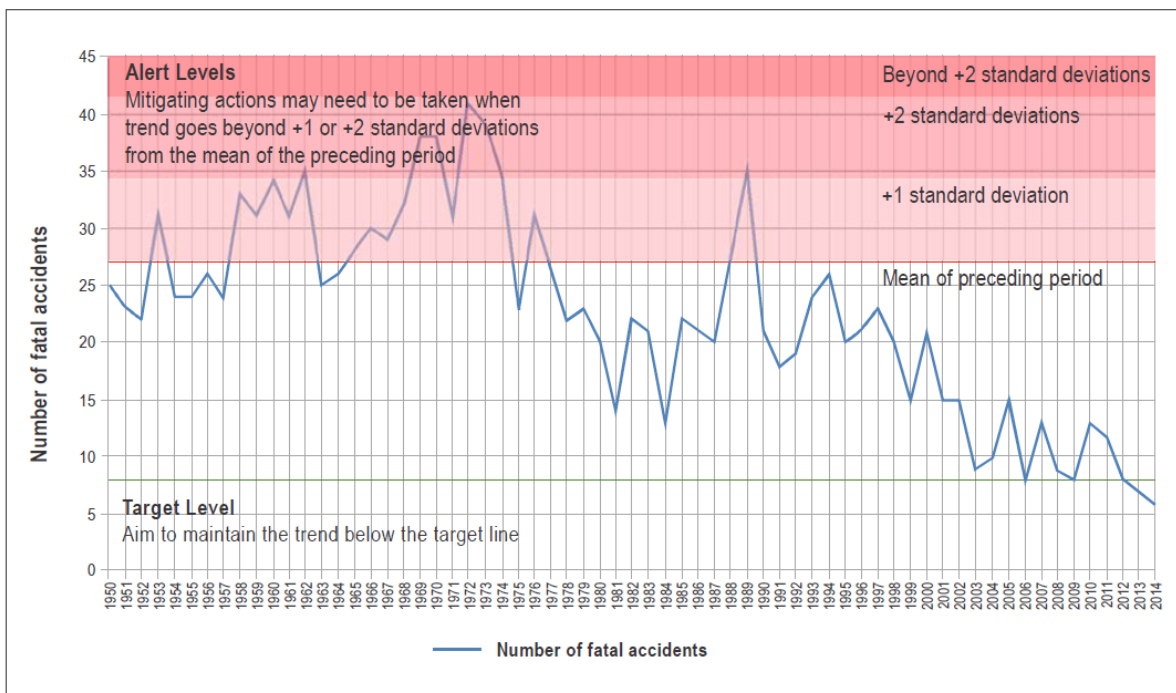
- (a) SPIs continually report the same value (such as zero per cent or 100 per cent); these SPIs are unlikely to provide meaningful input to senior management decision-making;
- (b) SPIs that have similar behaviour and as such are considered a duplication;
- (c) the SPT for an SPI implemented to measure the introduction of a programme or targeted improvement has been met;
- (d) another safety concern becomes a higher priority to monitor and measure;
- (e) to gain a better understanding of a particular safety concern by narrowing the specifics of an SPI (i.e. reduce the “noise” to clarify the “signal”); and
- (f) safety objectives have changed and as a consequence the SPIs require updating to remain relevant.

### **4.13 Safety triggers**

4.13.1 A brief perspective on the notions of triggers is relevant to assist in their eventual role within the context of the management of safety performance by an organization.

4.13.2 A trigger is an established level or criteria value that serves to trigger (start) an evaluation, decision, adjustment or remedial action related to the particular indicator. One method for setting out-of-limits trigger criteria for SPTs is the use of the population standard deviation (STDEVP) principle. This method derives the standard deviation (SD) value based on the preceding historical data points of a given safety indicator. The SD value plus the average (mean) value of the historical data set forms the basic trigger value for the next monitoring period. The SD principle (a basic statistical function) sets the trigger level criteria based on actual historical performance of the given indicator (data set), including its volatility (data point fluctuations). A more volatile historical data set will usually result in a higher (more generous) trigger level value for the next monitoring period. Triggers provide early

warnings which enable decision makers to make informed safety decisions, and thus improve safety performance. An example of trigger levels based on standard deviations (SDs) is provided at Figure 4-5 below. In this example, data-driven decisions and safety mitigation actions may need to be taken when the trend goes beyond +1SD or +2SD from the mean of the preceding period. Often the trigger levels (in this case +1SD, +2SD or beyond +2SD) will align with decision management levels and urgency of action.



**Figure 4-5. Example of representation of safety triggers (alert) levels**

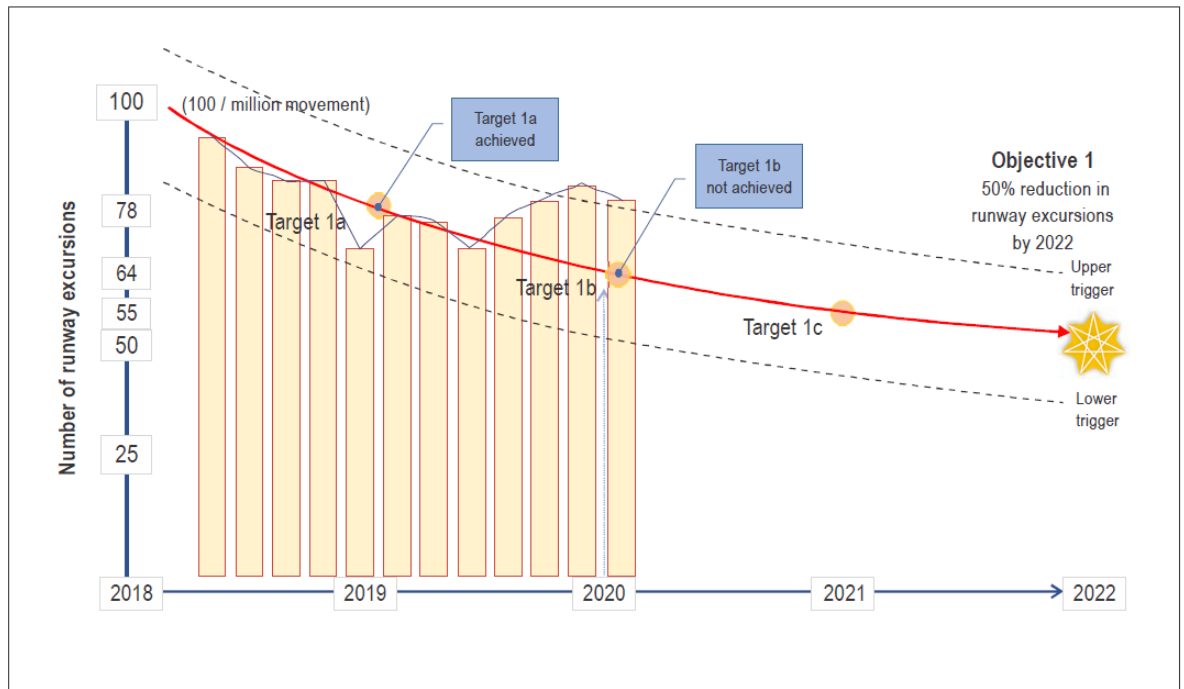
- 4.13.3 Once SPTs and trigger settings (if used) have been defined, their associated SPI may be tracked for their respective performance status. A consolidated summary of the overall SPT and trigger performance outcome of the complete SPIs package may also be compiled and/or aggregated for a given monitoring period. Qualitative values (satisfactory/unsatisfactory) may be assigned for each SPT achievement and each trigger level not breached. Alternatively, numeric values (points) may be used to provide a quantitative measurement of the overall performance of the SPIs package.
- 4.13.4 It should be noted that trigger values serve to trigger (start) an evaluation, decision, adjustment or remedial action related to the particular indicator. An SPI being triggered is not necessarily catastrophic or an indication of failure. It is merely a sign that the activity has moved beyond the predetermined limit. The trigger aims to attract



the attention of decision makers who are now in a position to take remedial action, or not, depending on the circumstances.

#### **4.14 Caveat on triggers**

- 4.14.1 There are challenges in identifying reliable trigger levels. Triggers and their associated levels work best when there are ample safety data and safety data management capabilities. This can impose an additional workload on the organization. The notion of trigger was designed and is best suited to SRM of purely technical systems (e.g. aircraft engine monitoring). In this case, large amounts of quantitative data support the identification of accurate triggers and trigger levels. The notion of triggers is arguably less relevant to SRM of socio-technical systems. Socio-technical systems are systems where people actively interact with the processes and technologies to achieve the system's service delivery or production objectives. Both SSP and SMS are socio-technical systems. The less reliable and meaningful triggers used in socio-technical systems are due to the limitations of reliable measures when humans are involved.
- 4.14.2 A more flexible approach is therefore needed for the triggers to be meaningful. Annex 19 does not require that service providers define trigger levels for each SPI. However, there are benefits for organizations where their data for an SPI is very specific, there are enough data points and the data is sufficiently trustworthy.



4.14.3

Figure 4-6, is an extension of the previous example, “50 per cent reduction in runway excursions by 2022”. In this scenario, it is now the year 2020. The organization has been collecting safety data (SPI – “No runway excursions/million movement/yr”) and working with stakeholders to reduce the instances. The SPT for 2019 (<78 runway excursions/million movement in year) was achieved. However, the SPI shows that, not only was the SPT for 2020 (<64 runway excursions/million movement in year) not achieved, the number of excursions has exceeded the trigger in two consecutive reporting periods. The decision makers have been alerted to the deterioration in safety performance and are in a position to make decisions based on the data to take further action(s). Their data-driven decisions will aim to drive the safety performance back to within the acceptable zone, and on track to achieve their safety objective.

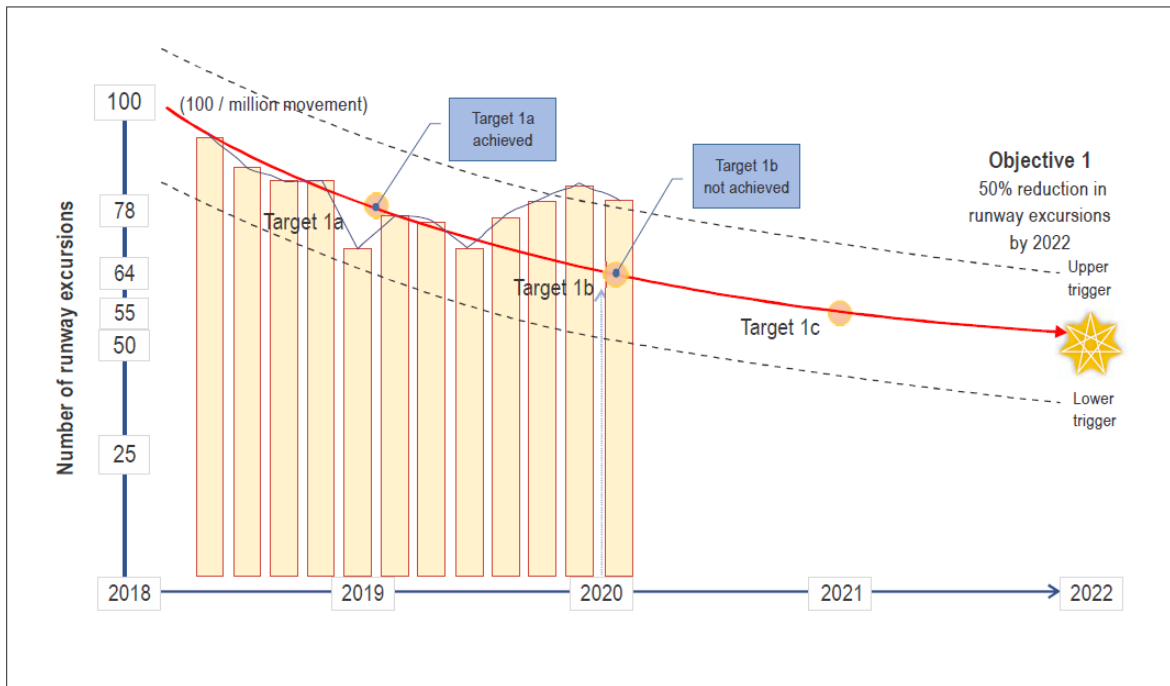


Figure 4-6. Example of setting safety triggers

#### 4.15 Identifying actions required

- 4.15.1 Arguably the most important outcome of establishing a safety performance management structure is the presentation of information to the organization's decision makers so they can make decisions based on current, reliable safety data and safety information. The aim should always be to make decisions in accordance with the safety policy and towards the safety objectives.
- 4.15.2 In relation to safety performance management, data-driven decision-making is about making effective, well-informed decisions based on the results of monitored and measured SPIs, or other reports and analysis of safety data and safety information. Using valid and relevant safety data combined with information that provides context supports the organization in making decisions that align with its safety objectives and targets. Contextual information may also include other stakeholder priorities, known deficiencies in the data, and other complementary data to evaluate the pros, cons, opportunities, limitations and risks associated with the decision. Having the information readily available and easy to interpret helps to mitigate bias, influence and human error in the decision-making process.
- 4.15.3 Data-driven decision-making also supports the evaluation of decisions made in the past to support any realignment with the safety objectives.

## **4.16 Update of safety objectives**

4.16.1 Safety performance management is not intended to be “set and forget”. Safety performance management is dynamic and central to the functioning of every State and every service provider, and should be reviewed and updated:

- (a) routinely, in accordance with the periodic cycle established and agreed upon by the high-level safety committee;
- (b) based on inputs from safety analyses; and
- (c) in response to major changes in the operation, top risks or environment.

## **CHAPTER 5. SAFETY MANAGEMENT SYSTEM (SMS)**

### **5.1 SMS Framework**

5.1.1 Annex 19 and Airworthiness Notice 2101 specifies the framework for the implementation and maintenance of an SMS. Regardless of the service provider's size and complexity, all elements of the SMS framework apply. The implementation should be tailored to the organization and its activities

5.1.2 There are four components that form the fundamentals of an SMS. Each component is sub-divided into elements that comprise the process or activities. These twelve elements combine prescriptive and performance-based approaches and support the implementation of SMS by service providers. The four components and twelve elements of an SMS framework are:

<b>COMPONENT</b>		<b>ELEMENT</b>	
<b>1</b>	Safety policy and objectives	<b>1.1</b>	Management commitment
		<b>1.2</b>	safety accountabilities and responsibilities
		<b>1.3</b>	Appointment of key safety personnel
		<b>1.4</b>	Coordination of emergency response planning
		<b>1.5</b>	SMS documentation
<b>2</b>	Safety risk management	<b>2.1</b>	Hazard identification
		<b>2.2</b>	Safety risk assessment and mitigation
<b>3</b>	Safety assurance	<b>3.1</b>	Safety performance monitoring and measurement
		<b>3.2</b>	The management of change
		<b>3.3</b>	Continuous improvement of the SMS
<b>4</b>	Safety promotion	<b>4.1</b>	Training and education
		<b>4.2</b>	Safety communication

## CHAPTER 6. COMPONENT 1 : SAFETY POLICY AND OBJECTIVE

### 6.1 Safety Policy and Objective

- 6.1.1 The first component of the SMS framework focuses on creating an environment where safety management can be effective. It is founded on a safety policy and objectives that set out senior management's commitment to safety, its goals and the supporting organizational structure.
- 6.1.2 Management commitment and safety leadership is key to the implementation of an effective SMS and is asserted through the safety policy and the establishment of safety objectives. Management commitment to safety is demonstrated through management decision-making and allocation of resources; these decisions and actions should always be consistent with the safety policy and objectives to cultivate a positive safety culture.
- 6.1.3 The safety policy should be developed and endorsed by senior management, and is to be signed by the accountable executive. Key safety personnel, and where appropriate, staff representative bodies (employee forums, trade unions) should be consulted in the development of the safety policy and safety objectives to promote a sense of shared responsibility.

### 6.2 Element 1.1 - Management Commitment

#### 6.2.1 Safety Policy

- (a) The safety policy should be visibly endorsed by senior management and the accountable executive. "Visible endorsement" refers to making management's active support of the safety policy visible to the rest of the organization. This can be done via any means of communication and through the alignment of activities to the safety policy.
- (b) It is the responsibility of management to communicate the safety policy throughout the organization to ensure all personnel understand and work in accordance with the safety policy.
- (c) To reflect the organization's commitment on safety, the safety policy should include a commitment to:
  - (i) continuously improve the level of safety performance;

- (ii) promote and maintain a positive safety culture within the organization;
  - (iii) comply with all applicable regulatory requirements;
  - (iv) provide the necessary resources to deliver a safe product or service;
  - (v) ensure safety is a primary responsibility of all managers; and
  - (vi) ensure it is understood, implemented and maintained at all levels.
- (d) The safety policy should also make reference to the safety reporting system to encourage the reporting of safety issues and inform personnel of the disciplinary policy applied in the case of safety events or safety issues that are reported.
- (e) The disciplinary policy is used to determine whether an error or rule breaking has occurred so that the organization can establish whether any disciplinary action should be taken. To ensure the fair treatment of persons involved, it is essential that those responsible for making that determination have the necessary technical expertise so that the context of the event may be fully considered
- (f) A policy on the protection of safety data and safety information, as well as reporters, can have a positive effect on the reporting culture. The service provider and the State should allow for the de-identification and aggregation of reports to allow meaningful safety analyses to be conducted without having to implicate personnel or specific service providers. Because major occurrences may invoke processes and procedures outside of the service provider's SMS, the relevant State authority may not permit the early de-identification of reports in all circumstances. Nonetheless, a policy allowing for the appropriate de-identification of reports can improve the quality of data collected.
- (g) A sample safety policy statement, based on ICAO Doc 9859 (3<sup>rd</sup> edition) – Safety Management Manual, is provided in Appendix A.

### 6.2.2 **Safety objectives**

- (a) Taking into consideration its safety policy, the service provider should also establish safety objectives to define what it aims to achieve in respect of safety outcomes. Safety objectives should be short, high-level statements of the organization's safety priorities and should address its most significant safety risks. Safety objectives may be included in the safety policy (or documented separately), and requires the establishment of safety objectives defining what the organization intends to achieve in terms of safety management. Safety performance indicators (SPIs) and safety performance targets (SPTs) are needed to monitor the achievement of these safety objectives and are further elaborated on later in this Guidance under Component 3.
- (b) The safety policy and safety objectives should be periodically reviewed to ensure they remain current (a change in the accountable executive would require its review for instance).

### **6.3 Element 1.2 - Safety accountability and responsibilities**

#### **6.3.1 Accountable Executive**

- (a) The accountable executive is the person who has ultimate authority over the safe operation of the organization, typically known as the chief executive officer, the accountable executive establishes and promotes the safety policy and safety objectives that instil safety as a core organizational value. They should have the authority to make decisions on behalf of the organization; have control of resources, both financial and human; and be responsible for ensuring appropriate actions are taken to address safety issues and safety risks, and responding to accidents and incidents.
- (b) There might be challenges for the service provider to identify the most appropriate person to be the accountable executive, especially in large complex organizations with multiple entities and approvals. It is important the person selected is organizationally situated at the highest level of the organization, thus ensuring the right strategic safety decisions are made.
- (c) The service provider is required to identify the accountable executive, placing the responsibility for the overall safety performance at a level in the organization with the authority to take action to ensure the SMS is effective. Specific safety accountabilities of all members of management should be



defined and their role in relation to the SMS should reflect how they can contribute towards a positive safety culture. The safety responsibilities, accountabilities and authorities should be documented and communicated throughout the organization. The safety accountabilities of managers should include the allocation of the human, technical, financial or other resources necessary for the effective and efficient performance of the SMS.

*Note.— The term “accountability” refers to obligations which cannot be delegated. The term “responsibilities” refers to functions and activities which may be delegated.*

- (d) In the case where an SMS applies to several different approvals, that are all part of the same legal entity, there should be a single accountable executive. Where this is not possible, individual accountable executives should be identified for each organization approval and clear lines of accountability defined; it is also important to identify how their safety accountabilities will be coordinated.
- (e) One of the most effective ways the accountable executive can be involved, and seen to be involved, is by leading regular executive safety meetings. As they are ultimately responsible for the safety of the organization, being actively involved in these meetings allows the accountable executive to:
  - (i) review safety objectives;
  - (ii) monitor safety performance and the achievement of safety targets;
  - (iii) make timely safety decisions;
  - (iv) allocate appropriate resources;
  - (v) hold managers accountable for safety responsibilities, performance and implementation timelines; and
  - (vi) be seen by all personnel as an executive who is interested in, and in charge of, safety.
- (f) The accountable executive is not usually involved in the day-to-day activities of the organization or the problems faced in the workplace and should ensure there is an appropriate organizational structure to manage and operate the SMS. Safety management responsibility is often delegated to

the senior management team and other key safety personnel. Although responsibility for the day-to-day operation of the SMS can be delegated, the accountable executive cannot delegate accountability for the system nor can decisions regarding safety risks be delegated. For example, the following safety accountabilities cannot be delegated:

- (i) ensuring safety policies are appropriate and communicated;
  - (ii) ensuring necessary allocation of resources (financing, personnel, training, acquisition); and
  - (iii) setting of the acceptable safety risk limits and resourcing of necessary controls.
- (g) It is appropriate for the accountable executive to have the following safety accountabilities:
- (i) provide enough financial and human resources for the proper implementation of an effective SMS;
  - (ii) promote a positive safety culture;
  - (iii) establish and promote the safety policy;
  - (iv) establish the organization's safety objectives;
  - (v) ensure the SMS is properly implemented and performing to requirements; and
  - (vi) see to the continuous improvement of the SMS.
- (h) The accountable executive's authorities include, but are not limited to having final authority:
- (i) for the resolution of all safety issues; and
  - (ii) over operations under the certificate/approval of the organization, including the authority to stop the operation or activity.
- (i) The authority to make decisions regarding safety risk tolerability should be defined. This includes who can make decisions on the acceptability of risks as well as the authority to agree that a change can be implemented. The

authority may be assigned to an individual, a management position or a committee.

- (j) Authority to make safety risk tolerability decisions should be commensurate with the manager's general decision-making and resource allocation authority. A lower level manager (or management group) may be authorized to make tolerability decisions up to a certain level. Risk levels that exceed the manager's authority must be escalated for consideration to a higher management level with greater authority.

### 6.3.2 ***Accountability and responsibilities***

- (a) Accountabilities and responsibilities of all personnel, management and staff, involved in safety-related duties supporting the delivery of safe products and operations should be clearly defined. The safety responsibilities should focus on the staff member's contribution to the safety performance of the organization (the organizational safety outcomes). The management of safety is a core function, as such every senior manager has a degree of involvement in the operation of the SMS.
- (b) All defined accountabilities, responsibilities and authorities should be stated in the service provider's SMS documentation and should be communicated throughout the organization. The safety accountabilities and responsibilities of each senior manager are integral components of their job descriptions. This should also capture the different safety management functions between line managers and the safety manager (see Element 3 for further details).
- (c) Lines of safety accountability throughout the organization and how they are defined will depend on the type and complexity of the organization, and their preferred communication methods. Typically, the safety accountabilities and responsibilities will be reflected in organizational charts, documents defining departmental responsibilities, and personnel job or role descriptions.
- (d) The service provider should aim to avoid conflicts of interest between staff members' safety responsibilities and their other organizational responsibilities. They should allocate their SMS accountabilities and responsibilities, in a way that minimizes any overlaps and/or gaps.

### 6.3.3 ***Accountability and responsibilities and in respect to external organizations***

A service provider is responsible for the safety performance of external organizations where there is an SMS interface. The service provider may be held accountable for the safety performance of products or services provided by external organizations supporting its activities even if the external organizations are not required to have an SMS. It is essential for the service provider's SMS to interface with the safety systems of any external organizations that contribute to the safe delivery of their product or services.

## 6.4 **Element 1.3 - Appointment of key safety personnel**

6.4.1 Appointment of a competent person or persons to fulfil the role of safety manager is essential to an effectively implemented and functioning SMS. The safety manager may be identified by different titles. For the purposes of this manual, the generic term "safety manager" is used and refers to the function, not necessarily to the individual. The person carrying out the safety manager function is responsible to the accountable executive for the performance of the SMS and for the delivery of safety services to the other departments in the organization.

6.4.2 The safety manager advises the accountable executive and line managers on safety management matters, and is responsible for coordinating and communicating safety issues within the organization as well as with external members of the aviation community. Functions of the safety manager include, but are not limited to:

- (a) manage the SMS implementation plan on behalf of the accountable executive (upon initial implementation);
- (b) perform/facilitate hazard identification and safety risk analysis;
- (c) monitor corrective actions and evaluate their results;
- (d) provide periodic reports on the organization's safety performance;
- (e) maintain SMS documentation and records;
- (f) plan and facilitate staff safety training;
- (g) provide independent advice on safety matters;

- (h) monitor safety concerns in the aviation industry and their perceived impact on the organization's operations aimed at product and service delivery; and
- (i) coordinate and communicate (on behalf of the accountable executive) with the CAAM and other State authorities as necessary on issues relating to safety.

6.4.3 In most organizations, an individual is appointed as the safety manager. Depending on the size, nature and complexity of the organization the safety manager role may be an exclusive function or it may be combined with other duties. Moreover, some organizations may need to allocate the role to a group of persons. The organization must ensure that the option chosen does not result in any conflicts of interest. Where possible, the safety manager should not be directly involved in the product or service delivery but should have a working knowledge of these. The appointment should also consider potential conflicts of interest with other tasks and functions . Such conflicts of interest could include:

- (a) competition for funding (e.g. financial manager being the safety manager);
- (b) conflicting priorities for resources; and
- (c) where the safety manager has an operational role and their ability to assess the SMS effectiveness of the operational activities they are involved in.

6.4.4 In cases where the function is allocated to a group of persons, (e.g. when service providers extend their SMS across multiple activities) one of the persons should be designated as "lead" safety manager, to maintain a direct and unequivocal reporting line to the accountable executive.

6.4.5 The competencies for a safety manager should include, but not be limited to, the following:

- (a) safety/quality management experience;
- (b) operational experience related to the product or service provided by the organization;
- (c) technical background to understand the systems that support operations or the product/service provided;
- (d) interpersonal skills;

- (e) analytical and problem-solving skills;
- (f) project management skills;
- (g) oral and written communications skills; and
- (h) an understanding of human factors.

6.4.6 Depending on the size, nature and complexity of the organization, additional staff may support the safety manager. The safety manager and supporting staff are responsible for ensuring the prompt collection and analysis of safety data and appropriate distribution within the organization of related safety information such that safety risk decisions and controls, as necessary, can be made.

6.4.7 Service providers should establish appropriate safety committees that support the SMS functions across the organization. This should include determining who should be involved in the safety committee and frequency of the meetings.

6.4.8 Additionally, a function of the safety manager is to assess the effectiveness of any risk mitigation strategies used to achieve the safety objectives of the organization. This can be done through the highest-level safety committee such as a safety review board (SRB). The SRB is strategic and deals with high-level issues related to policies, resource allocation and organizational performance monitoring. The SRB should include the accountable executive and senior management who monitor the:

- (a) effectiveness of the SMS;
- (b) timely response of necessary safety risk control actions;
- (c) safety performance against the organization's safety policy and objectives;
- (d) effectiveness of the organization's safety management processes which support:
  - (i) the declared organization priority of safety management; and
  - (ii) promotion of safety across the organization.

6.4.9 Once a strategic direction has been developed by the highest-level safety committee, implementation of safety strategies should be coordinated throughout the organization. This may be accomplished by creating a safety action group (SAG) that is more operationally focused. SAGs are normally composed of managers and front-

line personnel and are chaired by a designated manager. SAGs are tactical entities that deal with specific implementation issues per the direction of the SRB. The SAG:

- (a) monitors operational safety performance within the functional areas of the organization and ensures that appropriate SRM activities are carried out;
- (b) reviews available safety data and identifies the implementation of appropriate safety risk control strategies and ensures employee feedback is provided;
- (c) assesses the safety impact related to the introduction of operational changes or new technologies;
- (d) coordinates the implementation of any actions related to safety risk controls and ensures that actions are taken promptly; and
- (e) reviews the effectiveness of the safety risk controls.

## **6.5 Element 1.4 - Coordination of emergency response planning**

6.5.1 By definition, an emergency is a sudden, unplanned situation or event requiring immediate action. Coordination of emergency response planning refers to planning for activities that take place within a limited period of time during an unplanned aviation operational emergency situation. An emergency response plan (ERP) is an integral component of a service provider's SRM process to address aviation related emergencies, crises or events. Where there is a possibility of a service provider's aviation operations or activities being compromised by emergencies such as a public health emergency/pandemic, these scenarios should also be addressed in its ERP as appropriate. The ERP should address foreseeable emergencies as identified through the SMS and include mitigating actions, processes and controls to effectively manage aviation-related emergencies.

6.5.2 The overall objective of the ERP is the safe continuation of operations and the return to normal operations as soon as possible. This should ensure an orderly and efficient transition from normal to emergency operations, including assignment of emergency responsibilities and delegation of authority. It includes the period of time required to re-establish "normal" operations following the emergency. The ERP identifies actions to be taken by responsible personnel during an emergency. Most emergencies will require coordinated action between different organizations, possibly with other service providers and with other external organizations such as non-aviation related

emergency services. The ERP should be easily accessible to the appropriate key personnel as well as to the coordinating external organizations.

- 6.5.3 Coordination of emergency response planning applies only to those service providers required to establish and maintain an ERP. Annex 19 does not require the creation or development of an ERP; emergency response planning is applicable only to specific service providers as established in the relevant ICAO Annexes (different terms for provisions related to dealing with emergency situations may be used in other Annexes). This coordination should be exercised as part of the periodic testing of the ERP.

## **6.6 Element 1.5 - SMS documentation**

- 6.6.1 The SMS documentation should include a top-level “SMS manual”, which describes the service provider’s SMS policies, processes and procedures to facilitate the organization’s internal administration, communication and maintenance of the SMS. It should help personnel to understand how the organization’s SMS functions, and how the safety policy and objectives will be met. The documentation should include a system description that provides the boundaries of the SMS. It should also help clarify the relationship between the various policies, processes, procedures and practices, and define how these link to the service provider’s safety policy and objectives. The documentation should be adapted and written to address the day-to-day safety management activities that can be easily understood by personnel throughout the organization.
- 6.6.2 The SMS manual also serves as a primary safety communication tool between the service provider and key safety stakeholders (e.g. CAAM for the purpose of regulatory acceptance, assessment and subsequent monitoring of the SMS). The SMS manual may be a stand-alone document, or it may be integrated with other organizational documents (or documentation) maintained by the service provider. Where details of the organization’s SMS processes are already addressed in existing documents, appropriate cross-referencing to such documents is enough. This SMS document will need to be kept up to date. As a controlled manual, CAAM agreement may be required before significant amendments are made.
- 6.6.3 The SMS manual should include a detailed description of the service provider’s policies, processes and procedures including:
- (a) safety policy and safety objectives;



- (b) reference to any applicable regulatory SMS requirements;
- (c) system description;
- (d) safety accountabilities and key safety personnel;
- (e) voluntary and mandatory safety reporting system processes and procedures;
- (f) hazard identification and safety risk assessment processes and procedures;
- (g) safety investigation procedures;
- (h) procedures for establishing and monitoring safety performance indicators;
- (i) SMS training processes and procedures and communication;
- (j) safety communication processes and procedures;
- (k) internal audit procedures;
- (l) management of change procedures;
- (m) SMS documentation management procedures; and
- (n) where applicable, coordination of emergency response planning.

6.6.4 SMS documentation is in the form of an SMS Manual with references to relevant documents as necessary. APPENDIX B provides example and guidance on the overall structure of the SMS Manual.

6.6.5 SMS documentation also includes the compilation and maintenance of operational records substantiating the existence and ongoing operation of the SMS. Operational records are the outputs of the SMS processes and procedures such as the SRM and safety assurance activities. SMS operational records should be stored and kept in accordance with existing retention periods. Typical SMS operational records should include:

- (a) hazards register and hazard/safety reports;
- (b) SPIs and related charts;
- (c) record of completed safety risk assessments;
- (d) SMS internal review or audit records;

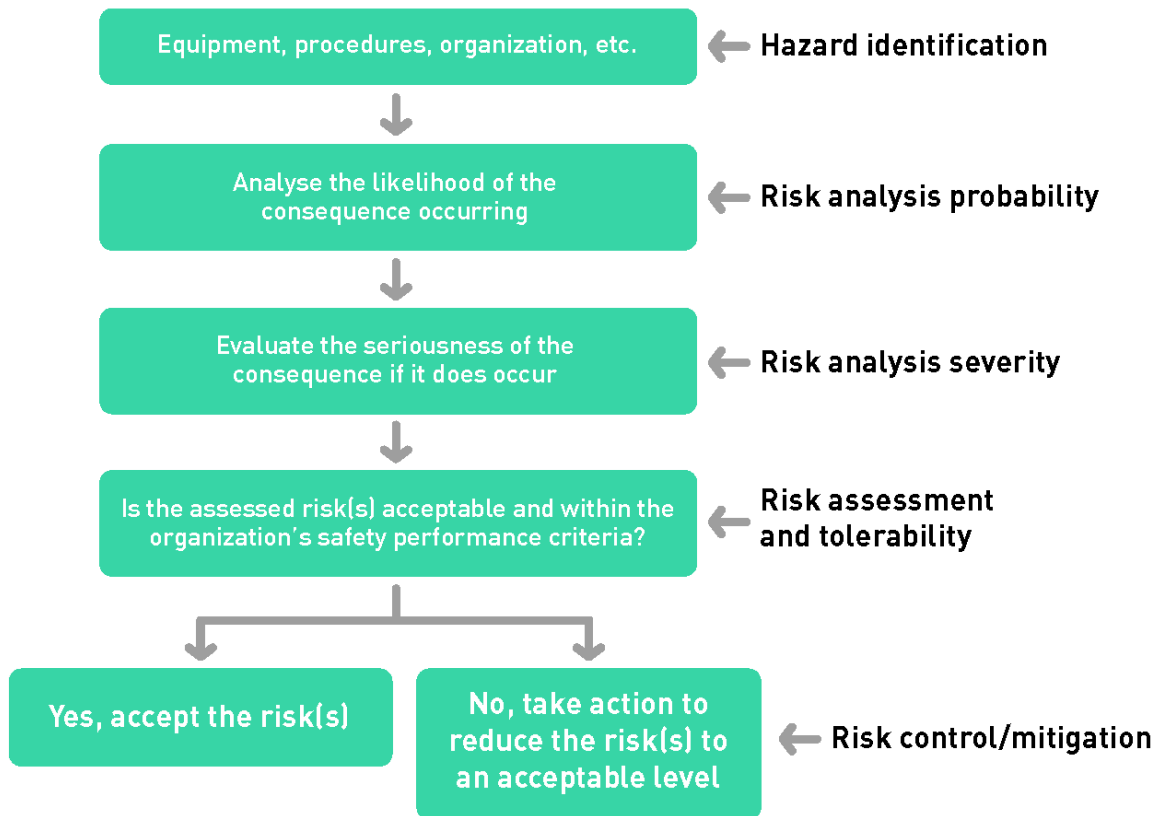
- (e) internal audit records;
- (f) records of SMS/safety training records;
- (g) SMS/safety committee meeting minutes;
- (h) SMS implementation plan (during the initial implementation); and
- (i) gap analysis to support implementation plan.

## CHAPTER 7. COMPONENT (2) SAFETY RISK MANAGEMENT

### 7.1 Safety Risk Management

- 7.1.1 Service providers should ensure they are managing their safety risks. This process is known as safety risk management (SRM), which includes hazard identification, safety risk assessment and safety risk mitigation.
- 7.1.2 The SRM process systematically identifies hazards that exist within the context of the delivery of its products or services. Hazards may be the result of systems that are deficient in their design, technical function, human interface or interactions with other processes and systems. They may also result from a failure of existing processes or systems to adapt to changes in the service provider's operating environment. Careful analysis of these factors can often identify potential hazards at any point in the operation or activity lifecycle.
- 7.1.3 Understanding the system and its operating environment is essential for the achievement of high safety performance. Having a detailed system description that defines the system and its interfaces will help. Hazards may be identified throughout the operational life cycle from internal and external sources. Safety risk assessments and safety risk mitigations will need to be continuously reviewed to ensure they remain effective. Figure 7-1 provides an overview of the hazard identification and safety risk management process for a service provider.

*Note : Detailed guidance on hazard identification and safety risk assessment procedures is addressed in Chapter 3.*



**Figure 7-1. Hazard identification and risk management process**

## 7.2 Element 2.1 - Hazard identification

Hazard identification is the first step in the SRM process. The service provider should develop and maintain a formal process to identify hazards that could impact aviation safety in all areas of operation and activities. This includes equipment, facilities and systems. Any aviation safety-related hazard identified and controlled is beneficial for the safety of the operation. It is important to also consider hazards that may exist as a result of the SMS interfaces with external organizations.

### 7.2.1 Sources for Hazard Identification

- (a) There are a variety of sources for hazard identification, internal or external to the organization. Some internal sources include:
  - (i) *Normal operations monitoring*; this uses observational techniques to monitor the day to day operations and activities such as line operations safety audit (LOSA).

- (ii) *Automated monitoring systems*; this uses automated recording systems to monitor parameters that can be analysed such as flight data monitoring (FDM).
  - (iii) *Voluntary and mandatory safety reporting systems*; this provides everyone, including staff from external organizations, with opportunities to report hazards and other safety issues to the organization.
  - (iv) *Audits*; these can be used to identify hazards in the task or process being audited. These should also be coordinated with organizational changes to identify hazards related to the implementation of the change.
  - (v) *Feedback from training*; training that is interactive (two way) can facilitate identification of new hazards from participants.
  - (vi) *Service provider safety investigations*; hazards identified in internal safety investigation and follow-up reports on accidents/incidents.
- (b) Examples of external sources for hazard identification include:
- (i) *Aviation accident reports*; reviewing accident reports, this may be related to accidents in the same State or to a similar aircraft type, region or operational environment.
  - (ii) *State mandatory and voluntary safety reporting systems*; some States provide summaries of the safety reports received from service providers.
  - (iii) *State oversight audits and third-party audits*; external audits can sometimes identify hazards. These may be documented as an unidentified hazard or captured less obviously within an audit finding.
  - (iv) *Trade associations and information exchange systems*; many trade associations and industry groups are able to share safety data that may include identified hazards.

### 7.2.2 **Safety Reporting System**

- (a) One of the main sources for identifying hazards is the safety reporting system, especially the voluntary safety reporting system. Whereas the mandatory system is normally used for incidents that have occurred the voluntary system provide an additional reporting channel for potential safety issues such as hazards, near misses or errors. They can provide valuable information to the State and service provider on lower consequence events.
- (b) It is important that service providers provide appropriate protections to encourage people to report what they see or experience. For example, enforcement action may be waived for reports of errors, or in some circumstances, rule-breaking. It should be clearly stated that reported information will be used solely to support the enhancement of safety. The intent is to promote an effective reporting culture and proactive identification of potential safety deficiencies.
- (c) Voluntary safety reporting systems should be confidential, requiring that any identifying information about the reporter is known only to the custodian to allow for follow-up action. The role of custodian should be kept to a few individuals, typically restricted to the safety manager and personnel involved in the safety investigation. Maintaining confidentiality will help facilitate the disclosure of hazards leading to human error, without fear of retribution or embarrassment. Voluntary safety reports may be de-identified and archived once necessary follow-up actions are taken. De-identified reports can support future trending analyses to track the effectiveness of risk mitigation and to identify emerging hazards.
- (d) Personnel at all levels and across all disciplines are encouraged to identify and report hazards and other safety issues through their safety reporting systems. To be effective, safety reporting systems should be readily accessible to all personnel. Depending on the situation, a paper-based, web-based or desktop form can be used. Having multiple entry methods available maximizes the likelihood of staff engagement. Everyone should be made aware of the benefits of safety reporting and what should be reported.
- (e) Anybody that submits a safety report should receive feedback on what decisions or actions have been taken. The alignment of reporting system requirements, analysis tools and methods can facilitate exchange of safety information as well as comparisons of certain safety performance indicators. Feedback to reporters in voluntary reporting schemes also serves to

demonstrate that such reports are considered seriously. This helps to promote a positive safety culture and encourage future reporting.

- (f) There may be a need to filter reports on entry when there are a large number of safety reports. This may involve an initial safety risk assessment to determine whether further investigation is necessary and what level of investigation is required.
- (g) Safety reports are often filtered through the use of a taxonomy, or a classification system. Filtering information using a taxonomy can make it easier to identify common issues and trends. The service provider should develop taxonomies that cover their type(s) of operation. The disadvantage of using a taxonomy is that sometimes the identified hazard does not fit cleanly into any of the defined categories. The challenge then is to use taxonomies with the appropriate degree of detail; specific enough that hazards are easy to allocate, yet generic enough that the hazards are valuable for analysis.
- (h) Other methods of hazard identification include workshops or meetings in which subject matter experts conduct detailed analysis scenarios. These sessions benefit from the contributions of a range of experienced operational and technical personnel. Existing safety committee meetings (SRB, SAG, etc.) could be used for such activities; the same group may also be used to assess associated safety risks.
- (i) Identified hazards and their potential consequences should be documented. This will be used for safety risk assessment processes.
- (j) The hazard identification process considers all possible hazards that may exist within the scope of the service provider's aviation activities including interfaces with other systems, both within and external to the organization. Once hazards are identified, their consequences (i.e. any specific events or outcomes) should be determined.

### 7.2.3 ***Investigation of hazards***

- (a) Hazard identification should be continuous and part of the service provider's ongoing activities. Some conditions may merit more detailed investigation. These may include:

- (i) instances where the organization experiences an unexplained increase in aviation safety-related events or regulatory non-compliance; or
- (ii) significant changes to the organization or its activities.

### **7.3 Service provider safety investigation**

- 7.3.1 Effective safety management depends on quality investigations to analyse safety occurrences and safety hazards, and report findings and recommendations to improve safety in the operating environment.
- 7.3.2 There is a clear distinction between accident and incident investigations under Annex 13 and service provider safety investigations. Investigation of accidents and serious incidents under Annex 13 are the responsibility of the State, as defined in Annex 13. This type of information is essential to disseminate lessons learned from accidents and incidents. Service provider safety investigations are conducted by service providers as part of their SMS to support hazard identification and risk assessment processes. There are many safety occurrences that fall outside of Annex 13 that could provide a valuable source of hazard identification or identify weaknesses in risk controls. These problems might be revealed and remedied by a safety investigation led by the service provider.
- 7.3.3 The primary objective of the service provider safety investigation is to understand what happened, and how to prevent similar situations from occurring in the future by eliminating or mitigating safety deficiencies. This is achieved through careful and methodical examination of the event and applying the lessons learned to reduce the probability and/or consequence of future recurrences. Service provider safety investigations are an integral part of the service provider's SMS.
- 7.3.4 Service provider investigations of safety occurrences and hazards are an essential activity of the overall risk management process in aviation. The benefits of conducting a safety investigation, include:
  - (a) gaining a better understanding of the events leading up to the occurrence;
  - (b) identifying contributing human, technical and organizational factors;
  - (c) identifying hazards and conducting risk assessments;
  - (d) making recommendations to reduce or eliminate unacceptable risks; and



- (e) identifying lessons learnt that should be shared with the appropriate members of the aviation community.

### 7.3.5 ***Investigation triggers***

- (a) A service provider safety investigation is usually triggered by a notification (report) submitted through the safety reporting system. Figure 7-2 outlines the safety investigation decision process and the distinction between when a service provider safety investigation should take place and when an investigation under Annex 13 provisions should be initiated.
- (b) Not all occurrences or hazards can or should be investigated, the decision to conduct an investigation and its depth should depend on the actual or potential consequences of the occurrence or hazard. Occurrences and hazards considered to have a high-risk potential are more likely to be instigated and should be investigated in greater depth than those with lower risk potential. Service providers should use a structured decision-making approach with defined trigger points. These will guide the safety investigation decisions: what to investigate and the scope of the investigation. This could include:
  - (i) the severity or potential severity of the outcome
  - (ii) regulatory or organizational requirements to carry out an investigation;
  - (iii) safety value to be gained;
  - (iv) opportunity for safety action to be taken;
  - (v) risks associated with not investigating;
  - (vi) contribution to targeted safety programmes;
  - (vii) identified trends;
  - (viii) training benefit; and
  - (ix) resources availability.

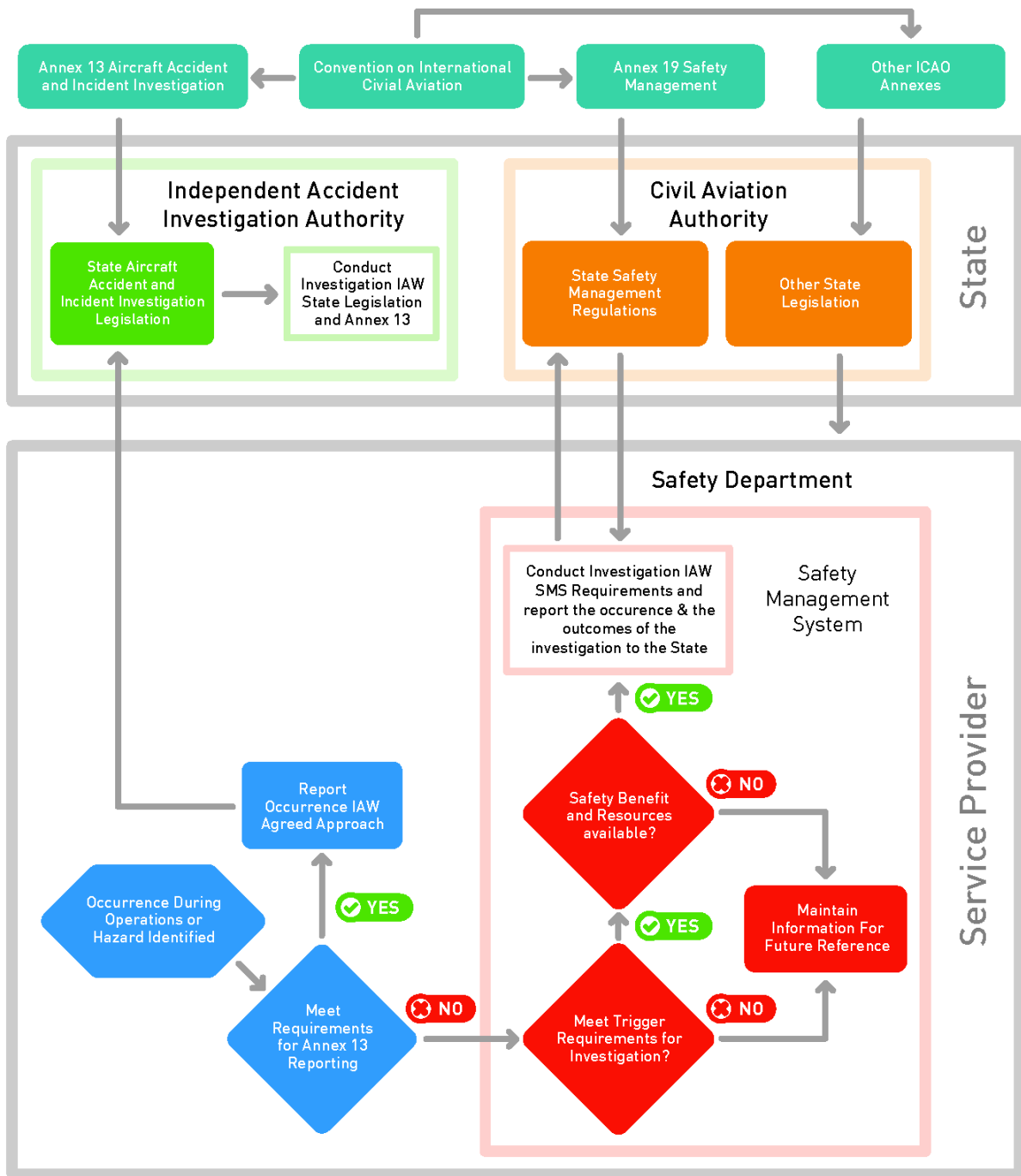


Figure 7-2. Safety investigation decision process

### 7.3.6 ***Assigning an investigator***

- (a) If an investigation is to commence, the first action will be to appoint an investigator or where the resources are available, an investigation team with the required skills and expertise. The size of the team and the expertise profile of its members depend on the nature and severity of the occurrence being investigated. The investigating team may require the assistance of other specialists. Often, a single person is assigned to carry out an internal investigation, with support from operations and safety office experts.
- (b) Service provider safety investigators are ideally organizationally independent from the area associated with the occurrence or identified hazard. Better results will be obtained if the investigator(s) are knowledgeable (trained) and skilled (experienced) in service provider safety investigations. The investigators would ideally be chosen for the role because of their knowledge, skills and character traits, which should include: integrity, objectivity, logical thinking, pragmatism and lateral thinking.

### 7.3.7 ***The investigation process***

- (a) The investigation should identify what happened and why it happened and this may require root cause analysis to be applied as part of the investigation. Ideally, the people involved in the event should be interviewed as soon as possible after the event. The investigation should include:
  - (i) establishing timelines of key events including and the actions of the people involved;
  - (ii) review of any policies and procedures related to the activities;
  - (iii) review of any decisions made related to the event;
  - (iv) identifying any risk controls that were in place that should have prevented the event occurring; and
  - (v) reviewing safety data for any previous or similar events.
- (b) The safety investigation should focus on the identified hazards and safety risks and opportunities for improvement, not on blame or punishment. The way the investigation is conducted, and most importantly, how the report is

written, will influence the likely safety impact, the future safety culture of the organization, and the effectiveness of future safety initiatives.

- (c) The investigation should conclude with clearly defined findings and recommendations that eliminate or mitigate safety deficiencies.

#### **7.4 Element 2.2 - Safety risk assessment and mitigation**

- 7.4.1 The service provider needs to develop a safety risk assessment model and procedures which will allow a consistent and systematic approach for the assessment of safety risks. This should include a method that will help determine what safety risks are acceptable or unacceptable and to prioritize actions.
- 7.4.2 The SRM tools used may need to be reviewed and customized periodically to ensure they are suitable for the service provider's operating environment. The service provider may find more sophisticated approaches that better reflect the needs of their operation as their SMS matures. The service provider and CAAM should agree on a methodology.
- 7.4.3 More sophisticated approaches to safety risk classification are available. These may be more suitable if the service provider is experienced with safety management or operating in a high-risk environment.
- 7.4.4 The safety risk assessment process should use whatever safety data and safety information is available. Once safety risks have been assessed, the service provider will engage in a data-driven decision-making process to determine what safety risk controls are needed.
- 7.4.5 Safety risk assessments sometimes have to use qualitative information (expert judgement) rather than quantitative data due to unavailability of data. Using the safety risk matrix allows the user to express the safety risk(s) associated with the identified hazard in a quantitative format. This enables direct magnitude comparison between identified safety risks. A qualitative safety risk assessment criterion such as "likely to occur" or "improbable" may be assigned to each identified safety risk where quantitative data is not available.
- 7.4.6 For service providers that have operations in multiple locations with specific operating environments, it may be more effective to establish local safety committees to conduct safety risk assessments and safety risk control identification. Advice is often sought from a specialist in the operational area (internal or external to the service

provider). Final decisions or control acceptance may be required from higher authorities so that the appropriate resources are provided.

7.4.7 How service providers go about prioritizing their safety risk assessments and adopting safety risk controls is their decision. As a guide, the service provider should find the prioritization process:

- (a) assesses and controls highest safety risk;
- (b) allocates resources to highest safety risks;
- (c) effectively maintains or improves safety;
- (d) achieves the stated and agreed safety objectives and SPTs; and
- (e) satisfies the requirements of the State's regulations with regards to control of safety risks.

7.4.8 After safety risks have been assessed, appropriate safety risk controls can be implemented. It is important to involve the “end users” and subject matter experts in determining appropriate safety risk controls. Ensuring the right people are involved will maximize the practicality of safety risk chosen mitigations. A determination of any unintended consequences, particularly the introduction of new hazards, should be made prior to the implementation of any safety risk controls.

7.4.9 Once the safety risk control has been agreed and implemented, the safety performance should be monitored to assure the effectiveness of the safety risk control. This is necessary to verify the integrity, efficiency and effectiveness of the new safety risk controls under operational conditions.

7.4.10 The SRM outputs should be documented. This should include the hazard and any consequences, the safety risk assessment and any safety risk control actions taken. These are often captured in a register so they can be tracked and monitored. This SRM documentation becomes a historical source of organizational safety knowledge which can be used as reference when making safety decisions and for safety information exchange. This safety knowledge provides material for safety trend analyses and safety training and communication. It is also useful for internal audits to assess whether safety risk controls and actions have been implemented and are effective.

## **CHAPTER 8. COMPONENT (3) : SAFETY ASSURANCE**

### **8.1 Safety Assurance**

- 8.1.1 Airworthiness Notice 2101 paragraph 9.1(b) requires that service providers develop and maintain the means to verify the safety performance of the organization and to validate the effectiveness of safety risk controls. The safety assurance component of the service provider's SMS provides these capabilities.
- 8.1.2 Safety assurance consists of processes and activities undertaken to determine whether the SMS is operating according to expectations and requirements. This involves continuously monitoring its processes as well as its operating environment to detect changes or deviations that may introduce emerging safety risks or the degradation of existing safety risk controls. Such changes or deviations may then be addressed through the SRM process.
- 8.1.3 Safety assurance activities should include the development and implementation of actions taken in response to any identified issues having a potential safety impact. These actions continuously improve the performance of the service provider's SMS.

### **8.2 Element 3.1 - Safety performance monitoring and measurement**

- 8.2.1 To verify the safety performance and validate the effectiveness of safety risk controls requires the use of a combination of internal audits and the establishment and monitoring of SPIs. Assessing the effectiveness of the safety risk controls is important as their application does not always achieve the results intended. This will help identify whether the right safety risk control was selected and may result in the application of a different safety risk control strategy.

#### **8.2.2 *Internal audit***

- (a) Internal audits are performed to assess the effectiveness of the SMS and identify areas for potential improvement. Most aviation safety regulations are generic safety risk controls that have been established by the State. Ensuring compliance with the regulations through the internal audit is a principle aspect of safety assurance.
- (b) It is also necessary to ensure that any safety risk controls are effectively implemented and monitored. The causes and contributing factors should be

investigated and analysed where non-conformances and other issues are identified. The main focus of the internal audit is on the policies, processes and procedures that provide the safety risk controls.

- (c) Internal audits are most effective when conducted by persons or departments independent of the functions being audited. Such audits should provide the accountable executive and senior management with feedback on the status of:
  - (i) compliance with regulations;
  - (ii) compliance with policies, processes and procedures;
  - (iii) the effectiveness of safety risk controls;
  - (iv) the effectiveness of corrective actions; and
  - (v) the effectiveness of the SMS.
- (d) Some organizations cannot ensure appropriate independence of an internal audit, in such cases, the service provider should consider engaging external auditors (e.g. independent auditors or auditors from another organization).
- (e) Planning of internal audits should take into account the safety criticality of the processes, the results of previous audits and assessments (from all sources), and the implemented safety risk controls. Internal audits should identify non-compliance with regulations and policies, processes and procedures. They should also identify system deficiencies, lack of effectiveness of safety risk controls and opportunities for improvement.
- (f) Assessing for compliance and effectiveness are both essential to achieving safety performance. The internal audit process can be used to determine both compliance and effectiveness. The following questions can be asked to assess compliance and effectiveness of each process or procedure:

(i) *Determining compliance*

- Does the required process or procedure exist?
- Is the process or procedure documented (inputs, activities, interfaces and outputs defined)?
- Does the process or procedure meet requirements (criteria)?
- Is the process or procedure being used?
- Are all affected personnel following the process or procedure consistently?
- Are the defined outputs being produced?
- Has a process or procedure change been documented and implemented?

(ii) *Assessing effectiveness*

- Do users understand the process or procedure?
- Is the purpose of the process or procedure being achieved consistently?
- Are the results of the process or procedure what the “customer” asked for?
- Is the process or procedure regularly reviewed?
- Is a safety risk assessment conducted when there are changes to the process or procedure?
- Have process or procedure improvements resulted in the expected benefits?

(g) In addition, internal audits should monitor progress in closing previously identified non-compliances. These should have been addressed through root cause analysis and the development and implementation of corrective and preventive action plans. The results from analysis of cause(s) and contributing factors for any non-compliance should feed into the service provider’s SRM processes.

(h) The results of the internal audit process become one of the various inputs to the SRM and safety assurance functions. Internal audits inform the service provider’s management of the level of compliance within the organization,



the degree to which safety risk controls are effective and where corrective or preventive action is required.

- (i) CAAM may provide additional feedback on the status of compliance with regulations, and the effectiveness of the SMS and industry associations or other third parties selected by the service provider to audit their organization and processes. Results of such second- and third-party audits are inputs to the safety assurance function, providing the service provider with indications of the effectiveness of their internal audit processes and opportunities to improve their SMS.

### 8.2.3 ***Safety performance monitoring***

- (a) Safety performance monitoring is conducted through the collection of safety data and safety information from a variety of sources typically available to an organization. Data availability to support informed decision-making is one of the most important aspects of the SMS. Using this data for safety performance monitoring and measurement are essential activities that generate the information necessary for safety risk decision-making.
- (b) Safety performance monitoring and measurement should be conducted observing some basic principles. The safety performance achieved is an indication of organizational behaviour and is also a measure of the effectiveness of the SMS. This requires the organization to define:
  - (i) safety objectives, which should be established first to reflect the strategic achievements or desired outcomes related to safety concerns specific to the organization's operational context;
  - (ii) SPIs, which are tactical parameters related to the safety objectives and therefore are the reference for data collection; and
  - (iii) SPTs, which are also tactical parameters used to monitor progress towards the achievement of the safety objectives.
- (c) A more complete and realistic picture of the service provider's safety performance will be achieved if SPIs encompass a wide spectrum of indicators. This should include:
  - (i) low probability/high severity events (e.g. accidents and serious incidents);

- (ii) high probability/low severity events (e.g. uneventful operational events, non-conformance reports, deviations etc.): and
  - (iii) process performance (e.g. training, system improvements and report processing).
- (d) SPIs are used to measure operational safety performance of the service provider and the performance of their SMS. SPIs rely on the monitoring of data and information from various sources including the safety reporting system. They should be specific to the individual service provider and be linked to the safety objectives already established.
- (e) When establishing SPIs service providers should consider:
- (i) *Measuring the right things*: Determine the best SPIs that will show the organization is on track to achieving its safety objectives. Also consider what are the biggest safety issues and safety risks faced by the organization, and identify SPIs which will show effective control of these.
  - (ii) *Availability of data*: Is there data available which aligns with what the organization wants to measure? If there isn't, there may be a need to establish additional data collection sources. For small organizations with limited amounts of data, the pooling of data sets may also help to identify trends. This may be supported by industry associations who can collate safety data from multiple organizations.
  - (iii) *Reliability of the data*: Data may be unreliable either because of its subjectivity or because it is incomplete.
  - (iv) *Common industry SPIs*: It may be useful to agree on common SPIs with similar organizations so that comparisons can be made between organizations. The regulator or industry associations may enable these.
- (f) Once SPIs have been established the service provider should consider whether it appropriate to identify SPTs and alert levels. SPTs are useful in driving safety improvements but, implemented poorly, they have been known to lead to undesirable behaviours – that is, individuals and

departments becoming too focused on achieving the target and perhaps losing sight of what the target was intended to achieve – rather than an improvement in organizational safety performance. In such cases it may be more appropriate to monitor the SPI for trends.

- (g) The following activities can provide sources to monitor and measure safety performance:
- (i) *Safety studies* are analyses to gain a deeper understanding of safety issues or better understand a trend in safety performance.
  - (ii) *Safety data analysis* uses the safety reporting data to uncover common issues or trends that might warrant further investigation.
  - (iii) *Safety surveys* examine procedures or processes related to a specific operation. Safety surveys may involve the use of checklists, questionnaires and informal confidential interviews. Safety surveys generally provide qualitative information. This may require validation via data collection to determine if corrective action is required. Nonetheless, surveys may provide an inexpensive and valuable source of safety information.
  - (iv) *Safety audits* focus on assessing the integrity of the service provider's SMS and supporting systems. Safety audits can also be used to evaluate the effectiveness of installed safety risk controls or to monitor compliance with safety regulations. Ensuring independence and objectivity is a challenge for safety audits. Independence and objectivity can be achieved by engaging external entities or internal audits with protections in place - policies, procedures, roles, communication protocols.
  - (v) *Findings and recommendations from safety investigations* can provide useful safety information that can be analysed against other collected safety data.
  - (vi) *Operational data collection systems* such as FDA, radar information can provide useful data of events and operational performance.

- (h) The development of SPIs should be linked to the safety objectives and be based on the analysis of data that is available or obtainable. The monitoring and measurement process involves the use of selected safety performance indicators, corresponding SPTs and safety triggers.
- (i) The organization should monitor the performance of established SPIs and SPTs to identify abnormal changes in safety performance. SPTs should be realistic, context specific and achievable when considering the resources available to the organization and the associated aviation sector.
- (j) Primarily, safety performance monitoring and measurement provides a means to verify the effectiveness of safety risk controls. In addition, they provide a measure of the integrity and effectiveness of SMS processes and activities.
- (k) The State may have specific processes for the acceptance of SPIs and SPTs that will need to be followed. Therefore, during development of SPIs and SPTs, the service provider should consult with the organization's regulatory authority or any related information that the State has published.
- (l) For more information about safety performance management, refer to CHAPTER 4.

### **8.3 Element 3.2 -The management of change**

8.3.1 Service providers experience change due to a number of factors including, but not limited to:

- (a) organizational expansion or contraction;
- (b) business improvements that impact safety; these may result in changes to internal systems, processes or procedures that support the safe delivery of the products and services;
- (c) changes to the organization's operating environment;
- (d) changes to the SMS interfaces with external organizations; and
- (e) external regulatory changes, economic changes and emerging risks.

- 8.3.2 Change may affect the effectiveness of existing safety risk controls. In addition, new hazards and related safety risks may be inadvertently introduced into an operation when change occurs. Hazards should be identified and related safety risks assessed and controlled as defined in the organization's existing hazard identification or SRM procedures.
- 8.3.3 The organization's management of change process should take into account the following considerations:
- (a) Criticality. How critical is the change? The service provider should consider the impact on their organization's activities, and the impact on other organizations and the aviation system.
  - (b) Availability of subject matter experts. It is important that key members of the aviation community are involved in the change management activities; this may include individuals from external organizations.
  - (c) Availability of safety performance data and information. What data and information is available that can be used to give information on the situation and enable analysis of the change?
- 8.3.4 Small incremental changes often go unnoticed, but the cumulative effect can be considerable. Changes, large and small, might affect the organization's system description, and may lead to the need for its revision. Therefore, the system description should be regularly reviewed to determine its continued validity, given that most service providers experience regular, or even continuous, change.
- 8.3.5 The service provider should define the trigger for the formal change process. Changes that are likely to trigger formal change management include:
- (a) introduction of new technology or equipment;
  - (b) changes in the operating environment;
  - (c) changes in key personnel;
  - (d) significant changes in staffing levels;
  - (e) changes in safety regulatory requirements;
  - (f) significant restructuring of the organization; and
  - (g) physical changes (new facility or base, aerodrome layout changes etc.).

8.3.6 The service provider should also consider the impact of the change on personnel. This could affect the way the change is accepted by those affected. Early communication and engagement will normally improve the way the change is perceived and implemented.

8.3.7 The change management process should include the following activities:

- (a) *understand and define the change*; this should include a description of the change and why it is being implemented;
- (b) *understand and define who and what it will affect*; this may be individuals within the organization, other departments or external people or organizations. Equipment, systems and processes may also be impacted. A review of the system description and organizations' interfaces may be needed. This is an opportunity to determine who should be involved in the change. Changes might affect risk controls already in place to mitigate other risks, and therefore change could increase risks in areas that are not immediately obvious;
- (c) *identify hazards related to the change and carry out a safety risk assessment*; this should identify any hazards directly related to the change. The impact on existing hazards and safety risk controls that may be affected by the change should also be reviewed. This step should use the existing organization's SRM processes;
- (d) *develop an action plan*; this should define what is to be done, by whom and by when. There should be a clear plan describing how the change will be implemented and who will be responsible for which actions, and the sequencing and scheduling of each task;
- (e) *sign off on the change*; this is to confirm that the change is safe to implement. The individual with overall responsibility and authority for implementing the change should sign the change plan; and
- (f) *assurance plan*; this is to determine what follow-up action is needed. Consider how the change will be communicated and whether additional activities (such as audits) are needed during or after the change. Any assumptions made need to be tested.

## 8.4 Element 3.3 - Continuous improvement of the SMS

- 8.4.1 Paragraph 9.3 of Airworthiness Notice 2101 requires that “...*the service provider monitor and assess its SMS processes to maintain or continuously improve the overall effectiveness of the SMS.*” Maintenance and continuous improvement of the service provider’s SMS effectiveness is supported by safety assurance activities that include the verification and follow up of actions and the internal audit processes. It should be recognized that maintaining and continuously improving the SMS is an ongoing journey as the organization itself and the operational environment will be constantly changing.
- 8.4.2 Internal audits involve assessment of the service provider’s aviation activities that can provide information useful to the organization’s decision-making processes. The internal audit function includes evaluation of all of the safety management functions throughout the organization.
- 8.4.3 SMS effectiveness should not be based solely on SPIs; service providers should aim to implement a variety of methods to determine its effectiveness, measure outputs as well as outcomes of the processes, and assess the information gathered through these activities. Such methods may include:
- (a) *Audits*; this includes internal audits and audits carried out by other organizations.
  - (b) *Assessments*; includes assessments of safety culture and SMS effectiveness.
  - (c) *Monitoring of occurrences*: monitor the recurrence of safety events including accidents and incidents as well as errors and rule-breaking situations.
  - (d) *Safety surveys*; including cultural surveys providing useful feedback on staff engagement with the SMS. It may also provide an indicator of the safety culture of the organization.
  - (e) *Management reviews*; examine whether the safety objectives are being achieved by the organization and are an opportunity to look at all the available safety performance information to identify overall trends. It is important that senior management review the effectiveness of the SMS. This may be carried out as one of the functions of the highest-level safety committee.

- (f) *Evaluation of SPIs and SPTs*; possibly as part of the management review. It considers trends and, when appropriate data is available, can be compared to other service providers or State or global data.
- (g) *Addressing lessons learnt*, from safety reporting systems and service provider safety investigations. These should lead to safety improvements being implemented.

8.4.4 In summary, the monitoring of the safety performance and internal audit processes contributes to the service provider's ability to continuously improve its safety performance. Ongoing monitoring of the SMS, its related safety risk controls and support systems assures the service provider and the State that the safety management processes are achieving their desired safety performance objectives.



## **CHAPTER 9. COMPONENT 4: SAFETY PROMOTION**

### **9.1 Safety promotion**

- 9.1.1 Safety promotion encourages a positive safety culture and helps achieve the service provider's safety objectives through the combination of technical competence that is continually enhanced through training and education, effective communication, and information-sharing. Senior management provides the leadership to promote the safety culture throughout an organization.
- 9.1.2 Effective safety management cannot be achieved solely by mandate or strict adherence to policies and procedures. Safety promotion affects both individual and organizational behaviour, and supplements the organization's policies, procedures and processes, providing a value system that supports safety efforts.
- 9.1.3 The service provider should establish and implement processes and procedures that facilitate effective two-way communication throughout all levels of the organization. This should include clear strategic direction from the top of the organization and the enabling of "bottom-up" communication that encourages open and constructive feedback from all personnel.

### **9.2 Element 4.1 - Training and education**

- 9.2.1 Airworthiness Notice 2101, paragraph 10.1(a) requires that "the service provider shall develop and maintain a safety training programme that ensures that personnel are trained and competent to perform their SMS duties." It also requires that "the scope of the safety training programme be appropriate to each individual's involvement in the SMS." The safety manager is responsible for ensuring there is a suitable safety training programme in place. This includes providing appropriate safety information relevant to specific safety issues met by the organization. Personnel who are trained and competent to perform their SMS duties, regardless of their level in the organization, is an indication of management's commitment to an effective SMS. The training programme should include initial and recurrent training requirements to maintain competencies. Initial safety training should consider, as a minimum, the following:
- (a) organizational safety policies and safety objectives;
  - (b) organizational roles and responsibilities related to safety;

- (c) basic SRM principles;
- (d) safety reporting systems;
- (e) the organization's SMS processes and procedures; and
- (f) human factors.

9.2.2 Recurrent safety training should focus on changes to the SMS policies, processes and procedures, and should highlight any specific safety issues relevant to the organization or lessons learned.

9.2.3 The training programme should be tailored to the needs of the individual's role within the SMS. For example, the level and depth of training for managers involved in the organization's safety committees will be more extensive than for personnel directly involved with delivery of the organization's product or services. Personnel not directly involved in the operations may require only a high level overview of the organization's SMS.

#### 9.2.4 ***Training needs analysis***

- (a) For most organizations, a formal training needs analysis (TNA) is necessary to ensure there is a clear understanding of the operation, the safety duties of the personnel and the available training. A typical TNA will normally start by conducting an audience analysis, which usually includes the following steps:
  - (i) Every one of the service provider's staff will be affected by the implementation of the SMS, but not in the same ways or to the same degree. Identify each staff grouping and in what ways they will interact with the safety management processes, inputs and outputs - in particular with safety duties. This information should be available from the position/role descriptions. Normally groupings of individuals will start to emerge that have similar learning needs. The service provider should consider whether it is valuable to extend the analysis to staff in external interfacing organizations;
  - (ii) Identify the knowledge and competencies needed to perform each safety duty and required by each staff grouping.

- (iii) Conduct an analysis to identify the gap between the current safety skill and knowledge across the workforce and those needed to effectively perform the allocated safety duties.
  - (iv) Identify the most appropriate skills and knowledge development approach for each group with the aim of developing a training programme appropriate to each individual or group's involvement in safety management. The training programme should also consider the staff's ongoing safety knowledge and competency needs; these needs will typically be met through a recurrent training programme.
- (b) It is also important to identify the appropriate method for training delivery. The main objective is that, on completion of the training, personnel are competent to perform their SMS duties. Competent trainers are usually the single most important consideration; their commitment, teaching skills and safety management expertise will have a significant impact on the effectiveness of the training delivered. The safety training programme should also specify responsibilities for development of training content and scheduling as well as training and competency records management.
- (c) The organization should determine who should be trained and to what depth, and this will depend on their involvement in the SMS. Most people working in the organization have some direct or indirect relationship with aviation safety, and therefore have some SMS duties. This applies to any personnel directly involved in the delivery of products and services, and personnel involved in the organization's safety committees. Some administrative and support personnel will have limited SMS duties and will need some SMS training, as their work may still have an indirect impact on aviation safety.
- (d) The service provider should identify the SMS duties of personnel and use the information to examine the safety training programme and ensure each individual receives training aligned with their involvement with SMS. The safety training programme should specify the content of safety training for support staff, operational personnel, managers and supervisors, senior managers and the accountable executive.
- (e) There should be specific safety training for the accountable executive and senior managers that includes the following topics:

- (i) specific awareness training for new accountable executives and post holders on their SMS accountabilities and responsibilities;
  - (ii) importance of compliance with national and organizational safety requirements;
  - (iii) management commitment;
  - (iv) allocation of resources;
  - (v) promotion of the safety policy and the SMS;
  - (vi) promotion of a positive safety culture;
  - (vii) effective interdepartmental safety communication;
  - (viii) safety objective, SPTs and alert levels; and
  - (ix) disciplinary policy.
- (f) The main purpose of the safety training programme is to ensure that personnel, at all levels of the organization, maintain their competence to fulfil their safety roles; therefore competencies of personnel should be reviewed on a regular basis.

### **9.3 Element 4.2 - Safety communication**

9.3.1 The service provider should communicate the organization's SMS objectives and procedures to all appropriate personnel. There should be a communication strategy that enables safety communication to be delivered by the most appropriate method based on the individual's role and need to receive safety related information. This may be done through safety newsletters, notices, bulletins, briefings or training courses. The safety manager should also ensure that lessons learned from investigations and case histories or experiences, both internally and from other organizations, are distributed widely. Safety communication therefore aims to:

- (a) *ensure that staff are fully aware of the SMS*; this is a good way of promoting the organization's safety policy and safety objectives.
- (b) *convey safety-critical information*; Safety critical information is specific information related to safety issues and safety risks that could expose the organization to safety risk. This could be from safety information gathered

from internal or external sources such as lessons learned or related to safety risk controls. The service provider determines what information is considered safety critical and the timeliness of its communication.

- (c) *raise awareness of new safety risk controls and corrective actions;* The safety risks faced by the service provider will change over time, and whether this is a new safety risk that has been identified or changes to safety risk controls, these changes will need to be communicated to the appropriate personnel.
- (d) *provide information on new or amended safety procedures;* when safety procedures are updated it is important that the appropriate people are made aware of these changes.
- (e) *promote a positive safety culture and encourage personnel to identify and report hazards;* safety communication is two-way. It is important that all personnel communicate safety issues to the organization through the safety reporting system.
- (f) *provide feedback;* provide feedback to personnel submitting safety reports on what actions have been taken to address any concerns identified.

9.3.2 Service providers should consider whether any of the safety information listed above needs to be communicated to external organizations.

9.3.3 Service providers should assess the effectiveness of their safety communication by checking personnel have received and understood any safety critical information that has been distributed. This can be done as part of the internal audit activities or when assessing the SMS effectiveness.

9.3.4 Safety promotion activities should be carried out throughout the life cycle of the SMS, not only at the beginning.

## CHAPTER 10. IMPLEMENTATION PLANNING

### 10.1 System description

- 10.1.1 A system description helps to identify the organizational processes, including any interfaces, to define the scope of the SMS. This provides an opportunity to identify any gaps related to the service provider's SMS components and elements and may serve as a starting point to identify organizational and operational hazards. A system description serves to identify the features of the product, the service or the activity so that SRM and safety assurance can be effective.
- 10.1.2 Most organizations are made up of a complex network of interfaces and interactions involving different internal departments as well as different external organizations that all contribute to the safe operation of the organization. The use of a system description enables the organization to have a clearer picture of its many interactions and interfaces. This will enable better management of safety risk and safety risk controls if they are described, and help in understanding the impact of changes to the SMS processes and procedures.
- 10.1.3 When considering a system description, it is important to understand that a "system" is a set of things working together as parts of an interconnecting network. In an SMS, it is any of an organization's products, people, processes, procedures, facilities, services, and other aspects (including external factors), which are related to, and can affect, the organization's aviation safety activities. Often, a "system" is a collection of systems, which may also be viewed as a system with subsystems. These systems and their interactions with one another make up the sources of hazards and contribute to the control of safety risks. The important systems include both those which could directly impact aviation safety and those which affect the ability or capacity of an organization to perform effective safety management.
- 10.1.4 An overview of the system description and the SMS interfaces should be included in the SMS documentation. A system description may include a bulleted list with references to policies and procedures. A graphic depiction, such as a process flow chart or annotated organization chart, may be enough for some organizations. An organization should use a method and format that works for that organization.
- 10.1.5 Because each organization is unique, there is no "one size fits all" method for SMS implementation. It is expected that each organization will implement an SMS that works for its unique situation. Each organization should define for itself how it intends

to go about fulfilling the fundamental requirements. To accomplish this, it is important that each organization prepare a system description that identifies its organizational structures, processes, and business arrangements that it considers important to safety management functions. Based on the system description, the organization should identify or develop policy, processes, and procedures that establish its own safety management requirements.

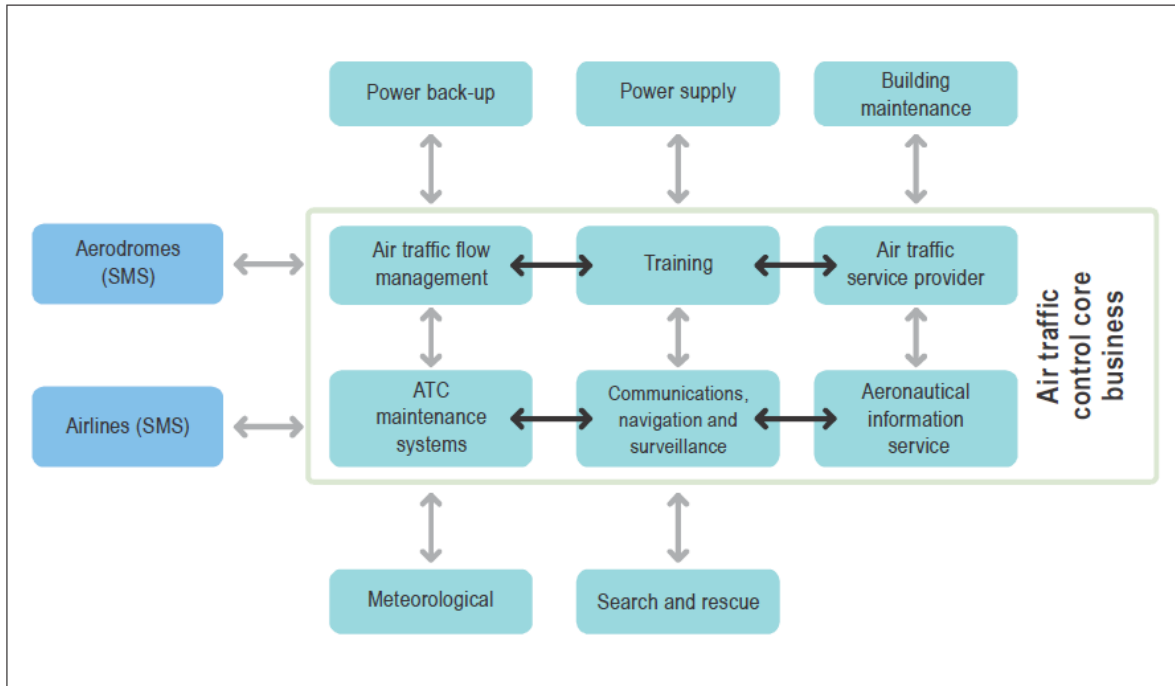
- 10.1.6 When an organization elects to make a significant or substantive change to the processes identified in the system description, the changes should be viewed as potentially affecting its baseline safety risk assessment. Thus, the system description should be reviewed as part of the management of change processes.

## **10.2 Interface management**

Safety risks faced by service providers are affected by interfaces. Interfaces can be either internal (e.g. between departments) or external (e.g. other service providers or contracted services,). By identifying and managing these interfaces the service provider will have more control over any safety risks related to the interfaces. These interfaces should be defined within the system description.

## **10.3 Identification of SMS interfaces**

- 10.3.1 Initially service providers should concentrate on interfaces in relation to its business activities. The identification of these interfaces should be detailed in the system description that sets out the scope of the SMS and should include internal and external interfaces.
- 10.3.2 Figure 10-1 is an example of how a service provider could map out the different organizations it interacts with to identify any SMS interfaces. The objective of this review is to produce a comprehensive list of all interfaces. The rationale for this exercise is that there may be SMS interfaces which an organization is not necessarily fully aware of. There may be interfaces where there are no formal agreements in place, such as with the power supply or building maintenance companies.



**Figure 10-1. Example of air traffic service provider SMS interfaces**

10.3.3 Some of the internal interfaces may be with business areas not directly associated with safety, such as marketing, finance, legal and human resources. These areas can impact safety through their decisions which impact on internal resources and investment, as well as through agreements and contracts with external organizations, and may not necessarily address safety.

10.3.4 Once the SMS interfaces have been identified, the service provider should consider their relative criticality. This enables the service provider to prioritize the management of the more critical interfaces, and their potential safety risks. Things to consider are:

- (a) what is being provided;
- (b) why it is needed;
- (c) whether the organizations involved has an SMS or another management system in place; and
- (d) whether the interface involves the sharing of safety data / information.

**10.3.5 Assessing safety impact of interfaces**



- (a) The service provider should then identify any hazards related to the interfaces and carry out a safety risk assessment using its existing hazard identification and safety risk assessment processes.
- (b) Based on the safety risks identified, the service provider may consider working with the other organization to determine and define an appropriate safety risk control strategy. By involving the other organization, they may be able to contribute to identifying hazards, assessing the safety risk as well as determining the appropriate safety risk control. This collaborative effort is needed because the perception of safety risks may not be the same for each organization. The risk control could be carried out by either the service provider or the external organization.
- (c) It is also important to recognize that each organization involved has the responsibility to identify and manage hazards that affect their own organization. This may mean the critical nature of the interface is different for each organization as they may apply different safety risk classifications and have different safety risk priorities (in term of safety performance, resources, time, etc.).

#### 10.3.6 ***Managing and monitoring interfaces***

- (a) The service provider is responsible for managing and monitoring the interfaces to ensure the safe provision of their services and products. This will ensure the interfaces are managed effectively and remain current and relevant. Formal agreements are an effective way to accomplish this as the interfaces and associated responsibilities can be clearly defined. Any changes in the interfaces and associated impacts should be communicated to the relevant organizations.
- (b) Challenges associated with the service provider's ability to manage interface safety risks include:
  - (i) one organization's safety risk controls are not compatible with the other organizations';
  - (ii) willingness of both organizations to accept changes to their own processes and procedures;

- (iii) insufficient resources or technical expertise available to manage and monitor the interface; and
  - (iv) number and location of interfaces.
- (c) It is important to recognize the need for coordination between the organizations involved in the interface. Effective coordination should include:
- (i) clarification of each organization's roles and responsibilities;
  - (ii) agreement of decisions on the actions to be taken (e.g. safety risk control actions and timescales);
  - (iii) identification of what safety information needs to be shared and communicated;
  - (iv) how and when coordination should take place (task force, regular meetings, ad hoc or dedicated meetings); and
  - (v) agreeing on solutions that benefit both organizations but that do not impair the effectiveness of the SMS.
- (d) All safety issues or safety risks related to the interfaces should be documented and made accessible to each organization for sharing and review. This will allow the sharing of lessons learned and the pooling of safety data that will be valuable for both organizations. Operational safety benefits may be achieved through an enhancement of safety reached by each organization as the result of shared ownership of safety risks and responsibility.

## **10.4 SMS Scalability**

- 10.4.1 The organization's SMS, including the policies, processes and procedures, should reflect the size and complexity of the organization and its activities. It should consider:
- (a) the organizational structure and availability of resources;
  - (b) size and complexity of the organization (including multiple sites and bases); and
  - (c) complexity of the activities and the interfaces with external organizations.

10.4.2 The service provider should carry out an analysis of its activities to determine the right level of resources to manage the SMS. This should include the determination of the organizational structure needed to manage the SMS. This would include considerations of who will be responsible for managing and maintaining the SMS, what safety committees are needed, if any, and the need for specific safety specialists.

#### 10.4.3 ***Safety risk considerations***

Regardless of the size of the service provider, scalability should also be a function of the inherent safety risk of the service provider's activities. Even small organizations may be involved in activities that may entail significant aviation safety risks. Therefore, safety management capability should be commensurate with the safety risk to be managed.

#### 10.4.4 ***Safety data and safety information and its analysis***

- (a) For small organizations, the low volume of data may mean that it is more difficult to identify trends or changes in the safety performance. This may require meetings to raise and discuss safety issues with appropriate experts. This may be more qualitative than quantitative but will help identify hazards and risks for the service provider. Collaborating with other service providers or industry associations can be helpful, since these may have data that the service provider does not have. For example, smaller service providers can exchange with similar organizations/operations to share safety risk information and identify safety performance trends. Service providers should adequately analyse and process their internal data even though it may be limited.
- (b) Service providers with many interactions and interfaces will need to consider how they gather safety data and safety information from multiple organizations. This may result in large volumes of data being collected to be collated and analysed later. These service providers should utilize an appropriate method of managing such data. Consideration should also be given to the quality of the data collected and the use of taxonomies to help with the analysis of the data.

## **10.5 Integration of management systems**

10.5.1 Safety management should be considered as part of a management system (and not in isolation). Therefore, a service provider may implement an integrated management system that includes the SMS. An integrated management system may be used to capture multiple certificates, authorizations or approvals or to cover other business management systems such as quality, security, occupational health and environmental management systems. This is done to remove duplication and exploit synergies by managing safety risks across multiple activities. For example, where a service provider holds multiple certificates it may choose to implement a single management system to cover all of its activities. The service provider should decide the best means to integrate or segregate its SMS to suit its business or organizational needs.

10.5.2 A typical integrated management system may include a:

- (a) quality management system (QMS);
- (b) safety management system (SMS);
- (c) security management system (SeMS), further guidance may be found in the Aviation Security Manual (Doc 8973 — Restricted);
- (d) environmental management system (EMS);
- (e) occupational health and safety management system (OHSMS);
- (f) financial management system (FMS);
- (g) documentation management system (DMS); and
- (h) fatigue risk management system (FRMS).

10.5.3 service provider may choose to integrate these management systems based on their unique needs. Risk management processes and internal audit processes are essential features of most of these management systems. It should be recognized that the risks and risk controls developed in any of these systems could have an impact on other systems. In addition, there may be other operational systems associated with the business activities that may also be integrated, such as supplier management, facilities management, etc.

10.5.4 A service provider may also consider applying the SMS to other areas that do not have a current regulatory requirement for an SMS. Service providers should determine the most suitable means to integrate or segregate their management system to suit their business model, operating environment, regulatory, and statutory requirements as well as the expectations of the aviation community. Whichever option is taken, it should still ensure that it meets the SMS requirements.

10.5.5 ***Benefits and challenges of management system integration***

- (a) Integrating the different areas under a single management system will improve efficiency by:
  - (i) reducing duplication and overlapping of processes and resources;
  - (ii) reducing potentially conflicting responsibilities and relationships;
  - (iii) considering the wider impacts of risks and opportunities across all activities; and
  - (iv) allowing effective monitoring and management of performance across all activities.
- (b) Possible challenges of management system integration include:
  - (i) existing systems may have different functional managers who resist the integration; this could result in conflict;
  - (ii) there may be resistance to change for personnel impacted by the integration as this will require greater cooperation and coordination;
  - (iii) impact on the overall safety culture within the organization as there may be different cultures in respect of each system; this could create conflicts;
  - (iv) regulations may prevent such an integration or the different regulators and standards bodies may have diverging expectations on how their requirements should be met; and
  - (v) integrating different management systems (such as QMS and SMS) may create additional work to be able to demonstrate that the separate requirements are being met.

- (c) To maximize the benefits of integration and address the related challenges, senior management commitment and leadership is essential to manage the change effectively. It is important to identify the person who has overall responsibility for the integrated management system.

## **10.6 SMS and QMS integration**

10.6.1 Some service providers have both an SMS and QMS. These sometimes are integrated into a single management system. The QMS is generally defined as the organizational structure and associated accountabilities, resources, processes and procedures necessary to establish and promote a system of continuous quality assurance and improvement while delivering a product or service.

10.6.2 Both systems are complementary; the SMS focuses on managing safety risks and safety performance while the QMS focuses on compliance with prescriptive regulations and requirements to meet customer expectations and contractual obligations. The objectives of an SMS are to identify hazards, assess the associated safety risk and implement effective safety risk controls. In contrast, the QMS focuses on the consistent delivery of products and services that meet relevant specifications. Nonetheless, both the SMS and the QMS:

- (a) should be planned and managed;
- (b) involve all organizational functions related to the delivery of aviation products and services;
- (c) identify ineffective processes and procedures;
- (d) strive for continuous improvement; and
- (e) have the same goal of providing safe and reliable products and services to customers.

10.6.3 The SMS focuses on:

- (a) identification of safety-related hazards facing the organization;
- (b) assessment of the associated safety risk;
- (c) implementation of effective safety risk controls to mitigate safety risks;
- (d) measuring safety performance; and

- (e) maintaining an appropriate resource allocation to meet safety performance requirements.

10.6.4 The QMS focuses on:

- (a) compliance with regulations and requirements;
- (b) consistency in the delivery of products and services;
- (c) meeting the specified performance standards; and
- (d) delivery of products and services that are “fit for purpose” and free of defects or errors.

10.6.5 Monitoring compliance with regulations is necessary to ensure that safety risk controls, applied in the form of regulations, are effectively implemented and monitored by the service provider. The causes and contributing factors of any non-compliance should also be analysed and addressed.

10.6.6 Given the complementary aspects of SMS and QMS, it is possible to integrate both systems without compromising each function. This can be summarized as follows:

- (a) an SMS is supported by QMS processes such as auditing, inspection, investigation, root cause analysis, process design, and preventive actions;
- (b) a QMS may identify safety issues or weaknesses in safety risk controls;
- (c) a QMS may foresee safety issues that exist despite the organization’s compliance with standards and specifications;
- (d) quality principles, policies and practices should be aligned with the objectives of safety management; and
- (e) QMS activities should consider identified hazards and safety risk controls for the planning and performance of internal audits.

10.6.7 In conclusion, in an integrated management system with unified goals and decision-making that considers the wider impacts across all activities, quality management and safety management processes will be highly complementary and will support the achievement of the overall safety goals.

## **10.7 SMS gap analysis and implementation**

- 10.7.1 Before implementing an SMS, the service provider should carry out a gap analysis. This compares the service provider's existing safety management processes and procedures with the SMS requirements as determined by the State. It is likely that the service provider already has some of the SMS functions in place. The development of an SMS should build upon existing organizational policies and processes. The gap analysis identifies the gaps that should be addressed through an SMS implementation plan that defines the actions needed to implement a fully functioning and effective SMS.
- 10.7.2 The SMS implementation plan should provide a clear picture of the resources, tasks and processes required to implement the SMS. The timing and sequencing of the implementation plan may depend on a variety of factors that will be specific to each organization, such as:
- (a) regulatory, customer and statutory requirements;
  - (b) multiple certificates held (with possibly different regulatory implementation dates);
  - (c) the extent to which the SMS may build upon existing structures and processes;
  - (d) the availability of resources and budgets;
  - (e) interdependencies between different steps (a reporting system should be implemented before establishing a data analysis system); and
  - (f) the existing safety culture.
- 10.7.3 The SMS implementation plan should be developed in consultation with the accountable executive and other senior managers, and should include who is responsible for the actions along with timelines. The plan should address coordination with external organizations or contractors where applicable.
- 10.7.4 The SMS implementation plan may be documented in different forms, varying from a simple spread sheet to specialized project management software. The plan should be monitored regularly and updated as necessary. It should also clarify when a specific element can be considered successfully implemented.



10.7.5 Both the State and the service provider should recognize that achieving an effective SMS may take several years. Service providers should refer to their State as there may be requirements for a phased approach for SMS implementation.

## CHAPTER 11. TERMS USED IN SMS

### 11.1 Definitions

**Acceptable level of safety performance (ALoSP).** The level of safety performance agreed by State authorities to be achieved for the civil aviation system in a State, as defined in its State safety programme, expressed in terms of safety performance targets and safety performance indicators.

**Accountable executive.** A single, identifiable person having responsibility for the effective and efficient performance of the service provider's SMS.

**Change management.** A formal process to manage changes within an organization in a systematic manner, so that changes which may impact identified hazards and risk mitigation strategies are accounted for, before the implementation of such changes.

**Defences.** Specific mitigating actions, preventive controls or recovery measures put in place to prevent the realization of a hazard or its escalation into an undesirable consequence.

**Errors.** An action or inaction by an operational person that leads to deviations from organizational, or the operational person's, intentions or expectations.

**Hazard.** A condition or an object with the potential to cause or contribute to an aircraft incident or accident.

**Risk mitigation.** The process of incorporating defences, preventive controls or recovery measures to lower the severity and/or likelihood of a hazard's projected consequence.

**Safety.** The state in which risks associated with aviation activities, related to, or in direct support of the operation of aircraft, are reduced and controlled to an acceptable level.

**Safety data.** A defined set of facts or set of safety values collected from various aviation-related sources, which is used to maintain or improve safety.

*Note.— Such safety data is collected from proactive or reactive safety-related activities, including but not limited to:*

- a) accident or incident investigations;
- b) safety reporting;
- c) continuing airworthiness reporting;
- d) operational performance monitoring;
- e) inspections, audits, surveys; or
- f) safety studies and reviews.

**Safety information.** Safety data processed, organized or analysed in a given context so as to make it useful for safety management purposes.

**Safety management system (SMS).** A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilities, policies and procedures.

**Safety objective.** A brief, high-level statement of safety achievement or desired outcome to be accomplished by the State safety programme or service provider's safety management system.

*Note.— Safety objectives are developed from the organization's top safety risks and should be taken into consideration during subsequent development of safety performance indicators and targets.*

**Safety oversight.** A function performed by a State to ensure that individuals and organizations performing an aviation activity comply with safety-related national laws and regulations.

**Safety performance.** A State's or service provider's safety achievement as defined by its safety performance targets and safety performance indicators.

**Safety performance indicator.** A data-based parameter used for monitoring and assessing safety performance.

**Safety performance target.** The State or service provider's planned or intended target for a safety performance indicator over a given period that aligns with the safety objectives.

**Safety risk.** The predicted probability and severity of the consequences or outcomes of a hazard.

**State safety programme (SSP).** An integrated set of regulations and activities aimed at improving safety.

**Surveillance.** The State activities through which the State proactively verifies through inspections and audits that aviation licence, certificate, authorization or approval holders continue to meet the established requirements and function at the level of competency and safety required by the State.

**System.** An organized, purposeful structure that consists of interrelated and interdependent elements and components, and related policies, procedures and practices created to carry out a specific activity or solve a problem.

**Trigger.** An established level or criteria value for a particular safety performance indicator that serves to initiate an action required, (e.g., an evaluation, adjustment or remedial action).

## **APPENDIX A: SAMPLE SAFETY POLICY STATEMENT FOR SERVICE PROVIDER**

### **SAFETY POLICY STATEMENT**

Safety is one of our core business functions. We are committed to developing, implementing, maintaining and constantly improving strategies and processes to ensure that all our aviation activities take place under an appropriate allocation of organisational resources, aimed at achieving the highest level of safety performance and meeting regulatory requirements, while delivering our services.

All levels of management and all employees are accountable for the delivery of this highest level of safety performance, starting with the [Chief executive officer (CEO)/managing director/or as appropriate to the organisation].

Our commitment is to:

- support the management of safety through the provision of all appropriate resources that will result in an organisational culture that fosters safe practices, encourages effective safety reporting and communication, and actively manages safety with the same attention to results as the attention to the results of the other management systems of the organisation;
- ensure that the management of safety is a primary responsibility of all managers and employees;
- clearly define, for all staff, managers and employees alike, their accountabilities and responsibilities for the delivery of the organisation's safety performance and the performance of our safety management system;
- establish and operate hazard identification and risk management processes, including a hazard reporting system, in order to eliminate or mitigate the safety risks of the consequences of hazards resulting from our operations or activities, to achieve continuous improvement in our safety performance;
- ensure that no action will be taken against any employee who discloses a safety concern through the hazard reporting system, unless such disclosure indicates, beyond any reasonable doubt, gross negligence or a deliberate or wilful disregard of regulations or procedures;
- comply with and, wherever possible, exceed, legislative and regulatory requirements and standards;
- ensure that sufficient skilled and trained human resources are available to implement safety strategies and processes;
- ensure that all staff are provided with adequate and appropriate aviation safety information and training, are competent in safety matters, and are allocated only tasks commensurate with their skills;
- establish and measure our safety performance against realistic safety performance indicators and safety performance targets;
- continually improve our safety performance through continuous monitoring and measurement, regular review and adjustment of safety objectives and targets, and diligent achievement of these; and
- ensure that externally supplied systems and services to support our operations are delivered meeting our safety performance standards.

(Signed by Accountable Executive)

## **APPENDIX B: GUIDANCE FOR THE DEVELOPMENT OF AN SMS MANUAL**

This appendix provides guidance on the structure of a typical SMS Manual. The guidance is generic and could be applied to the various types of service providers in Malaysian aviation system. While all the components and elements of the SMS framework must be put in place, the degree of implementation should commensurate with the size, nature and complexity of operations.

The SMS Manual may be formatted in the following manner:

- a) Section headings. The section headings are listed under manual contents.
- b) Objective. This paragraph provides a short write-up on what the section is intended to achieve.
- c) Consideration. This paragraph provides a non-exhaustive list of points to consider in drafting the section.

Cross-reference documents, with information supporting the SMS elements found in other relevant manuals or SOPs of the service provider, may be included in the SMS Manual.

### *Manual Contents*

1. Document Control
2. SMS Regulatory Requirements
3. Scope and Integration of the Safety Management System
4. Safety Policy
5. Safety Objectives
6. Safety Accountabilities and Key Personnel
7. Non-Punitive Reporting Policy
8. Safety Reporting
9. Hazard Identification, Safety Risk Assessment and Mitigation
10. Safety Performance Monitoring and Measurement
11. Safety Investigations
12. Safety Training and Communication
13. Continuous Improvement and SMS Audit
14. SMS Data and Records Management
15. Management of Change
16. Coordination of Emergency Response Plan

## ***Example of Manual Content***

### **1.0 DOCUMENT CONTROL**

#### *Objective*

Describe how the manual is kept up to date and that all personnel have the most current version.

#### *Consideration*

- a) Describe the correlation of this manual with updates to other documentation, such as Company Exposition Manual, Maintenance Control Manual, Operations Manual, as applicable.
- b) Describe the process for periodic review of SMS documentation to ensure relevance and effectiveness.
- c) Describe the format of the document and how the distribution would be carried out.
- d) Describe how the manual is made readily accessible to all personnel.
- e) Show the manual is approved by the Accountable Executive.

### **2.0 SMS REGULATORY REQUIREMENTS**

#### *Objective*

Elaborate on current CAAM SMS regulations for reference and awareness to all personnel.

#### *Consideration*

- a) Describe the current CAAM SMS regulations, requirement and make reference to CAAM guidance material as applicable.
- b) Explain the relevance and implications of the regulations to the service provider.

### **3.0 SCOPE AND INTEGRATION OF THE SAFETY MANAGEMENT SYSTEM**

#### *Objective*

Describe scope and extent of the service provider's aviation related operations and facilities within which the SMS will apply. The scope of safety risk management processes, equipment and operations should also be addressed.

#### *Consideration*

- a) Describe the nature of the business and its interaction with other aviation service providers.
- b) Identify equipment, facilities, work scope, capabilities and other relevant aspects of the organisation within which the SMS will apply.
- c) Identify the scope of the relevant processes, operations and equipment which are deemed to be eligible for the service provider's safety risk management processes.
- d) Describe the accountabilities of each player, where the SMS is expected to be operated or administered across a group of interlinked organisations or contractors.
- e) Management systems may have been implemented for other purposes e.g. quality, human factor (HF) and error, environment, occupational health and safety

management system and security. Describe the interaction of these management systems with SMS.

#### **4.0 SAFETY POLICY**

##### *Objective*

Describe the service provider's intentions, management principles, and commitment to improve aviation.

##### *Consideration*

- a) Describe the safety policy.
- b) Show that the safety policy is approved and signed by the Accountable Executive.
- c) Describe the process to periodically review the safety policy.
- d) Describe the process to involve all personnel in the establishment and maintenance of the SMS.
- e) Describe the process to communicate the safety policy to all personnel to raise awareness of their individual safety obligations.

#### **5.0 SAFETY OBJECTIVES**

##### *Objective*

Describe the service provider's intentions, management principles, and commitment to improve aviation.

##### *Consideration*

- a) Describe the safety objectives.
- b) Show that the safety objectives is approved and signed by the Accountable Executive.
- c) Describe the process to periodically review the safety objective.
- d) Describe the process to involve all personnel in the establishment and maintenance of the SMS.
- e) Describe the process to communicate the safety objective to all personnel to raise awareness of their individual safety obligations.

#### **6.0 ROLES AND RESPONSIBILITIES**

##### *Objective*

Describe the safety authorities, responsibilities and accountabilities for personnel involved in the SMS.

##### *Consideration*

- a) Describe the roles of the Accountable Executive, Safety Manager and safety platforms, meetings and working groups.
- b) Define and document the Safety authorities, responsibilities and accountabilities of personnel at all levels of the service provider.

## **7.0 NON-PUNITIVE REPORTING POLICY**

### *Objective*

Describe the system or policy under which employees are encouraged to report errors, safety deficiencies, hazards, accidents, and incidents.

### *Consideration*

- a) Describe the policy and processes in place that encourages employees to report errors, safety deficiencies, hazards or occurrences.
- b) Describe the conditions under which punitive disciplinary action would be considered (e.g. illegal activity, recklessness, gross negligence or willful misconduct) are clearly defined.

## **8.0 SAFETY REPORTING**

### *Objective*

Safety data and information can be collected from reports, safety surveys and audits. Describe how the reporting system is designed. Factors to consider include: report format, confidentiality, data collection and analysis and subsequent dissemination of information on corrective actions, preventive measures and recovery controls.

### *Consideration*

- a) Describe the process or system that captures internal information including incidents, accidents, hazards and other data relevant to SMS.
- b) Describe how information is received from all areas of the service provider within the scope of the SMS.
- c) Describe how reports are reviewed at the appropriate management level.
- d) Describe the feedback process to notify contributors that their reports have been received and to share the results of the analysis.
- e) Provide form(s)/template(s) that are standardized and accessible across the service provider.
- f) Describe the process to monitor and analyze trends.

## **9.0 HAZARD IDENTIFICATION, RISK ASSESSMENT AND MITIGATION**

### *Objective*

Describe the hazard identification system and related schemes, from the collation of data to safety risk assessments and implementation of preventive action plans.

### *Consideration*

- a) Describe the process for the assessment of risk associated with identified hazards, expressed in terms of severity and likelihood.
- b) Describe the risk assessment and tolerability of the service provider and mitigating factors to be put in place.
- c) Describe the risk control strategies that include corrective action plans.
- d) Describe the process for evaluating the effectiveness of risk control strategies.



## **10.0 SAFETY PERFORMANCE MONITORING AND MEASUREMENT**

### *Objective*

Describe the plan to review the effectiveness of the SMS. This includes the review of the safety performance through safety performance indicators.

### *Consideration*

- a) Describe the formal process to develop and maintain a set of safety performance indicators and safety performance targets for monitoring.
- b) Indicate how the safety performance indicators and safety performance targets are linked to the safety objectives.

## **11.0 SAFETY INVESTIGATIONS**

### *Objective*

Describe how accidents and incidents are investigated. Explain how the contributing factors to accidents and incidents are determined and how corrective actions are implemented to prevent recurrence. Describe how such corrective/preventive actions are reviewed to update any existing safety assessments.

### *Consideration*

- a) Describe the process for investigation of reported occurrences. Show that the investigation identifies contributing or causal factors, identifies and ensures the implementation of necessary corrective actions.
- b) Show appropriate SMS follow up actions from the investigations, such that identified controls are implemented to prevent a repetition of occurrence.

## **12.0 SAFETY TRAINING AND COMMUNICATION**

### *Objective*

Describe the type of SMS and other safety related training that personnel receives and the process for assuring the effectiveness of the training. Describe the safety communication processes/ channels within the service provider.

### *Consideration*

- a) Show that the SMS training is part of the service provider's overall training programme.
- b) Describe the training scope (initial and recurrent training), eligibility criteria and training requirements for personnel.
- c) Describe the validation process that assures the effectiveness of training.
- d) Describe the safety communication processes/ channels within the service provider.

## **13.0 CONTINUOUS IMPROVEMENT AND SMS AUDIT**

### *Objective*

Describe the process for continuous improvement and review of your SMS.

### *Consideration*

- a) Describe the process for periodic reviews of safety performance indicators to ensure their continuing suitability, adequacy and effectiveness.
- b) Describe the regular audit/reviews of company's SMS.
- c) Describe any other programs contributing to continuous improvement of the service provider's SMS and safety performance.

## **14.0 SMS DATA AND RECORDS MANAGEMENT**

### *Objective*

Describe the method of recording and storing all SMS related documents.

### *Consideration*

- a) Describe the records system that ensures the generation and retention of all records necessary to document the SMS.
- b) Provide records of hazard reports, risk assessments reports, meeting notes, safety performance monitoring charts, SMS audit reports, SMS training records etc.

## **15.0 MANAGEMENT OF CHANGE**

### *Objective*

Describe the management of organisational internal or external changes that may have an impact on safety.

### *Consideration*

- a) Describe the procedures and policies to perform or review safety assessments for all substantial internal or external changes which may have safety implications.
- b) Include all concerned stakeholders within or outside of the service provider in relevant reviews.
- c) Describe how the reviews are documented and approved by management as applicable.

## **16.0 COORDINATION OF EMERGENCY RESPONSE PLAN**

### *Objective*

Describe the service provider's intentions and commitment to dealing with emergency situations and their corresponding recovery controls, where applicable. Outline the roles and responsibilities of key personnel. The Emergency Response Plan can be developed as a separate document or it can be placed in this manual.

### *Consideration*

- a) Describe the emergency plan that outlines roles and responsibilities in the event of a major incident, crisis or accident.
- b) Describe the notification and personnel mobilization processes.

- c) Describe the arrangements with other organisations for aid and the provision of emergency services as applicable.
- d) Describe the procedures for emergency mode operations where applicable.
- e) Describe the procedure for overseeing the welfare of all affected individuals and for notifying next of kin.
- f) Describe procedures for handling media and insurance related issues.
- g) Describe the processes for preservation of evidence, securing affected area and mandatory/governmental reporting.
- h) Describe the emergency preparedness and response training to be carried out for personnel involved in emergency response.
- i) Describe the disabled aircraft or equipment evacuation plan in consultation with aircraft/ equipment owners, aerodrome operators or other agencies as applicable.
- j) Describe the procedure for post-occurrence review including debrief and record of significant lessons learned.