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Civil Aviation Regulatory Commission



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Safety Management System

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Regulatory Commission

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A handwritten signature in blue ink, appearing to read 'Haitham Misto'.

Capt. Haitham Misto
Chief Commissioner/CEO



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DOCUMENT APPROVAL

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Safety management system (SMS)

Introduction

It is the responsibility of the aerodrome certificate holder to apply An SMS system to assure the safe operation of aircraft through effective management of safety risk. This system is designed to continuously improve safety by identifying hazards, collecting and analyzing data and continuously assessing safety risks. The SMS seeks to proactively contain or mitigate risks before they result in aviation accidents and incidents. It is a system that is commensurate with the organization's regulatory obligations and safety goals.

SMS is necessary for an aviation organization to identify hazards and manage safety risks encountered during the delivery of its products or services. An SMS includes key elements that are essential for hazard identification and safety risk management by ensuring that:

- a. The necessary information is available;
- b. The appropriate tools are available for the organization's use;
- c. The tools are appropriate to the task;
- d. The tools are commensurate with the needs and constraints of the organization; and
- e. Decisions are made based on full consideration of the safety risk.

Scope

SMS should address the aviation activities of an aerodrome certificate holder that are related to the safe operation of aircraft. The scope of an SMS may indirectly include other organizational activities that support operational or product development, such as finance, human resources and legal. It is therefore essential to involve all internal and external aviation system stakeholders having a potential impact on the organization's safety performance. Furthermore, any potential inputs should be taken into consideration at an early stage of SMS implementation and throughout future internal evaluations of the SMS. The following stakeholders may provide inputs to service providers depending upon their potential impact on safety performance:



- a. Aviation professionals;
- b. Aviation regulatory and administrative authorities;
- c. Industry trade associations;
- d. Professional associations and federations;
- e. International aviation organizations;
- f. Subcontractors or principals of a service provider; and
- g. The flying public.

SMS Framework

It should be noted that the implementation of the framework should be commensurate with the size of the organization and the complexity of the products or services provided. The framework includes four components and twelve elements, representing the minimum requirements for SMS implementation. The four components of an SMS are:

- a. Safety policy and objectives;
- b. Safety risk management;
- c. Safety assurance; and
- d. Safety promotion.

Safety policies and objectives create the frame of reference for the SMS. The objective of the safety risk management component is to identify hazards, assess the related risks and develop appropriate mitigations in the context of the delivery of the organization's products or services. Safety assurance is accomplished through ongoing processes that monitor compliance with international standards and national regulations. Furthermore, the safety assurance process provides confidence that the SMS is operating as designed and is effective. Safety promotion provides the necessary awareness and training.

Safety Components



The four components and twelve elements that comprise the ICAO SMS framework are as follows:

1. Safety policy and objectives

- 1.1 Management commitment and responsibility
- 1.2 Safety accountabilities
- 1.3 Appointment of key safety personnel
- 1.4 Coordination of emergency response planning
- 1.5 SMS documentation

2. Safety risk management

- 2.1 Hazard identification
- 2.2 Safety risk assessment and mitigation

3. Safety assurance

- 3.1 Safety performance monitoring and measurement
- 3.2 The management of change
- 3.3 Continuous improvement of the SMS

4. Safety promotion

- 4.1 Training and education
- 4.2 Safety communication.

Additional details regarding each of the four components and twelve elements follow. A high-level summary of each component is provided, followed by the text from the SMS framework for each element.

SMS Component 1

Safety Policy and Objectives

Safety policy outlines the principles, processes and methods of the organization's SMS to achieve the desired safety outcomes. The policy establishes senior management's commitment to incorporate and continually improve safety in all aspects of its activities. Senior management develops measureable and attainable organization wide safety objectives to be achieved.



SMS Element 1.1

Management commitment and responsibility

The service provider shall define its safety policy in accordance with international and national requirements the safety policy shall:

- a. reflect organizational commitment regarding safety;
- b. include a clear statement about the provision of the necessary resources for the implementation of the safety policy;
- c. include safety reporting procedures;
- d. clearly indicate which types of behaviors are unacceptable related to the service provider's aviation activities and include the circumstances under which disciplinary action would not apply;
- e. be signed by the accountable executive of the organization;
- f. be communicated, with visible endorsement, throughout the organization; and
- g. Be periodically reviewed to ensure it remains relevant and appropriate to the Service provider.

Implementation strategy:

Senior management develops and endorses the safety policy, which is signed by the accountable executive.

Once the safety policy has been developed senior management should:

- a. Visibly endorse the policy;
- b. Communicate the policy to all appropriate staff;
- c. Establish safety performance targets for the SMS and the organization; and
- d. Establish safety objectives that identify what the organization intends to achieve in terms of safety management.



The safety policy must include a commitment to:

- a. Achieve the highest safety standards;
- b. Comply with all applicable regulatory requirements;
- c. Comply with international standards;
- d. Adopt proven best practices appropriate to the activity;
- e. Provide all the necessary resources;
- f. Ensure safety is a primary responsibility of all managers;
- g. Follow the disciplinary policy; and
- h. Ensure that the safety policy is understood, implemented and maintained at all levels.

The safety standards achieved are an indication of organizational behavior and are also a measure of SMS performance. Furthermore, safety objectives and the safety performance standards must be linked to:

- a. safety performance indicators;
- b. safety performance targets; and
- c. SMS mitigation actions.

The disciplinary policy is used to determine whether a violation has occurred requiring action beyond the analysis requirements of the risk management systems. Therefore, it is essential to assure that persons responsible for making that determination have the necessary technical expertise to fully consider the context related to the report, thereby diminishing the likelihood that such personnel and the service provider itself may be exposed to unfair or inappropriate “disciplinary/judicial” proceedings. One approach to be used in making this determination is James Reason’s unsafe acts algorithm to help front-line managers determine the accountability of person(s) involved in an incident. 1 Another resource in this regard is Sidney Dekker’s book entitled *Just Culture: Balancing Safety and Accountability*.

A policy to appropriately protect safety data, as well as the reporters of such data, can have a significant positive effect on the reporting culture. Once it is clear that a



report does not involve a violation, the service provider and the State should allow for the de-identification and aggregation of reports so as to conduct meaningful safety analysis without implicating 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 dramatically improve the quality of data collected.

Element 1.2

Safety accountabilities

The service provider shall:

- a. identify the accountable executive who, irrespective of other functions, has ultimate responsibility and accountability, on behalf of the organization, for the implementation and maintenance of the SMS;
- b. clearly define lines of safety accountability throughout the organization, including a direct accountability for safety on the part of senior management;
- c. identify the accountabilities of all members of management, irrespective of other functions, as well as of employees, with respect to the safety performance of the SMS;
- d. document and communicate safety responsibilities, accountabilities and authorities throughout the organization; and
- e. define the levels of management with authority to make decisions regarding safety risk tolerability.

Implementation strategy

Safety management should be a core function for any aviation service provider. The definition of accountabilities for all personnel involved in safety-related duties will serve to ensure the delivery of safe products and operations, as well as an appropriately balanced allocation of resources.

The accountable executive identified by the service provider is the single person having ultimate responsibility for the SMS, including responsibility to provide the



resources essential to its implementation and maintenance. The accountable executive's authorities and responsibilities include, but are not limited to:

- a. provision and allocation of human, technical, financial or other resources necessary for the effective and efficient performance of SMS;
- b. direct responsibility for the conduct of the organization's affairs;
- c. final authority over operations under the certificate/approval of the organization;
- d. establishment and promotion of the safety policy;
- e. establishment of the organization's safety objectives and safety targets;
- f. acting as the organization's safety champion;
- g. having final responsibility for the resolution of all safety issues; and
- h. establishing and maintaining the organization's competence to learn from the analysis of data collected through its safety reporting system.

Note.— The responsibilities outlined above should not be delegated.

Depending on the size, structure and complexity of the organization, the accountable executive may be:

- a. the chief executive officer (CEO) of the service provider organization;
- b. the chairperson of the board of directors;
- c. a partner; or the proprietor.

Additionally, the appointment of an accountable executive who is given the required authorities and responsibilities requires that the individual has the necessary attributes to fulfil the role. The accountable executive will have many functions in the organization. Nonetheless, the accountable executive's role is to instill safety as a core organizational value and to ensure that the SMS is properly implemented and maintained through the allocation of resources and tasks.

All aviation safety-related positions, responsibilities and authorities should be defined, documented and communicated throughout the organization. The safety accountabilities of each senior manager (departmental head or person responsible for a functional unit) are integral components of their job descriptions. Given that the management of safety is a core business function, every senior manager has a



degree of involvement in the operation of the SMS. This involvement is certainly deeper for those managers directly responsible for functional units that deliver the organization's products or services (operations, manufacturing, maintenance, engineering, training and dispatch, hereafter referred to by the generic term "line managers") than for those responsible for support functions (human resources, administration, legal and financial).

A service provider is responsible for the safety performance of products or services provided by subcontractors that do not separately require safety certification or approval. While all subcontractors may not necessarily be required to have an SMS, it is nevertheless the service provider's responsibility to ensure that its own safety performance requirements are met. In any case, it is essential for the service provider's SMS to interact as seamlessly as possible with the safety systems of subcontractors that provide products or services pertinent to the safe operation of aircraft. The interface between the organization's SMS and that of the sub product or subservice provider's safety systems must address the identification of hazards, assessment of risk and development of risk mitigation strategies where applicable. The service provider should ensure that:

- a. there is a policy clearly establishing a safety accountability and authority flow between the service provider and the subcontractor;
- b. the subcontractor has a safety reporting system commensurate with its size and complexity that facilitates the early identification of hazards and systemic failures of concern to the service provider;
- c. the service provider's safety review board includes subcontractor representation, where appropriate;
- d. safety/quality indicators to monitor subcontractor performance are developed, where appropriate;
- e. the service provider's safety promotion process ensures subcontractor employees are provided with
- f. the organization's applicable safety communications; and
- g. any subcontractor roles, responsibilities and functions relevant to the service provider's emergency
- h. response plan are developed and tested.

The SMS-related accountabilities, responsibilities and authorities of all appropriate senior managers must be described in the organization's SMS documentation. Mandatory safety functions performed by the safety manager, safety office, safety action groups, etc., may be embedded into existing job descriptions, processes and procedures.

The safety manager function is described in detail in the next section. From an accountability perspective, 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.

SMS Element 1.3

Appointment of key safety personnel

The service provider shall appoint a safety manager who is responsible for the implementation and maintenance of an effective SMS.

Implementation strategy

In most organizations the safety manager is the individual responsible for the development and maintenance of an effective SMS. The safety manager also 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 stakeholders. The safety manager's functions include, but are not necessarily limited to:

- a. managing the SMS implementation plan on behalf of the accountable executive;
- b. performing/facilitating hazard identification and safety risk analysis;
- c. monitoring corrective actions and evaluating their results;
- d. providing periodic reports on the organization's safety performance;
- e. maintaining records and safety documentation;
- f. planning and facilitating staff safety training;
- g. providing independent advice on safety matters;

- h. monitoring safety concerns in the aviation industry and their perceived impact on the organization's operations aimed at service delivery;
- i. coordinating and communicating (on behalf of the accountable executive) with the State's oversight authority and other State agencies as necessary on issues relating to safety; and
- j. coordinating and communicating (on behalf of the accountable executive) with international organizations on issues relating to safety.

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

- a. safety/quality management experience;
- b. operational experience;
- c. technical background to understand the systems that support operations;
- d. people skills;
- e. analytical and problem-solving skills;
- f. project management skills; and
- g. oral and written communications skills.

The safety manager is generally supported by additional staff. This will depend upon the size of the organization and the nature and complexity of the organization. The safety manager liaises directly with line managers or their delegates, such as where operational units are supported by dedicated safety officers.

The safety manager is the person responsible for the collection and analysis of safety data and the distribution of related safety information to line managers. The distribution of safety information by the safety services office is the first step in the safety risk management process. This information must be used by line managers to mitigate safety risks, which inevitably requires the allocation of resources. The necessary resources may be readily available to the line managers for this purpose.

Additionally, a formal process is required to assess the effectiveness and efficiency of any mitigation strategies used to achieve the agreed safety performance targets of the organization. One potential process includes the



creation of a safety review committee (SRC). The SRC provides the platform to achieve the objectives of resource allocation and to assess the effectiveness and efficiency of risk mitigation strategies. The SRC is a very high-level committee, chaired by the accountable executive and composed of senior managers, including line managers responsible for functional areas as well as those from relevant administrative departments. The safety manager participates in the SRC in an advisory capacity only. The SRC may meet infrequently, unless exceptional circumstances dictate otherwise. The SRC:

- a. monitors the effectiveness of the SMS;
- b. monitors that any necessary corrective action is taken in a timely manner;
- c. monitors safety performance against the organization's safety policy and objectives;
- d. monitors the effectiveness of the organization's safety management processes which support the
- e. declared corporate priority of safety management as another core business process;
- f. monitors the effectiveness of the safety supervision of subcontracted operations; and
- g. ensures that appropriate resources are allocated to achieve safety performance beyond that required by regulatory compliance.

The SRC is strategic and deals with high-level issues related to policies, resource allocation and organizational performance monitoring. Once a strategic direction has been developed by the SRC, implementation of safety strategies must be coordinated throughout the organization. This can be accomplished by creating a safety action group (SAG). SAGs are composed of line managers and front-line personnel and are normally chaired by a designated\ line manager. SAGs are tactical entities that deal with specific implementation issues per the direction of the SRC. The SAG:

- a. oversees operational safety performance within the functional areas of the organization and ensures that appropriate safety risk management activities are carried out with staff involvement as necessary to build up safety awareness;



- b. coordinates the resolution of mitigation strategies for the identified consequences of hazards and ensures that satisfactory arrangements exist for safety data capture and employee feedback;
- c. assesses the safety impact related to the introduction of operational changes or new technologies;
- d. coordinates the implementation of corrective action plans and ensures that corrective action is taken in a timely manner;
- e. reviews the effectiveness of previous safety recommendations; and
- f. oversees safety promotion activities as necessary to increase employee awareness of safety issues and to ensure that they are provided appropriate opportunities to participate in safety management activities.

SMS Element 1.4

Coordination of emergency response planning

The service provider shall ensure that an emergency response plan is properly coordinated with the emergency response plans of those organizations it must interface with during the provision of its services.

Implementation strategy

An emergency response plan (ERP) documents actions to be taken by all responsible personnel during aviation-related emergencies. The purpose of an ERP is to ensure that there is an orderly and efficient transition from normal to emergency operations, including assignment of emergency responsibilities and delegation of authority. Authorization for action by key personnel is also contained in the plan, as well as the means to coordinate efforts necessary to cope with the emergency. The overall objective is to save lives, the safe continuation of operations and the return to normal operations as soon as possible.

The applicability of emergency response planning extends to providers of aviation products that may be attributable to, or affected by, an aviation safety occurrence. The product provider's processes are generally called "contingency product support" and include emergency airworthiness action, alert services, and aircraft accident on-site support. The product provider need not change the name of these



product support processes to ERP processes; however, they must be noted appropriately in the organization's SMS documentation.

SMS Element 1.5

SMS documentation

The service provider shall develop an SMS implementation plan, formally endorsed by the organization, that defines the organization's approach to the management of safety in a manner that meets the organization's safety objectives.

The service provider shall develop and maintain SMS documentation that describes:

- a. the safety policy and objectives;
- b. SMS requirements;
- c. SMS processes and procedures;
- d. accountabilities, responsibilities and authorities for SMS processes and procedures; and
- e. SMS outputs.
- f. The service provider shall develop and maintain an SMS manual as part of its SMS documentation.

Implementation strategy

The SMS documentation covers all elements and processes of the SMS and normally includes:

a consolidated description of the SMS components and elements such as:

- a. document and records management;
- b. regulatory SMS requirements;
- c. framework, scope and integration;
- d. safety policy and safety objectives;
- e. safety accountabilities and key personnel;
- f. voluntary hazard reporting system;
- g. incident reporting and investigation procedures;
- h. hazard identification and risk assessment processes;



- i. safety performance indicators;
- j. safety training and communication;
- k. continuous improvement and SMS audit;
- l. management of change; and
- m. emergency or operations contingency planning;
- n. a compilation of current SMS related records and documents such as:
 - o. hazards report register and samples of actual reports;
 - p. safety performance indicators and related charts;
 - q. record of completed or in-progress safety assessments;
 - r. SMS internal review or audit records;
 - s. safety promotion records;
 - t. personnel SMS/safety training records;
 - u. SMS/safety committee meeting minutes; and
 - v. SMS implementation plan (during implementation process).

SMS Component 2.

Safety Risk Management

Service providers should ensure that the safety risks encountered in aviation activities are controlled in order to achieve their safety performance targets. This process is known as safety risk management and includes hazard identification, safety risk assessment and the implementation of appropriate remediation measures. 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 during the planning, design and implementation phases can often identify potential hazards before the system becomes operational.

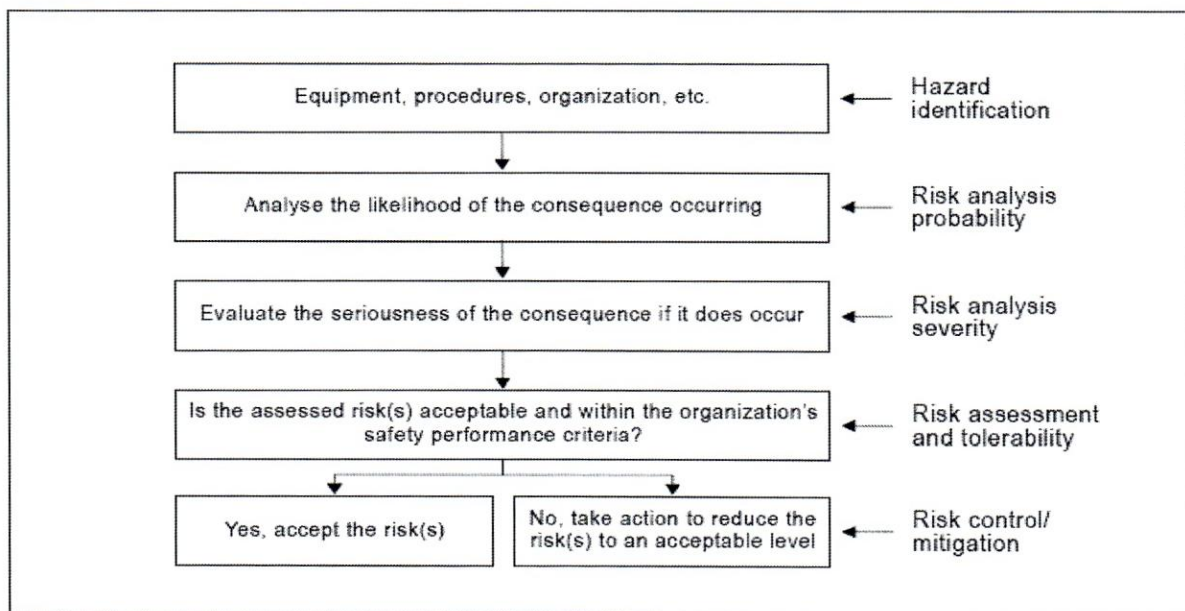
Understanding the system and its operating environment is also essential for achievement of high safety performance. Hazards may be discovered during the operational life cycle, through employee reports or incident investigations. Analysis of these hazards should be conducted in the context of the system. This context is key to avoiding attribution of events to "human error," where defects in the system may be neglected, remaining latent for future and potentially more serious events .



SMS Element 2.1 Hazard identification

The service provider shall develop and maintain a formal process that ensures that hazards associated with its aviation products or services are identified.

Hazard identification shall be based on a combination of reactive, proactive and predictive methods of safety data collection. **Example on The safety management process**



Implementation strategy

The following may be considered while engaged in the hazard identification process:

- design factors, including equipment and task design;
- human performance limitations (e.g. physiological, psychological and cognitive);

- c. procedures and operating practices, including their documentation and checklists and their validation
- d. 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, the
- g. compatibility of production and safety goals, the allocation of resources, operating pressures and the corporate safety culture;
- h. factors related to the operational environment of the aviation system (e.g. ambient noise and vibration,
- i. temperature, lighting and the availability of protective equipment and clothing);
- j. regulatory oversight factors, including the applicability and enforceability of regulations and the
- k. certification of equipment, personnel and procedures;
- l. performance monitoring systems that can detect practical drift or operational deviations; and
- m.** human-machine interface factors.

Hazards may be identified through proactive and predictive methodologies or as a result of accident or incident investigations. There are a variety of data sources of hazard identification that may be both internal and external to the organization. Examples of the internal hazard identification data sources include:

- a. normal operation monitoring schemes (e.g. flight data analysis for aircraft operators);
- b. voluntary and mandatory reporting systems;
- c. safety surveys;
- d. safety audits;
- e. feedback from training; and
- f. investigation and follow-up reports on accidents/incidents
- g. Examples of external data sources for hazard identification include:
- h. industry accident reports;.
- i. State mandatory incident reporting systems;

- j. State voluntary incident reporting systems;
- k. State oversight audits; and
- l. information exchange systems.

The type of technologies used in the hazard identification process will depend upon the size and complexity of the service provider and its aviation activities. In all cases the service provider's hazard identification process is clearly described in the organization's SMS/safety documentation. 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. Refer to Appendix 5 for guidance on an organization's voluntary and confidential reporting system.

SMS Element 2.2

Safety risk assessment and mitigation

The service provider shall develop and maintain a process that ensures analysis, assessment and control of the safety risks associated with identified hazards.

Risk probability	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

Example of a safety risk (index) assessment matrix

SMS Component 3. Safety Assurance

Safety assurance consists of processes and activities undertaken by the service provider to determine whether the SMS is operating according to expectations and requirements. The service provider continually monitors its internal processes as well as its operating environment to detect changes or deviations that may introduce emerging safety risks or the degradation of existing risk controls. Such changes or deviations may then be addressed together with the safety risk management process.

The safety assurance process complements that of quality assurance, with each having requirements for analysis, documentation, auditing and management reviews to assure that certain performance criteria are met. While quality assurance typically focuses on the organization's compliance with regulatory requirements, safety assurance specifically monitors the effectiveness of safety risk controls.

The complementary relationship between safety assurance and quality assurance allows for the integration of certain supporting processes. Such integration can serve to achieve synergies to assure that the service provider's safety, quality and commercial objectives are met.

Finally, safety assurance activities should include the development and implementation of corrective actions in response to findings of systemic deficiencies having a potential safety impact. Organizational responsibility for the development and implementation of corrective actions should reside with the departments cited in the findings.

SMS Element 3.1 Safety performance monitoring and measurement

The service provider shall develop and maintain the means to verify the safety performance of the organization and to validate the effectiveness of safety risk controls.

The service provider's safety performance shall be verified in reference to the safety performance indicators and safety performance targets of the SMS.

Implementation strategy

information used to measure the organization's safety performance is generated through its safety reporting systems.

There are two types of reporting systems:

- a. mandatory incident reporting systems; and
- b. voluntary incident reporting systems.

Mandatory incident reporting systems require the reporting of certain types of events (e.g. serious incidents, runway incursions). This necessitates implementation of detailed regulations identifying the reporting criteria and scope of reportable occurrences. Mandatory reporting systems tend to collect more information related to high-consequence technical failures than other aspects of operational activities.

Voluntary reporting systems allow for the submission of information related to observed hazards or inadvertent errors without an associated legal or administrative requirement to do so. In these systems, regulatory agencies or organizations may offer an incentive to report. For example, enforcement action may be waived for reports of inadvertent errors or unintentional violations. Under these circumstances, reported information should be used solely to support the enhancement of safety. Such systems are considered "non-punitive" because they afford protection to reporters thereby ensuring the continued availability of such information to support continuous improvements in safety performance. While the nature and extent of service providers' non-punitive policies may vary, the intent is to promote an effective reporting culture and proactive identification of potential safety deficiencies.

Voluntary reporting systems may be confidential, requiring that any identifying information about the reporter is known only to "gatekeepers" in order to allow for follow-up action. Confidential incident reporting systems facilitate the disclosure



of hazards leading to human error, without fear of retribution or embarrassment. Voluntary incident reports may be archived and de-identified once any 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.

To be effective, safety reporting tools should be readily accessible to operational personnel. Operational personnel should be educated on the benefits of safety reporting systems and provided with positive feedback regarding remedial actions taken in response to the report. The alignment of reporting system requirements, analysis tools and methods can facilitate exchange of safety information as well as comparisons of certain safety indicators.

Other sources of safety information to support safety performance monitoring and measurement may include:

Safety studies are analyses used to gain an understanding of broad safety issues or those of a global nature. For example, the airline industry may produce safety recommendations and implement measures to reduce accidents and incidents during the approach and landing phases. Individual service providers may find that these global recommendations improve safety performance in the context of their aviation activities.

Safety reviews are a fundamental component of change management. They are conducted during the introduction of new technologies, new procedures or systemic changes that affect aviation operations.

Safety reviews have a clearly defined objective that is linked to the change under consideration.

Safety reviews ensure that safety performance is maintained at appropriate levels during periods of change.

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 that may require validation to determine appropriate corrective action.



Nonetheless, surveys may provide an inexpensive source of significant safety information.

Audits focus on the integrity of the organization's SMS and its supporting systems. Audits provide an

assessment of safety risk controls and related quality assurance processes. Audits may be conducted by entities that are external to the service provider or through an internal audit process having the necessary policies and procedures to ensure its independence and objectivity. Audits are intended to provide assurance of the safety management functions, including staffing, compliance with approved regulations, levels of competency and training.

Internal investigations are conducted for certain reportable safety events in accordance with internal or regulatory requirements. Accidents and serious incidents investigated by the appropriate State or regional authorities may also provide the impetus for internal investigations to be undertaken by service provider organizations

The final output of a safety performance monitoring and measurement process is the development of safety performance indicators based on analysis of data collected through the sources referenced above. The monitoring and measurement process involves the use of selected safety performance indicators, corresponding safety performance targets and alert levels.

SMS Element 3.2 The management of change:

The service provider shall develop and maintain a formal process to identify changes which may affect the level of safety risk associated with its aviation products or services and to identify and manage the safety risks that may arise from those changes.

Implementation strategy

Aviation service providers experience change due to a number of factors including, but not limited to:

- a. organizational expansion or contraction;

- b. changes to internal systems, processes or procedures that support delivery of the products and services; and
- c. changes to the organization's operating environment.

Change may affect the appropriateness or effectiveness of existing safety risk mitigation strategies. In addition, new hazards, and related safety risks may be inadvertently introduced into an operation whenever change occurs. Such hazards should be identified so as to enable the assessment and control of any related safety risks. Safety reviews, as discussed in the discussion on safety performance monitoring and measurement, can be valuable sources of information to support decision-making processes and manage change effectively.

The organization's management of change process should take into account the following three considerations:

Criticality. Criticality assessments determine the systems, equipment or activities that are essential to the safe operation of aircraft. While criticality is normally assessed during the system design process, it is also relevant during a situation of change. Systems, equipment and activities that have higher safety criticality should be reviewed following change to make sure that corrective actions can be taken to control potentially emerging safety risks.

Stability of systems and operational environments. Changes may be planned and under the direct control of the organization. Such changes include organizational growth or contraction, the expansion of products or services delivered, or the introduction of new technologies. Unplanned changes may include those related to economic cycles, labour unrest, as well as changes to the political, regulatory or operating environments.

Past performance. Past performance of critical systems and trend analyses in the safety assurance process should be employed to anticipate and monitor safety performance under situations of change. The monitoring of past performance will also assure the effectiveness of corrective actions taken to address safety deficiencies identified as a result of audits, evaluations, investigations or reports.

As systems evolve, incremental changes can accumulate, requiring amendments to the initial system description. Therefore, change management necessitates periodic



reviews of the system description and the baseline hazard analysis to determine their continued validity.

SMS Element 3.3 Continuous improvement of the SMS

The service provider shall monitor and assess the effectiveness of its SMS processes to enable continuous improvement of the overall performance of the SMS.

Implementation strategy

Continuous improvement is measured through the monitoring of an organization's safety performance indicators and is related to the maturity and effectiveness of an SMS. Safety assurance processes support improvements to the SMS through continual verification and follow-up actions. These objectives are achieved through the application of internal evaluations and independent audits of the SMS

Internal evaluations involve assessment of the service provider's aviation activities that can provide information useful to the organization's decision-making processes. It is here where the key activity of SMS — hazard identification and risk mitigation (HIRM) takes place. Evaluations conducted for the purpose of this requirement must be conducted by persons or organizations that are functionally independent of the technical processes being evaluated. The internal evaluation function includes evaluation of safety management functions, policymaking, safety risk management, safety assurance and safety promotion throughout the organization.

Internal audits involve the systematic and scheduled examination of the service provider's aviation activities, including those specific to implementation of the SMS. To be most effective, internal audits are conducted by persons or departments that are independent of the functions being evaluated. Such audits provide the accountable executive, as well as senior management officials responsible for the SMS, the ability to track the implementation and effectiveness of the SMS as well as its supporting systems.

External audits of the SMS may be conducted by relevant authorities responsible for acceptance of the service provider's SMS. Additionally, audits may be conducted by industry associations or other third parties selected by the service

provider. These external audits enhance the internal audit system as well as provide independent oversight.

In summary, the evaluation and audit processes contribute to the service provider's ability to achieve continuous improvement in safety performance. Ongoing monitoring of the SMS, its related safety controls and support systems assures that the safety management process is achieving its objectives.

SMS Component 4. Safety Promotion

Safety promotion encourages a positive safety culture and creates an environment that is conducive to the achievement of the service provider's safety objectives. A positive safety culture is characterized by values, attitudes and behavior that are committed to the organization's safety efforts. This is achieved through the combination of technical competence that is continually enhanced through training and education, effective communications and information sharing. Senior management provides the leadership to promote the safety culture throughout an organization.

An organizational safety effort cannot succeed solely by mandate or strict adherence to policies. Safety promotion affects both individual and organizational behavior and supplements the organization's policies, procedures and processes, providing a value system that supports safety efforts.

The service provider must establish and implement processes and procedures that facilitate effective communication throughout all levels of the organization. Service providers should communicate their safety objectives, as well as the current status of any related activities and events. Service providers must also encourage "bottom-up" communication, providing an environment that allows senior management to receive open and constructive feedback from operational personnel.

SMS Element 4.1 Training and education

The service provider shall develop and maintain a safety training programme that ensures that personnel are trained and competent to perform their SMS duties.



The scope of the safety training programme shall be appropriate to each individual's involvement in the SMS.

The safety manager should provide current information and facilitate training relevant to specific safety issues encountered by organizational units. The provision of training to appropriate staff, regardless of their level in the organization, is an indication of management's commitment to an effective SMS. Safety training and education curricula should consist of the following:

- a. organizational safety policies, goals and objectives;
- b. organizational safety roles and responsibilities related to safety;
- c. basic safety risk management principles;
- d. safety reporting systems;
- e. safety management support (including evaluation and audit programmes);
- f. lines of communication for dissemination of safety information;
- g. a validation process that measures the effectiveness of training; and
- h. documented initial indoctrination and recurrent training requirements.

Training requirements consistent with the needs and complexity of the organization should be documented for each area of activity. A training file should be developed for each employee, including management.

Safety training within an organization must ensure that personnel are competent to perform their safety related duties. Training procedures should specify initial and recurrent safety training standards for operational personnel, managers and supervisors, senior managers and the accountable executive. The amount of safety training should be appropriate to the individual's responsibility and involvement in the SMS. The SMS training documentation should also specify responsibilities for development of training content and scheduling as well as training records management.

The training should include the organization's safety policy, safety roles and responsibilities, SMS principles related to safety risk management and safety assurance, as well as the use and benefits of the organization's safety reporting system(s).



Safety training for senior managers should include content related to compliance with national and organizational safety requirements, allocation of resources and active promotion of the SMS including effective interdepartmental safety communication. In addition, safety training for senior managers should include material on establishing safety performance targets and alert levels. Finally, the safety training programme may include a session designed specifically for the accountable executive. This training session should be at a high level providing the accountable executive with an understanding of the SMS and its relationship to the organization's overall business strategy.

SMS Element 4.2 Safety communication

The service provider shall develop and maintain formal means for safety communication that:

- a. ensures personnel are aware of the SMS to a degree commensurate with their positions;
- b. conveys safety-critical information;
- c. explains why particular safety actions are taken; and
- d. explains why safety procedures are introduced or changed.

Implementation strategy

The service provider should communicate the organization's SMS objectives and procedures to all operational personnel. The safety manager should regularly communicate information regarding the safety performance trends and specific safety issues through bulletins and briefings. 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 performance will be more efficient if operational personnel are actively encouraged to identify and report hazards. Safety communication therefore aims to:

- a. ensure that staff are fully aware of the SMS;
- b. convey safety-critical information;
- c. raise awareness of corrective actions; and



- d. provide information regarding new or amended safety procedures.

Examples of organizational communication initiatives include:

- a. dissemination of the SMS manual;
- b. safety processes and procedures;
- c. safety newsletters, notices and bulletins; and
- d. websites or email.

SMS IMPLEMENTATION PLANNING

System description

A system review and description of the SMS elements and their interface with existing systems and processes is the first step in defining the scope and applicability of the SMS. This exercise provides an opportunity to identify any gaps related to the service provider's SMS components and elements. The system description includes the SMS interfaces within the organization, as well as pertinent interfaces with other external organizations such as subcontractors. An overview of the system description and its accountability and reporting structure should be included in the SMS documentation. For large and complex organizations, details of basic systems and organizational procedures are addressed in the service provider's relevant exposition or administrative manuals. In such cases, a brief outline together with an organizational chart with appropriate cross references may be adequate for the purpose of the system description.

Integration of management systems

Depending upon the organizational, operational and regulatory contexts, a service provider may implement an integrated SMS. Integration has the potential to provide synergies by managing safety risks across multiple areas of aviation activities. For example, a service provider may implement a single SMS for its design organization, production organization, and business aviation flight department. Alternatively, there may be situations where an individual SMS for

each type of aviation activity is appropriate. The organization may define the best means to integrate or segregate its SMS as suits its business or organizational model, subject to satisfying the State that its SMS duties in all service provider roles are being properly discharged. The service provider's SMS may also be integrated with security, occupational health and environmental management systems.

SMS and QMS integration

Aviation service providers typically implement enterprise-wide management systems. Organizational safety performance is dependent on the effective integration of these systems to support the delivery of products and services.

In the context of SMS, the most significant aspect of integration is with the service provider's quality management system (QMS). 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. QMS is an existing aviation regulatory requirement for most service providers including production approval maintenance organizations and meteorological and aeronautical data service providers .

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

- a. must be planned and managed;
- b. depend upon measurement and monitoring of performance indicators;
- c. involve all organizational functions related to the delivery of aviation products and services; and
- d. strive for continuous improvement.

SMS and QMS utilize similar risk management and assurance processes. The objective of the SMS is to identify safety-related hazards the organization must confront and to control the associated risks. SMS is designed to manage safety risk and measure safety performance during delivery of products and services. The safety risk management process eliminates hazards or provides effective controls



to mitigate safety risks by maintaining an appropriate resource allocation balance between production and protection to meet safety performance requirements.

A QMS provides consistency in the delivery of products and services to meet performance standards as well as customer expectations. The QMS also has an independent assurance function that utilizes a feedback loop to assure delivery of products and services that are “fit for purpose” and free of defects or errors. The quality assurance function identifies ineffective processes and procedures that must be redesigned for efficiency and effectiveness.

Furthermore, SMS and QMS utilize similar tools. Safety and quality practitioners are essentially focused on the same goal of providing safe and reliable products and services to customers. Both quality and safety practitioners are trained on various analysis methods including root-cause analysis and statistical trending analysis.

Given the complementary aspects of SMS and QMS, it is possible to establish a synergistic relationship between both systems that can be summarized as follows:

- a. an SMS is supported by QMS processes such as auditing, inspection, investigation, root cause analysis, process design, statistical analysis and preventive measures;
- b. a QMS may anticipate safety issues that exist despite the organization's compliance with standards and specifications; and
- c. quality principles, policies and practices are linked to the objectives of safety management.

The relationship between SMS and QMS leads to the complementary contributions of each system to the attainment of the organization's safety and quality goals.

Gap analysis

A gap analysis compares the service provider's existing safety management processes and procedures with requirements contained in the SMS framework. Aviation service providers will have typically implemented various SMS functions due to their compliance with national regulations or adoption of industry best practices. The development of an SMS should build upon existing organizational structures and control systems. The gap analysis facilitates development of an SMS implementation plan by identifying the gaps that must be addressed to fully implement an SMS.



Once the gap analysis has been completed and fully documented, the resources and processes that have been identified as missing or inadequate will form the basis of the SMS implementation plan.

SMS implementation plan

An SMS implementation plan is developed in consultation with the accountable executive and managers responsible for the delivery of products and services related to, or in support of, the safe operation of aircraft. Once completed, the accountable executive endorses the plan. The SMS implementation plan includes timelines and milestones consistent with the requirements identified in the gap analysis process, the size of the service provider and the complexity of its products or services. The plan should address coordination with external organizations or contractors where applicable.

The service provider's implementation plan may be documented in different forms, varying from a simple spreadsheet to specialized project management software. The implementation plan should address gaps through completion of specific actions and milestones according to the stated timeline. Assignment of each task assures accountability throughout the implementation process. The plan should be reviewed regularly and updated as necessary.

Safety performance indicators

An SMS defines measurable performance outcomes to determine whether the system is truly operating in accordance with design expectations and not simply meeting regulatory requirements. The safety performance indicators are used to monitor known safety risks, detect emerging safety risks and to determine any necessary corrective actions.

Safety performance indicators also provide objective evidence for the regulator to assess the effectiveness of the service provider's SMS and to monitor achievement

of its safety objectives. The service provider's safety performance indicators consider factors such as the organization's safety risk tolerance, the cost/benefits of implementing improvements to the system, regulatory requirements and public expectations. Safety performance indicators should be selected and developed in consultation with the service provider's regulatory authority. This process is necessary to facilitate the regulator's aggregation and harmonization of the service provider's safety performance indicators for the same aviation sector.

The safety performance indicators and associated targets should be accepted by the State responsible for the service provider's authorization, certification or designation. Safety performance indicators are supplementary to any legal or regulatory requirements and do not relieve service providers from their regulatory obligations.

In practice, the safety performance of an SMS is expressed by safety performance indicators and their corresponding alert and target values. The service provider should monitor the performance of current indicators in the context of historical trends to identify any abnormal changes in safety performance. Likewise, target and alert settings should take into consideration recent historical performance for a given indicator. Desired improvement targets should be realistic and achievable for the service provider and the associated aviation sector.

Establishing an alert level for a safety indicator is pertinent from a risk-monitoring perspective. An alert level is a common criteria to delineate the acceptable from the unacceptable performance regions for a particular safety indicator. As per generic safety metrics textbooks, a basic objective method for setting out-of-control (OOC) alert criteria is the use of the standard deviation principle. This method takes into consideration the standard deviation and average values of the preceding historical data points for a given safety indicator. These two values are then used to establish the alert level for the next monitoring period of the indicator.

A range of high-consequence as well as lower-consequence safety performance indicators provide a more comprehensive insight into the service provider's safety performance. This will ensure that high-consequence outcomes (e.g. accidents and serious incidents) as well as lower-consequence events (e.g. incidents, non-conformance reports, deviations) are addressed. Safety performance indicators are essentially data trending charts that track occurrences in terms of event rates (e.g. number of incidents per 1 000 flying hours). High-consequence indicators should be addressed first while lower-consequence indicators may be developed at the more mature phase of SMS implementation.



Once safety performance indicators and their corresponding targets and alert settings have been defined, the performance outcome of each indicator should be updated and monitored on a regular basis. The target and alert level for each indicator may be tracked for their respective performance status. A consolidated summary of the overall target and alert performance outcome of the complete safety performance indicators package may also be compiled/aggregated for a given monitoring period. Qualitative values (satisfactory/unsatisfactory) may be assigned for each “target achieved” and each “alert level not breached”. Alternatively, numeric values (points) may be used to provide a quantitative measurement of the overall performance of the package of indicators. Examples of safety performance indicators and their target and alert setting criteria are provided in Appendix 6 to this chapter.

On-site verification of the SMS

As a minimum, the items to be in place when applying for the initial certification are:

1. safety policy: a safety policy has been endorsed by the accountable executive to reflect the organization’s commitments regarding safety;
2. operator’s organizational structure: the aerodrome operator has appointed an accountable executive and a safety manager;

The safety manager should be independent from any operational task regarding aerodrome safety. The criteria for assessing the operator’s SMS structure might be tailored to the size of the operator, notably concerning the independence of the safety manager;

3. The capability and competence of the aerodrome operator should be assessed so as to ensure sufficient management commitment to and responsibility for safety at the aerodrome. This is usually achieved through the competence of the accountable executive;
 - a. responsibilities and assignments: the aerodrome operator has formally defined the responsibilities of each staff member regarding safety as well as the lines of responsibility;



- b. training: the aerodrome operator formally monitors the staff's and subcontractors' training, ensuring that it is adequate, and takes action when necessary;
- c. accident and incident reporting: the aerodrome operator has a procedure ensuring that:
 - a. incidents are reported by staff and subcontractors, including a description of the actions in place in order to be able to report them;
 - b. incidents are promptly analysed and the actions to be subsequently taken are monitored;
 - c. the reports and analyses of the incidents are filed;
 - d. incidents are reported to the State;
 - e. coordination is in place with other stakeholders;
- 4. existing hazards at the aerodrome: a procedure in order to identify, analyse and assess hazards to the safe operation of aeroplanes and to put in place suitable mitigating measures;
- 5. risk assessment and mitigation of changes: a procedure ensuring that for any change at the aerodrome, its impact on safety is analysed, listing the subsequent hazards that could be generated. This procedure describes who conducts the analysis, when and how the hazards are monitored, what actions are subsequently taken, and the criteria leading to the analysis. These assessments are filed;
- 6. safety indicators: the aerodrome operator sets and monitors its own safety indicators that illustrate its safety criteria, in order to be able to analyse the potential deficiencies;
- 7. safety audits: the aerodrome operator has a safety audit programme in place which includes a training programme for those involved;
- 8. safety promotion: the aerodrome operator should have a process to promote safety-related information.



Risk assessment and development of mitigation measures

The level of risk of each identified potential consequence is estimated by conducting a risk assessment. This risk assessment will determine the severity of a consequence (effect on the safety of the considered operations) and the probability of the consequence occurring and will be based on experience as well as on any available data (e.g. accident database, occurrence reports).

1. Understanding the risks is the basis for the development of mitigation measures, operational procedures and operating restrictions that might be needed to ensure safe aerodrome operations.
2. The method for risk evaluation is strongly dependent on the nature of the hazards. The risk itself is evaluated by combining the two values for severity of its consequences and probability of occurrence.
3. Once each hazard has been identified and analysed in terms of causes, and assessed for severity and probability of its occurrence, it must be ascertained that all associated risks are appropriately managed. An initial identification of existing mitigation measures must be conducted prior to the development of any additional measures.
4. All risk mitigation measures, whether currently being applied or still under development, are evaluated for the effectiveness of their risk management capabilities.

Note.— The exposure to a given risk (e.g. duration of a change, time before implementation of corrective actions, traffic density) is taken into account in order to decide on its acceptability.

5. In some cases, a quantitative approach may be possible, and numerical safety objectives can be used. In other instances such as changes to the



operational environment or procedures, a qualitative analysis may be more relevant.

6. In some cases, the result of the risk assessment may be that the safety objectives will be met without any additional specific mitigation measures.

Development of an implementation plan and conclusion of the assessment

1. The last phase of the safety assessment process is the development of a plan for the implementation of the identified mitigation measures.
2. The implementation plan includes time frames, responsibilities for mitigation measures as well as control measures that may be defined and implemented to monitor the effectiveness of the mitigation measures.

Promulgation of safety information

The aerodrome operator determines the most appropriate method for communicating safety information to the stakeholders and ensures that all safety-relevant conclusions of the safety assessment are adequately communicated. In order to ensure adequate dissemination of information to interested parties, information that affects the current integrated aeronautical information package (IAIP) or other relevant safety information is:

- a. promulgated in the relevant section of the IAIP or automatic terminal information service (ATIS); and
- b. published in the relevant aerodrome information communications through appropriate means.