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Safety Management Manual (SMM)

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AMENDMENTS

Amendments are announced in the supplements to the Catalogue of ICAO Publications; the Catalogue and its supplements are available on the ICAO website at www.icao.int. The space below is provided to keep a record of such amendments.

AMENDMENTS		
No.	Date	Entered by

CORRIGENDA		
No.	Date	Entered by

SAFETY MANAGEMENT MANUAL

EXECUTIVE SUMMARY

Summary of SMM Ed4 content to be completed after the Peer Review

Xxxx

FOREWORD

The Standards and Recommended Practices (SARPs) in Annex 19 - *Safety Management* and the guidance provided in this ICAO Safety Management Manual (SMM) (Doc 9859) are intended to support States in fulfilling their obligations regarding the Convention through the management of aviation safety risks. Annex 19 and this manual support the continued evolution of a proactive strategy to improve safety performance. The foundation of this proactive safety strategy is based on the implementation of State Safety Programmes (SSP), which includes ensuring service providers to implement Safety Management Systems (SMS), to systematically address safety risks. This fourth edition of the SMM supersedes the third edition, published in May 2013, in its entirety.

Purpose and objectives

The purpose of the SMM is to provide States and service providers with guidance when implementing or maintaining safety management in their organisation in accordance with the SARPs in ICAO Annex 19. The objectives of this manual are to assist States to:

- transition towards a performance-based approach to safety;
- put in place mechanisms for the protection of safety information; and
- achieve the objectives outlined in the GASP.

Indirectly the manual should also support service providers in their transition towards a performance-based approach to safety while delivering their product and/or service.

Note 1.— *In this manual, the use of the male gender should be understood to include both male and female persons.*

Scope and exclusions

The scope of this 4th edition of the SMM includes:

- Safety management guidance for all States, regardless of size or complexity;
- Safety management guidance for service providers required to implement SMS in Annex 19 regardless of size or complexity; and
- Safety management guiding principles that may be applied to aviation activities outside of the applicability of Annex 19.

The following are excluded from the scope the 4th edition of the SMM:

- Guidance to support sector-specific safety management SARPs found outside of Annex 19 (e.g. flight data analysis programmes);
- Guidance on the conduct of independent State accident and serious incident investigations.

Intended audiences

The intended audiences for the SMM are:

- **States**. In particular: Senior managers with a role in aviation safety, safety managers, safety auditors, safety analysts from Civil Aviation Authorities (CAA) and Departments/Ministries of Transport; and
- **Service providers**. In particular, accountable executives, safety managers, internal safety auditors, safety investigators and safety analysts.

Manual Structure

The SMM is divided into three parts. Each part is divided into chapters. The manual structure intends to progressively build the reader's understanding of safety management. From background information, to key underpinning concepts to guidance on safety management implementation.

- **Part I – Introduction and background**: Introduces the reader to the concept of safety management and explains the background, benefits and history of ICAO safety management development. This part provides the reader with fundamental information underpinning safety management practice, such as: accident causation, practical drift and safety risk management. Safety culture is covered in detail in a separate chapter because of its importance as an enabler to effective safety management implementation.
- **Part II – Developing safety intelligence:** Part II comprises three important and interrelated topics about safety data and safety information. Part II begins with an important chapter about protection of safety data, safety information and related sources which is important to ensure its continued availability. A chapter follows this on safety performance management that provides the direction for safety management activities. Part II culminates by introducing and explaining data driven decision-making, and how this concept is leveraging the data collected to empower aviation leaders.
- **Part III – Effective safety management:** Provides specific guidance on implementing safety management on two levels:
    - for States to fulfil their safety management obligations through the implementation of a State safety programme (SSP); and
    - related to the implementation of SMS by service providers. States should use the guidance on the process for accepting the SMS of a service provider found in both chapters in Part III.

  These two levels of safety management interact to drive the continuous improvement of safety performance for the aviation system of a State that consequently contributes to the overall improvement of global aviation safety.

Safety Management Implementation Website

This 4th edition of the SMM is complemented by the ICAO Safety Management website (http://www.icao.int/XXXXXXXXX). The website was established to address a recommendation stemming from the second High-level Safety Conference held in 2015 requesting ICAO to establish a mechanism for the sharing of best practices related to safety management. The website includes some of the examples and tools from the third edition of the SMM with additional practical examples, tools, and supporting educational material to be collected, reviewed and posted on an ongoing basis. A summary of the major changes between the fourth edition and the third edition of the SMM is also posted on the website.

Comments on this manual, particularly with regard to its application and usefulness, would be appreciated from all States, safety oversight audit missions and ICAO technical cooperation field missions. These will be taken into consideration in the preparation of subsequent editions. Comments should be addressed to:

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ACRONYMS AND ABBREVIATIONS

ADREP	Accident/incident data reporting
AIB	Accident investigation board
ALoSP	Acceptable level of safety performance
AMO	Approved maintenance organization
ANS	Air navigation service
AOC	Air operator certificate
ATC	Air traffic control
ATM	Air traffic management
ATS	Air traffic service(s)
CAA	Civil aviation authority
CBA	Cost-benefit analysis
CEO	Chief executive officer
Cir	Circular
CMA	Continuous monitoring approach
CNS	Communications, navigation and surveillance
CRM	Crew resource management
CVR	Cockpit voice recorder
D&M	Design and manufacturing
DOA	Design organization approval
Doc	Document
ECCAIRS	European Coordination Centre for Accident and Incident Reporting Systems
EMS	Environmental management system
ERP	Emergency response plan
FDR	Flight data recorder
FMS	Financial management system
FRMS	Fatigue risk management systems
HF	Human factors
HIRA	Hazard identification and risk assessment
HIRM	Hazard identification and risk mitigation
ICAO	International Civil Aviation Organization
ISO	International Organization for Standardization
iSTARS	Integrated Safety Trend Analysis and Reporting System
LEI	Lack of effective implementation
LOS	Loss of separation
LOSA	Line operations safety audit
MDR	Mandatory defect report
MOR	Mandatory occurrence report
N/A	Not applicable
OEM	Original equipment manufacturer

OHSMS	Occupational health and safety management system
OPS	Operations
ORP	Organization risk profile
OSC	Organization safety culture
OSHE	Occupational safety, health and environment
PC	Preventive control
POA	Production organization approval
PIRG	Planning and Implementation Regional Group
QA	Quality assurance
QC	Quality control
QM	Quality management
QMS	Quality management system
RAIO	Regional accident and incident investigation organization
RASG	Regional Aviation Safety Group
RM	Recovery measure
RSOO	Regional safety oversight organization
SAG	Safety action group
SARPs	Standards and Recommended Practices
SD	Standard deviation
SDCPS	Safety data collection and processing system
SeMS	Security management system
SHEL	Software/hardware/environment/liveware
SM	Safety management
SMM	Safety management manual
SMP	Safety Management Panel
SMS	Safety management system(s)
SOPs	Standard operating procedures
SPI	Safety performance indicator
SRB	Safety review board
SRC	Safety review committee
SRM	Safety risk management
SSO	State safety oversight
SSP	State safety programme
STDEVP	Population standard deviation
TBD	To be determined
TOR	Terms of reference
UC	Ultimate consequence
UE	Unsafe event
USOAP	Universal Safety Oversight Audit Programme

RELATED ICAO PUBLICATIONS

PROCEDURES FOR AIR NAVIGATION SERVICES (PANS)

Aerodromes (Doc 9981)

Aircraft Operations (Doc 8168)

Air Traffic Management (Doc 4444)

Training (9868)

CIRCULARS

A Unified Framework for Collision Risk Modelling in Support of the Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689) (Cir 319)

Assessment, Measurement and Reporting of Runway Surface Conditions (Cir 329)

Assessment of ADS-B and Multilateration Surveillance to Support Air Traffic Services and Guidelines for Implementation (Cir 326)

Civil Military Cooperation in Air Traffic Management (Cir 330)

Hazards at Aircraft Accident Sites (Cir 315)

Operation of New Larger Aeroplanes at Existing Aerodromes (Cir 305)

Training Guidelines for Aircraft Accident Investigators (Cir 298)

Unmanned Aircraft Systems (UAS) (Cir 328)

GUIDANCE MATERIAL

Advanced Surface Movement Guidance and Control Systems (A-SMGCS) Manual (Doc 9830)

Airport Services Manual (Doc 9137)
- Part 1 — Rescue and Fire Fighting
- Part 5 — Removal of Disabled Aircraft
- Part 7 — Airport Emergency Planning

Airworthiness Manual (Doc 9760)

Fatigue Management Guide for Airline Operators

Fatigue Management Guide for Air Traffic Services Providers

Fatigue Management Guide for General Aviation Operators of Large and Turbojet Aeroplanes

Global Air Navigation Plan (Doc 9750)

Global Aviation Safety Plan (GASP) (Doc 10007)

Global Air Traffic Management Operational Concept (Doc 9854)

Human Factors Guidelines for Air Traffic Management (ATM) Systems (Doc 9758)

Human Factors Guidelines for Aircraft Maintenance Manual (Doc 9824)

Human Factors Guidelines for Safety Audits Manual (Doc 9806)

Human Factors Training Manual (Doc 9683)

Line Operations Safety Audit (LOSA) (Doc 9803)

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Manual Concerning Safety Measures Relating to Military Activities Potentially Hazardous to Civil Aircraft Operations (Doc 9554)

Manual for the Oversight of Fatigue Management Approaches (Doc 9966)

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Part I — Organization and Planning
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Manual of All-Weather Operations (Doc 9365)

Manual of Civil Aviation Medicine (Doc 8984)

Manual of Procedures for Operations Inspection, Certification and Continued Surveillance (Doc 8335)

Manual of Radiotelephony (Doc 9432)

Manual of Surface Movement Guidance and Control Systems (SMGCS) (Doc 9476)

Manual on Air Traffic Management System Requirements (Doc 9882)

Manual on Airspace Planning Methodology for the Determination of Separation Minima (Doc 9689)

Manual on Certification of Aerodromes (Doc 9774)

Manual on Flight Data Analysis Programmes (FDAP) (Doc 10000)

Manual on Global Performance of the Air Navigation System (Doc 9883)

Manual on Implementation of a 300 m (1 000 ft) Vertical Separation Minimum Between FL 290 and FL 410 Inclusive (Doc 9574)

Manual on Monitoring the Application of Performance-Based Horizontal Separation Minima (Doc 10063)

Manual on Regional Accident and Incident Investigation Organization (Doc 9946)

Manual on Remotely Piloted Aircraft Systems (RPAS) (Doc 10019)

Performance-based Communication and Surveillance (PBCS) Manual (Doc 9869)

Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR) (Doc 9643)

Manual on the Investigation of Cabin Safety Aspects in Accidents and Incidents (Doc 10062)

Manual on the Prevention of Runway Incursions (Doc 9870)

Manual on the Protection of Safety Information (Doc 10053)
Part I — Protection of Accident and Incident Investigation Records

Manual on the Quality Management System for the Provision of Meteorological Service for International Air Navigation (Doc 9873)

Normal Operations Safety Survey (NOSS) Manual (Doc 9910)

Performance-based Navigation (PBN) Manual (Doc 9613)

Performance-Based Navigation (PBN) Operational Approval Manual (Doc 9997)

Safety Oversight Manual (Doc 9734)
Part A – The Establishment and Management of a State’s Safety Oversight System
Part B – The Establishment and Management of a Regional Safety Oversight Organization

Universal Safety Oversight Audit Programme Continuous Monitoring Manual (Doc 9735)

Manual on the Competencies of Civil Aviation Safety Inspectors (Doc 10070)

GLOSSARY

Acceptable level of safety performance (ALoSP). The minimum level of safety performance of civil aviation in a State, as defined in its State safety programme, expressed in terms of safety performance targets and safety performance indicators.

Note.— An acceptable level of safety performance for the State can be demonstrated through the implementation and maintenance of the SSP as well as safety performance indicators and safety performance targets showing that safety is effectively managed, built on the foundation of implementation of existing safety-related SARPs.

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

Alert. An established level or criteria value that serves as the primary trigger for an evaluation, adjustment or remedial action related to the particular indicator.

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.

High-consequence indicators. Safety performance indicators pertaining to the monitoring and measurement of high-consequence occurrences, such as accidents or serious incidents. High-consequence indicators are sometimes referred to as reactive indicators.

Lower-consequence indicators. Safety performance indicators pertaining to the monitoring and measurement of lower-consequence occurrences, events or activities such as incidents, non-conformance findings or deviations. Lower-consequence indicators are sometimes referred to as proactive indicators.

Risk mitigation. The process of incorporating defences or preventive controls 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 assessment. A term used in other ICAO documents to refer to a hazard identification and safety risk mitigation process.

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 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 systems.

Note 1.— Safety objectives are developed from the safety risk picture of the State and should be taken into consideration during subsequent development of the ALoSP indicators and targets.

Note 2.— Safety objectives are developed by the Service provider to reflect the organization's commitment to safety and form one basis for the development of safety performance indicators and safety performance 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 management system. A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilities, policies and procedures.

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.

Service provider. Any organization providing aviation products and/or services. The term thus encompasses approved training organizations that are exposed to safety risks during the provision of their services, aircraft operators, approved maintenance organizations, organizations responsible for type design and / or manufacture of aircraft, engines or propellers, air traffic service providers and certified aerodromes.

State safety programme. 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.

Part I
INTRODUCTION AND BACKGROUND

1. Chapter INTRODUCTION

1.1 WHAT IS SAFETY MANAGEMENT?

1.1.1 Introduction to safety management

1.1.1.1 Safety management seeks to proactively mitigate safety risks before they result in aviation accidents and incidents. Safety management enables States to manage their safety activities in a more disciplined and focused manner. When a State and its aviation industry have a clear understanding of their role and contribution to safe operations, it enables them to prioritise safety risks and more effectively manage their resources for optimal aviation safety benefit.

1.1.1.2 The foundation of safety management is the implementation of a State safety programme (SSP) by States and safety management systems (SMS) by service providers. Each State's SSP combines with the benefits of each applicable service provider's SMS to synergistically and systematically address safety risks, improve the safety performance of each service provider, and consequently, the safety performance of the State.

1.1.2 State safety programmes

A State safety programme is defined in Annex 19 as… "an integrated set of regulations and activities aimed at improving safety." The SSP is established and maintained by States as a structured approach to assist in managing aviation safety risks.

1.1.3 Safety management systems

A safety management system is defined in Annex 19 as… ". A systematic approach to managing safety, including the necessary organizational structures, accountability, responsibilities, policies and procedures. An SMS is established and maintained by each service provider and operator identified in Chapter 3 of Annex 19 (see para 1.4 of this Part, for details on SMS applicability) to continuously improve safety performance by identifying hazards, collecting and analysing data and continuously assessing safety risks.

1.1.4 Benefits of safety management

Below are listed some of the many benefits of safety management:

1) **Strengthened safety culture -** Effective safety management can strengthen an organization's safety culture by increasing the visibility of management's support and improving active involvement of staff in managing safety risk. When leadership actively endorses safety as a priority, it becomes part of the normal operations. 'The way we do things around here'.

2) **Documented, process-based approach to assure safety -** implementing safety management will result in a clear and documented approach to achieving safe operations that is understandable by personnel and can be readily explained to others. In addition, clearly defining baseline performance allows controlled changes when continuously improving the safety programme/system. This can help the organization optimize the resources required to implement change.

3) **Better understanding of safety-related interdependencies and relationships -** The process of documenting and defining linkages between SSP/SMS elements can benefit the organisation's understanding of the inter-process relationships. This leads to an enhanced understanding of the end-to-end process and exposes opportunities for increased efficiencies.

4) **Enhanced early detection of safety risks** - An effective SSP/SMS can improve the State/service provider's ability to detect emerging safety issues and can prevent incidents through

the proactive identification and management of safety risks. This, in turn, can result in the avoidance of costs - both monetary and social - from prevented incidents and accidents.

5) **Safety data-driven decision making -** An effective SSP/SMS can improve the State/service provider's ability to gather safety data about safety risks and present this as safety information to decision makers - in near real-time – so they can make better-informed and defensible decisions.

6) **Enhanced communication of safety -** SSP/SMS provides a common safety language throughout an organisation and throughout the industry. A common safety language is a key enabler to the development of a common understanding of the organisation's safety goals and accomplishments. In particular, it provides an appreciation for the organisation's safety objectives, safety performance indicators and safety performance targets, which provide the direction and motivation for safety. Staff will be more aware of the State/organisation's performance against its safety targets, and their individual contribution to the organisation's safety success.

   The common safety language enables the aggregation of safety information across organisational entities. It is desirable for service providers with multiple aviation businesses. It is necessary for States overseeing multiple entities that are separate but have important interfaces.

7) **Demonstrable evidence that safety is a priority -** SSP/SMS provides demonstrable evidence that safety is a priority for the organisation. It can be demonstrated how:

   - management supports and enables safety;
   - safety risks are identified and managed; and
   - safety is assured and continually improved.

   This results in increased confidence by the aviation community, internal and external to the organisation. Staff are confident about the organisation's safety performance – which can lead to the increased attraction and retention of high calibre staff. States and regional safety oversight organizations (RSOOs) are confident about the service provider's safety performance - which can lead to a change in regulatory involvement. This could ultimately decrease direct and indirect oversight costs. The general public is confident about the State and individual service provider's safety performance – which can lead to increased aviation activity, on-going viability and public/shareholder confidence.

8) **Resource Optimisation -** Having more safety information from multiple sources will enable more data-driven decision making. This enables decision makers in States and service providers to allocate:

   - decisions to the appropriate level; and
   - resources according to greatest concern or need.

9) **Possible Insurance Savings -** Some service providers may experience insurance cost savings or reduced workers' compensation premiums due to SMS results.

10) **Cost Savings -** Once effectively implemented, SSP/SMS can reduce the cost of operations by exposing inefficiencies in existing processes and systems. Integration with other internal or external management systems may also save additional costs.

11) **Cost Avoidance -** Proactive hazard identification and safety risk management can avoid the costs of having an occurrence. Direct costs from avoiding an occurrence may include: equipment repairs, compensation, injuries, property damage and schedule delays. Indirect costs may include: loss of business and damage to reputation, legal action, surplus spares, tools and training, increased insurance premiums, loss of staff productivity, equipment recovery and clean-up, cost of internal investigation, loss of use of equipment leading to short term replacement equipment.

12) Increased Income - Depending how the State or service provider is set up, effective safety management can potentially improve income for the organisation through a positive public image and increased market share and departures. This in turn could lead to a more favourable perception by the aviation community.

1.2 ANNEX 19 - SAFETY MANAGEMENT

1.2.1 Historical background

1.2.1.1 The provisions in Annex 19 were developed in response to recommendations provided by the Directors General of Civil Aviation Conference on a Global Strategy for Aviation Safety (Montréal, 20 to 22 March 2006) (DGCA/06) and the High-level Safety Conference (Montréal, 29 March to 1 April 2010) (HLSC/2010) regarding the need for an Annex dedicated to safety management. The Air Navigation Commission, having determined these issues to be of sufficient scope and importance, agreed to establish the Safety Management Panel (SMP) to provide recommendations for the development of the Annex.

1.2.2 Development of Annex 19

1.2.2.1 In its report to the ICAO Council on the HLSC/2010 outcomes, the Air Navigation Commission recommended that the development of the new Annex follow a two-phased process.

Annex 19 - Phase One

1.2.2.2 Phase one was to establish the safety management Annex through the consolidation and reorganization of existing SARPs.

1.2.2.3 In February 2012 the SMP delivered its recommendations for the transfer of the safety management provisions in Annexes 1; 6, Parts I, II and III; 8; 11; 13 and 14, Volume I to a new Annex 19. The ICAO Council adopted Annex 19 on 28 February 2013 and the new Annex became applicable on 14 November 2013.

1.2.2.4 Although the new Annex was not intended to introduce any new provisions, some modifications were made for the purposes of consistency and clarity. The following provisions were considered new:

- applicability of the SMS framework was extended to organizations responsible for the type design and manufacture of aircraft;
- four components of the SSP framework were elevated to the status of Standards in Chapter 3;
- scope of the State safety oversight (SSO) system critical elements (CEs) found in Appendix 1 addressed all service providers; and
- Safety data collection, analysis, sharing and exchange (Chapter 5) and the Principles for protection of safety data, safety information and related sources (Appendix 3) were introduced to support safety management activities.

1.2.2.5 Select sector-specific safety management requirements were retained in the Annex applicable to the field or activity of each specific service provider (e.g. requirements for flight data analysis programmes for air operators are retained in Annex 6, Part I).

Annex 19 - Phase Two

1.2.2.6 Phase two incorporates recent developments in safety management and lessons learned to date. The Safety Management Panel (SMP) and the Safety Information Protection Task Force (SIPTF) together contributed to the proposals for the first amendment to Annex 19. Amendment 1 was adopted by the Council on 2 March 2016, became effective on 11 July 2016 and is applicable on 7 November 2019. It addressed the following areas:

- An upgrade to SSP elements integrated with the SSO system CEs;
- The enhancement of SMS provisions, including the extension of an SMS to organizations responsible for the type design and/or manufacture of engines and propellers; and

- An upgrade and enhancement of provisions for the protection of safety data, safety information and related sources.

1.2.2.7 The second edition of Annex 19 was published as a result of the adoption of Amendment 1. This edition reflects the extensive nature of the amendment that completes the second phase of the development of the Annex.

1.2.2.8 The implementation of safety management provisions is highlighted in the GASP, which prioritizes the implementation of a SSO system as a prerequisite to establishing an SSP.

1.3 SAFETY MANAGEMENT APPLICABILITY

1.3.1 Initial Introduction

1.3.1.1 The applicability dates for the original introduction of safety management provisions in the sector-specific Annexes are shown in Table 1 and Table 2, for States and service providers, respectively.

Description	Annex	Applicability Date
Safety Programme	6, 11 and 14	23 November 2006
State Safety Programmes	1, 8, 13	18 November 2010
SSP Framework (Attachment)	1, 6, 8, 11, 13 and 14	18 November 2010

Table 1: Initial introduction of safety management SARPs for States

Description	Annex	Service Provider	Applicability Date
Safety Management Programme	11, amdt. 40	Air Traffic Services (ATS) Providers	1 November 2001
Safety Management Programme	14, Vol 1, amdt. 4	Certified Aerodromes	1 November 2001
Safety Management Systems (SMS)	11, amdt 44	ATS providers	23 November 2006
SMS	14, Vol 1, amdt. 8	Certified Aerodromes	23 November 2006
SMS	6, amdt. 31	Air Operators and Approved Maintenance Organizations (AMOs)	1 January 2009
SMS	6, Part II, amdt. 27	International general aviation	18 November 2010
SMS	1, amdt. 169B	Safety Management principles applied to the medical assessment process of license holders and Approved Training Organizations	18 November 2010
SMS Framework (Appendix)	1, amdt. 169B	Approved Training Organizations	18 November 2010
SMS Framework (Appendix)	6, amdt. 33B	Air Operators and AMOs	18 November 2010

Description	Annex	Service Provider	Applicability Date
SMS Framework (Appendix)	11, amdt. 47B	ATS providers	18 November 2010
SMS Framework (Appendix)	14, Vol 1, amdt. 10B	Certified Aerodromes	18 November 2010
SMS	8, amdt. 101	Aircraft design and manufacturing organizations	14 November 2013

Table 2: Initial introduction of safety management SARPs for industry

1.3.2 Scope of Safety Management

1.3.2.1 State safety management responsibilities for all States are outlined in Annex 19, Chapter 3 and include requiring the service providers and operators identified in that Chapter to implement SMS. Safety management systems provisions are found in Chapter 4 and Appendix 2 of Annex 19.

1.3.2.2 Occupational safety, health and environment (OSHE) (also referred as occupational health and safety [OHS] or workplace health and safety [WHS]) is a field concerned with the safety, health, and welfare of people at work. The primary difference between aviation safety management and occupational health and safety (OSHE) systems is the intent. In many States employers have a legal duty to take reasonable care of the health and safety of their employees. The intention of OSHE programmes is to meet the legal and ethical obligation by fostering a safe and healthy work environment. These issues are normally addressed under a different government ministry from the one that handles aviation matters. As such, Annex 19, Chapter 2, Applicability, is written to intentionally exclude these issues from the scope of SSP and SMS by indicating that, "*The Standards and Recommended Practices contained in this Annex shall be applicable to safety management functions related to, or in direct support of, the safe operation of aircraft.*"

1.3.2.3 No provision of Annex 19 is intended to transfer to the State the responsibilities of the aviation service provider or operator. This includes functions related to, or in direct support of, the safe operation of aircraft. States possess many tools to manage safety within its system and should consider the best options for the oversight of aviation activities that may not fall within current ICAO Annexes or are new or emerging activities.

1.3.3 SMS applicability

1.3.3.1 The assessment to determine the applicability of SMS was based on a set of criteria. These same criteria are expected to be used periodically to reassess the need to extend the applicability to other aviation organizations.

Total system approach

1.3.3.2 A systems safety approach considers the entire aviation industry as a system, and all entities (States and service providers) - and their safety management systems - as sub-systems. From this perspective, the State can consider the interactions and cause and effects throughout the whole system. To maximise interoperability between the individual sub-systems, ideally, all States and services providers would implement the same basic safety management processes. However, in reality, it is often impossible or impractical to build all SMS the same. In all likelihood, the primary concern of States and service providers will be how to best manage the interfaces between the similar interacting systems.

1.3.3.3 When considering SMS applicability, the link between the activity or category and other service providers who already have an SMS requirement under Annex 19 was considered. Application of SMS should reduce the risk of safety gaps or overlaps and responsibilities not increase safety risk through decreased interoperability.

Effectiveness of safety risk management across service providers

1.3.3.4 For safety risk management (SRM) to be effective across service providers there should be defined responsibilities for identification of hazards and management of associated safety risks for the entire chain of services within the system; without gaps or overlaps. Where a service provider with an SMS requirement contracts to an organisation not subject to SMS, the hazards and safety risks entailed by the contractor are addressed by the SMS of the service provider. This places additional SRM responsibilities on the service provider to ensure they are knowledgeable about the safety risks induced by the activities of the contractor. For more information on safety risk management, see Part I, Chapter 2.

Practicality of SMS implementation

1.3.3.5 Annex 19 defines SMS as a systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies, and procedures. For some organisations, such organisational structures and capabilities may be too challenging to effectively implement SMS. It may be impractical to implementation SMS if the organisation lacks the required expertise or structures to fully understand the impact of the products or services that they deliver on aviation safety.

Safety risk control through legislation

1.3.3.6 It should be assessed whether the existing legislation adequately addresses the hazards entailed by the category or activity. It could be that existing requirements provide sufficient safety risk mitigation and imposing a requirement for SMS in addition to the prescriptive requirements may not yield substantial safety benefit.

1.3.4 Discretionary SMS applicability

1.3.4.1 The criteria outlined above may also serve as guidance for States when considering an extension of SMS applicability beyond that defined in Annex 19 or to promote voluntary application. Application of discretionary SMS applicability should be thoughtfully considered before acting. If the decision is taken, the SMS implementation should be monitored as part of the SSP. The decision to extend the SMS applicability should take into account the safety risks identified in the State. Before requiring SMS, States are asked to consider:

- if there are any other viable options for achieving the desired improvement in safety performance; and
- the additional resources required by the State and industry sector to monitor and implement SMS.

1.3.4.2 States should weigh the possible safety benefits of extending SMS applicability against the cost for the industry and the additional resources required by the State for the acceptance and monitoring. In particular States should consider the possible impact on staffing and the potential challenges in acquiring the necessary skills and knowledge.

1.3.4.3 Each State should consider the acceptable level of safety performance across their industry and institute an SMS applicability regime that is most likely to achieve their State's safety performance objectives, noting that this is a dynamic situation that should evolve in continual alignment with the State's safety performance.

1.3.5 Applicability for State owned or military service providers

1.3.5.1 In some States, the State civil service or the military has a service provider function. Some civilian service providers are contracted services by the military and some military organizations provide civilian service. Regardless of the arrangement in the State, the Annex 19 applicability requirements for SMS pertain to the organization providing the service. The State or service provider's system description should have regard for the functions of these organisation and their relationships to each other. The accountable executive of the service provider, whether civil or military, should be capable of explaining the arrangements, and how safety risks are managed. Put simply, service providers should manage safety, regardless of the organisational arrangements.

1.3.5.2 Where the State operates as a service provider there should be clear separation from the service provider functions and the State oversight organisation functions. This should be accomplished by having clearly defined roles and responsibilities for individuals to ensure there are no conflicts of interest.

1.4 IMPLEMENTING SAFETY MANAGEMENT

1.4.1 Prerequisites for implementation

There are prerequisites which organisations should consider before implementing an SSP or SMS:

- **Senior management commitment**: It is essential that senior management of all affected areas be committed to an effective implementation.
- **Safety oversight capability**: The State should already have a mature oversight system in place for the licensing, certification and approval of individuals and organizations performing aviation activities in their State, including qualified technical personnel.
- **Enforcement regime**: An enforcement policy and frameworks to enable parties to manage and resolve deviations and minor violations.
- **Safety information protection**: It is essential to have the protective legal framework to ensure the continued availability of safety data and safety information.

1.4.2 System description

1.4.2.1 The system description provides a starting point to implement the SSP/SMS. It is used to identify the processes, activities and interfaces that need to be assessed for hazard identification and safety risk assessment.

1.4.2.2 For guidance on how to describe the system – States refer to Part III, Chapter 1; service providers refer to Part III, Chapter 2.

1.4.3 Interfaces

1.4.3.1 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). States and service providers have greater control over any related safety risks when interfaces are identified and managed. Interfaces should be defined within the system description.

Interface safety impact assessment

1.4.3.2 The State or service provider should identify any hazards related to the interfaces and carry out a safety risk assessment using its existing hazard identification and safety risk assessment processes (see Part I, Chapter 2 for details). For external interfaces, the State or service provider may consider working with the other organization to determine an appropriate safety risk control strategy based on the safety risks identified. The organizations working collaboratively may be able to identify hazards, assessing the safety risk as well as determining the appropriate safety risk control. This collaborative effort is needed because the safety risk perception may not be the same for each organization. The State, service provider and/or external organizations may carry out the safety risk control.

1.4.3.3 It is also important to recognise 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).

Managing and monitoring the interfaces

1.4.3.4 States and service providers are ultimately responsible for managing and monitoring their interfaces to ensure the safe provision of services. An effective approach to interface safety risk management is to establish formal agreements between interfacing organisation with clearly defined responsibilities.

1.4.3.5 All safety issues or safety risks related to the interfaces should be documented and made accessible to each organization for sharing and review. This allows lessons to be shared and safety data to be pooled. Sharing also enables transfer of knowledge and working practices that could improve the safety effectiveness of each organization.

1.4.4 Gap analysis

A gap analysis should be conducted before embarking on a safety programme/system implementation. The gap analysis aims to expose the gap between the current organisational structures and processes, and those required for effective SSP or SMS operation. For SSP the gap analysis should include a review of the Universal Safety Oversight Audit Programme (USOAP) protocol questions that are considered to be prerequisites for each element.

1.4.5 Implementation plan

The SSP or SMS implementation plan should provide a clear picture of the resources, tasks and processes required to implement the programme/system. Timing and sequencing of the implementation tasks and key responsibilities should be included in the plan. For guidance on how to implement safety management – States refer to Part III, Chapter 1; service providers refer to Part III, Chapter 2.

1.4.6 Maturity assessment

Once the basic aspects of the SSP or SMS are implemented, an assessment can be conducted to ensure the necessary component and functions are present and suitable for purpose. As the system matures, evidence should be sought that provides assurance that the programme/system is operating as intended, and is effective at achieving its stated safety objectives and targets.

1.4.7 Size and complexity considerations

1.4.7.1 Each State and each service provider is different. SSPs and SMSs are designed to be scalable to meet the exact needs of each State and service provider. All components and all elements of SSP/SMS are interconnected and interdependent, and necessary for the programme/system to function effectively. Although it is tempting, it is important that SSP and SMS are not implemented in too prescriptive a manner to avoid defeating the purpose - to complement the traditional prescriptive requirements with a performance-based approach.

1.4.7.2 An important aspect of SSP and SMS design is scalability to ensure the SSP/SMS is commensurate with the size and nature of the organisation. The programme/system is designed to deliver the desired outcomes for each organisation without being burdensome. On the contrary, SSP and SMS – well implemented – should augment and enhance existing systems and processes. With thoughtful planning and implementation, the programme/system will fit and reflect the size, shape and operating context and complexity of any aviation organisation.

1.4.7.3 For guidance on how to appropriately scale the SSP/SMS – States refer to Part III, Chapter 1; service providers refer to Part III, Chapter 2.

1.5 INTEGRATED RISK MANAGEMENT

1.5.1 The aviation system as a whole comprises many and different functional systems such as operations, finance, environment, safety and security. These share important features as they are all concerned with the risk of events with consequence of various magnitudes. Safety and Security are often confused with each other, but, they differ in the important element of intent. Security is concerned with the malicious, intentional acts to disrupt the performance of a system. Safety is focusing on negative impact to the concerned systems' performance caused by unintended consequences of a combination of a host of factors.

1.5.2 In the operational context all of the functional systems produce some sort of risk that needs to be appropriately managed to lessen any adverse consequence. Traditionally each system has developed sector-specific risk management frameworks and practices designed to address the distinct characteristics of each system. Most of those risk management practises include comprehensive analysis on intra-system consequences, often referred to as the management of unintended consequences. Another aspect is inter-system consequences resulting from system

specific risk management processes. This relates to the fact that a very effective risk management strategy of one specific sector can have an adverse impact on another operational sector of aviation. In aviation, the most often emphasized inter-system dependence is the safety/security dilemma. Very effective security measure may have negative impacts on the safety component, and vice versa.

1.5.3 Successful risk management in aviation needs to aim at the overall risk reduction of the system, including all of the involved functional systems. This process requires the analytical process of a holistic system assessment at the highest level of the appropriate entity (State, regional organizations, service providers). The holistic assessment and integration of functional system needs and interdependence is referred to as integrated risk management (IRM). IRM focuses on the overall risk reduction of the organization (whereas organization may refer to States as well as service providers). This is achieved through formalized quantitative and qualitative analysis of both the inherent risks, and even more so the effectiveness and impact of sector-specific risk management processes. IRM has a system wide responsibility to coordinate, harmonize and optimize risk management processes with the single goal of risk reduction. This may involve emerging aspects such as risk communication and social-network analysis. IRM cannot replace the operating specific risk managements of the functional systems, and at the same time does not intent to delegate additional duties and responsibilities to them. IRM is a distinct high level concept to leverage the expert advice of sector specific risk management and provide holistic feedback to achieve the highest level of system performance at a socially acceptable level.

2. Chapter
SAFETY MANAGEMENT FUNDAMENTALS

2.1 CONCEPT OF SAFETY AND ITS EVOLUTION

2.1.1 Context

2.1.1.1 Within the context of aviation, safety is “the state in which aviation safety risks are reduced or controlled to an acceptable level through a continuing process of hazard identification and safety risk management”.

2.1.1.2 While the elimination of aircraft accidents and/or serious incidents remains the ultimate goal, it is recognized that the aviation system cannot be entirely free of hazards and associated safety risks. Human activities or human-built systems cannot be guaranteed to be absolutely free from errors and their consequences. Therefore, aviation safety is dynamic and safety risks must be continuously mitigated. It is important to note that the acceptability of safety performance is often influenced by domestic and international norms and culture. 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.

2.1.1.3 The history of the progress in aviation safety can be divided into four eras as listed below and illustrated in **Figure** 1.

a) **Technical era** — 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. 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 era** — from the early 1970s until the mid-1990s. In the early 1970s, the frequency of aviation accidents was significantly reduced 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 issues including the man/machine interface. Despite the investment of resources in error mitigation, human factors continues 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 first acknowledged that individuals operate in a complex environment, which includes multiple factors having the potential to affect behaviour.

c) **Organizational era** — from the mid-1990s to the present day. During the organizational era safety began to be viewed from a systemic perspective, which was to encompass organizational factors in addition to human and technical factors. As a result, the notion of the “organizational accident” was introduced, considering the impact of organizational culture and policies on the effectiveness of safety risk controls. Routine safety data collection and analysis using reactive and proactive methodologies enabled organizations to monitor known safety risks and detect emerging safety issues. These enhancements formulated the rationale for moving towards a safety management approach.

d) **Total Aviation System Approach** — from the 2000s into the future. As of today, many States and service providers have reached a higher level of maturity with the implementation of their SSP or SMSs. However, SMSs have focused more on their own safety performance and what they have control over rather than consider the wider context of the total aviation system. This has led to growing recognition of the complexity of the aviation system and the different organisations that all play a part in aviation safety. There are numerous examples (accidents

and incidents) showing that interfaces with other organizations have contributed to negative outcomes.

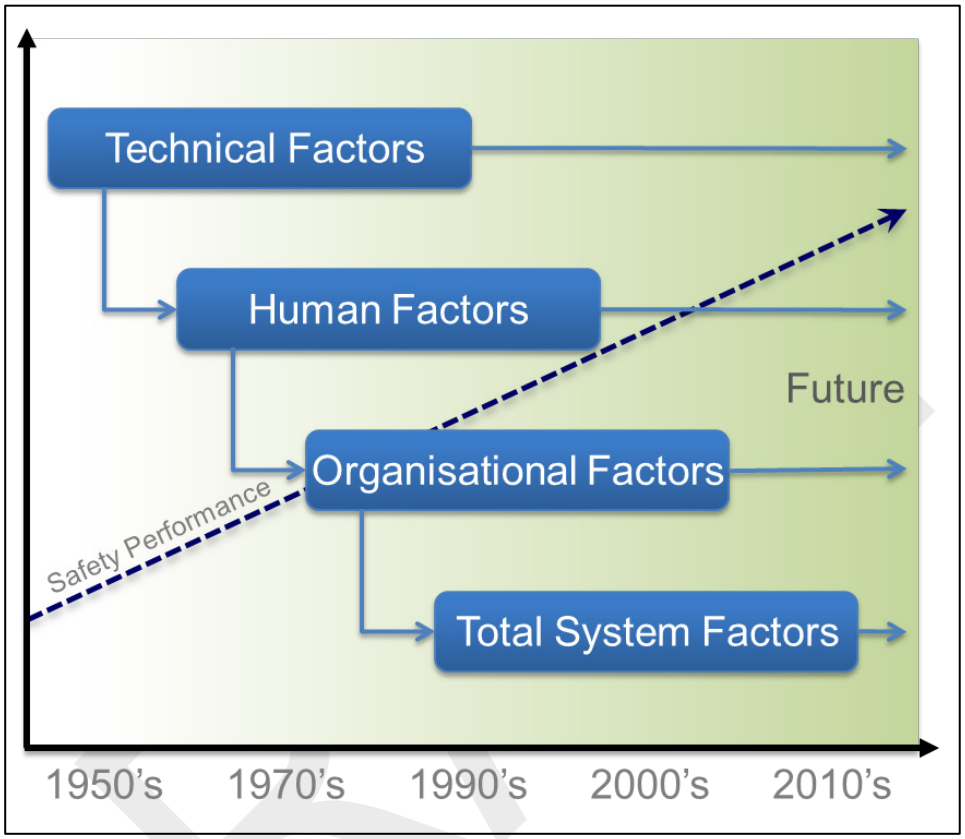


Figure 1: Evolution of safety

2.1.1.4 This has led to States and service providers considering the interactions and interfaces between the different parts of the system (human, social, technical, information, political, economic and organisational). This also requires a greater focus on the positive part that people play in the system. This requires greater collaboration between service providers and in some cases between service providers and States. This has also resulted in a number of initiatives that recognize that multiple service providers need to act together to address a safety issue (e.g. the ICAO Runway Safety Programme).

2.1.1.5 This requires the interfaces and interactions between all the different organizations in the aviation system (including States) to be understood and managed effectively to improve safety performance. States are also starting to recognize the total aviation system in how they develop their SSP and manage safety risks that cut across different types of service providers.

2.2 ACCIDENT CAUSATION

2.2.1 Swiss cheese metaphor

2.2.1.1 The "Swiss-Cheese" Model, developed by Professor James Reason, illustrates that accidents involve successive breaches of multiple system defences. These breaches can be triggered by a number of enabling factors such as equipment failures or operational errors. Since the Swiss-Cheese Model contends that complex systems such as aviation are extremely well defended by layers of defences, single-point failures are rarely consequential in

such systems. Breaches in safety defences can be a delayed consequence of decisions made at the highest levels of the organization, which may remain dormant until their effects or damaging potential are activated by specific operational circumstances. Under such specific circumstances, human failures or active failures at the operational level act to breach the system's inherent safety defences. The Reason Model proposes that all accidents include a combination of both active and latent conditions.

2.2.1.2 Active failures are actions or inactions, including errors and rule breaking, which have an immediate adverse effect. They are generally viewed, with the benefit of hindsight, as unsafe acts. Active failures are generally associated with front-line personnel (pilots, air traffic controllers, aircraft mechanical engineers, etc.) and may result in a harmful outcome.

2.2.1.3 Latent conditions are those that exist in the aviation system well before a damaging outcome is experienced. The consequences of latent conditions may remain dormant for a long time. Initially, these latent conditions are not perceived as harmful, but will become evident once the system's defences have been breached. People far removed in time and space from the event generally create these conditions. Latent conditions in the system may include those created by a lack of safety culture; poor equipment or procedural design; conflicting organizational goals; defective organizational systems or management decisions. The perspective underlying the organizational accident aims to identify and mitigate these latent conditions on a system-wide basis, rather than through localized efforts to minimize active failures by individuals.

2.2.1.4 **Figure 2** illustrates how the Swiss-Cheese Model assists in understanding the interplay of organizational and managerial factors in accident causation. It illustrates that various defences are built into the aviation system to protect against variations in human performance or decisions at all levels of the organization. While these defences act to protect against the safety risks, breaches that penetrate all defensive barriers may potentially result in a catastrophic outcome. Reason's Model represents how latent conditions are ever present within the system prior to the accident and can manifest through local triggering factors. It is important to recognize that some of these defences sit within other organizations, it is therefore important that the service provider assess and manage those defences, whoever is responsible for them. This also means that latent conditions may exist externally within the interfacing organization rather than the service provider itself.

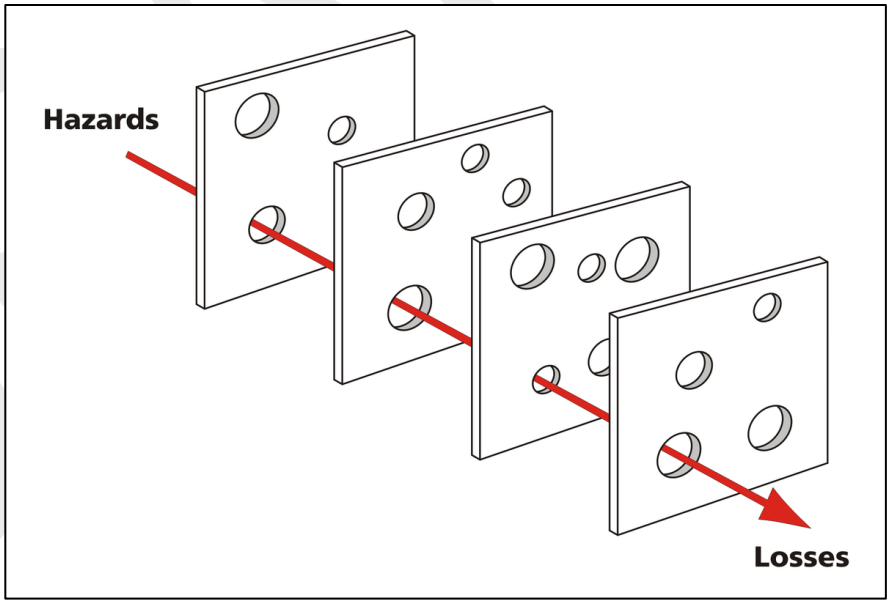


Figure 2: Concept of accident causation

2.2.2 Swiss Cheese applications for safety management

2.2.2.1 The 'Swiss Cheese' model of accident causation can be used as an analysis guide by both State and service providers. The model helps guide the user to look past the individuals involved in an incident or identified hazard into the organisational circumstances which may have influenced the situation. 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 organisation's defences were effective, which were breached and where additional ones are needed. Once identified, any weaknesses in the defences can be addressed by the organisation to bolster the organisation's defences against accidents and incidents.

2.2.2.2 It is important to note that the Swiss Cheese model is one of many models available to assist States and service providers in understanding accident causation and system deficiency. Organisations should consider the options available and implement a model that suits the size, complexity and operational context of their State/operation.

2.2.3 Practical drift

2.2.3.1 Scott A. Snook's theory of practical drift is used as the basis to understand how performance of any system "drifts away" from its original design. This results from the organization's processes and procedures not anticipating all situations that may arise in daily operations. It is also as a result of human factors and the people in the system optimising processes to get the task done.

2.2.3.2 During the early stages of system design, operational interactions between people and technology, as well as the operational context, are taken into consideration to identify the expected performance limitations as well as potential hazards. The initial system design is based on three fundamental assumptions: the technology needed to achieve the system production goals is available, the people are trained and competent to properly operate the technology, and the 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 (**Figure 3**).

2.2.3.3 Once operationally deployed, the system performs as designed, following baseline performance most of the time. In reality, however, operational performance is different from baseline performance as a consequence of real-life operations, human factors and changes in the operational environment. 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.

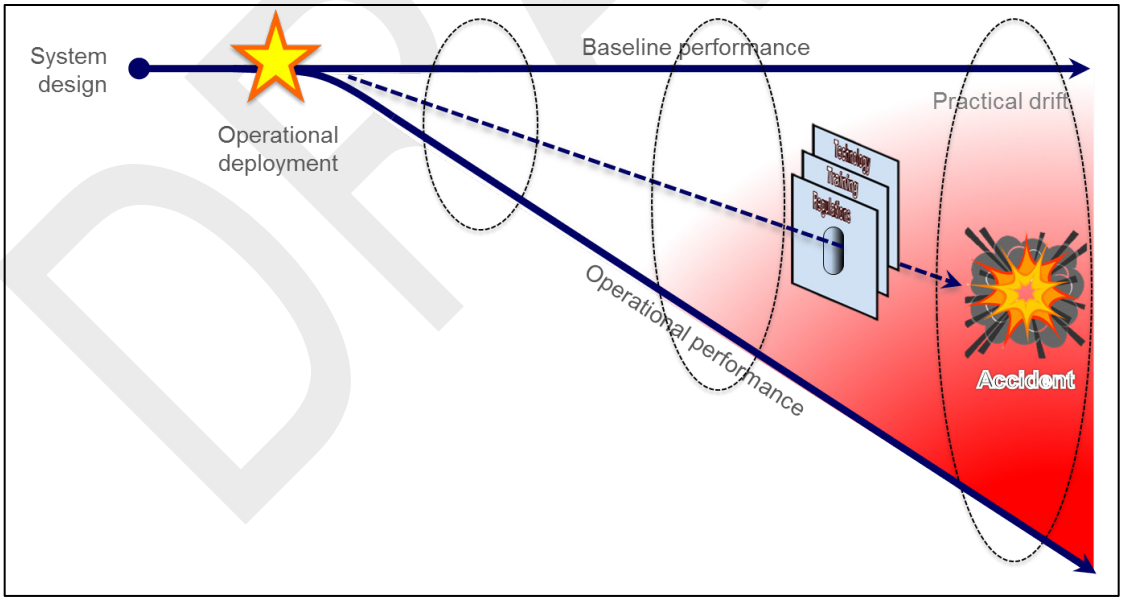


Figure 3: Practical drift

2.2.3.4 Practical drift is inevitable in any system, no matter how careful and well thought out its design planning may have been. Some of the reasons for the practical drift may include:

- technology that does not always operate as predicted;

- procedures that cannot be executed as planned under certain operational conditions;
- introduction of changes to the system, including the addition of new components;
- the interaction with other systems; and so forth.

2.2.3.5 The fact remains however that people make the system work on a daily basis despite all the shortcomings of the system leading to the drift, applying local adaptations (or workarounds) and personal strategies "beyond what the book says". These workarounds may bypass the protection of existing safety risk controls and defences.

2.2.3.6 Safety assurance activities such as audits and observations can help to expose practical drift. Analysing the safety information to ascertain why the practical drift is happening helps to mitigate safety risks. The closer to the beginning of the operational deployment that practical drift is identified, the earlier the organisation can intervene. If practical drift is allowed to continue unchecked, the likelihood of an incident or accident increases.

2.2.4 Humans in the system

2.2.4.1 Aviation is a complex system with many organizations and individual interacting together to provide a safe operation. The primary focus of safety management is on the organizational processes and procedures but it also relies on the humans in the system. The organization and the way it operates can also have a significant impact on human performance. Therefore, safety management necessarily addresses how humans can contribute both positively and negatively to an organisation's safety outcomes, recognising that human behaviour is influenced by the organisational environment. The following are key ways in which safety management processes do this:

- The role and responsibilities of the organisation and those of involved individuals with regards to safety management are recognised and described to ensure common understandings and expectations;
- Personnel are trained to ensure they are competent to perform their duties. The effectiveness of training of all involved individuals (including managers) is reviewed and training programmes are adapted to meet changing needs;
- Human resourcing levels are monitored and adjusted to ensure there are enough individuals to meet operational demands;
- Safety risk assessments include consideration of those safety risks related to variable human performance and human limitations;
- Procedures and processes are identified which aim to: a) optimise human performance; b) prevent inadvertent errors; c) reduce the consequences of sub-optimal human performance or d) encourage hazard reporting;
- Personnel are provided with information by the organisation that: a) identifies appropriate behaviours; b) describes organisational procedures and processes and the expectations of the organisation regarding individual behaviours; c) describes what actions will be/have been taken by the organisation in response to individual behaviours;
- On-going monitoring of safety outcomes includes assessment of whether procedures and processes are followed and rationales for diversions are investigated (see practical drift above);
- Safety investigations include the assessment of contributing human factors, examining not just behaviours but reasons for such behaviours (context).

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

2.2.4.3 Aviation is a complex system with many organizations and individual interacting together to provide a safe operation. The primary focus of safety management is on the organizational processes and procedures but it

also relies on the humans in the system. The organization and the way it operates can also have a significant impact on human performance. Therefore, safety management requires an assessment of the human contribution to safety and an understanding of how the organizations can affect human performance. Several terms related to the human in the system are commonly used and the relationship with SMS is described below:

- Human factors is everything that affects human performance. (How we understand and design how humans work)
- Human Performance is about how the human works and contributes to system performance.
- Therefore Human Factors needs to be addressed as part of safety management to optimise human performance with the objective of improving overall system performance.

2.2.4.4 Human Factors the whole of the aviation system and all of the organisations that operate within it (State aviation organisations and service providers). It is not always explicitly labelled as Human Factors but if it affects human performance then it is still Human Factors. The following are the key areas where Human Factors needs to be embedded within safety management processes:

- Analysis of safety data and safety information to identify Human Factors and Human Performance issues
- Assessing Human Factors as part of the safety risk assessment and safety investigations
- Monitoring Human Factors and Human Performance during normal operations
- There is adequate Human Factors expertise to support safety management activities
- Identify roles where Human Performance is safety critical
- Human Factors have been considered in designing systems, roles and supporting procedures (including safety risk mitigation)
- Staff (including managers) have received an appropriate level of training and are competent to perform their duties
- Human Factors is considered in communications
- Evaluation of culture and its impact on Human Performance
- Human Factors considerations for fitness for duty.

2.2.4.5 To address the way that the organisation influences human performance there needs to be senior level support to implement effective safety management (SMS/SSP). 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 organisation.

2.2.4.6 The impact of human factors on safety performance is well recognised and a number of models have been created to support the assessment of these impacts. The SHELL Model is useful to show the impact and interaction of the different system components on the human. This emphasizes the need to consider human factors as an integrated part of the safety risk assessment processes that the organisation conducts.

2.2.4.7 Figure 4 illustrates the relationship between the central human and workplace components. The SHELL Model contains the four satellite components:

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

2.2.4.8 **Liveware**. The critical focus of the model is the humans at the front line of operations. 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. To avoid tensions that may compromise human performance, the effects of irregularities at the interfaces between the various SHELL blocks and the central Liveware block must be understood. The jagged edges of the modules represent the imperfect coupling of each module The SHELL Model is useful in visualizing the following interfaces between the various components of the aviation system:

Figure 4: SHELL model

- **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. This considers how safety information is displayed and how switches and operating levers are labelled and operated so they are logical and intuitive to operate
- **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 recency of experience, accuracy, format and presentation, vocabulary, clarity and symbology. All processes and procedures should be written in plain language and written in way that they are understandable and can be followed as intended.
- **Liveware-Liveware** (L-L). The L-L interface is the relationship and interaction between people in the work environment. Some of these interactions are within the organization (colleagues, supervisors, managers) but many are between individuals in different organisations with different roles (air traffic controllers with pilots, pilots with engineers etc.). Therefore, it is important to recognize that communication and interpersonal skills, as well as group dynamics, play a role in determining human performance. The advent of crew resource management (CRM) and its extension to air traffic services (ATS) and maintenance operations has created a focus on team performance to manage errors. Also within the scope of this interface are staff / management relationships and organizational culture.
- **Liveware-Environment** (L-E). This interface involves the relationship between the human and the physical environment. This includes such physical considerations as temperature, ambient light, noise, vibration and air quality. This also considers the external environment includes operational aspects such as weather factors, infrastructure and terrain.

2.2.5 Errors and rule breaking

2.2.5.1 Humans should be considered as a key safety resource as they are capable of recognising and resolving threats to safe operations. However, it should be recognised that their ability to anticipate, adapt and innovate as wells as their other physiological, psychological and cognitive features that define them as humans, also makes them susceptible to making errors and breaking rules. Both errors and breaking rules can result in a significant incident or accident.

2.2.5.2 Understanding and investigating errors and rule breaking needs to go beyond examining an individual's actions to consider why they behaved the way they did, including to what extent they were influenced by organisational, regulatory and environmental factors. Therefore, safety management should aim to optimise human performance and increase system tolerance rather than focus on an individual committing errors or breaking rules.

2.2.5.3 Further, formal or informal punitive measures, whether taken by the service provider or the State in response to errors and rule breaking, may lead to a reduction in safety reporting. Hence, effective SMS implementation by the service provider as well as effective SMS monitoring by the State are both dependent upon a clear, mutual understanding of errors and rule breaking and their associated consequences.

2.2.5.4 The difference between errors and rule breaking lies in intent. An error can be described as "an action or inaction by an operational person that leads to deviations from organizational or the individual's intentions or expectations". The organisation needs to establish defences to reduce the likelihood of errors occurring and improve error detection. The use of checklists, cross checking, independent inspections and similar processes act as defences as well as capturing errors before they result in adverse consequences. Safety risk management must include consideration of organizational policies, processes and procedures related to communication, scheduling of personnel, allocation of resources and budgeting constraints that may contribute to the incidence of errors.

2.2.5.5 In contrast, rule breaking can be described as "a deliberate act or omission resulting in a deviation from established regulations, procedures or practices". However, rule breaking is not always an act of malicious intent and should not automatically result in disciplinary actions without understanding the reasons for breaking a rule.

2.2.5.6 Rule breaking can be further divided into two main categories:

- **Rule breaking for organisational gain**: This may be the result of organisational failings where the safest or most efficient or effective way for an individual to deal with a situation is rule breaking. This could be as a result of the unavailability of resources or commercial pressures or poorly written procedures.
- **Rule breaking for personal gain**: This is where the individuals benefit from the rule breaking (selfishness, laziness, bad attitude etc.). This indicates a greater disregard of safety and is more likely to result in punitive action.

2.2.5.7 This highlights the importance of an impartial safety investigation to ensure that appropriate follow-up actions to prevent similar future errors or breaking of rules, are undertaken.

2.2.5.8 To help reduce the numbers or errors and rule breaking situations and to improve safety, organizations should:

- Include in their safety policy an expectation that personnel should follow company policies, processes, and procedures at all times; where this is not possible personnel should immediately notify their supervisor;
- Develop and employ a disciplinary policy to deal with errors and rule breaking and apply the policy consistently. This should clearly define the line between acceptable and unacceptable behaviour and should result in increased safety reporting and greater openness in safety investigations. This should be supported with transparent processes and procedures on how the policy will be applied; and
- Modify company job descriptions to include procedural compliance as a job performance expectation, and use procedural compliance as one measure of management and worker performance.

2.3 MANAGEMENT DILEMMA

Safety management processes identify hazards with the potential to adversely affect safety. These processes also systematically assess the safety risk presented and implement ways to eliminate these hazards or mitigate the safety

risks associated with them. The result of these processes is to achieve an acceptable level of safety while maintaining profitability. Balancing the allocation of resources between profitability (production) and safety (protection) can achieve this. From a resource allocation perspective, the concept of a safety space is especially useful in describing how this balance is achieved.

2.3.1 Safety space

2.3.1.1 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 use technology, training and 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.

2.3.1.2 The safety space is 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 should involve 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.

2.3.1.3 On the other hand, excess allocation of resources for production at the expense of protection can have an impact on the safety performance of the production process or of 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 utilise financial management systems to recognise when they are getting too close to bankruptcy and should use the safety management system to recognise when they are getting close to have an accident – to operate successfully they have to balance both within the safety space boundaries. Refer to **Figure 5** for an illustration of the boundaries of an organization's safety space. Organizations will need to continuously manage the safety space as the safety risks and external influences on the organization will change over time.

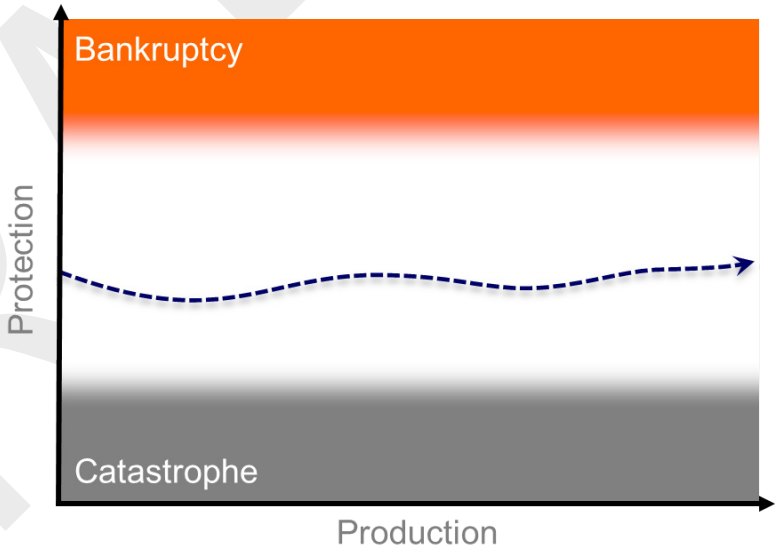


Figure 5: Safety space

2.3.1.4 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 its SSP, given the requirement to balance resources required for State protective functions that include certification and surveillance.

2.4 SAFETY RISK MANAGEMENT

2.4.1 Introduction to safety risk management

Safety risk management (SRM) is the key component of a safety management system that includes hazard identification, safety risk assessment, safety risk mitigation and risk acceptance. The term SRM is meant to differentiate this function from the management of financial risk, legal risk, economic risk and so forth. **Table** 3 below is a summary of the SRM processes. It is important to recognise that this is should be a continuous activity as some hazards, the safety risk assessment and the effectiveness of safety risk mitigations will change over time.

2.4.2 Human factors considerations in safety risk assessment

2.4.2.1 Assessing human factors (HF) risks is more complex than other aspects, like technology and environment. Implicit in SMS is the expectation that all aspects of organisational risk will be addresses, including those related to humans in the system HP issues should be considered as one of the many risks to be considered within an SMS

2.4.2.2 A mature SSP and SMS should consider both human and organizational factors as part of their risk management system. In the course of any hazard identification and risk mitigation exercise involving human elements, it is recommended that existing or new defences have taken human factors (HF) and organizational factors into consideration. Supplementary HF analysis may be conducted to support a particular risk mitigation exercise / team. An HF analysis provides an understanding of the impact of human error on the situation and ultimately contributes to the development of more comprehensive and effective mitigation / corrective actions.

2.4.2.3 A human error model is the basis of the analysis process. It categorizes errors so that contributing factors and root causes can be more readily identified and better understood. Individual actions and decisions viewed out of context can appear to be virtually random events, escaping their due attention. Human behaviour is not necessarily random and it is important to analyze the results of any investigations and events to look for trends and common issues. It is often an organizational factor that contributes to human error and unless these are identified and acted upon similar errors are likely to occur.

2.4.2.4 Ultimately, this important HF perspective results in a more comprehensive and in-depth mitigation process. An HF analysis ensures that during the organization's risk mitigation process the root causes and contributory factors are addressed.

Safety risk management decision making

2.4.2.5 Aviation decision makers can or should use safety risk decision-making tools and processes. As example of a safety risk decision aid is provided below in Table 2-1. A decision aid is used to ensure a repeatable, defensible, well-understood process is followed when making aviation decisions. In this case the following questions are asked:

Step	Meaning	Answer	Action
1	Start - Does the organisation or an individual think that there is a safety concern?	Yes	Go to S2
		No	Finish
2	Identify the hazard(s) and assess the safety risks by following the process above | Define the level of probability and severity | Define level of safety risk.		Go to S3
3	Is the safety risk level acceptable?	Yes	Go to S7
		No	Go to S4
4	Can the safety risk be eliminated?	Yes	Go to S7
		No	Go to S5

Step	Meaning	Answer	Action
5	Can the safety risk be mitigated?	Yes	Go to S6
		No	Go to S8
6	Is the residual safety risk (if any) acceptable?	Yes	Go to S7
		No	Go to S8
7	Take necessary actions and continue with the operation.		Go to S9
8	Do not perform the operation.		Go to S9
9	For feedback purposes, record the hazard and safety risks assessed and any mitigating actions taken - Finish.		

Table 3: Example of a safety risk based decision process

Introduction to hazards

2.4.2.6 Hazard identification is a prerequisite to the SRM process. For personnel involved in the SRM process a clear understanding of hazards and their related consequences is essential to the implementation of sound SRM.

2.4.3 Understanding hazard and consequences

2.4.3.1 For the purpose of aviation SRM, the term hazard should be focused on those conditions or objects that could cause or contribute to 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 2.5.13 and 2.5.14).

2.4.3.2 Consider, for example, a fifteen-knot wind, which is not necessarily a hazardous condition. In fact, a fifteen-knot wind blowing directly down the runway improves aircraft take-off and landing performance. However, a fifteen-knot wind blowing in a direction ninety degrees across a runway of intended take-off or landing creates a crosswind condition that may be hazardous due to its potential to contribute to an aircraft operational occurrence, such as a lateral runway excursion.

2.4.3.3 Hazards are an inevitable part of aviation activities. However, their manifestation and possible consequences can be addressed through various mitigation strategies to contain the potential for a hazard to result in unsafe operations of aircraft or aviation equipment.

2.4.3.4 There is a common tendency to confuse hazards with their consequences or outcomes. A consequence is an outcome that can be triggered by a hazard. For example, a runway excursion (overrun) is a projected consequence in relation to the hazard of a contaminated runway. By clearly defining the hazard first, one can then identify possible consequences or outcomes.

2.4.3.5 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 materializes through one or many consequences. It is therefore important for safety assessments to identify all likely consequences. The most extreme consequence, loss of human life, should be differentiated from those that involve the potential for lesser consequences such as increased flight crew workload, passenger discomfort or reduction in safety margins. The description of the consequences will facilitate the development and implementation of effective mitigation strategies through proper prioritization and allocation of limited resources. Detailed hazard identification will enable a more accurate assessment of the safety risk.

Hazard identification and prioritisation

2.4.3.6 Hazards exist at all levels in the organization and are detectable through use of reporting systems, inspections or audits. Hazards should be identified before they lead to accidents, incidents or other safety-related occurrences. An important mechanism for proactive hazard identification is a voluntary safety reporting system. Additional guidance on voluntary safety reporting systems can be found in Chapter 5. Information collected through such reporting systems may be supplemented by observations or findings recorded during routine site inspections or organization audits.

2.4.3.7 Hazards can also be identified from the review or study of internal and external investigation reports. The review of accident / incident investigation reports for hazards is a good mechanism to enhance an organization's hazard identification system. This is particularly relevant where an organization's safety culture is not sufficiently mature to support an effective voluntary safety reporting system or for a small organization where there may be limited events or reports.

2.4.3.8 An important source of safety data for hazard identification may come from ICAO or other international bodies or trade associations.

2.4.3.9 Hazard identification should also consider hazards that are generated outside of the organisation and hazards that are outside the direct control of the organisation such as extreme weather or volcanic ash. It is also important to consider hazards relating to emerging safety risks so that organisations are better prepared for when they become realised.

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

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

Occupational safety health and environment hazards

2.4.3.11 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 such 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. Since OSHE and aviation safety consequences of such compound hazards are not the same, due consideration should be taken to manage them separately. The purpose and focus of preventive controls for OSHE and aviation safety consequences would be different.

Hazard identification methodologies

2.4.3.12 The two main methodologies for identifying hazards are:

- **Reactive**. This methodology involves analysis of past outcomes or events. Hazards are identified through investigation of safety occurrences. Incidents and accidents are clear indicators of system deficiencies and therefore can be used to determine the hazards that contributed to the event.
- **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 that could lead to an incident or accident exists. The safety information for proactive hazard identification primarily comes from safety reporting systems and the safety assurance function, including internal audits, with its safety data and safety information

Hazards related to SMS interfaces with external organizations

2.4.3.13 The State or service provider should also identify any hazards related to SMS interfaces it has with external organizations. This should, where possible, be carried out as a joint exercise with the other relevant organizations. This should consider the operational environment of SMS interfaces and the different organization capabilities (human, procedures, equipment) that contribute to the safe delivery of the services or products in terms of availability, functionality and performance.

2.4.3.14 As an example an aircraft turnaround involves many organisations and individuals all working in and around an aircraft. In this situations there will be hazards relating to the interactions between individuals and the co-ordination of the turnaround activity.

2.4.3.15 More details on the management of SMS interfaces is found in Chapter 8

2.4 SAFETY RISK ASSESSMENT AND MITIGATION

2.4.1 Introduction to safety risk management

This section presents the fundamentals of safety risk assessment and mitigation. This includes the necessary actions to be taken once hazards and their consequences have been identified. It includes the following topics:

- safety risk probability;
- safety risk severity;
- safety risk tolerability; and
- safety risk mitigation.

2.4.2 Safety risk probability

2.4.2.1 The process of controlling safety risks starts by assessing the probability that the consequences of hazards will materialize. It is important to consider different accident scenarios so that all potential consequences are considered. Safety risk probability is the likelihood or frequency that a safety consequence or outcome might occur. The determination of probability can be aided by questions such as:

- Is there a history of occurrences similar to the one under consideration, or is this an isolated occurrence?

- What other equipment or components of the same type might have similar defects?
- How many personnel are following, or are subject to, the procedures in question?
- What is the exposure of the hazard under consideration? Such as the percentage of the time is the equipment or activity is in use.

2.4.2.2 Any factors underlying these questions will help in assessing the probability of the hazard consequences occurring, taking into consideration all foreseeable scenarios.

Foreseeable

2.4.2.3 An occurrence is considered foreseeable if a reasonable person should have anticipated that kind of occurrence under the circumstances. Identification of every conceivable or theoretically possible hazard is neither possible nor desirable; therefore, judgment is required to determine the adequate level of detail in hazard identification. Service providers should exercise due diligence in identifying significant and reasonably foreseeable hazards related to their product or service.

Note - *Regarding product design, the term "foreseeable" is intended to be consistent with its use in airworthiness regulations, policy, and guidance.*

2.4.2.4 Table 4 presents a typical safety risk probability classification table, in this case, a five-point table. The table 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 whereas quantitative terms could be defined to provide a more accurate assessment if appropriate safety data is available.

2.4.2.5 It must be stressed that this is an example only and that the level of detail and complexity of tables and matrices should be adapted to be commensurate with the particular needs and complexities of different organizations. Also, it should be noted that organizations might include both qualitative and quantitative criteria.

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

Table 4: Safety risk probability table

2.4.3 Safety risk severity

2.4.3.1 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 occur as a consequence or outcome of the identified hazard. The severity classification should consider the following:

- Fatalities or serious injury as a result of:
  - being in the aircraft;

- direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or
- direct exposure to jet blast;

- Damage
  - Aircraft sustains damage or structural failure which:
    - adversely affects the structural strength, performance or flight characteristics of the aircraft; and
    - would normally require major repair or replacement of the affected component;
  - ATS or aerodrome equipment sustains damage which:
    - management of aircraft separation is adversely affected; or
    - landing capability is adversely affected.

2.4.3.2 The severity assessment should consider all possible consequences related to a hazard, taking into account the worst foreseeable situation. **Table** 5 below 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.

Severity	Meaning	Value
Catastrophic	• Aircraft / equipment destroyed • Multiple deaths	A
Hazardous	• A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely • Serious injury • Major equipment damage	B
Major	• A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency • Serious incident • Injury to persons	C
Minor	• Nuisance • Operating limitations • Use of emergency procedures • Minor incident	D
Negligible	• Few consequences	E

Table 5: Safety risk severity table

2.4.4 Safety risk tolerability

2.4.4.1 The safety risk probability and severity assessment process can be used to derive a safety risk index. The index created through the methodology described above consists of an alphanumeric designator, indicating the combined results of the probability and severity assessments. The respective severity / probability combinations are presented in the safety risk assessment matrix in **Table** 6.

2.4.4.2 The safety risk assessment matrix is used to determine safety risk tolerability. First For example, consider a situation where a safety risk probability has been assessed as occasional (4), and safety risk severity has

been assessed as hazardous (B). The composite of probability and severity (4B) is the safety risk index of the consequence.

Note.— *In determining the safety risk tolerability, the precision of the hazard identification and safety risk probability should be considered to ensure appropriate conservatisms are applied.*

Safety Risk Probability		**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

Table 6: Example safety risk matrix

2.4.4.3 The index obtained from the safety risk assessment matrix should then be exported to a safety risk tolerability matrix that describes the tolerability criteria for the particular organization. Using the example above, the criterion for safety risk assessed as 4B falls in the “unacceptable under the existing circumstances” category. In this case, the safety risk index of the consequence is unacceptable. The organization should therefore:

- take measures to reduce the organization’s exposure to the particular safety risk, i.e. reduce the probability component of the safety risk to an acceptable level;
- take measures to reduce the severity of consequences related to the hazard, i.e. reduce the severity component of the safety risk to an acceptable level; or (need to describe that to reach an acceptable safety risk can be accomplished by reducing severity or probability or a combination of both)
- If the safety risk cannot be reduced to an acceptable level cancel or don’t start the operation or activity.

Note.— *The inverted pyramid in* **Table** 7 *reflects a constant effort to drive the safety risk index and consequently managing safety risks towards the bottom apex of the pyramid.* **Table** 8 *provides an example of an alternate safety risk tolerability matrix.*

2.4.4.4 SRM encompasses the assessment and mitigation of safety risks. The objective of SRM is to assess the safety risks associated with identified hazards and develop and implement effective and appropriate mitigations. SRM is therefore a key component of the safety management process at both the State and product/service provider level.

2.4.4.5 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 immediate mitigation action is required or activities are stopped.

2.4.4.6 Safety risks assessed in the tolerable region are acceptable provided that appropriate mitigation strategies are implemented by the organization. A safety risk initially assessed as intolerable may be mitigated and subsequently moved into the tolerable region provided that such safety risks remain controlled by appropriate mitigation strategies. In both cases, a cost-benefit analysis may be performed if deemed appropriate.

2.4.4.7 Safety risks assessed as initially falling in the acceptable region are acceptable as they currently stand and require no action to bring or keep the probability and / or severity of the consequences of hazards under organizational control.

2.4.5 Safety risk mitigation

2.4.5.1 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. A safety risk mitigation is often referred to as a safety risk control.

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

- **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
- **Reduction**: The frequency of the operation or activity is reduced or action is taken to reduce the magnitude of the consequences of the safetyrisk.
- **Segregation**: Action is taken to isolate the effects of the consequences of the safety risk or build in redundancy to protect against them.

2.4.5.3 It is also important to avoid relying on a single human action as mitigation as this is subject to variations of human performance and the many external influences that can lead to errors. Where this is unavoidable additional error capturing strategies should be developed as part of the risk mitigation. Human performance limitations should be considered as part of any safety risk mitigation strategy.

2.4.6 Safety risk mitigation strategies

2.4.6.1 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 can be taken. Each proposed safety risk mitigation alternative should be examined from the following perspectives:

- **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.
- **Cost/benefit**. The extent to which the perceived benefits of the mitigation outweighs the costs.
- **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, etc.
- **Acceptability**. The extent to which the alternative is consistent with aviation community paradigms.

- **Enforceability**. The extent to which compliance with new rules, regulations or operating procedures can be monitored.
- **Durability**. The extent to which the mitigation will be sustainable and effective.
- **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.
- **Unintended consequences**. The introduction of new hazards and related safety risks associated with the implementation of any mitigation alternative.

2.4.6.2 Corrective action should take into account any existing defences and their inability 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.

2.4.7 Safety risk management documentation

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 basic spread sheet or table whereas for some organizations it may require a database or other software where large amounts of safety data and safety information needs to be stored and analyzed.

Tolerability Description	Assessed Safety Risk Index	Criteria
Intolerable	5A, 5B, 5C, 4A, 4B, 3C	Unacceptable under existing circumstances
Tolerable	5D, 5E, 4C, 4D, 4E, 3B, 3C, 3D, 2A, 2B, 2C, 1A	Acceptable based on the safety risk mitigation. It may require management decision
Acceptable	3E, 2D, 2E, 1B, 1C, 1D, 1E	Acceptable

Table 7: Example safety risk tolerability matrix

Safety Risk Index Range	Safety Risk Description	Recommended Action
5A, 5B, 5C, AA, AB, 3A	HIGH	Cease or cut back operation promptly if necessary. Perform priority safetyrisk mitigation to ensure additional or enhanced preventative controls are in place to bring down the safety risk index to moderate or low.
5D, 5E, 4C, 4D, 4E. 3B, 3C, 3D, 2A, 2B, 2C, 1A	MODERATE	Schedule performance of a safety risk assessment to bring down the safety risk index to low range if viable.

3E, 2D, 2E, 1B, 1C, 1D, 1E	LOW	Acceptable as is. No further safety risk mitigation required.

Table 8: Alternate example safety risk tolerability matrix

2.4.8 Cost-benefit analysis (CBA)

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

3. Chapter

SAFETY CULTURE

3.1 INTRODUCTION

3.1.1 Introduction to safety culture

3.1.1.1 Annex 19 has introduced the need for both States and service providers to promote a positive safety culture. This chapter covers guidance on what a safety culture is and how a positive safety culture can be promoted. Safety culture is an expression of how safety is perceived, valued and prioritized by management and employees in an organization as well as the relationship between States and service providers. Figure 6 illustrates some of the attributes of safety culture. Whether an organization realizes it or not, it will have a safety culture that reflects the organization's attitude and behaviours to safety and will exist at most levels within the organization. It has been described as "how an organization behaves in relation to safety and risk when no one is watching". In this section, the term "organization" encompasses both civil aviation authorities and service providers unless explicitly stated otherwise.

Figure 6: Safety culture

3.1.1.2 A safety culture within an organization can be regarded as a set of beliefs, norms, attitudes, roles and social and technical practices concerned with minimizing exposure of employees, managers, customers and members of the general public to conditions considered dangerous or hazardous.

3.1.1.3 A broad definition of safety culture is "Safety culture is the set of enduring values, behaviours and attitudes regarding safety issues, shared by every member at every level of an organization". It refers to the extent to which every individual and every part of the organization is:

- aware of the safety risks and known hazards induced by its activities;
- continuously behaving to preserve and enhance safety;
- willing and able to adapt when facing safety issues;
- willing to communicate safety issues; and
- consistently evaluating safety related behaviours throughout the organization.

3.1.1.4 The more individuals within an organisation incorporate these safety values, behaviours and attitudes as part of “how they do things in this organisation”, the more positive a safety culture an organisation will have. The collaborative nature of aviation activities and their complexity, procedures and data mean that most parts of an organization are related in some way or another to delivering safe outcomes. Safety culture should be meaningful to most individuals within an organization as it influences how people think; how people talk and how people act. Safety culture can be observed in all aspects of organizations activities: procedures, processes, documents, ideas, principles, rationale, goals, indicators, targets, behaviours, anecdotes and conversations.

3.1.1.5 Any service provider or State will have a unique safety culture, as no two organizations are identical. The safety culture may well vary within the service provider or State depending upon location and scope of activities, and this variation may be appropriate for different activities.

3.1.2 Value of safety culture

3.1.2.1 Safety culture is one of those nebulous things, like safety management. You cannot see it or touch it. You can only see evidence or absence of its existence. A safety culture is not something you get or buy; it develops over time and has to be maintained – like your professional reputation. A positive safety culture relies on a high degree of trust and respect between personnel and management and must therefore be created and supported at the senior management level. Like trust, positive safety culture takes time and effort to establish and can be easily lost.

3.1.2.2 Safety culture has a direct impact on safety performance. If someone believes that safety is not really important to themselves, the service provider or State, even temporarily, then workarounds, cutting corners, or making unsafe decisions or judgements may well be the result, especially when safety risk is perceived as low and there is no obvious danger. If management do not treat individuals who identify hazards and report adverse events in a consistently fair and just way, those individuals are unlikely to be willing to communicate safety issues or to work with management to effectively manage their safety risks.

3.2 SAFETY CULTURE MATURITY

3.2.1.1 Various stages of maturity have been used to describe the development of an increasingly positive safety culture. While many maturity models are available, Figure 7 presents a five-level safety culture maturity model:

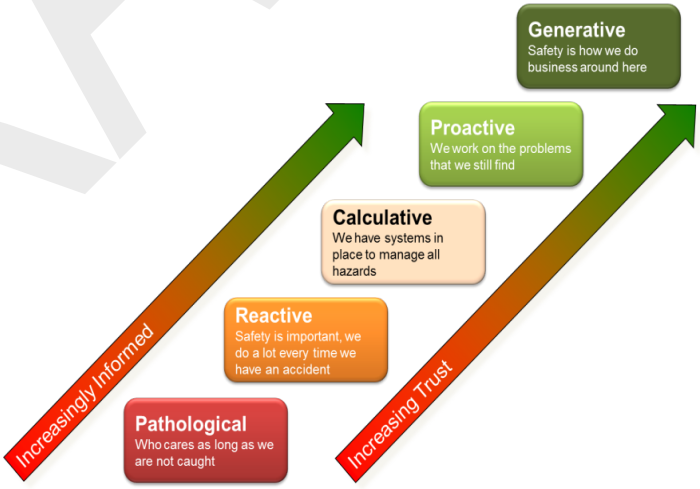


Figure 7: Safety culture maturity model

Pathological *(also known as emerging culture)*

3.2.2.1 In a pathological safety culture, safety is defined in terms of technical and procedural solutions and compliance with regulations and is not seen as a key business risk. There is a “who cares” approach to safety with many accidents seen as either “not going to happen to them” or as an unavoidable part of the job. Most frontline staff are uninterested in safety and may only use safety as the basis for other arguments (e.g. a change in shift patterns).

Reactive *(also known as managing)*

3.2.2.2 In a reactive safety culture, safety is generally regarded as a burden that is imposed from Authorities, regulations or the general public. Safety is taken into account to meet the requirements imposed by the regulations.

Action is taken only to satisfy the law, or after a safety occurrence, in which case it mainly consists of identifying and punishing the directly responsible person(s). Only in case of severe safety occurrences, it becomes a topic of communication and measures are taken to prevent recurrence. There is only a willingness to take action against an existing safety risk when it is too late. Behaviour is barely influenced by safety considerations. Unsafe behaviour to the benefit of other interests is allowed.

Calculative *(also known as involving)*

3.2.2.3 In a calculative safety culture, safety is taken into account in management's decision making, but in itself safety is not a core value. Action is only taken after a safety occurrence, and next to identifying directly responsible person(s), it also aims at investigating the organizational processes that might have played a role. A safety reporting system is installed to meet legal requirements, and is only used for gathering information in the aftermath of safety problems. There is a general awareness of the safety risks induced by its operations, and the organization is willing to take measures if these become too large. There are situations in which unsafe behaviour in the benefit of other interests is allowed, but in general there is a mutual expectation of safe behaviour.

Proactive *(also known as cooperating)*

3.2.2.4 In a proactive safety culture, safety is considered as a priority. Safety is a core value of the organization and plays an important role in decision making at management level as well as in day-to-day operations. The safety reporting system is not only used for detecting severe safety issues, but also for issues with less or no impact on safety. Safety reports only have consequences for the direct responsible(s) if there appear to be recklessness or negligence. The operations are regularly assessed on their level of safety, and safety measures are thoroughly evaluated after implementation. After a safety occurrence, the first concern of management is to prevent recurrence. Consideration is given not only to the individual but also to organizational factors. There is a general awareness of the safety risks induced by the operation, and action is taken to reduce them as much as possible.

Generative *(also known as continually improving)*

3.2.2.5 In a generative safety culture organizations set high standards and attempt to exceed them. They use failure to improve, not to blame. Management knows what is really going on, because the workforce tells them. People are trying to be as informed as possible, because it prepares them for the unexpected. This state of "chronic unease" reflects a belief that despite all efforts, errors will occur and those even minor problems can quickly escalate into system-threatening failures. An organization at the generative level will tend to be characterized by a need to seek further improvement even in the absence of incidents. Safety is not driven by numbers, but by a core value that safety is an integral part of the operation. Safety improvement is seen as an investment, not a cost. Typically, employees will feel comfortable and safe in airing issues and will have an almost absolute confidence and trust in their management team. Figure 8 includes questions which can help organizations determine whether values, behaviours and attitudes regarding safety are shared by every member of every level of the organization.

Figure 8: Safety Culture Values and Behaviours

PROMOTING A POSITIVE SAFETY CULTURE

Table 6 summarises what actions management may take to enable an increasingly positive safety culture within their organisation. Management actions are grouped to address key elements upon which an organization's safety culture is built.

Element	General Description	Enablers	Disablers
Commitment to safety			
	Commitment to safety reflects the extent to which appropriate levels within the organization have a positive attitude towards safety and recognizes its importance. Senior management should be genuinely committed to achieving and maintaining a high level of safety and give employees' motivation and the means to do so as well.	• Management leads safety culture and is actively motivating its employees to care for safety, not only by talking but by acting as role models • Management provides resources for a range of safety related tasks (e.g. training) • Continuous safety management oversight and governance is established	• Management is actively demonstrating that profit, cost reduction and efficiency come first • Investments to improve safety are often made when required by regulations or after accidents • Neither oversight nor governance with regards to safety management is established
Adaptability			
	Adaptability reflects the extent to which employees and the management are willing to learn from past experiences and are able to take action necessary in order to enhance the level of safety within the organization.	• Employee input is actively encouraged when addressing safety issues • All incidents and audit findings are investigated and acted upon • Organizational processes and procedures are questioned for their safety impact (high extent of self-criticism) • A clear proactive approach to safety is demonstrated and followed	• Employee input on safety issues is not sought from all levels of the employees • Actions are often taken only after accidents or when required by regulations • Organizational processes and procedures are considered adequate as long as no accident occurs (complacency or lack of self-criticism) • Even when an accident occurs the organization is unwilling to question itself. • A reactive approach to safety is demonstrated and followed.
Awareness			
	Awareness reflects the extent to which employees and management are aware of the aviation risks faced by the organization and its activities. From a State perspective personnel are aware of both the safety risks induced by their own activities and the organizations they oversee. Employees and management should be constantly maintaining a high degree of vigilance with respect to safety issues.	• An effective way of hazard identification has been established • Investigations seek to establish the root cause • The organization stays abreast of important safety improvements, and adapts itself accordingly as necessary • The organization systematically evaluates if safety improvements are	• No effort is spent on hazard identification • Investigations stop at the first viable cause rather than seek the root cause • The organization does not stay abreast of important safety improvements • The organization does not evaluate if safety improvements are implemented properly • Where appropriate members of the organization are not aware of

Element General Description	Enablers	Disablers
	implemented and working as intended • Where appropriate members of the organization are well aware of the safety risks induced by their individual actions and company operations / activities	the safety risks induced by their individual actions and company operations • Safety data is gathered but not analysed and acted upon
Behaviour with respect to safety		
Behaviour with respect to safety reflects the extent to which every level of the organization behaves such as to maintain and improve the level of safety. The importance of safety should be recognized and processes and procedures needed to maintain it should be put in place.	• The employees motivate themselves to act safely and by acting as role models • Continuous monitoring of safe behaviour is practised • Intentional unsafe behaviour is not tolerated by management and colleagues • The working conditions support aviation safety at all times	• Employees are not punished for intentional unsafe behaviour to the benefits of their own or other interests • The working conditions provoke behaviour and work-arounds that are detrimental to aviation safety • No monitoring of aviation safety within the organization's products or services is practised • Constructive criticism to the benefit of aviation safety is not welcomed
Information		
Information reflects the extent to which information is distributed to all necessary people within the organization. Employees should be enabled and encouraged to report aviation safety concerns and receive feedback on their reports. Work information related to aviation safety has to be communicated meaningfully to the right people in order to avoid miscommunication that could lead to hazardous aviation system situations and consequences. The State is open to share aviation safety related information to all service providers.	• An open and just safety-reporting environment exists. • Employees are provided with safety-relevant information in a timely manner in order to allow for safe operations or decisions to be made. • Management and supervisors regularly check whether safety-relevant information is understood and acted upon • Knowledge transfer and training with regards to aviation safety is actively practiced (e.g. sharing of lessons learned)	• A blaming safety reporting environment is evident • Safety relevant information is withheld • Safety communication is not monitored for its effectiveness • No knowledge transfer or training is provided
Trust		
Employees and operational personnel contribution to safety thrives in a reporting environment that fosters trust - trust that their actions or omissions, commensurate with their training and experience, will not be punished. A workable approach is to apply a reasonableness test – i.e. is it reasonable to anticipate that a person with the same level of experience and training might do, or fail to do, the same thing. Such an environment is fundamental to effective	• There is a distinction between acceptable and unacceptable behaviour, which is known to all employees. • Occurrences (including accidents and incidents) investigations consider individual as well as organizational factors. • Good aviation safety performance is recognized	• There is no identifiable distinction between acceptable and unacceptable behaviour. • Employees are systematically and rigorously punished for human errors. • Accident and occurrence investigations focus on individual factors only. • Good safety performance and safe behaviour is taken for

Element	General Description	Enablers	Disablers
	and efficient safety reporting. Effective safety reporting systems help to ensure that people are and remain willing to report their errors and experiences, so that States and service providers have access to relevant data and information that is necessary to address existing and potential safety deficiencies and hazards. Creating an environment in which people can be confident that safety data provides this assurance and safety information will be used exclusively for maintaining and improving safety.	and rewarded on a regular basis. • There is a willingness among employees and operational personnel to report events in which they have been involved.	granted.

Table 4-1: Safety culture attributes

3.3 SAFETY CULTURE AND NATIONAL CULTURE

3.3.1 National culture differentiates the characteristics of particular nations, including the role of the individual within society, the manner in which authority is distributed, and national priorities with respect to resources, accountabilities, morality, objectives and different legal systems. From a safety management perspective, national culture influences the organizational culture and plays a large part in determining the nature and scope of regulatory enforcement policies, including the relationship between regulatory authority personnel and industry personnel, and the extent to which safety information is protected.

3.3.1 Organizational culture may therefore be significantly affected by the national cultures present among the members of its workforce.

3.3.2 When applying a safety management programme, managers should closely assess and consider the differences in the national cultures of their personnel. For instance, safety risk perceptions can differ greatly between different national cultures. Safety-related aspects, including communication and leadership styles as well as the interaction between supervisors and subordinates, may need to reflect a multicultural workforce.

3.4 SAFETY CULTURE, SAFETY REPORTING

3.4.1 Reporting culture emerges from personnel beliefs about, and attitudes toward, the benefits and disadvantages associated with reporting systems and the ultimate effect on their acceptance or utilization of such systems. It is greatly influenced by organizational, professional and national cultures and is one means for judging the effectiveness of a safety system. A positive reporting culture aims to differentiate between intentional and unintentional deviations and determine the best course of action for both the organization as a whole and the individuals directly involved.

3.4.2 The success of a reporting system depends upon the continuous flow of information from, and feedback to, organisations and individuals. Policies and supporting processes that distinguish gross negligence and criminal activities from inadvertent errors are essential to assure the effective reporting of systemic safety deficiencies. A culture that fails to distinguish unintentional errors or mistakes from acts of gross negligence and criminal activities will inhibit the reporting process. If organisations or individuals avoid reporting for fear of punishment, States or service providers miss opportunities to gain important information.

3.4.3 Overall, organisations and individuals must believe that they will be supported in any reports made by them in the interests of safety (including personal mistakes) but they should understand that intentional unilateral breaches of safety policy by them would not be accepted. A voluntary safety reporting system should be operated in accordance with an appropriate disciplinary policy and, where practical, be confidential. This may be extended to the mandatory safety reporting system. An organisation or individual reporting anonymously can signify that while they want to identify potential hazards they are yet to feel confidence in the confidentiality of the reporting system and the

safety culture of the organization. An increase in confidential reports and a reduction in anonymous reports is usually a sign that the organization is making progress towards a more positive safety culture. The system should also provide feedback to personnel for the reports received. This requires secure and easy access to safety reporting systems, active safety data collection and analysis and management taking appropriate action and a means for communication feedback.

3.4.4 Safety data and safety information should be collected solely for maintaining or improving aviation safety, and their protection is essential in ensuring the continued availability of such data and information. This may be realized through a safety reporting system that is confidential, and not to be used for purposes other than maintaining or improving safety. The benefits are twofold. Often operational personnel are the closest to safety hazards, so the reporting system enables them to actively identify these hazards. At the same time, management is able to gather important safety hazard information and also build trust with personnel. For more information about the protection of safety data, safety information and related source, refer to Part II, Chapter 1.

3.5 PROMOTION AND ASSESSMENT OF A POSITIVE SAFETY CULTURE

3.5.1 The promotion of a positive safety culture starts at the top of the organization with visible safety leadership from the Accountable Executive. It is communicated through the safety policy and through training and other promotional material. It needs constant reinforcement so it becomes the way the organization does business. The promotion of a safety culture must be positively reinforced by everyone in the organization, including the accountable executive, who initially sets and actively promotes that culture.

3.5.2 The effectiveness of a safety culture can be assessed and monitored through the use of tangible metrics. Most organizations are in a position to introduce tools or surveys to carry out an internal safety culture assessment. Concurrently, industry organizations and/or regulators may consider developing promotional schemes (e.g. a safety culture award) to encourage service providers to participate in a voluntary assessment of their organizations. The parameters to be assessed in an assessment should include organizational factors and outcomes that are beyond conventional regulatory requirements, but which are nevertheless pertinent to an organization's safety culture, and therefore have an impact on its safety performance. This is the main purpose of an assessment. It serves to supplement traditional regulatory oversight by addressing organizational factors (latent conditions) that are otherwise beyond regulatory oversight.

3.5.3 Dependent upon the maturity of the organization's safety culture there are means by which the organization can assess the effectiveness of their safety culture (self or independent assessment) as well as drivers for the assessment (improvement or management of change):

3.5.4 Self-Assessment

3.5.4.1 The safety culture of an organization could be estimated through simple web-based self-assessment questionnaire. These questionnaires could include questions relating to their management commitment to safety with regard to the language of managers, their behaviour with regard to safety and service delivery and their responsibilities to safety issues. It could also include information relating to the organization's successful provision of resources in terms of facilities, people and training.

Independent Assessment

3.5.4.2 The safety culture of an organization may be assessed independently through a combination of questionnaires, interviews and workshops against a model of good safety culture. These safety culture elements may include the assessment of individual responsibilities and the degree to which operational staff and managers are willing and able to intervene or challenge their colleagues. It may also include evaluation of individuals at all levels within the organization regarding safety risk assessment and mitigation. This element may assess the degree to which the organization shares safety related information throughout its workforce. The sharing of information extends to the support within and between teams to enhance team working.

Part II

DEVELOPMENT OF SAFETY INTELLIGENCE

1. Chapter
PROTECTION OF SAFETY DATA, SAFETY INFORMATION AND RELATED SOURCES

1.1 OBJECTIVES AND CONTENT

1.1.1 This chapter describes the basic principles governing the protection of safety data and safety information captured by or derived from safety reporting systems, as well as the sources of such data and information.[1] It also provides guidance and advice on the implementation of these principles by State aviation regulatory authorities, service providers, legislators, lawyers, prosecutors, judicial officers and other competent authorities with responsibility for making decisions about the use and protection of safety data and safety information and their related sources. This chapter may be of use to any other persons seeking access to or the disclosure of safety data or safety information.

1.1.2 The chapter includes the following topics:

a) Fundamental principles;

b) Scope and level of protection;

c) Principles of protection;

d) Principles of exception;

e) Public disclosure;

f) Protection of recorded data; and

g) Safety information exchange and sharing.

1.2 FUNDAMENTAL PRINCIPLES

1.2.1 The objective of protecting safety data, safety information and their related sources is to ensure their continued availability, with a view to using it for maintaining or improving aviation safety, while encouraging individuals and organizations to report safety data and safety information. In this context, the importance of implementing protections cannot be overstated. The protections are not intended to relieve sources of their safety related obligations or interfere with the proper administration of justice.

1.2.2 Aviation safety is not the sole responsibility of States or service providers. It is a shared responsibility to which all stakeholders should contribute by, among other things, providing relevant data and information through safety reports.

1.2.3 While data and information can come from various sources, reporting of safety data and safety information by individuals and organizations in the aviation system is fundamental to safety management. Effective safety reporting systems help to ensure that people are and remain willing to report their errors and experiences, so that States and service providers have access to relevant data and information that is necessary to address existing and potential safety deficiencies and hazards. This assurance is provided by creating an environment in which people can be confident that safety data and safety information will be used exclusively for maintaining and improving safety, unless one of the principles of exception applies.

1.2.4 Annex 19 does not provide protection to individuals or organizations mentioned in the report. However, States can extend the protection to individuals or organizations mentioned in the report.

1.2.5 It is important to protect both individuals and organisations, as well as the safety data and safety information they report. Individuals and organisations are protected by:

[1] As per Annex 19, sources of safety data and safety information include both individuals and organizations.

- ensuring they are not punished on the basis of their report; and
- limiting the use of reported safety data and safety information to purposes aimed at maintaining or improving safety.

These protections apply unless one of the principles of exception discussed below is applicable.

1.2.6 Annex 19 requires States to ensure that safety data and safety information are not used for the purposes other than those set out in the ***principles of protection*** unless a principle of exception applies. The ***principles of exception*** set out the circumstances in which a departure from those protective principles may be permissible.

1.2.7 Preventive, corrective or remedial action, based on reported safety data and safety information, may necessarily be taken by States and service providers for the purposes of maintaining or improving safety—that is, to allow States and service providers to take appropriate steps to:

- guard against the potential for immediate harm or injury as a result of a safety risk until that risk can be identified and mitigated;
- ensure that appropriate action is taken to minimise the likelihood that such a risk might occur again in the future;
- prevent exposure to an unmitigated safety risk; or
- ensure the integrity of the reporting system itself and the larger system of which the reporting system is a part.

1.2.8 Because such actions are fundamental to the objectives and efficacy of any safety management system, Annex 19 expressly provides that preventive, corrective or remedial action to maintain or improve aviation safety shall not be prevented. Such actions may be taken as a function of applicable safety management processes and are therefore are not subject to the principles of exception set out in Annex 19.

1.2.9 Preventive, corrective or remedial action may entail restricting, limiting or preventing[2] the exercise of certain privileges[3], the performance of services or the operation of aircraft, until the safety risks identified have been effectively addressed. When taken for these purposes, under established protocols, protective or precautionary actions are not to be regarded as punitive or disciplinary. The purpose of such actions is to prevent or minimise the exposure to an unmitigated safety risk.

1.2.10 The principles related to the protection of safety data and safety information, and of their sources, contained in Annex 19 provide for more clarity and transparency, as well as a level playing field, with a view to facilitating the exchange of safety data and safety information between States required by Annex 19.

1.3 SCOPE OF PROTECTION

1.3.1 Scope of safety data and safety information covered by the principles of protection

1.3.1.1 Protection applies to safety data captured by and safety information derived from voluntary safety reporting systems and related sources. This may apply to mandatory safety reporting systems, where it is applicable (refer to 5.4.3 below). Sources of safety data and safety information can be individuals or organizations.

1.3.1.2 In some States, safety reporting systems may include the reporting of data to safety investigations by State authorities or aviation service providers, data and information captured by self-disclosure reporting systems (including automatic data capture systems and manual data capture systems) or other relevant safety data and information. The principles of protection and exception therefore may be extended to safety data and safety information captured by those systems as well.

[2] Preventing the exercise of privileges may include the suspension or revocation of license privileges.
[3] Privileges of an authorization holder are specified by the licence or certificate issued by State aviation regulatory authorities.

1.3.1.3 There are other cases when the principles of protection and exception will apply. For example, Annex 6 — Operation of Aircraft, Part 1 — International Commercial Air Transport – Aeroplanes, provides that sources of flight data analysis programmes should be protected in accordance with the principles contained in Annex 19.

1.3.1.4 The type of safety data and safety information that can be captured by and the kinds of systems that can be part of safety reporting systems may evolve over time along with the evolution of safety management systems themselves. Safety data and safety information and safety reporting systems that are not expressly identified in Annex 19 today, may be governed by Annex 19 in the future.

1.3.2 Interaction with the principles of protection contained in other Annexes

1.3.2.1 Certain types of safety data and safety information that are protected under Annex 19 may, in certain circumstances, be subject to other protection requirements.

1.3.2.2 In particular, Annex 19 specifies that when an investigation under Annex 13 – Aircraft Accident and Incident Investigation has been instituted, accident and incident investigation records listed in Annex 13 are subject to the protections accorded in Annex 13, not those in Annex 19.

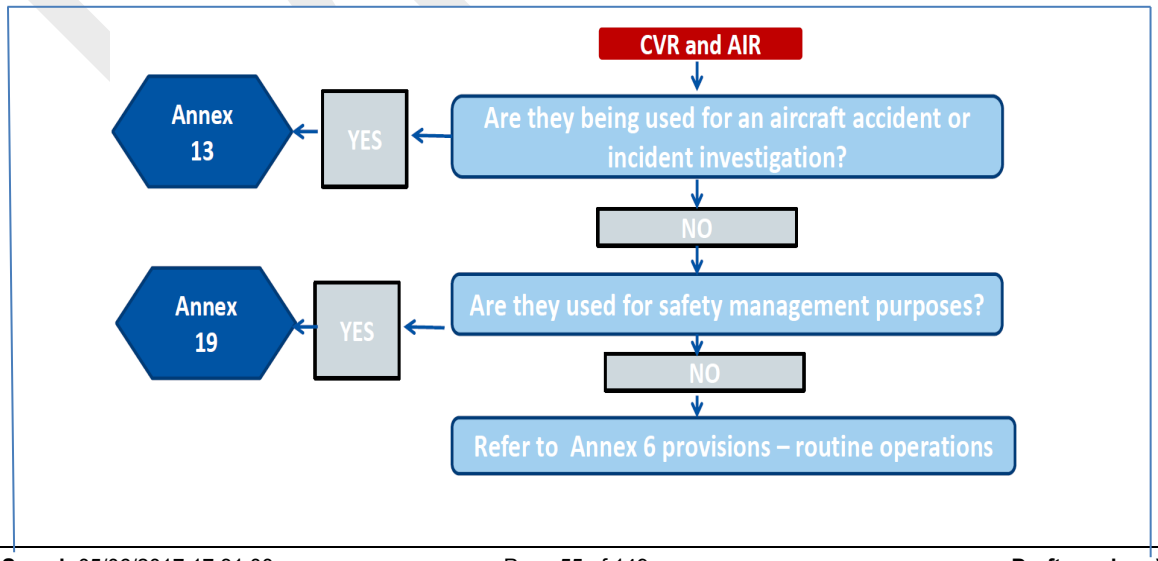
1.3.2.3 This principle applies from the opening of the investigation under Annex 13 and remains applicable even after the publication of the Final Report.

1.3.2.4 Similarly, while Annex 19 provides protection to recorded data when it is used for safety management purposes, Annex 6 affords protection to the flight recorder recordings in normal operations, outside Annex 13 type investigations.

1.3.2.5 Annex 6 addresses the use of cockpit voice recorders (CVRs) and airborne image recorders (AIRs) which should be limited to safety-related purposes with appropriate safeguards, for inspections of flight recorder systems, or when associated recordings or transcripts are sought for criminal proceedings. Such criminal proceedings are introduced into the amendment as an exception to the protections accorded to CVRs and AIRs in order to allow competent authorities to access and use this type of recordings and their transcripts without restriction in cases where criminal offences are committed and crew members involved may not have consented to such use (e.g. cases of hijacking).

1.3.2.6 Likewise, the use of flight data recorders (FDRs), aircraft data recording systems (ADRS) as well as Class B and C AIR and airborne image recording systems (AIRS) should be limited to airworthiness or maintenance purposes, including flight data analysis programmes, with appropriate protections accorded by Annex 19.

1.3.2.7 The following flow chart provides general guidelines regarding the interaction between the protective frameworks in Annexes 6, 13 and 19 and is meant to be used in consultation with applicable provisions.



1.3.2.8 With respect to flight data analysis programme, the sources remain, in any situation, protected by the principles contained in Annex 19.

1.3.3 Application of Annex 19 principles to service providers

1.3.3.1 Annex 19 describes a reporting environment that fosters trust as an environment "where employees and operational personnel may trust that their actions or omissions that are commensurate with their training and experience will not be punished". An action or omission is commensurate with a person's training and experience where it is reasonable to anticipate that a person with the same level of experience and training might do or fail to do, the same thing. Such an environment is fundamental to effective and efficient safety reporting.

1.3.3.2 Encouraging people to report relevant safety data or information requires that the sources of those reports are protected from actions taken by a State in accordance with Annex 19, as well as from actions taken within their working environment.

1.3.3.3 The Annex provisions are designed to provide the minimum requirements to be met by all States, regardless of the size and complexity of their civil aviation activities. Individual States are responsible for developing requirements sufficient to ensure satisfactory compliance by the State and service providers.

1.3.3.4 The principles of protection and exception applied to safety data and information and related sources under Annex 19 should be implemented by States and service providers alike. To ensure the achievement of this objective, States are expected to adopt relevant national laws, regulations and policies to ensure that their service providers implement the provisions contained in Annex 19.

1.4 LEVEL OF PROTECTION

1.4.1 Conditions to qualify for the protection under Annex 19

1.4.1.1 Annex 19 requires States to determine the conditions under which safety data and safety information qualify for protection. In doing so, States are expected to consider the following:

- safety data or safety information is covered under the scope of Annex 19;
- there are no specific circumstances under which Annex 6 or Annex 13 would take precedence over Annex 19; and
- a principle of exception does not apply.

1.4.2 Actions necessary for maintaining or improving aviation safety

1.4.2.1 Annex 19 ensures that States and service providers are not prevented from using safety data or safety information to take any preventive, corrective, or remedial action that is necessary to maintain or improve aviation safety. Consistent with that objective, such action, when taken, should avoid wherever possible financial, reputational or other adverse impacts on the source of the safety data or safety information.

1.4.2.2 Preventive, corrective or remedial action aims to address circumstances or conditions that present unacceptable risks to aviation safety.

1.4.2.3 **Preventive action** may be understood to involve action taken to prevent the occurrence or recurrence of an event or a hazard that poses a risk to safety.

1.4.2.4 **Corrective action** may be understood to involve action taken to address particular safety related shortcomings or deficiencies, such as an authorization holder who is unable to demonstrate compliance with

applicable safety or competency standards. Corrective action may be necessary to bring an authorization holder back into compliance.

1.4.2.5 **Remedial action** may be understood to involve action taken to address the underlying causes of particular safety-related shortcomings or deficiencies, such as training. Remedial action might also involve restricting, limiting, suspending or revoking the privileges of an authorization, certificate or license holder who fails to continue to meet the necessary qualifications to exercise those privileges.

1.4.2.6 Although they may be specified as serving one or another purpose, such actions may serve more than one purpose. For example, action may be taken by a regulator or a service provider, requiring the holder of a licence or certificate to undertake additional training, and to refrain from exercising the privileges of that licence or certificate until such training is successfully completed. Action may also be taken by a regulator to revoke, remove or suspend certain privileges of an organization's certificate. Such actions, while remedial because they address the underlying cause of a safety issue, may also be considered corrective because they address a particular deficiency. Regardless of the characterization of the action taken, there should be a clear and demonstrable link between the particular action taken and the maintenance or improvement of safety.

1.4.2.7 Safety data or safety information might reveal hazards or deficiencies that necessitate remedial or corrective action to maintain safety or identify areas where preventive action would enhance the safety by addressing potential or emerging risks. To substantiate the underlying condition or hazard warranting the preventive, corrective, or remedial action, States may need to use the safety data or safety information. For example, safety data and safety information may be necessary to establish the basis for an administrative license action or satisfy requisite burdens of proof. Or safety data and safety information may be necessary to establish the need for additional training of a licensee or changes to an operator's systems. It may also be necessary to use safety data or safety information to ensure the integrity and proper operation of the reporting system, and the larger system of which the reporting system is a part.

1.4.2.8 Depending on the circumstances, preventive, corrective or remedial actions, while not intended to be, may be perceived as punitive by the individual or the service provider, subject to such action. Indeed, some may view any license actions taken to address competency deficiencies as punitive, rather than an action necessary to correct or remediate a risk to safety.

1.4.2.9 Despite these perceptions, Annex 19 does not prevent States from using safety data and safety information to support action necessary to maintain or improve aviation safety. Where actions are needed to maintain or improve the level of aviation safety, or to prevent the safety of the aviation system from deteriorating in the short term or over a longer term, States may use safety data or safety information to support those actions, provided that they have a demonstrably preventive, corrective or remedial objective and effect. In such cases, States should consider taking the necessary measures to clearly communicate the rationale behind the action taken, in order to demonstrate the safety purpose and minimize any adverse impact on future reporting. On the other hand, the use of safety data and safety information to take actions that cannot be shown to serve one or more of these purposes, and which can be shown instead to have a purely punitive or disciplinary objective and effect, are prohibited, unless one of the principles of exception applies.

1.4.3 Protection of mandatory reporting systems

1.4.3.1 Annex 19 specifies different requirements for the protection of safety data and safety information and related sources captured by voluntary and mandatory safety reporting systems. Protecting safety data and safety information captured by voluntary safety reporting systems is a Standard, to ensure the continued availability and greater uniformity among States, whereas for mandatory safety reporting systems the provision of such protection is a Recommended Practice.

1.4.3.2 In certain jurisdictions, safety data and safety information captured by mandatory and voluntary safety reporting systems are subject to different levels of protection, offering greater protection to safety data and information from voluntary systems compared to safety data and safety information from mandatory ones. This distinction can be justified by the need to incentivize the voluntary provision of safety data or safety information in ways that are not seen to be necessary in the case of a mandatory reporting system.

1.4.3.3 Other States offer the same high level of protection to safety data and safety information in both mandatory and voluntary safety reporting systems. This can be justified by the recognition that requiring reporting by law may not, in itself, be sufficient, to ensure that relevant safety data and safety information are reported and that the value of a trustworthy environment is fundamental to any kind of reporting. Extending protections to mandatory reporting systems may also encourage reporters to supply additional details that they may otherwise not provide if those protections were not available.

1.4.3.4 If a State extends the protection afforded to safety data and safety information captured by voluntary safety reporting systems to mandatory safety reporting systems, the principles of protection and exception contained in Annex 19 should apply to safety data and safety information captured by both of those systems as well as to their respective sources.

1.4.4 Protection of data and information that are in public domain

1.4.4.1 There may be cases in which safety data or safety information is available in the public domain. In some cases, it may be that such safety data or safety information is not sensitive and its further disclosure will not adversely impact the continued availability of safety data or safety information. Safety data and information related to weather may be an example of such non-sensitive data and information.

1.4.4.2 In other cases, safety data and safety information normally subject to the principles of protection may find its way into the public domain, for instance, through a leak to the media. In such cases, States should refrain from further disclosure of the leaked data and information as the principles of protection will not be automatically waived.

1.5 PRINCIPLES OF PROTECTION

1.5.1 Application of the Principles of Protection

1.5.1.1 The protection of safety data, safety information and related sources should be the default position for a State. A State may provide effective protection by law, supported by comprehensive and clear procedures.

1.5.1.2 The basic purpose of providing protection is to ensure the continued availability of safety data and safety information by encouraging individuals and organizations to identify, report, analyze and correct deficiencies. This requires that all involved know the governing rules and processes for protection in advance. Such rules and processes should be formalized, and they should not be open to arbitrary application if they are to serve as the foundation of a system based on trust.

1.5.1.3 In protecting safety data or safety information, consideration should be given to the objective such protection is meant to achieve. The objective may be evident from the type of data and information to be protected. In many cases, protection aims to prevent safety data and safety information from being used against the individual or organization that reported the specific data or information. In other cases, it may be important to shield safety data or safety information from general publication or use in non-safety related contexts, such as local land use controversies concerning airport operations and noise abatement issues.

1.5.1.4 State action is central to creating protective provisions. In formal proceedings where there are rules governing what evidence is allowed to be presented, only State action can provide the necessary protection by the enactment of appropriate legislation that either prohibit or strictly limit admissibility of protected information. For example, in criminal proceedings against an individual, the use of a voluntary report filed by the accused person should be prohibited if it is not directly related to the alleged criminal act.

1.5.1.5 In civil proceedings against a service provider, a rule should, at a minimum, require a rebuttable presumption[4] that protected information may not be used. In an action against an airline for damages sustained as a result of an occurrence, a plaintiff may seek general access to the operator's SMS files to attempt to discover general

[4] Rebuttable presumption is an assumption that is held to be true unless refuted by evidence.

information that might not be directly related to the incident, but which might tend to cast the operator in an unfavourable light. The established procedure for determining such questions should direct the competent authority (in this case most likely a court) that is tasked with applying the principles of exception, (discussed more fully in section 5.6) to require the plaintiff to show precisely what information is intended to be discovered and to demonstrate the relevance of the information to the action, as well as demonstrating the unavailability of alternative sources for the same or similar information. The competent authority might also ask a plaintiff to show how they are prejudiced by not having access to the information. Where the decision is to allow such access, formal safeguards should be imposed by the competent authority in accordance with applicable procedural requirements, such as a protective order to preclude publication generally and restricting access to the relevant portions of the proceedings.

1.5.1.6 In administrative proceedings where particular operational or technical qualifications, competencies and capabilities of an individual or an organization are in question, safety will almost invariably be at issue. Use of safety data or safety information may be required in such cases, but enforceable requirements should provide for the controlled and limited use of such data and information. Where safety data or safety information provide the basis for decision in such safety-related cases, extraordinary care should be required to prevent adverse or prejudicial consequences to the source of the information as a result of use of the data and information. Generally, individuals and organizations who are encouraged to report under a protected reporting scheme will recognize that there are circumstances in which action in the interest of safety must be taken, based, in whole or in part, on a protected report. Enforceable requirements should ensure that such action complies with fundamental fairness in pursuit of the objective of maintaining or improving safety.

1.5.1.7 An example of such a situation might be a report by an air traffic controller who lost consciousness for a short period of time while working. No separation was lost and the only proof that the event occurred was the controller's own report. For safety-related purposes, analysis of that report required further investigation, which in turn required that the reporting individual be identifiable by some process. Immediate correction might involve removal of the controller from active duty (without financial or reputational disadvantage) while a comprehensive medical examination and review is conducted. Upon completion of the medical review, the result may entail medical clearance, medical treatment or medical retirement (again, without financial or reputational disadvantage). If the controller were simply discharged, it is highly unlikely that similar reports from others would be forthcoming in the future.

1.5.1.8 Up to this point, the focus has been on direct State action to provide necessary and appropriate protection. In practice, much of the safety data and safety information for which protection is required is within the operational environment of a service provider and involves relations between employers and employees. Protection in these situations may not always be provided for in legislation or other forms of enforceable State requirements. Even in such cases, however, States may be in a position to require effective protection through their certification, approval and continuing surveillance processes. Annex 19 requires specified service providers to implement an effective SMS. Effective safety management is based on data collection, analysis and protection. Without data the system would lose effectiveness. SSP should allow States to direct organizations to implement policies that provide protection to their employees as an element of their SMS.

1.5.1.9 One way of providing for such protection might involve de-identification of the reporter. While confidentiality of reports is a useful strategy, complete de-identification, where possible, removes the opportunity for follow-up during the analysis phase. Policies should focus on what use the competent authority may make of, and allow for, the safety data and safety information in question. The discussion above (refer to 5.5.1.6) in relation to administrative proceedings is equally applicable in the employer/employee context. Again, those from whom reports are necessary will be reluctant to provide such reports if those reports or other data or data capture is used to support a punitive or disciplinary suspension or discharge.

1.5.1.10 The capture of safety data and safety information by automatic means, such as flight data recorders, voice or video recorders or air traffic environment recorders, should be part of any protection policy or regulation. Use of these devices as a part of SMS data capture where allowed by regulation or policy must fully respect the principles of protection in the same way voluntarily submitted reports are respected. The trust of the reporting population is fundamental to effective safety management.

1.5.2 Proceedings

1.5.2.1 Annex 19 requires States to ensure that safety data and safety information are not used in disciplinary, civil, administrative and criminal proceedings against employees, operational personnel or organizations, unless a principle of exception applies.

1.5.2.2 The term “proceeding” may be more comprehensive and broader in scope than the term “action”. It may also refer rather more narrowly to the processes of a particular body to review or enforce “actions” that have been taken by another authority (or an agency within the same authority). In a general sense, the terms “proceeding” and “action” may be understood to encompass all the steps taken or measures adopted in order to initiate, give effect to, or review a decision of an authority affecting a person’s rights, privileges, legitimate interests or reasonable expectations (as these may be identified under applicable laws). In view of the different legal systems, the nature and scope of particular actions or proceedings may vary. For example, in some States::

- **Criminal and civil actions or proceedings** usually involve judicial authorities. These proceedings may include the commencement of the action, the appearance of the defendant, all ancillary or provisional steps, the pleadings, the trial discovery processes and other formal inquiries. As a consequence of such actions or proceedings, a person may be subject to monetary damages, fines or in some cases incarceration.
- **Administrative actions or proceedings** may involve an inquiry, investigation or hearing before a regulator or a tribunal that relates to action to vary, suspend, revoke or cancel an authorisation (for demonstrably safety-related purposes in some cases, and for punitive purposes in others).
- **Disciplinary actions or proceedings** may refer to the process by which by an employer responds to actual or apparent violations or breaches of rules and procedures by an employee. The result of such actions or proceedings may be to absolve an employee of the alleged misconduct, or to discipline or discharge an employee if the allegations are substantiated. Other authorities may be involved in the actions and proceedings mentioned above, such as administrative tribunals, professional, ethical bodies or other review bodies within an organization.

1.5.2.3 Other authorities may be involved in the actions and proceedings mentioned above, such as administrative tribunals, professional, ethical bodies or other review bodies within an organization.

1.5.2.4 It is important to remember that the principles of protection do not apply when States take a preventive, corrective or remedial action that is necessary to maintain or improve aviation safety (refer to 5.4.2 above). This also applies to any proceeding, action or measure associated with a preventive, corrective or remedial action taken for purposes of maintaining or improving safety. For example, the use of safety data or safety information to justify the adoption of a preventive, corrective or remedial action is allowed in proceedings initiated by an individual or an organization seeking to challenge the said action.

1.5.2.5 While there may be cases when safety data or safety information is used in litigation initiated by a third party against the source of the report, States are encouraged to take all necessary measures to ensure that safety data and safety information is not used for purposes other than maintaining or improving aviation safety (unless a principle of exception applies).

1.5.3 Authoritative Safeguards

1.5.3.1 Certain factors may mitigate the negative consequences associated with the disclosure or use of safety data or safety information for purposes other than maintaining or improving aviation safety. It might be possible to limit any potential damage from the proposed disclosure or use by putting in place safeguards to further limit the disclosure or use of safety data or safety information. A State may include in its legislation, pursuant to which the application of the principles of exception is considered, the power for the competent authority to impose requirements for the safety data or safety information to be kept confidential following a decision to allow access.

1.5.3.2 De-identification of the source of the safety data and safety information is another safeguard that may be used before release for purposes other than maintaining or improving aviation safety is granted by a competent

authority. De-identification may however be difficult where the sources providing the safety data or safety information may be readily ascertainable from the substance of the data or information reported. For example, the report of an occurrence involving a type of aircraft that is used only by a single operator within a particular jurisdiction may immediately point to that operator (or even to an individual employee) simply by identifying the type of aircraft involved. In such cases, how and where the safety data or safety information is proposed to be disclosed or used, and the nature of the information involved, would be of especial significance.

1.5.3.3 If the safety data or safety information is proposed to be used in a forum where knowledge of the persons or organizations connected to the data or information is limited, then the competent authority might be confident that de-identification would provide a sufficient safeguard for the sources. Similarly, if the nature of the information is primarily technical, then there may not be much identifying information in the safety data or safety information that needs to be removed or redacted, making the protective task more easily achievable. The competent authority should also consider whether the forum of the proposed disclosure or use of the data or information and the nature of the information, will affect the degree to which the sources can be identified, and whether removing identifying information would be enough. If the proposed disclosure or use may adversely affect a company or organization, such as an aircraft operator, then the competent authority should decide whether de-identification of the data or information would provide reasonable protection similar to that which the company or operator would have obtained if the disclosure or use had not been allowed.

1.5.3.4 If the competent authority considers that the de-identification of the safety data and safety information may prevent the intended or otherwise permissible use of safety data or safety information, de-identification will not be appropriate. Therefore, States may opt to implement different kinds of safeguards (or combinations of safeguards) to allow limited disclosure for a specific purpose while preventing wider use or public disclosure of the safety data or safety information. Protective orders, closed proceedings, in camera review and summaries are examples of such safeguards.

1.5.3.5 States and organizations may also adopt best practices such as ensuring that the environment in which information is collected, stored, processed and transmitted is sufficiently secure, and that controls over access and authorization are sufficient to protect the safety data and safety information.

1.6 PRINCIPLES OF EXCEPTION

1.6.1 The principles of protection apply to safety data, safety information and related sources, unless a competent authority determines that one of three principles of exception applies. The custodian of SDCPS should be aware of the protections applied to safety data, safety information and related sources and ensure that they are released and used in accordance with the Annex 19 provisions.

1.6.2 Designation of a competent authority

1.6.2.1 As the principles of exception will be administered for a range of different purposes, the competent authority will be different depending on the nature of the data or information in question and the type of use that is being sought. In each particular case, the task of the competent authority will be to decide whether a particular principle of exception applies. The competent authority will need to be capable of balancing competing interests, such as right-to-know laws, regulations unrelated to aviation safety, litigation disclosure rules, and others in order for the public to have confidence in its decision-making capabilities. Competent authorities could include judicial authorities, regulatory authorities or those otherwise entrusted with aviation responsibilities designated in accordance with national laws and other enforceable requirements.

1.6.2.2 States and organizations will need to identify competent authorities appropriate to the task of applying the principles of exception for different purposes.

Example Situation	Possible Competent Authority
Where disclosure or use of safety data or safety information is sought by a member of the public pursuant to right-to-know laws[5].	Government department or administrative body
If the question of the disclosure or use of the data or information in itself becomes the subject of litigation brought under the same right-to-know laws, or if the safety data or safety information is sought for use in judicial proceedings.	Court or administrative tribunal
Where action is to be taken by a regulatory authority to maintain or improve safety.	State
In the case of disclosure or use of safety data or safety information in the custody of an organisation	Person in the organization who is responsible for aviation safety, such as a manager or a panel comprised of management, an employee representative and, in some States, a representative of the regulator

1.6.2.3 Where an organization identifies its competent authority, the responsible exercise of discretion of the competent authority on the application of the principles of exception and the principles of protection may well provide sufficient self-policing within the organization. The final determination of the competent authority for each specific purpose remains a matter for each State and organization, depending on the applicable laws and policies.

1.6.2.4 Permanent designation of the office and jurisdiction of the competent authority (e.g., judicial authorities for matters involving litigation, the civil aviation authority for matters involving regulatory actions) may be considered to allow for expeditious decision-making. A permanent designation will also provide certainty in the competent authority's standing and experience in dealing with these matters. Furthermore, it is critical that the competent authority has in place rules and procedures governing the decision-making process. These rules and procedures should flow from applicable national laws. This can only be achieved if the designation of the competent authority in a particular area remains constant.

1.6.3 Application of the principles of exception

1.6.3.1 The first case in which a competent authority may determine that an exception to the protection applies is where there are "facts and circumstances reasonably indicating that an occurrence may have been caused by an act or omission considered, in accordance with national laws, to be conduct constituting gross negligence, wilful misconduct or criminal activity". The appropriate competent authority for undertaking such a determination will, in most cases, be a judicial, administrative or prosecutorial authority.

1.6.3.2 Because an assessment of the substance of the safety data or safety information in question will often determine whether the conduct involved satisfies one or another of the conditions for exceptional use, it is not, therefore, necessary that facts and circumstances of the case make it unequivocally clear that such exceptional conduct has occurred. Rather, it is only necessary that those facts and circumstances provide a reasonable basis on which it could be found that the occurrence may have been caused by such conduct. Where the competent authority determines that, on the basis of the facts and circumstances of a case, an occurrence may have been the result of either gross negligence, wilful misconduct or criminal activity—as these terms are understood under national law—a principle of exception applies and the safety data, safety information or related sources may be released.

1.6.3.3 Different legal systems may have different understandings under national law as to what is meant by these terms. In general, gross negligence refers to an act or omission undertaken with a serious disregard or indifference to an obvious risk, regardless of whether the risk was fully appreciated by the actor. This is sometimes described as reckless conduct. Wilful misconduct is a wrongful act or omission which the actor either knows to be

[5] For further information regarding right-to-know laws refer to Section 1.7 of this Chapter.

wrongful, or is consciously indifferent to the question of whether it is wrongful or not. Knowledge and intent in such cases may also sometimes have regard to the consequences of the conduct, as opposed to its formal depiction as unlawful. In any case, the evidentiary tests and measures applicable in making a determination as to the nature of the conduct involved should be consistent with the laws of the relevant jurisdiction. Also, because the exception principle differentiates between conduct constituting “gross negligence” or “wilful misconduct”, on the one hand, and “criminal activity” on the other, it is clear that conduct that might constitute either “gross negligence” or “wilful misconduct” (however such conduct may be described under the applicable national law) is meant to be assessed on the basis of a civil, as opposed to a criminal, standard.

1.6.3.4 The second case in which a competent authority may determine that an exception to the protection rule applies is where, having reviewed the safety data or safety information in question, the competent authority determines that release of such data or information is “necessary for the proper administration of justice” and “the benefits of its release outweighs the adverse domestic and international impact such release is likely to have on the future collection and availability of safety data and safety information”.

1.6.3.5 This involves a two-step assessment process, in which the competent authority must consider first, whether the data or information is “necessary for the proper administration of justice”, which may not be the case if alternative sources for the same information are available; and second, if it finds that the release is necessary for the proper administration of justice, whether, on balance, the value of such data or information outweighs the prejudice its release is likely to have on the future collection and availability of safety data and safety information for the purposes of maintaining or improving safety.

1.6.3.6 If the safety data or safety information is proposed for use in an action or proceeding (civil, administrative, criminal or disciplinary), then the potential negative impact of such use may relate to the source of such data or information. Even if safeguards can be put in place to prevent the safety data or safety information from being disclosed outside the confines of the action or proceeding, any negative impact from the use of such data or information during a proceeding may still discourage future reporting or disclosure of safety data and safety information for the purposes of maintaining or improving safety. If the proposed use of the safety data or safety information involves dissemination or publication of such data or information beyond the confines of the proceeding, the competent authority should also consider the potential prejudicial effect on the wider community (domestic and international).

1.6.3.7 On the individual level, making the information public can have prejudicial detriment to the person involved such as the potential loss of livelihood and/or embarrassment. On a broader level, the publication or dissemination of safety data or safety information in a particular case may create a general disincentive for people similarly situated, but not involved in the particular action or proceeding, to report or contribute to the collection of such data and information.

1.6.3.8 In making a determination regarding the first two principles of exception, the competent authority must be satisfied, that:

- in the first case, the content of the safety data or safety information sought to be disclosed or used is necessary in order to decide whether the act or omission constitutes gross negligence, wilful misconduct or criminal activity; or,
- in the second case, that such data, information or the related source is necessary for the proper administration of justice.

1.6.3.9 The competent authority will determine whether the safety data, safety information or the identity of the source of such data or information is necessary to the case. If a competent authority can reasonably make a decision without referring to the protected data, information or source, then greater weight must be given to preserving the protection of the safety data, safety information and related sources. There is no need to prejudice the collection and availability of safety data, safety information and related sources when a decision can be made by the competent authority without requiring the disclosure (or use) of such data and. This will help ensure the continued availability of safety data and safety information for maintaining or improving aviation safety.

1.6.3.10 Adverse consequences might flow from the disclosure or use of safety data, safety information and related sources, such as the reluctance of aviation operational personnel to willingly cooperate with inspectors. If such data, information or details about their sources are not necessary to prove an essential fact in a proceeding, then the future collection and availability of safety data, safety information and related sources should not be jeopardized by unnecessary release under either of these principles of exception. Furthermore, if the required information can practicably be obtained from alternate sources, the competent authority might decide against allowing access to the safety data or safety information until all reasonable alternative avenues to acquire the information have been exhausted.

1.6.3.11 Similarly, if a competent authority in a State that does not have a right-to-know law is asked to decide whether the safety data or safety information should be disclosed to the public (for example, in response to a request from the media), the competent authority would most likely want to know how important it is that the public knows the contents of such data or information. In such a situation, the competent authority might ask a question like, “Without knowing the contents of the data or information, would the public have a proper understanding of the occurrence, or would the event have safety consequences for the travelling public?” Being able to substantiate a view that the public’s knowledge would be compromised without access to the safety data or safety information might give weight to an argument for its disclosure. However, this data or information would not have to be disclosed just because these grounds are established. If disclosure would seriously compromise the continued availability of safety data and safety information by discouraging future safety reporting, the scales may not necessarily be tipped in favour of disclosure.

1.6.3.12 The third exception involves cases in which, “after reviewing the safety data or safety information” the competent authority “determines that release is necessary for the purpose of maintaining or improving safety, and that the benefits of its release outweigh the adverse domestic and international impact such release is likely to have on the future collection and availability of safety data and safety information”. At the outset, it is important to note that this exception applies in relation to the release of safety data or safety information, where it is considered necessary to do so for maintaining or improving safety. It has no application to situations involving the use of safety data or safety information in connection with an action taken, by a regulatory authority or a service provider, for the purpose of maintaining or improving safety. The latter situations are contemplated by, and within, the principles of protection, and it is neither necessary nor appropriate to consider the application of a principle of exception in such cases.

1.6.3.13 The circumstances contemplated by Annex 19 involve consideration by a competent authority of the benefits of releasing the safety data or safety information for more general purposes related to the maintenance or improvement of safety, including, for example, training and educational purposes or the publication of safety information and advice for the benefit of the wider community. The analysis for these situations involve the same kind of two-step process described in 5.6.3.5 above: first, requiring the competent authority to decide that the “release is necessary for maintaining or improving safety”, and, second, requiring the competent authority to determine that the benefits of releasing the safety data or safety information outweigh potential adverse impact such a release will have on the future collection and availability of such data and information.

1.6.3.14 In considering the second step of this analysis, Annex 19 encourages competent authorities to take into account the “consent of the source of the safety data or information.” The importance of that note underscores the critical distinction discussed in 5.6.3.10 above, differentiating between the release of safety data and safety information for purposes generally related to the maintenance or improvement of safety (in which case this principle of exception will apply), and the use of safety data and safety information for particular preventive, corrective and remedial purposes in support of the maintenance or improvement of safety (in which case it will not be necessary to satisfy the requirements of any principle of exception as this usage is already permitted within the principles of protection).

1.6.3.15 In keeping with the spirit of the principles of protection, when considering the use of safety data or safety information in support of preventive, corrective or remedial actions taken for the purpose of maintaining or improving safety, it may be possible for the competent authority to ascertain whether an appropriate alternative source for such data or information may practicably be available. If so, even this unexceptional use of protected safety data or safety information may be avoided.

1.6.3.16 However, such a consideration of practicability does not require or invite the formal application of a principle of exception called up in Annex 19. This is because the principle of exception applies where the interest of maintaining or improving safety is weighed against some other competing public interest (e.g., the proper administration of justice, providing public access to data or information, or facilitating training or educational processes by allowing for the inclusion of protected data or information). Preventive, corrective or remedial action taken for the purpose of maintaining or improving safety falls within the scope of the principles of protection, and there is no countervailing non-safety related interest against which such use needs to be balanced.

1.6.4 Additional considerations in applying a principle of exception

1.6.4.1 In deciding whether a principle of exception applies in a case, the competent authority should always take into account the consent of the source of the safety data or safety information. If a person has been given assurances of confidentiality in respect of safety data or safety information of which they are the source, then the use, disclosure or release of such data or information in a manner that conflicts with those assurances is likely to have an adverse impact on the safety data and safety information that may be provided by that person in the future. In addition, if safety data or safety information were to be released or used in spite of confidentiality assurances to the source, this may have a similarly adverse impact on any person who may become aware of the said fact.

1.6.4.2 To avoid undesirable situations of the kind mentioned in 5.6.4.1 from arising, it will be prudent to ensure that individuals and organizations clearly understand in advance how, when, where and for what purposes the data and information they provide may be used in accordance with the application of the principles of exception. Such an understanding is essential to the establishment and maintenance of a predictable reporting environment based on trust.

1.6.4.3 Figure 9 provides general guidelines regarding the application of the principles of exception by the competent authority consistently with the provisions of the Annex 19.[6]

[6] It is important to remember that States shall not be prevented from *using* safety data or safety information to take any preventive, corrective or remedial action that is necessary to maintain or improve aviation safety.

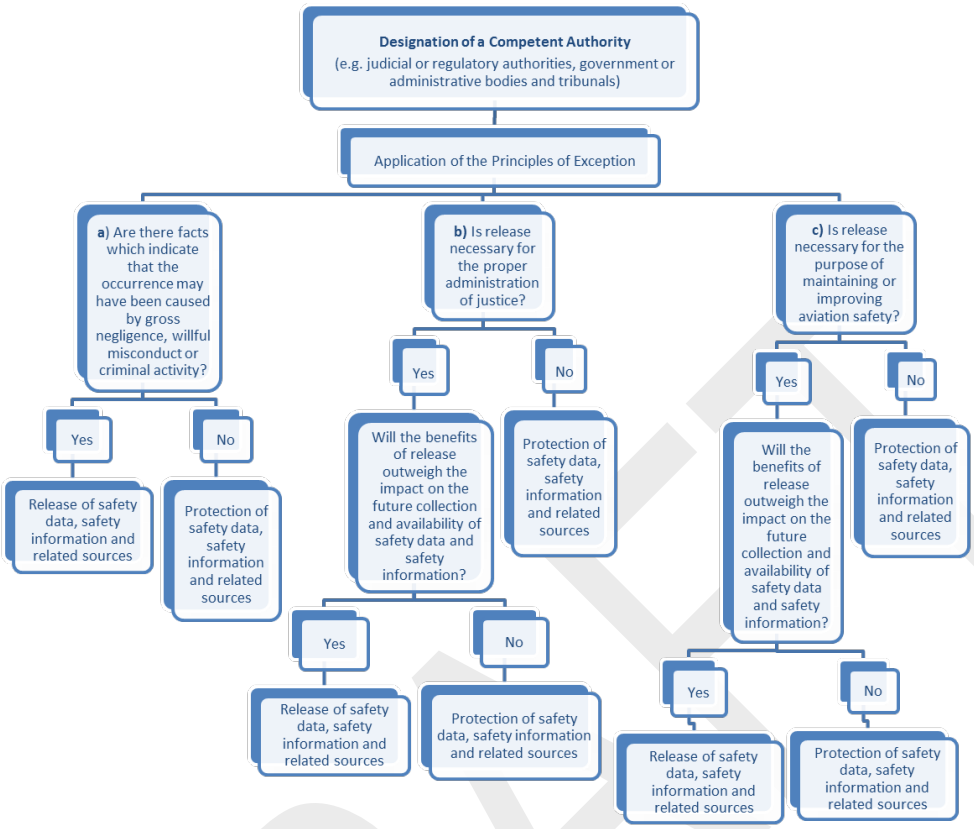


Figure 9. Guidelines for the application of the principles of exception

1.7 PUBLIC DISCLOSURE

1.7.1 The public has an overarching interest in safety data or safety information. The public's interest is in openness, transparency and accountability so that it has a general awareness of the safety of the system and can be assured that everything necessary to address safety is being done. Specific individuals or interest groups may also have an interest in the safety data or safety information for reasons other than those directly related to safety. Disclosure may occur voluntarily, as a result of a request for information to the government or in response to compulsion in through the processes of a judicial proceeding. Whether or not it is appropriate to disclose any safety data or safety information publicly depends on the nature of the safety data and safety information. Such determination is the province of the competent authority as previously discussed.

1.7.2 If safety data or safety information is disclosed publicly, it is not usually possible to limit how the information would be used. Certainly, openness and transparency should be encouraged but, at the same time, the rights and legitimate expectations of those involved in reporting and analysing the safety data and safety information, and the need to protect them from inappropriate damage to their interests or reputation, must be taken into account. However, this may not always apply to States with right-to-know laws.

1.7.3 Many States have legislation which in effect mandates release of all information held by State institutions. Such laws are sometimes referred to as right-to-know laws. Under these laws, unless there is an exemption for a particular type of information, it must be disclosed by the government upon request. Some examples of exemptions might be classified information, commercially sensitive information or information such as medical records which are protected by privacy laws. Safety data or safety information is not usually exempted. In accordance with Annex 19, States may choose to create exemptions or rules to protect from public disclosure in right-to-know laws or in any other type of laws, including aviation legislation.

1.7.4 Right-to-know laws generally apply to information held by the government. Since most safety data and safety information requiring protection from disclosure is obtained from operational personnel or a service provider, a practical approach would be to allow such data and information to remain with the organization rather than depositing it with a government authority. This way the question of public disclosure does not arise unless some additional government action such as an administrative proceeding is convened. Where an administrative or judicial proceeding is faced with the question of public disclosure, the competent authority should apply the basic principles of protection previously discussed. This approach may not work if service providers are obliged to report safety data and information to a government authority, or if the service provider is a governmental authority or agency or a part of a governmental authority or agency.

1.7.5 Failure to properly assess the competing claims made for access to safety data or safety information can impact current and future efforts in two ways. Public disclosure of certain data or information can be perceived as a violation of the privacy of individuals or the confidentiality expectations of organizations associated with the safety data or safety information. Use of certain data or information as part of an argument supporting sanctions against involved individuals or organizations can be seen to violate basic principles of fairness. Future availability of safety data and safety information may be impacted by the predictable human behaviour of withholding information that results from anticipating a perceived threat from its disclosure or incriminating use. This can have an obvious impact on both data collection and data analysis functions of safety management.

1.7.6 If a competent authority determines that safety data or safety information may be disclosed to the public, the State shall ensure that any public disclosure is made in accordance with applicable privacy laws or in a de-identified, summarized or aggregate form. Further information on authoritative safeguards is contained in 5.5.3 above.

1.8 PROTECTION OF RECORDED DATA

1.8.1 Protection of ambient workplace recordings

1.8.1.1 Ambient workplace recordings should be part of any protection policy or regulation. The use of these recordings as a part of safety management where allowed by regulation or policy should fully respect the principles of protection and exception. The trust of the reporting population is fundamental to an effective safety management. That trust should not be compromised.

1.8.1.2 Provisions contained in Annex 19 are applicable to safety management functions related to, or in direct support of, the safe operation of aircraft. Ambient workplace recordings may be governed by national privacy laws that are not defined in Annex 19.

1.8.1.3 Ambient workplace recordings may include cockpit voice recordings (CVRs), airborne image recorders (AIRs), other flight recorder recordings, or recordings of background communication and the aural environment at air traffic controller work stations.

1.9 SAFETY INFORMATION SHARING AND EXCHANGE

1.9.1 Protection of information shared between States

1.9.1.1 Taking into account that one of the main objectives of sharing and exchange of safety information is to ensure a consistent, fact-based and transparent response to safety concerns at the State and global levels, in the process of sharing and exchange of safety information, States shall act in accordance with the following principles:

a) compliance with the Convention on International Civil Aviation (Chicago Convention), its Annexes and other multilateral and bilateral obligations of States;

b) sharing and exchange of safety information does not lead to violation by the relevant States' authorities of national laws relating to the protection of safety information, including but not

limited to the national laws and regulations on state secret, personal data protection, commercial (trade) secret as well as violation of the rights of individuals and legal entities;

c) safety information shared and exchanged by a State should not be used in a way adversely affecting such State itself, its airlines, its public servants and its citizens as well as for other inappropriate purposes, including for the purpose of gaining economic advantage;

d) the sole purpose of protecting safety information from inappropriate use is to ensure its continued availability so that proper and timely preventive actions can be taken and aviation safety improved; and

e) sharing and exchange of safety information should be in line with the principles of protection provided in Annex 19.

1.9.1.2 A legal framework for sharing and exchange of information can be based on bilateral arrangements between States inserted, for instance, into their air transport (air services) agreement. For facilitating sharing and exchange of information, States can also agree that such bilateral arrangements apply provisionally, if applicable, pending their ratification and entry into force.

1.9.1.3 States should promote and facilitate the establishment of safety information sharing and exchange networks among users of its aviation system. The sharing and exchange of safety information is fundamental to ensuring a consistent, fact-based and transparent response to safety concerns at the State and global levels.

2. Chapter

SAFETY PERFORMANCE MANAGEMENT

2.1 INTRODUCTION

2.1.1 Introduction to Safety performance management

2.1.1.1 Similar to a financial management system or any other management system, the SSP for the State or the SMS for the service provider generates information that senior management use to make decisions regarding the allocation of resources to mitigate safety risk. Information to support decision-making is the basic and most important input of an SSP or SMS. This information is used for the management of safety performance that assists senior-management of safety risk[7].

2.1.1.2 Safety performance management refers to the joint consideration of (a) the safety outcomes attained by an organization[8], and (b) the effectiveness of the safety risk mitigations implemented by the organization to meet the safety achievements in question.

2.1.1.3 The management of safety performance – or safety performance management – by an organization follows the three basic phases; aligned with the basic elements of organizational control theory:

1. **Phase 1. Define**
   Setting safety objectives and associated safety performance indicators and targets (direction);
2. **Phase 2. Monitor**
   Safety performance monitoring based on measurement and collection of information (supervision); and
3. **Phase 3. Control**
   Allocation of resources, based on the results of the analysis of the information, to achieve the safety performance targets set (control), including reporting of safety performance.

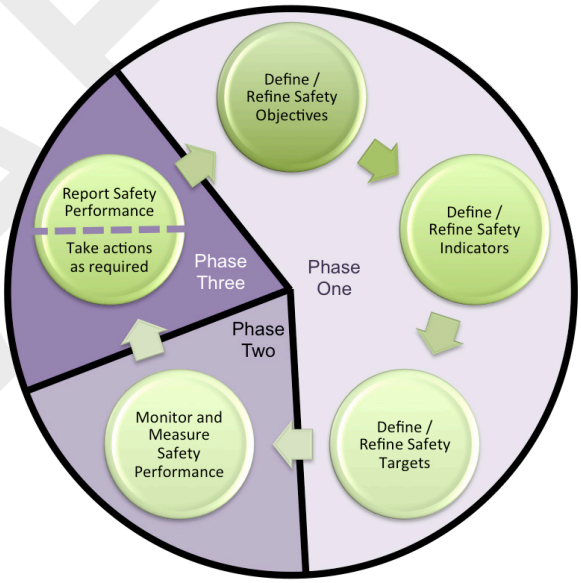


Figure 10: Safety performance management phases

2.1.1.4 Managing safety performance can show the balance between the efforts invested compared to the actual safety achievements attained. This is valuable information for senior management to demonstrate the results of their decisions and actions. The continuous process is illustrated in Figure 10.

[7] Data driven decision-making is discussed in detail in the Part II Chapter 3.

[8] In this chapter, “organization” is used as a generic term to refer to both State civil aviation organizations as well as service providers, unless explicitly indicated otherwise.

2.2 PHASES OF SAFETY PERFORMANCE MANAGEMENT

Phase One - Define

2.2.1.1 Phase one provides direction to the safety performance management activities. The organisation must first agree on its safety objectives – what the organisation wants to achieve in relation to safety. Safety objectives may be based upon regulatory requirements, industry trends, internal organization data, or combination of these considerations. Once the safety objectives have been established, it is necessary to determine what actions or activities are needed to achieve the agreed objectives.

2.2.1.2 An example of a safety objective is: “Reduction of non-conforming approaches over previous year”.

2.2.1.3 Once the organisation has agreed upon its objectives for safety (safety objectives), it should define safety performance indicators (SPI) and safety performance targets (SPT) that will indicate to the organisation that they are on track to achieve their safety objectives.

Phase Two - Monitor

2.2.1.4 During phase two the organisation supervises its safety objectives (in this example, “Reduction of non-conforming approaches over previous year”). To this effect, the organization should define what data is to be monitored that represent the performance of the specific activities. There are two important considerations involved in monitoring; it should be conducted:

1) with reference to parameters that are representative of the mitigations, not with reference to the mitigations themselves or outcomes; and

2) as close to real time as possible.

2.2.1.5 Examples of parameters to monitor the effectiveness of mitigations implemented for “Reduction of non-conforming approaches over previous year’ could include:

- Stabilized approach configuration achieved @ 10 NM from touchdown
- Stabilized approach configuration achieved @ FAF (final approach fix)
- Stabilized approach configuration achieved @ “window” (the point of decision whether the landing is continued or a missed approach is executed)
- Number of pilots trained on new stabilised approach configuration procedure.

Phase Three - Control

2.2.1.6 In phase three the organisation controls the effectiveness of the mitigations, by the analysis of data obtained through monitoring of the SPIs and SPTs. Control through such analysis leads to confirmation of the effectiveness of the mitigations - or lack of. And redesign of the mitigations in the latter case as necessary.

2.2.1.7 Phase three also includes internal and external reporting of safety performance. Reports of the mitigation effectiveness could indicate a need to reassess, and possible redefine, SPIs or SPTs to better align with safety objective achievement.

2.2.2 Phases of safety performance management summary

2.2.2.1 Management of safety performance is delivered by an SSP or an SMS. It is supported through safety performance monitoring and measurement. The safety objectives (direction), SPIs (supervision) and SPTs (control) monitor the status of progress towards safety achievements and effectiveness of the mitigations.

2.2.2.2 Defining, monitoring and control the essential aspects of safety through effective - safety objectives, SPIs and SPTs - are at the heart of safety performance management. The remainder of the chapter is dedicated to discussing the key aspects of safety objectives, STIs and STPs.

2.3 SAFETY OBJECTIVES

2.3.1.1 Safety objectives are brief, high-level statements of safety achievements or desired outcomes to be accomplished. They help to provide direction to the organisation's activities and should therefore align with the safety policy that sets out the organizations high-level safety commitment. They are also useful to communicate safety priorities to personnel and the aviation community as a whole.

2.3.1.2 Safety objectives provide direction to develop SPIs and SPTs, discussed in the next section. Establishing safety objectives for safety performance management informs the direction for organizational resources and activities to monitor SPIs and to measure status of SPTs.

2.3.1.3 Safety objectives may be:

- **process-oriented**, i.e. they may be stated in terms of safe behaviours expected from operational personnel or the performance of actions implemented by the organization to manage safety risk, or
- **outcome-oriented**, i.e. they may encompass actions and trends regarding containment of accidents or operational losses.

2.3.1.4 Safety objectives should combine both process-oriented and outcome-oriented safety objectives to provide effective direction for the SPIs and SPTs.

2.3.1.5 An example of a process-oriented safety objective relevant to SSP – regarding a safety intervention – would be "*[State] will implement an online safety reporting programme by dd/mm/yyyy".*

2.3.1.6 An example of an outcome-oriented safety objective relevant to SMS – regarding action for containment of operational losses – would be "*the airport operator will reduce the annual amount of adverse apron safety events from the previous year*".

2.4 SAFETY PERFORMANCE INDICATORS

2.4.1 Introduction

2.4.1.1 A SPI is used for monitoring and assessing safety performance. A safety performance target (SPT) is a planned or intended target for a SPI over a given period that aligns with the safety objectives.

2.4.1.2 Aviation safety metrics, have historically been biased towards performance indicators reflecting low-probability/high severity outcomes; typically, the number of accidents and serious incidents. This is understandable in the sense that accidents and serious incidents are high profile events and are easy to measure. Nevertheless, from the perspective of safety performance management, there are drawbacks in over-reliance in accidents and serious incidents as basis for the definition of SPIs.

2.4.1.3 Accidents and serious incidents occur less frequently so it is harder to use them to monitor safety performance and identify trends. As a result, they may provide a false sense of confidence that an organization safety performance is effective when it may be luck. An accident-free safety record does not necessarily indicate effective management of safety performance.

2.4.1.4 While not entirely inappropriate for SPIs development, low-probability/high severity events – accidents and serious incidents – should be combined with high-probability/low severity events and process orientated SPIs to provide a better picture of the organization's safety performance.

2.4.2 Types of Safety Performance Indicators

2.4.2.1 In many mature States and service providers SPIs are broken down into different types. The following section describes these different types. However it is more important that SPI are identified than classifying them.

2.4.2.2 These, two generic types of SPIs are lagging and leading. A discussion follows.

Lagging SPIs

2.4.2.3 Lagging SPIs are metrics that measure events that have already occurred and are sometimes known as “outcome SPIs”. These are normally the negative outcomes that the organization is aiming to prevent.

2.4.2.4 Lagging SPIs are used to get an understanding of what is happening in an organisation. They are also useful for aggregate, long-term trending, either at a high level or for specific occurrence types or locations (for example, types of accidents per aircraft types; specific incidents within a particular region). Because lagging SPIs measure safety outcomes, they can measure the effectiveness of safety mitigations, and are a way of validating the overall safety performance of the system. For example, monitoring the number of ramp collisions among ground vehicles following a re-design of ramp markings provides a measure of the effectiveness of the new markings. It should always be recognised that even if a reduction in collisions is achieved, it may not only be due to the new markings, but due to other factors. Nevertheless, the reduction in collisions validates an improvement in the overall safety performance of the ramp system.

2.4.2.5 Also, trends in these indicators can be analysed to determine conditions existing in the system that should be addressed. For example, an increasing trend regarding ramp collisions among ground vehicles may lead to identify sub-standard conditions of ramp markings.

2.4.2.6 Lagging SPIs are generally divided into two types:

- **high-severity/low-probability,** such as accidents or serious incidents. The low frequency of high severity outcomes means that aggregation (at industry segment level or regional level) may result in more meaningful analyses. An example of this type of lagging SPI would be: Aircraft damage due to bird strike.
- **lower-severity/higher-probability** outcomes that did not manifest themselves in a serious incident or accident. Such SPIs are sometimes referred to as “precursor event” indicators. SPIs for lower severity/higher probability outcomes are primarily useful to monitor specific safety issues and measure the effectiveness of safety risk mitigations in place against the potential consequences of hazards. An example of this type of precursor SPI would be: Bird radar detections (**Error! Reference source not found.**).

Leading SPIs

2.4.2.7 Leading indicators are metrics that focus on processes and inputs that are being implemented to improve or maintain safety. These are also known as “activity SPIs or process SPIs” as they monitor and measure conditions that have the potential to become or to contribute to a specific outcome.

2.4.2.8 Examples of leading SPIs driving the development of organizational capabilities for proactive safety performance management could be: “Percentage of staff who have successfully completed safety training on-time”. And “Percentage of on-time completion of agreed mitigation actions”.

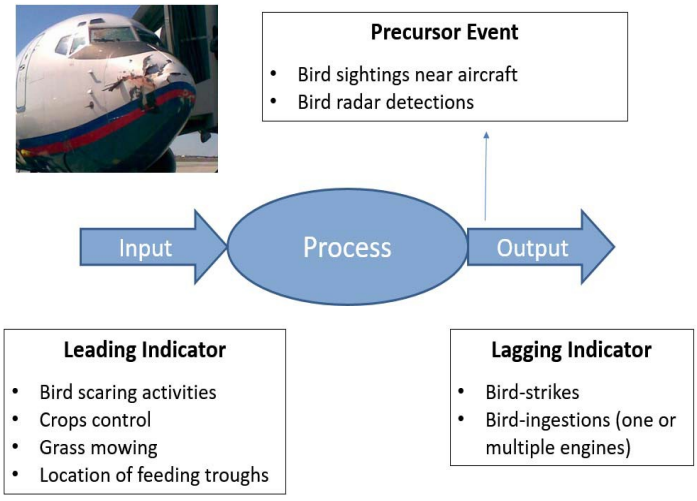


Figure 11: Leading verses Lagging indicator concept

2.4.2.9 Leading SPIs may also inform the organization about the operations and how it copes with changes, including changes in its operating environment. The focus will be either on anticipating weaknesses and vulnerabilities as a result of the change or on monitoring the performance after a change. An example of SPIs to monitor a change in operations would be: "Number of sites that have implemented a new procedure".

2.4.3 Safety Performance Indicator criteria

2.4.3.1 SPIs should be:

- Developed based on reliable measurement;
- Appropriately specific and quantifiable;
- Realistic, by taking into account possibilities and constraints of the organization; and
- Auditable.

2.4.4 Selecting appropriate Safety Performance Indicator

2.4.4.1 There should be a clear link between leading SPIs, precursor events SPI and Lagging SPIs. Ideally the lagging SPIs should be defined before determining the leading SPIs or precursor event SPIs. Before defining a precursor SPI linked to a more serious event or condition (the lagging SPI), this ensures that there is a clear correlation between the two. These linkages can be seen in **Figure** 12 below.

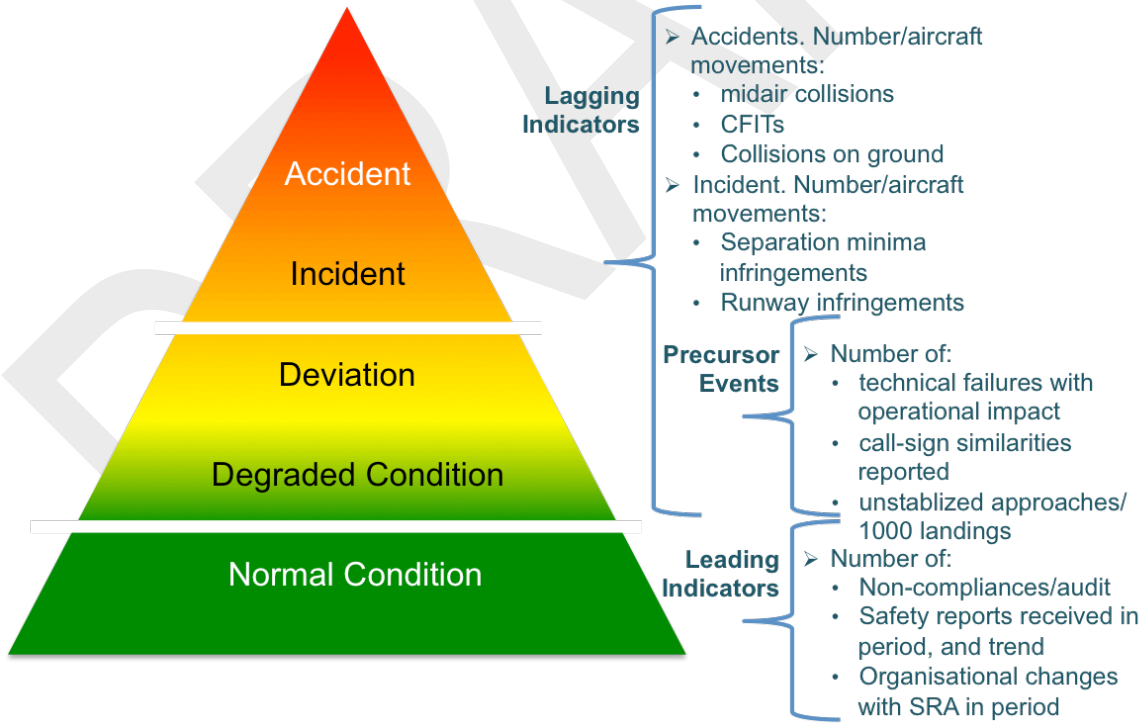


Figure 12: Leading / Lagging process

2.4.4.2 It is important to select SPIs that focus on the most significant safety objectives and outcomes. It will be easier to identify SPTs that will inform progress towards attainment of safety objectives if the SPIs are well defined and linked to the safety objectives. This will then allow the organization to assign resources for greatest effect.

2.4.4.3 It is likely that initial selection of SPIs will be limited to the monitoring and measurement of parameters representing safety concerns or processes that are easy or convenient to capture by the organization. This may also reflect the limited safety data available to organizations. SPIs should focus on parameters that are important to monitor and measure rather than on those that are easy to. SPIs are ultimately the parameters that provide senior management with a view of the current safety performance of the organization. The development of SPIs should therefore reflect realistic parameters that are relevant to the organization, regardless of their complexity.

2.4.4.4 When developing SPIs they should be representative of the processes, operational interactions and safety risks specific to the system. The values allocated to SPIs, SPTs and the associated alert levels (if applicable) should be unique to the particular organization. They should address the safety risk picture in the particular organization. Therefore organizations should consider the following for the definition of SPIs:

- There should not be any fixed or mandatory (i.e. industry-wide) prescribed SPIs, SPTs and their associated alert values (if applicable);
- Each organization should select their own SPIs and SPTs that are appropriate to its operational context, performance history and expectations.

2.4.5 SPIs and safety reporting

2.4.5.1 SPIs may be developed using safety reporting rates as a parameter. Caution should be exercised when reporting rates are the parameter upon which an SPI is selected. For example, changes in operational practices may lead to under-reporting until the impact of the modified practices in operations is fully appreciated by potential reporters. As another example, changes in the provisions protecting safety information and its related sources may also lead to over-reporting. In both examples, reporting bias may distort the intent and accuracy of SPIs and this where having SPTs may need to be avoided. Regardless of the previous caveat, safety reporting still provides valuable data for the management of safety performance.

2.4.6 SPIs and data aggregation

2.4.6.1 Aggregation of safety data is a valid alternative to select SPIs at State level for safety performance management, since aggregated data may identify areas of overarching safety concern across different aviation activities or sectors within the State. However, when implementing safety mitigations, de-aggregation may be necessary to address specifics of particular activities, at the “local level”. For example, aggregated safety data may be valid to define SPIs related to airspace management. De-aggregation may be necessary to address specific operational issues at particular facilities (i.e. ACAS/TCAS alerts), or related to different service providers (i.e. airline or ATS provider).

2.4.7 SPIs contents

2.4.7.1 The contents of each SPI should include:

- A description of what the SPI measures;
- The purpose of the SPI (what it is intended to manage and who it is intended to inform);
- The units of measurement and any requirements for its calculation;
- Who is responsible for collecting, validating, analysing, reporting and acting on the SPI (these may be different people within different parts of the organization);
- Where or how the data should be collected;
- The frequency of reporting, collecting and analysing the SPI; and

- Potential actions for when the SPI deviates from the expected level or accepted tolerances, including when the deviation should be reported to senior management.

2.5 SAFETY PERFORMANCE TARGETS

2.5.1 Safety performance targets considerations

2.5.1.1 SPTs define short and medium-term safety performance management outcomes. SPTs are expressed in numerical terms and should be specific, measurable, attainable, realistic and timely (SMART). SPTs must contain always achievement dates, with milestones if the target is to be achieved in phases or over an extended period of time.

2.5.1.2 SPTs provide a measurable way of verifying the effectiveness and efficiency of safety performance management activities. SPTs setting should take into consideration factors such as the prevailing level of safety risk, safety risk tolerability, the costs and benefits related to SPT achievement, as well as expectations regarding the safety of the particular aviation industry. The setting of SPTs should be determined after considering what is realistically achievable for the associated aviation sector. It should take into consideration recent performance of the particular associated SPI, where historical trend data are available.

2.5.2 Safety performance alerts

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

2.5.2.2 An alert is an established level or criteria value that serves as the primary trigger for an evaluation, adjustment or remedial action related to the particular indicator. A basic objective method for setting out-of-control (Ouch) alert criteria for SPTs is the use of the population standard deviation principle (STDEVP). This method derives the standard deviation (SD) value based on the preceding historical data points of a given safety indicator. This SD value plus the average (mean) value of the historical data set forms the basic alert value for the next monitoring period. The SD principle (a basic MS Excel function) sets the alert 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 result in higher (more generous) alert level values for the next monitoring period.

2.5.2.3 Once SPTs and alert settings have been defined, the SPT and the alert level for each associated SPI may be tracked for their respective performance status. A consolidated summary of the overall SPT and alert performance outcome of the complete SPIs package of the organization may also be compiled and/or aggregated for a given monitoring period. Qualitative values (satisfactory/unsatisfactory) may be assigned for each “SPT 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 SPIs package.

2.5.3 Caveat on alerts

2.5.3.1 The notion of alert was designed and therefore is best suited for SRM of technical systems, e.g. aircraft engines. In this case, reliability measures lend themselves to accurate alert and alert level definition. The notions were not designed for, and arguably less relevant and meaningful to, SRM of socio-technical systems; i.e., a State’s aviation system, air traffic services provider, and operator, an aerodrome service provider and so forth. Socio-technical systems are systems where people actively interact with technology to achieve the system’s service delivery or production objectives. The degraded relevance and meaningfulness of alerts in socio-technical systems is due to the acknowledged limitations of reliability measures when human performance is involved.

2.5.3.2 Both the SSP and an SMS are socio-technical systems; therefore, a flexible approach to the integration of alerts into the management of safety performance is necessary. Fundamentally, it is stressed that it is not a “must” for either States or service providers to define alert levels for each SPI.

2.5.3.3 There are benefits for organizations in developing alert levels, if trusted and reliable data is available. Mainly, alerts provide early warning flags and allow for proactive management of SPIs and, therefore, of safety performance. But there are also challenges in defining alert levels; mainly, alerts and their associated levels require safety data of high granularity as well as safety data management capabilities that may impose a high workload on either a State or service provider.

2.5.3.4 Therefore, the decision of whether and when the definition of alert levels for SPIs is within realistic possibilities of an organization, and if such development will indeed bring a benefit to safety performance management, is a decision that should be left to individual organizations.. The development of alerts should not be the result of a regulatory imposition.

2.5.4 Important consideration for SPIs and SPTs

2.5.4.1 Examples of most valuable consideration in SPI and SPT selection include:

- **Workload management**. Creating a workable amount of SPIs can help staff manage their analysis and reporting workload. The same is true if SPIs are appropriately complex, or if the necessary data to define the SPIs is readily accessible. It is better to agree on what is feasible and prioritise the selection of SPIs on this basis. If SPIs are no longer informing safety performance, or of lower priority, consider discontinuing them in favour of more useful or higher priority indicators.
- **Optimal spread of SPIs**. A combination of SPIs that encompass the four focus areas will help gain an insight to how the organization's overall safety performance;
- **Clarity of SPIs**. When selecting an SPI, it should be clear what is being measured and how often. SPIs with clear definitions will aid in understanding the results, avoid misinterpretation, and allow meaningful comparisons over time.
- **Encouraging desired behaviour**. SPTs can change behaviours and in contribute to desired outcomes. This is especially penitent if achievement of the target is linked to organisational rewards; such as management remuneration. As further example, thoughtful defined reportable events will enhance clarity and encourage appropriate reporting by operational personnel. SPTs should foster positive organizational and individual behaviours that deliberately result in improved safety performance, as result of meeting SPTs.
- **Choosing the valuable metrics**. It is imperative that the most valuable SPIs are selected, not only the ones which are easily measured. This could leads to measuring the most valuable safety parameters; those that guide the organisation to improved safety performance.
- **Achieving safety performance targets**. This is a particularly important consideration, one that is linked to the desired safety behaviours SPTs might induce or encourage. Achieving SPTs is not necessarily an indication of object safety management success. It is important to ascertain whether the safety improvement has been made with or without the SPT having been achieved, rather than looking at an individual SPT in isolation. The focus should be on assessing whether the organisation has recognised and taken action to improve safety performance. Recognition for ability to achieve the SPTs will foster desirable organizational behaviours and will encourage the 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.

2.5.5 Safety Performance management development

2.5.5.1 SPI development is an on-going activity as safety risks, the availability of data, or both constantly change over time. Initial SPIs may be developed using limited sources of safety information whereas over time more safety data is captured and analysis capabilities mature. It may be easier for less complex organizations to initially develop simple (broader) SPIs, and as they gather more data, they may then start to narrow down SPIs to help monitor and measure specific parameters. Thus, small organizations of non-complex nature may elect to scale down SPIs, and select generic SPIs that apply to most aviation systems. These SPIs are easier to monitor and inform about an organization's general safety performance. Some examples of generic SPIs would be:

- Events including structural damage, fire, explosion to equipment;
- Events indicating circumstances that an accident nearly occurred;
- Events in which operational personnel or members of the aviation community were fatally or seriously injured;
- Number of voluntary occurrence reports; and
- Number of mandatory occurrence reports.

2.5.5.2 Larger systems of increased complexity may elect to scale up, and integrate generic SPIs such as those listed above with activity-specific SPIs. Thus, a large airport providing services to major airlines and situated under a complex airspace may elect to combine some of the generic SPIs listed above with narrower-scope SPIs representing specific aspects of aerodrome operations, the monitoring of which requires greater effort than monitoring and measuring generic SPIs. Complex SPIs often rely on sophisticated technology such as flight data analysis (FDA) but are only available to a limited number of Service providers. It is clear that SPI simplicity and complexity issues are intertwined with scalability issues and both need to be considered in selecting SPIs.

2.5.6 Review safety performance effectiveness

2.5.6.1 The set of SPIs and SPTs selected by an organization should be periodically reviewed to check that they continue to provide meaningful information for safety performance improvements. Some reasons to discontinue or change SPIs include:

- Instances where SPIs continually report the same value (such as zero or 100%). These SPIs are unlikely to provide meaningful input to senior management decision making;
- An SPI that measures something similar to another SPI and provides the same assurances. This is duplicate effort;
- When the SPT for an SPI implemented to measure the introduction of a programme or targeted improvement has been met;
- When other safety concerns become a higher priority to monitor and measure; and
- 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").
- SPIs should be reviewed when safety objectives are changed to ensure they remain relevant and appropriate.

3. Chapter

DATA-DRIVEN DECISION MAKING

3.1 INTRODUCTION

3.1.1 Introduction to Safety performance management

3.1.1.1 Informed decision-making is one of the most important facets of any management system. The history of aviation has been full of many good decisions, but there have also been some poor decisions. Poor decisions result in a waste of money, labour, natural and other resources and sometimes, poor decisions, particularly in the aviation realm, may have fatal consequences. The goal of decision-makers, then, is to minimize poor outcomes and to achieve effective goals of the decision.

3.1.1.2 Good decision-making is not easy. People often make decisions without first informing themselves of all the relevant factors. People are also subject to bias that, consciously or subconsciously, affects decision-making.

3.1.1.3 Academics have long studied how decisions are made, both in strategic and operational contexts, in an effort to develop methodologies that improve the outcomes of decision-making processes. This has led to the decision-making challenges, whereby different methods applied to the same problem often generated a different decision.

3.1.1.4 The intent is not to make “perfect” or ideal decisions, but to rather make good decisions that fulfil defined objectives and meet the following criteria:

a) Transparent: the entire aviation community should know all the factors that influence a decision, including the process used to arrive at the decision.

b) Accountable: the decision-maker “owns” the decision and the associated outcomes. Clarity and transparency also bring about accountability – it’s not easy to hide behind a decision where roles and responsibilities are defined in detail and where expectations associated with the new decision are clearly outlined.

c) Fair and objective: the decision-maker is not influenced by considerations that are not relevant (e.g. monetary gain or personal relationships).

d) Justifiable and defensible: the decision can be shown to be reasonable given the inputs to the decision and the process followed.

e) Reproducible: given the same information that was available to the decision-maker and using the same process, another person would arrive at the same decision.

f) Executable: the decision is clear enough and that clarity minimizes uncertainty.

g) Pragmatic: humans are creatures of emotion, which means eliminating emotion from a decision isn't feasible. However, what can be eliminated are self-serving emotional biases. A healthy question to ask in the face of difficult decisions is: whom does the decision serve?

3.2 DEFINITIONS OF DATA AND INFORMATION

3.2.1.1 Data is what we record as the result of observations or measurements. It refers to, or represents an idea, a condition, and the properties of an object, event or the environment. It is limitless and present everywhere.

3.2.1.2 Data is unstructured and unorganized. Unstructured or “raw” data needs to be “processed”, i.e. it needs to be collected, measured, analysed and reported.

3.2.1.3 Information is data that is useful. Data is made useful by processing and giving it structure or order so that it has context and, therefore, is meaningful.

3.2.1.4 Annex 19 defines safety data as a defined set of facts or set of safety values collected from various aviation-related sources, which is used to maintain or improve safety.

3.2.1.5 Safety information is defined as safety data processed, organized and analysed in a given context so as to make it useful for safety management purposes.

3.2.1.6 These definitions reflect the distinction between data and information: once safety data is processed, organized, analysed and put in a certain context, it becomes safety information that is useful for a specific purpose, i.e. safety management.

3.3 DATA-DRIVEN DECISION MAKING

3.3.1.1 Data-driven decision-making (also referred to as DDDM or D3M) is a process-driven approach to decision making.

3.3.1.2 In D3M, effective and informed decisions are based on the results of analysing the right data. Using valid and relevant data helps put the “problem” in the right context and determine a best-fit “solution”. D3M provides credible evidence based on factual data to stakeholders and management regarding strengths, weaknesses, opportunities, limitations and risks associated with the decision. It also mitigates bias, influence and human error in the decision making process. Having said that, we cannot rely on data alone. The decision process (which includes interpretation of the data / information) must also take into consideration the context of the decision. This could include such things as stakeholder priorities, known deficiencies in the data, existing knowledge.

3.3.1.3 The D3M process can be a critical tool that increases the value and effectiveness of SSP and SMS. The effective management of safety depends on making defendable and informed decisions. This requires clearly defined safety data and information requirements, standards, collection methods, data management, analysis and sharing, all of which are components of a D3M process.

3.4 ADVANTAGES OF DATA-DRIVEN DECISION MAKING

3.4.1.1 Since D3M is a systematic and process-driven approach to decision-making, it enables managers to focus on strategy and policy issues and address various aspects related to change management, safety risk assessments, decisions etc. For example:

- changes that can be expected in statutory and regulatory requirements, emerging technologies or resources which may affect the organization;
- potential changes in the needs and expectations of the aviation community and interested parties;
- various priorities that need to be established and managed, e.g. strategic, operational, resources;
- new skills, competencies, tools and even change management processes that may be needed to implement new decision(s);
- risks that need to be identified, managed or minimized;
- existing services, products and processes that currently provide the most value for interested parties; and
- evolving demands for new services, products and processes.

3.4.1.2 Once an organization adopts the D3M approach, the organization’s board members and managers become the key members of the aviation community. As a result, data-driven decisions are more likely to be aligned with strategic safety objectives and the safety and business priorities of the organization.

3.4.1.3 A structured approach such as D3M makes it more difficult for decision makers to influence a decision if the evidence suggests that the option they would prefer is clearly not the best. This requires trust in the system. If there is confidence in the data and/or analysis, there will be trust in any decisions derived from it.

3.4.1.4 Since the D3M process is driven by data, it allows decision makers to measure the effectiveness of their past decisions in order to develop future decisions and associated data requirements. This can be achieved by referencing factual records of the past. It also enables decision makers to review, evaluate, challenge and change results of decisions already made

3.5 COMMON CHALLENGES

3.5.1.1 D3M has an associated degree of overhead. Implementing processes for data collection and analysis takes time and money, as well as expertise and skills that may not be available in the organization. The appropriate amount of time and resources to be invested into the decision-making process needs to be carefully and consciously considered. Factors in this decision include the amount of money involved in the decision, the extent of the influence of the decision and the permanence of the decision. If the aviation community does not understand what is involved, then the D3M process may become a source of frustration for some of its members that may cause them to undermine or abandon the process. Like SSP and SMS, D3M requires – not just a shift in thinking – but a commitment to build and sustain the structures and skills necessary to maximise the opportunities presented by D3M.

3.5.1.2 It is harder to build trust in data versus trust in an expert's input and opinion. Therefore, adopting the D3M approach requires a shift in the culture and mind-set of the organization where decisions are based upon factual data and objective evidence and not only on opinions and individual input.

3.5.1.3 In some extreme cases the decision-making process may become bogged down in an attempt to find the "best possible" decision. This problem is referred to as "analysis paralysis". Strategies that can be used to avoid this include:

- setting a deadline;
- having a well-defined scope and objective; and
- not aiming for a "perfect" decision or solution the first time, but rather coming up with a "suitable" and "practical" decision and improving it with every iteration of the decision.

3.6 THE DATA-DRIVEN DECISION MAKING PROCESS

3.6.1.1 Figure 13 below shows the D3M process:

Figure 63: D3M process

3.6.2 Step 1 - Defining the problem

3.6.2.1 The first step in planning and establishing the D3M process is to define the problem that needs to be solved or the decision that needs to be made through data collection and analysis. What is the question that needs to be answered? What decision does management need to make?

3.6.2.2 In the process of defining the problem statement, management needs to also consider the following questions:

- Does the collection and analysis of data support and relate to the organization's objectives and business requirements?
- Is the required data available? Or can it be obtained in a reasonable manner?
- Is it practical and feasible to collect and analyse the data?
- Are the required resources (people, equipment, software, funds) available?

3.6.2.3 In the safety management context, the main problem statements within the organization are related to evaluating and selecting safety priorities and establishing measures for safety risk mitigation.

3.6.3 Step 2 - Developing objectives

3.6.3.1 In the planning phase of the D3M process, the organization needs to define the objective of collecting and analysing data. Why does the organization need to address the identified problem? And how and where will managers and decision makers use the results of data collection and analysis? Having a clear understanding of why the organization needs to collect, analyse, share and exchange safety data and information is fundamental for any Safety Data Collection Processing System (SDCPS). The results of data analysis is needed to identify trends, make informed decisions, evaluate the safety performance in relation to defined objectives, assess risks or fulfil requirements.

3.6.4 Step 3 - Collecting data

3.6.4.1 The organization needs to determine what data needs to be collected and how. Identifying what data supports the effective management of safety within a State or organization shall be in line with the size and complexity of their aviation activities. In this step of the process, it should be noted that even data that may seem to be unrelated to safety may be critical for identifying safety issues and supporting related decision-making.

3.6.4.2 Requirements for the collection of safety data to support SSP and SMS implementation are already included in Annexes, SARPs, PANS and other ICAO documents. Table 1 provides examples of safety reporting systems reflected in various Annexes, PANS and guidance documents.

Reporting System	Reference	Provision Chapter Paragraph[9]	For State Service Provider	Year of initial adoption / approval
Service difficulty reporting	Annex 8 – Airworthiness of Aircraft	Part II, 4.2	State	1982
	Doc 9760 – Airworthiness manual	Part III, 9.8; Part IV, 4.8; Part V, 6.8	State	2014
Air traffic incident reporting	Doc 4444 – PANS Air Traffic Management	16.3	State and service provider	1970
	Doc 9426 – Air Traffic Services Planning Manual, Part 2	Chapter 3	service provider	1984
Wild-life/bird strike reporting	Annex 14, Volume I – Aerodromes, Aerodrome Design and Operations	9.4	State and service provider	1990
	Doc 9137 – Airport Service Manual, Part 3 – Bird Control and Reduction	3.5	State and service provider	1991
Laser emission reporting	Doc 9815 – Manual on Laser Emitters and Flight Safety	5.6	State	2003
Aerodrome safety reporting	Doc 9981 – PANS Aerodromes	Chapter 2	service provider	2014
Dangerous goods accident and incident reporting	Annex 18	Chapter 12	State	1981
Fatigue reporting	Annex 6, Part 1 – Operation of Aircraft, International Commercial Air Transport - Aeroplanes	4.10.6	service provider	2011
	Doc 9966 – Manual for the Oversight of the Fatigue Management Approach	3.3.1	service provider	2012

Table 9: Examples of reporting systems in various Annexes, PANS and ICAO Documents

[9] Current edition

Table 10: Typical data sources

3.6.4.3 Additional details regarding data collection are outlined in section 5.7.2.

3.6.5 Step 4 - Conducting data analysis

3.6.5.1 Data Analysis is the process of applying statistical or other analytical techniques to check, examine, describe, transform, condense, evaluate and visualize data in order to discover useful information, suggest conclusions and support decision making.

3.6.5.2 The use of suitable tools for analysis of data provides a more accurate understanding of the overall situation by examining the data in ways that reveal the existing relationships, connections, patterns and trends that exist within it.

3.6.5.3 Statistical analysis of data shows:

- whether the organization, system or process is improving;
- factors that cause change;
- connections or “correlations” between or among various factors;
- whether an assumption is valid or not; and
- the degree to which the obtained results can be trusted.

3.6.5.4 Statistical analysis of data also allows managers and decision makers to compare information to other groups (i.e. a control or comparison group) to help draw conclusions from the data.

3.6.5.5 Descriptive statistics help describe, show or summarize data in a meaningful way so that patterns might emerge from the data. Descriptive statistical techniques provide information about the data; however, they do not allow users to make conclusions beyond the analysed data or to reach conclusions regarding any hypotheses about the data. They are a way to describe the data.

3.6.5.6 Descriptive statistics are helpful, because if we simply presented the raw data, particularly in large quantities, it would be hard to visualize what the data was showing. Therefore, descriptive statistics enable users to present and see the data in a more meaningful way, allowing simpler interpretation of the data. Tools such as tables and matrices, graphs and charts and even maps are examples of tools used for summarizing data. Descriptive statistics include measures of central tendency such as mean (average), median and mode, as well as measures of variability such as range, quartiles, minimum and maximum, frequency distributions, variance and standard deviation. These summaries may either be the initial basis for describing the data as part of a more extensive statistical analysis or they may be sufficient in and of themselves for a particular investigation.

3.6.5.7 Inferential (or inductive) statistics are distinguished from descriptive statistics in that while descriptive statistics aim to summarize the date, inferential statistics use the data to learn about the larger population that the sample of data represents. It is not always convenient or possible to examine each member of an entire population and to have access to a whole population. Inferential statistics are techniques that allow users to available data to

make generalizations, inferences and conclusions about the population from which the samples were taken in order to describe what is going on. These include methods for estimating parameters, testing of statistical hypotheses, comparing the average performance of two groups on the same measure to identify differences or similarities and identifying possible correlations and relationships among variables.

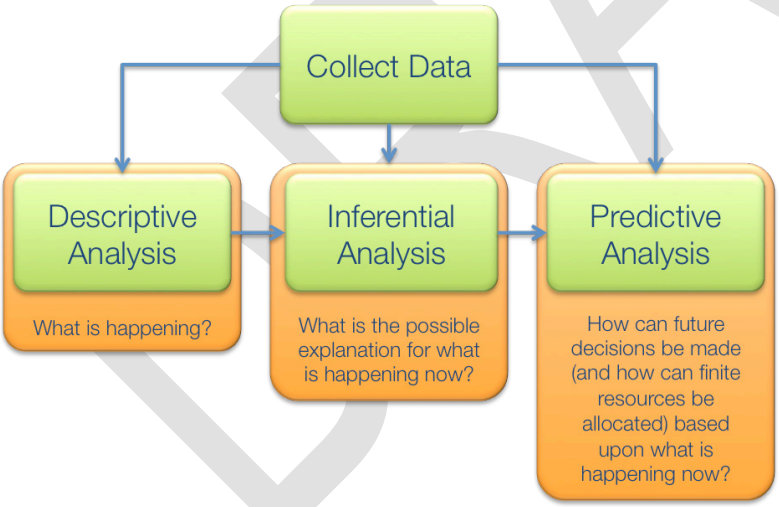
3.6.5.8 Other types of advanced analyses include probability or predictive analyses that extract information from historical and current data and use it to predict trends and behaviour patterns. The patterns found in the data help identify emerging risks and opportunities. Often the unknown event of interest is in the future, but predictive analytics can be applied to any type of unknown in the past, present or future. The core of predictive analytics relies on capturing relationships between variables from past occurrences and exploiting them to predict the unknown outcome. Some models allow users to tweak various conditions that generate different scenarios of risks or opportunities with different outcomes. This enables decision makers to assess the decisions they can make in the face of different unknown circumstances and to evaluate how they can effectively allocate limited resources to areas where the highest risks or best opportunities exist.

3.6.5.9 Various types of statistical analyses are interconnected and often conducted together. For example, an inferential technique may be the main tool used to draw conclusions regarding a set of data, but descriptive statistics are also usually used and presented. Also, outputs of inferential statistics are often used as the basis for predictive analysis. **Error! Reference source not found.** below summarizes the analytical methods described above.

3.6.5.10 Analytical techniques can be applied to safety analysis in order to:

- bring out useful information for identifying and reducing safety risks to an as low as reasonably practical (ALARP) level;
- identify the causes and contributing factors related to hazards and elements which are detrimental to the continuous improvement of aviation safety;
- examine areas for improvement and increases in the effectiveness of safety controls; and
- support on-going monitoring of safety performance and trends.

Figure 74: Statistical analysis



3.6.6 Step 5 - Reporting and sharing of analysis results

3.6.6.1 The results of data analysis need to be shared with and made available to members of the aviation community who need them, including internal decision makers and managers and external service providers and other States. The level and scope of the contents depend on whom a report is intended for. Therefore, it is important to have a clear understanding of a report's target audience. Executives, managers and technical experts have different needs and they will look for different information in the report. Executives usually skim through a high-level (executive) summary of the conclusions and recommendations; managers typically look for the detailed conclusions and recommendations that indicate the actions and decisions that need to be taken; technical experts may be interested in details and technical aspects of data collection and analyses, as well as conclusions and recommendations.

3.6.6.2 It is helpful to translate recommendations into action plans, decisions and priorities that decision makers in the organization need to consider and, if possible, to outline who needs to do what about the analysis results and by when.

3.6.6.3 Visualization tools such as charts, graphs, images and dashboards are simple yet effective means of presenting results of data analysis. Several examples of visual data analysis reports can be found on ICAO's Integrated Safety Trends Analysis and Reporting System (iSTARS) at https://portal.icao.int/space/

3.6.6.4 Imminent safety alerts are another means of reporting safety hazards with severe potentials to other States or service providers so that they can take necessary actions.

3.6.6.5 Collecting and analysing the data required for effective management and decision-making is an on-going process. The results of data analysis may reveal that more and better data need to be collected and analysed in support of the actions and decisions that the organization needs to take. Figure 15 below shows how reporting of analysis results may determine further requirements for data to be collected.

3.6.6.6 Results of safety data analysis highlight areas of high safety risk and assist decision makers and managers to:

- take immediate corrective actions;
- implement safety risk based surveillance;
- define or redefine safety policy and objectives;
- define or redefine safety performance indicators (SPIs);
- promote safety; and
- conduct safety risk assessment.

3.6.6.7 **Figure** 15 also shows how the D3M process of collecting and analysing data and the decisions resulting from the analyses contribute to these components of safety risk and safety management.

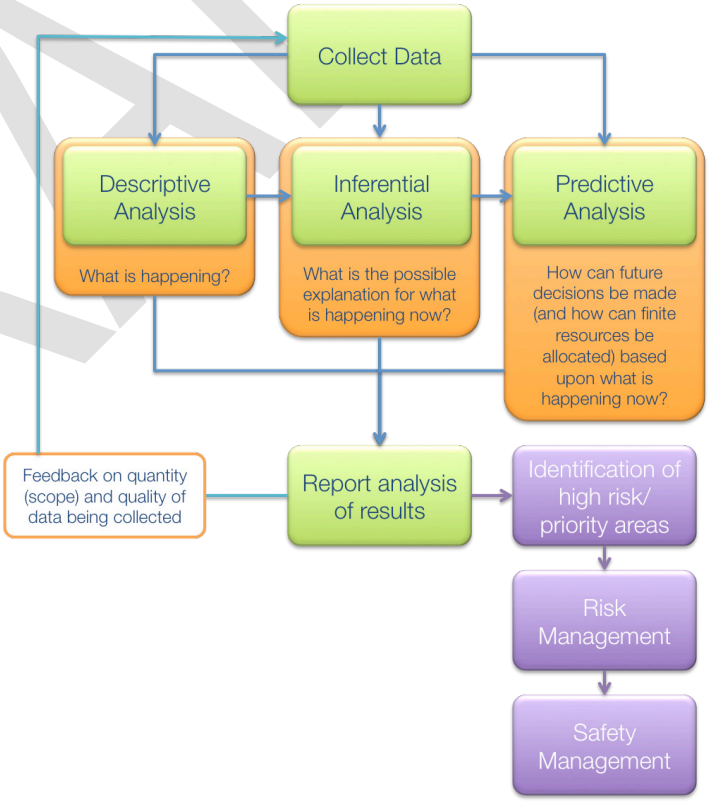


Figure 85: D3M and safety management

3.7 DATA MANAGEMENT

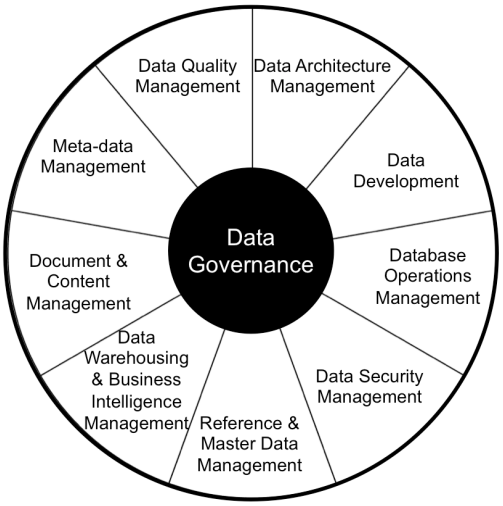


Figure 96: D3M and safety management

3.7.1.1 The Data Management Body of Knowledge of the Data Management Association (DAMA) defines data management as “the development, execution and supervision of plans, policies, programs and practices that control, protect, deliver and enhance the value of data and information assets.”

3.7.1.2 As demonstrated in **Figure 16**, data management is a broad field. However, this chapter focuses on the following data management topics as relevant to the scope of this manual and as applicable to the requirements of the D3M process:

1. data governance;
2. data collection (data development)
3. data quality;
4. data security and protection; and
5. metadata management.

3.7.2 Data governance

3.7.2.1 Data governance is the overall management of the availability, usability, integrity and security of the data used in an organization. It includes a governing body, a defined set of procedures and a plan to execute those procedures.

3.7.2.2 Good data governance ensures that the results of analysis are valid and valued by the decision makers. The breadth and complexity of data management require organizations to implement protocols, processes, standards and controls for the data governance programme defining, among others:

- roles and responsibilities and identifying the owners or custodians of the data assets in the organization;
- who is accountable for various portions or aspects of the data, including its accuracy, accessibility, consistency, completeness, and updating;
- how the data is to be collected and used by authorized personnel;
- how the data is to be stored, archived and backed up;
- how the data and analysis results are to be shared and exchanged with other parties;
- how the data is to be protected from mishaps, theft or attack;
- data definitions, taxonomies and formats that allow the data to be collected, stored and shared in a standard and harmonized manner; and
- controls and audits needed to ensure ongoing compliance with applicable regulations and requirements.

3.7.3 Data collection (data development)

3.7.3.1 Collecting the right quantity and quality of data is the basis for sound decision making. Effective implementation of D3M requires managers and experts in an organization to determine what data to collect and how. Collecting data that is fit for purpose includes the following considerations:

- identifying the business data needs;

- determining whether the data already exists; and
- collecting/acquiring the missing data.

3.7.3.2 Much of the data that is the basis of decision making for an organization comes from its routine, everyday operations and is available from different sources available within the organization. To determine the source of data and to decide how much data needs to be collected, the organization needs to identify the "object of interest": what is it that we are interested in? For safety analysis, the object of interest related to aviation activities typically include:

- **organizations** – examples: airlines, maintenance organizations, training organizations;
- **people** – examples: licensed personnel, qualified inspectors;
- **physical entities** – examples: airports, aircrafts; and
- **virtual entities** – example: airspace.

3.7.3.3 In most cases, the following sources of safety data are available within a civil aviation system:

- accident and incident investigations;
- safety investigations;
- mandatory safety reports;
- voluntary safety reports;
- continuing airworthiness reports;
- operational performance monitoring reports;
- safety risk assessments;
- audit findings/reports; and
- safety studies/reviews.

3.7.3.4 Routinely available data is not always enough for important decisions. In the initial phases of an SMS or an SSP, the organization may not have sufficient safety data available. In that case, the organization needs to obtain the information through additional research and observation or through a data sharing and exchange scheme with other sources and entities such as neighbouring States, other States with a similar aviation environment, service providers, regional or international aviation safety entities, regional safety oversight organizations (RSOOs), regional accident and incident investigation organizations (RAIOs) and ICAO. **Table** 11 below lists the types of data and information commonly used.

Data / information source	Reactive	Proactive	Predictive	Reference
Accident and incident investigation	X			Manual of Aircraft Accident and Incident Investigation (Doc 9756) Part IV, Reporting
Safety investigation	X			
Mandatory safety report	X	X		
Voluntary safety report	X	X		
Audit findings/report		X	X	
Safety risk assessment of change		X		

Table 11: Examples of reporting systems in various Annexes, PANS and ICAO Documents

3.7.3.5 Safety reporting systems are essential tools for collecting safety data required to support safety management activities. As discussed in section 5.6.3, requirements for data reporting are outlined in various Annexes, SARPs, PANS and ICAO documents. Safety reporting systems may be mandatory or voluntary, depending on the legislation established in a State or an organization's specific policies and procedures.

3.7.4 Data quality

3.7.4.1 Data quality deals with ensuring that the data is “fit for purpose” rather than having “perfect” data. Data quality involves the following aspects:

- relevance;
- timeliness; and
- accuracy and correctness.

3.7.4.2 The relevance of data is the degree to which it meets the needs of its users and whether the available data sheds light on issues that are most important to users. The organization needs to assess the relevance of data based on its needs and activities.

3.7.4.3 The timeliness of data refers to the delay between the reference point (or the end of the reference period) to which the information pertains and the date when the information becomes available. The timeliness of data will influence its relevance, i.e. data that is too old may be irrelevant to the organization’s present-time reality and issues. The organization needs to collect and use timely and up-to-date data that appropriately reflect its current activities.

3.7.4.4 The accuracy of data refers to whether the data values are the correct values. To be correct, data values must be the right values and must be represented in a consistent and unambiguous form. The most common cause of data inaccuracy is the initial data entry of users when the user entered the wrong value or made a typographical error. This problem can be overcome by having skilled and trained people doing data entry or by having components in the application such as spell check that detect typo errors. Data decay can also lead to inaccurate data. Many data values that are accurate can become inaccurate through time. Movement is another cause of inaccurate data. As data is extracted, transformed and moved from one database to another, it may be altered to some degree, especially if the software running one of the databases is not robust.

3.7.5 Data security and protection

3.7.5.1 Data security deals with ensuring that:

- the data is not lost, either as a result of internal loss by mistake or deletion or through external breaches such as hacking and theft;
- the data is backed up; and
- access to the data is controlled.

3.7.5.2 Agreements should be in place between the data owner and the custodian regarding the responsibility for the protection of the data. The data owner should pose the authority to decide how their data is used and have clearly defined agreements with potential data users or recipients. These agreements should also stipulate the types of standards and protections that must be applied and maintained by the user or recipient. For example, de-identification of a data set or the requirement that data shall only be used for the improvement of safety and not for punitive purposes. For more information about safety data and safety information protection, refer to Part II, Chapter 1.

3.7.6 Metadata management

3.7.6.1 Metadata is “data about the data”. It is essential to know the data and to catalogue its properties, including:

- what the data is;
- where it comes from (the original source);
- who created it;
- who owns it;
- who uses it;
- what we use it for;
- how we get it;

- how frequently we get it;
- where it is stored;
- the data format;
- file size; and
- any processing or transformation done to the data.

3.7.6.2 Metadata provides a common understanding of what the data is and to ensure correct and proper use and interpretation of the data by its owners and users.

3.8 Safety information sharing and exchange

3.8.1.1 It is acknowledged that sharing safety information amongst aviation stakeholders is an essential component for the continuous improvement of aviation safety. It ensures a consistent, fact-based and transparent response to safety concerns at the global, State and organizational levels.

3.8.1.2 Although each State and service provider has the autonomy to develop their own Safety Data Collection and Processing System (SDCPS) in the context of their organization, it is recognized that the aviation community as a whole benefits when the integration of safety information derived from these systems provide are shared to provide a more complete picture. As such, there are requirements in Annex 19 for States to share and exchange safety information, with other States and service providers as appropriate. They must also promote the establishment of safety information sharing and exchange networks amongst all stakeholders, unless national law provides otherwise. SMS and SSP are both dependent on this.

3.8.1.3 It is important to note that Annex 19 requires States to share and exchange safety information that may be of interest to other States. There is no requirement for any State or service provider to share their data.

3.8.1.4 It is also important to add that due to the sensitivity of the safety information and its sources, States or service providers need to agree on the level of protection and conditions on which safety information will be shared or exchanged. The level of protection and conditions shall be in line with Annex 19. Further information on the protection of safety data and safety information can be found in Part II, Chapter 1.

Part III

EFFECTIVE SAFETY MANAGEMENT

1. Chapter
STATE SAFETY MANAGEMENT

1.1 INTRODUCTION

1.1.1 Introduction to State safety management responsibilities

Chapter 3 of Annex 19 contains SARPs related to the safety management responsibilities of States. This includes the establishment and maintenance of a State Safety Programme (SSP) to manage safety in an integrated manner.

1.1.1 Background

1.1.1.1 The First Edition of Annex 19 contained two sets of provisions, that States were expected to address, the:

1) 8 Critical Elements (CEs) of a State's safety oversight system; and

2) SSP framework.

1.1.1.2 The safety oversight aspect reflected the traditional role of the State, which is to ensure the effective implementation by the aviation industry of prescriptive ICAO SARPs, while the SSP framework represented the incorporation of safety management principles.

1.1.1.3 Conceptually, from the beginning the safety oversight system and the SSP were closely connected in terms of the safety objectives that each seeks to achieve. Both address the functions and responsibilities of the State, the former primarily with regard to safety oversight and the latter with regard to safety management and safety performance. There are clearly some aspects of safety management within the 8 CEs that reflect the transition to a proactive approach in managing safety. For example, surveillance obligations (CE-7) can be considered an element of safety assurance and primary aviation legislation (CE-1) and specific operating regulations (CE-2) were also reflected in the original SSP framework as important safety risk controls.

1.1.1.4 In the second edition of Annex 19, these responsibilities have been integrated and are collectively referred to as the State's safety management responsibilities. The SARPs related to the State's safety management responsibilities, which cover both safety oversight and safety management, are inter-dependent and constitute an integrated approach towards safety management. Although the term SSP is still used in the second edition of Annex 19, the meaning has changed to encompass the integrated set of SARPs found in Chapter 3. As such, in the second edition of Annex 19 the SSP is no longer described as a framework, but rather as a programme to meet the State's safety management responsibilities, which includes safety oversight. This evolution is illustrated in **Figure** 17 below.

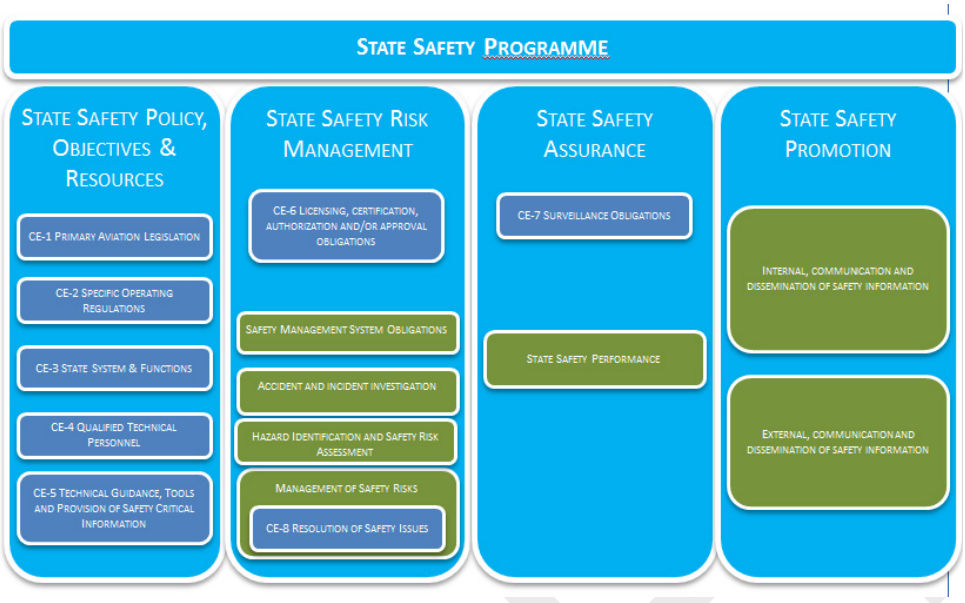


Figure 17: State safety programme

1.1.1.5 The integrated SSP provides a streamlined approach to support States in managing their aviation safety performance.

1.2 STATE SAFETY PROGRAMME

1.2.1 State safety oversight system critical elements

1.2.1.1 State safety oversight (SSO) system critical elements (CE) form the foundation upon which the SSP is built. Annex 19 reminds States that, "…*the State safety oversight system critical elements constitute the foundation of a State's SSP".*

1.2.1.2 The second edition of Annex 19 emphasizes the importance of a safety oversight system by maintaining the provisions related to the 8 CEs at the level of a Standard. The majority of the requirements from the SSP framework have been upgraded to Recommended Practices, with a few upgraded to a Standard. Details on the CEs of a SSO system are addressed in the *Safety Oversight Manual,* Part A*, The Establishment and Management of a State's Safety Oversight System* (Doc 9734).

1.2.2 Overview of the State safety programme

1.2.2.1 An SSP is an integrated set of regulations and activities aimed at improving safety. For the establishment and maintenance of the SSP, the ICAO SARPs are structured under the following four components:

1) State safety policy, objectives and resources;
2) State safety risk management;
3) State safety assurance; and
4) State safety promotion.

1.2.2.2 The implementation of an SSP requires coordination among multiple authorities responsible for the aviation functions of the State. The implementation of an SSP does not alter the respective roles of the State's aviation organizations or their normal interaction with one another; rather, the SSP aims to leverage the collective safety functions and capabilities to further enhance safety within the State. When starting to implement an SSP, most States find they already have existing processes and activities that address aspects of an SSP. The implementation

of SSP aims to consolidate and enhance these processes with additional performance and safety risk-based elements, and facilitate the effective implementation of SMS by the aviation industry in the State.

1.2.2.3 The SSP aims to:

a) ensure the State has an effective legislative framework in place with supporting specific operating regulations;

b) ensure SRM and safety assurance coordination and synergy amongst relevant State aviation authorities;

c) support effective implementation and appropriate interaction with service providers' SMS;

d) facilitate the monitoring and measurement of the safety performance of the State's aviation industry; and

e) maintain and/or continuously improve the State's overall safety performance.

1.2.3 Delegation of safety management functions and activities

1.2.3.1 The implementation of the safety management aspects of the SSP requires a paradigm shift. States are expected to complement their compliance-based oversight activities with activities to maintain and improve the State's aviation safety performance. Regulatory staff should be prepared to operate in a performance-based environment. Some safety management activities require new competencies (such as: conducting safety risk assessments or evaluating safety performance indicators (SPIs)).

1.2.3.2 Some States may find it challenging to adopt a safety management approach on their own because of the lack of necessary resources or competencies. These States may might consider combining their resources with other States to more effectively and efficiently implement their SSP. States may also wish to consider delegating specific safety management functions to a Regional Safety Oversight Organisation (RSOO), Regional Accident and Incident Investigation Organization (RAIO) or another State. States may also consider delegating activities to other qualified entities - like trade associations, industry representative organizations or other bodies that may collect and analyse data on their behalf, provide training or conduct surveillance and monitoring activities.

1.2.3.3 A State may choose to delegate some specific functions or tasks under the SSP to another State or RSOO. For example, the task of leading an accident investigation or managing a voluntary safety reporting system could be delegated. Although a State may delegate specific functions, it will still need sufficient personnel to interface with the delegated entity and to process information provided by the delegated relevant authority entities. States should also consider the establishment of appropriate technical and administrative processes to ensure that the delegated functions are carried out effectively.

1.2.3.4 States may choose to receive assistance from an RSOO for the development of surveillance processes which include the development of organizational safety risk profiles for service providers, the planning and prioritization of inspections, audits and monitoring activities of approved organization/service providers. The State may choose to delegate the surveillance activities to the RSOO. In such cases, the State should ensure they retain access to surveillance/oversight records with documented outcomes. If surveillance is delegated, the State should at a minimum periodically monitor and review each service provider safety performance.

1.2.3.5 Delegation is a means for States with limited resources to ensure they have access to the appropriate expertise. Delegation may also allow States with a relatively low level of aviation activities to collectively gather safety data to identify trends and coordinate mitigation strategies. Guidance on the establishment of an RSOO can be found in Safety Oversight Manual, Part B, The Establishment and Management of a Regional Safety Oversight Organization (Doc 9734).

1.2.3.6 Importantly, States should note, that the ultimate responsibility for the SSP remains with the State regardless of the safety management-related functions and activities they may choose to delegate.

1.3 COMPONENT 1: STATE SAFETY POLICY, OBJECTIVES AND RESOURCES

1.3.1 Introduction to State safety policy, objectives and resources

1.3.1.1 The first SSP component defines how a State will manage safety throughout its aviation system. It includes determining the requirements, obligations, functions and activities of the different State aviation authorities related to the SSP, as well as the broad safety objectives to be achieved. The State safety policy and objectives should be documented to provide clear expectations and keep the safety management efforts of the State's Civil Aviation Authority, and those of other State aviation authorities, focused on maintaining and improving safety performance. This enables the State to provide clear safety guidelines to support an air transportation system that is continuously growing and increasing in complexity.

1.3.1.2 The State's legal framework dictates how aviation safety will be managed. Service providers have the legal responsibility for the safety of their products and services; they must be in compliance with safety regulations established by the State. Furthermore, the State should ensure that aviation authorities involved with the implementation and maintenance of the SSP have the necessary resources for the SSP to be implemented effectively.

1.3.1.3 Component 1 of the SSP, State safety policy, objectives and resources, is composed of the following elements:

- Primary aviation legislation;
- Specific operating regulations;
- State system and functions;
- Qualified technical personnel; and
- Technical guidance, tools and provision of safety-critical information.

1.3.1.4 Guidance on each of these topics is covered below.

1.3.2 Primary aviation legislation

1.3.2.1 Guidance on primary aviation legislation (CE-1) can be found in Doc 9734, Part A.

Note.— Throughout this manual, the term "legislation" is used as a generic term to include primary aviation legislation and specific operating regulations.

1.3.2.2 There may be a need for legislative provisions that empower the various State aviation authorities (e.g. a Civil Aviation Authority or Accident and Incident Investigation Authority) to perform their roles. Whether or not the primary aviation legislation needs to specifically mention SSP implementation as a role of the Civil Aviation Authority depends on the legal system of the State. Some States may consider SSP implementation implied in the functions already mentioned in their primary aviation legislation. In this case amendment of the primary aviation legislation may not be necessary. In such cases, evidence of SSP implementation should be clearly available in formal State documents. The State should also be able to demonstrate its commitment to address its safety management responsibilities, as outlined in Annex 19.

1.3.2.3 As part of its SSP, a State is expected to establish an enforcement policy that:

a) supports and encourages a positive safety culture. (Ref. Part I, Chapter 3 for details of Safety Culture);

b) describes how the State assures protection of safety data and information sources, especially if information provided is self-incriminating. Part II, Chapter 1 contains more details on the protection of safety data and information, and related sources; and

c) specifies the conditions and circumstances under which service providers with an SMS are allowed to deal with and resolve events involving certain safety issues internally, within the context of their SMS and to the satisfaction of the relevant State authority, provided that the SMS is in accordance with the SMS framework and shown to be effective and mature.

1.3.2.4 By employing safety management principles, the relationship between a State and its service providers should evolve beyond compliance and enforcement, to a partnership aimed at maintaining or continuously improving safety performance.

1.3.3 Specific operating regulations

Guidance on specific operating regulations (CE-2), including adapting or adopting regulations from another State can be found in Doc 9734, Part A.

1.3.4 State system and functions

1.3.4.1 Guidance on State system and functions (CE-3) can be found in Doc 9734, Part A.

SSP placeholder organization

1.3.4.2 State's safety management responsibilities can be discharged by multiple aviation authorities within the State; for example the CAA and an independent Accident and Incident Investigation Authority. States should clarify which authority within the State is responsible for coordinating the maintenance and implementation of the SSP. This organization is sometimes referred to as the SSP placeholder organization. Many States assign this role to the CAA, given that the CAA is normally responsible for most of the SSP responsibilities. The roles and responsibilities of all the authorities involved should be identified and documented.

SSP coordination group

1.3.4.3 The State should establish a suitable coordination group with representation from the impacted aviation authorities with responsibilities related to the implementation and maintenance of the SSP. Appointment of a coordination group will facilitate good communication, avoid duplication of effort and conflicting policies and ensure effective and efficient SSP implementation. This group is a form of committee chaired by the head of the SSP placeholder organization.

1.3.4.4 The State may also find it beneficial to allocate the day-to-day planning and management of the SSP implementation to a person, a department or a team. Such a person, department or team can ensure that the various aspects work together to deliver the State's safety objectives.

SSP functions and activities

1.3.4.5 How States choose to organise their workforce and organisational structure to address the acceptance and monitoring of SMS implementation by service providers in compliance with Annex 19 is a matter for each State to decide. A State can choose to establish a new office or to add this responsibility to the responsibilities of existing offices - for example: airworthiness office, flight operation office, air navigation and aerodrome office, etc. The decision will depend on how the State chooses to address the new competencies required.

1.3.4.6 It is important for the various aviation authorities to have clarity on their role, as well as their SSP obligations, functions and activities. The State should ensure that each authority understands its contribution to meeting each requirement in Annex 19, and more importantly, to the management of safety in the State. The obligations and functions of each aviation authority with respect to SSP implementation should be documented so as to avoid ambiguity.

1.3.4.7 There should be appropriate governance structures in States where the staff involved in safety are located in different offices across the country. A complex governance structure may not be necessary for less complex aviation systems, where a limited number of people are involved in safety management. The State should ensure that all personnel have the same understanding of SSP implementation at a national level. The SSP implementation approach should be documented.

State safety policy and safety objectives

1.3.4.8 Effective implementation of a SSP requires commitment by the State's senior management and the support of personnel at all levels. State safety policies and State safety objectives are high-level statements endorsed by the State aviation authorities. They work together to guide safety behaviour and resource allocation, but they are not the same.

1.3.4.9 The commitment of senior management should be articulated in the State safety policy. The State safety policy is a formal document describing the State's safety intentions and direction. The State safety policy is a commitment by senior management to safety and to the promotion of a positive safety culture. It can be thought of as the State's safety mission and vision statement.

1.3.4.10 The safety policy demonstrates the senior management commitment to key practices that are essential for safety management and how they expect to deliver on their safety responsibilities, for example the use of a data-driven approach. The safety policy should reflect the State's core attitude, approach and commitment to safety. The principles reflected in the safety policy should be clearly visible in the day-to-day practices of the State.

1.3.4.11 A State safety policy is a statement of safety intent, and is implemented as a procedure or protocol. The State safety policy is endorsed by the State aviation authorities to demonstrate their commitment. A typical policy statement is: "We will achieve safety through our commitment to: (1) acceptance of accountability for safe conditions and behaviours (2) a culture of safety leadership, collaborative, open communication, etc.".

1.3.4.12 State safety objectives are brief, high-level statements that provide direction for all relevant State aviation authorities. They represent the desired safety outcomes that the State aims to achieve within a time frame and with available resources. Safety objectives are specific and measurable. Safety objectives serve as the basis for evaluating safety performance. An example of a State safety objective is: "Reduction in unstable approaches by 50% by year XX".

1.3.4.13 It is also important, when defining the safety objectives, to take into account the State's ability to influence the desired outcomes and whether the scope of the objective is within the State's control. The safety objectives provide a blueprint for implementing and directing the State's resources. They represent the State's priorities regarding the management of safety.

1.3.4.14 The safety objectives help to define the State's acceptable level of safety performance (ALoSP) and the subsequent selection of SPIs and safety performance targets (SPTs). The State should periodically review its safety performance and progress toward meeting its SPTs to achieve the ALoSP. Further guidance on SPIs, SPTs and the ALoSP can be found in Part II, Chapter 2.

State safety risk picture

1.3.4.15 Development of safety objectives starts with a clear understanding of the 'safety risk picture' in the State. The safety risk picture reflects the State's understanding of the most significant safety risks in its aviation system. Safety risk in the aviation system is influenced by many different factors, such as the size and complexity of the aviation system as well as the operational environment. A State is in a better position to develop safety objectives that address safety risks when it has a clear understanding of its safety risk picture.

1.3.4.16 The State may use qualitative information and expert analysis to develop its initial understanding of the State's safety risk picture. Quantitative data should be used where available. States can create a diverse group of selected experts to participate in guided discussions to develop an understanding of the State's safety risk picture. This group would have a similar role as the service provider's 'safety review board' (SRB), as discussed in Part III, Chapter 2; in this case at State level. These experts can be guided by available safety trend information, known accidents and serious incidents contributing factors, or known deficiencies in the State's SSO processes. They could also consider regional objectives or global objectives as identified in the GASP. This brainstorming-type approach could be done collaboratively with service providers, so as to identify 'known' safety issues for each aviation sector.

1.3.4.17 Once the SSP is implemented, the State should periodically reassess its safety risk picture (and consequently its safety objectives) by analysing the safety data generated by the SSP. The analysis will also support the identification of emerging issues. Guidance on safety analysis can be found in Part II, Chapter 3.

SSP Documentation

1.3.4.18 The State should describe its SSP in a document to ensure that all relevant personnel have a common understanding. The document should include its structure and associated programmes, how its various components work together, as well as the roles of the different State aviation authorities. The documentation should complement existing processes and procedures and broadly describe how the various SSP sub-programmes work together to improve safety. Cross-references to safety responsibilities and accountabilities of authorities in supporting documentation may also be included. The State should choose a means of documentation and dissemination that would best serve its environment, for example in a physical document or on an appropriately controlled website. Regardless of the communication channel, the aim is to facilitate a common understanding of the SSP by all relevant personnel.

1.3.5 Qualified technical personnel

1.3.5.1 Guidance on qualified technical personnel performing safety-related functions (CE-4) can be found in Doc 9734, Part A.

General guidance

1.3.5.2 States will need to identify and address the competencies required for effective implementation of SSP taking into account the roles and responsibilities under the SSP performed by their personnel. These competencies are in addition to those required for the conduct of compliance oversight and may be addressed by training existing staff or by hiring additional staff and include, but are not limited to:

a) Enhanced leadership skills;

b) Understanding of business processes;

c) Experience and judgement required to assess performance and effectiveness;

d) Safety risk-based surveillance;

e) Safety data collection and analysis; and

f) Safety performance measurement and monitoring.

1.3.5.3 Guidance on the development and maintenance of a strong inspectorate workforce can be found in ICAO Doc 10070 – Manual on the Competencies of Civil Aviation Safety Inspectors.

1.3.5.4 The State should determine the most appropriate training for personnel with different roles and responsibilities in the organization. The following are examples of training that should be considered:

a) briefings or familiarization training for senior management on SSP, SMS, safety policy, objectives and ALoSP.

b) training for inspectors on the SSP and SMS principles, how to carry out SMS assessments, how to evaluate a service provider's SPIs for acceptance and how to generally oversee the service provider in a safety management environment.

c) soft skills training (effective communication skills, negotiation skills, conflict resolution, etc.) to support inspectors in working collaboratively with service providers to improve safety performance whilst ensuring continued compliance with established regulations.

d) training for personnel responsible for data analysis, safety objectives, SPIs and SPTs;

e) protection of safety data, safety information and related sources and enforcement policy training for legal personnel, etc.;

f) SSP and SMS training for accident and incident investigators.

1.3.5.5 Safety training programmes for personnel involved in SSP-related duties should be coordinated amongst State organizations, as appropriate. The scope of SSP and SMS training or familiarization should reflect the actual SSP processes, and the SSP itself as it evolves and matures. Initial SSP and SMS training may be limited to generic SSP elements or SMS framework elements and guidance.

1.3.5.6 To ensure all relevant technical staff are properly qualified, the State should:

a) develop an internal training policy and procedures; and

b) develop an SSP and SMS training programme for relevant staff. Priority should be given to SSP-SMS implementation personnel and operational/field inspectors involved in service providers' SMS surveillance / monitoring; Including State-specific SSP processes and their relevance.

1.3.5.7 Many different types of SSP and SMS training are available including online courses, classroom courses, workshops, etc. The type and amount of training provided should ensure that relevant staff develops the competence needed to perform their roles and understand their contribution to the SSP. The aim is to ensure a person or team addresses each aspect of the SSP, and that they are trained to perform the allocated role.

1.3.5.8 Appropriate and sufficient training for inspectors will ensure consistent surveillance and inspector have the necessary capabilities to be effective in a safety management environment. States should consider the following:

a) Surveillance and monitoring of service providers' SMS will require competencies that may not have been critical before SMS requirements were introduced. Inspectors will need to complement their existing technical knowledge with additional skills to assess the suitability and effectiveness of the service providers' SMS implementation. This approach requires working in partnership with industry; to gain the trust of service providers to facilitate sharing of safety data and information. States will need to provide the appropriate training to ensure that personnel responsible for interaction with the industry have the competencies and flexibility to perform the surveillance activities in an SMS environment. A training needs analysis can be used to identify the appropriate training.

b) The training should also provide staff with an awareness of the role and contributions of other departments within their aviation authority and other State aviation authorities. This will allow inspectors as well as staff from different State aviation authorities to have a consistent approach. It will also facilitate a better understanding of safety risks across various sectors. Inspectors can also better understand how they contribute to achieving the State safety objectives.

1.3.6 Technical guidance, tools and provision of safety-critical information

1.3.6.1 Guidance on Technical guidance, tools and the provision of safety-critical information (CE5) can be found in Doc 9734, Part A.

1.3.6.2 The State should consider providing guidance to their inspectors and to service providers to help with the interpretation of safety management regulations. This will promote a positive safety culture and aid the service provider in meeting their safety objectives, and consequently, the State's safety objectives – which are often achieved through regulation. The assessment of SMS may require additional tools to determine both the compliance and performance of the service providers' SMS. Any tools developed will require training for affected staff before being implemented.

1.4 COMPONENT 2: STATE SAFETY RISK MANAGEMENT

1.4.1 Introduction to State Safety Risk Management

1.4.1.1 States need to anticipate potential safety risks to the aviation system. The State should augment its traditional methods of analyzing the causes of an accident or incident with proactive processes and metrics to achieve this. Proactive processes and metrics enable the State to identify and address precursors and contributors of accidents, and strategically manage safety resources to maximize safety improvements. States should:

a) require that their service providers implement SMS to manage and improve the safety of their aviation-related activities;

b) establish means to determine whether service providers' safety performance is acceptable; and

c) review and ensure that the service provider's SMS remains effective.

1.4.1.2 The State SRM component includes the implementation of SMS by service providers, including hazard identification processes and the management of associated safety risks. States should develop a mechanism to accept the SPIs and SPTs of service providers.

1.4.1.3 States should also apply the principles of SRM to their own activities. These include activities such as the development of regulations, selection of State SPIs and their associated SPTs, and prioritization of surveillance activities, among others.

1.4.1.4 An area often overlooked by service providers and regulators is the safety risk induced through interfaces with other entities. The interface between SSP and SMS(s) may pose a particular interface challenge for States and service providers. The State should consider highlighting through its regulations and supporting guidance material the importance of the SMS interface risk management. Examples of interface risk include:

a) Dependency – organisation A is dependent on organisation B to provide goods or services. Organisation B is not clear about the expectation and organisation A's dependency and fails to deliver.

b) Control – interfacing organisations often have minimal control of the quality or effectiveness of the interfacing organisation(s).

1.4.1.5 In both of these cases interface risk management can illuminate the risk, clarify the mutual expectations and mitigate unwanted consequences through mutually agreed boundary checks. Additional information on interfaces between service providers can be found in Part I, Chapter 1.

1.4.2 Licensing, certification, authorization and approval obligations

1.4.2.1 Guidance on licensing, certification, authorization and approval obligations (CE-6) can be found in Doc 9734, Part A.

1.4.2.2 Licensing, certification, authorization and approval obligations are important components of the State safety risk control strategy. They provide the State with assurance that service providers and other pertinent industry representative organizations have achieved the required standards to operate safely within the aviation system. Some States have established common operating regulations to facilitate the recognition or acceptance of certificates, approvals and licenses issued by other States. Such arrangements do not absolve the State from its obligations under the Chicago Convention.

1.4.3 Safety management system obligations

SMS regulatory requirements

1.4.3.1 In accordance with Annex 19, the State shall require that service providers and international general aviation operators implement SMS. The requirements established shall address the SMS framework found in Annex 19 Appendix 2 and the supporting guidance found in Part III, Chapter 2 of this manual. How these requirements are established will depend on the regulatory framework in the State.

1.4.3.2 States should institute a process that ensures the SMS is acceptable to the State. One approach is to establish timelines and milestones at the State level that represents the required SMS implementation progress. Additional guidance for service providers about how to develop and perform an SMS gap analysis and implementation plan can be found in Part III, Chapter 2.

1.4.3.3 The State's SMS regulatory requirements and SMS guidance material should be periodically reviewed, taking into consideration: industry feedback, periodic review of the State safety risk profile, current status, and applicability of ICAO SMS SARPs and guidance material.

International general aviation

1.4.3.4 SMS provisions for International general aviation (IGA) are addressed with some flexibility in Annex 19 and are therefore not included in the list of service provider. While this sector of aviation is expected to implement the SMS framework, the difference is that States are provided some flexibility in how the requirements are established . Consistent with other provisions found in Annex 6, Part II, the State of Registry shall establish criteria for IGA operators to implement an SMS.

1.4.3.5 The establishment of the criteria should require the application of the SMS framework as described in Annex 19, but this may be achieved in any of the following ways:

a) Promulgation of the criteria within the existing specific operating regulations for IGA;

b) The publication of requirements within the regulatory framework in a legal instrument other than specific operating regulations that defines the criteria; or

c) Making references within the regulatory framework to SMS industry codes of practice that are recognized by the State.

1.4.3.6 In selecting the best approach for the establishment of the SMS criteria for IGA, the State of Registry should consider how the monitoring of the SMS will be performed, including the delegation of oversight to third parties. As with the SMS of service providers, in determining the acceptability of the SMS, the State of Registry should allow for scalability based on the size, operational environment and complexity of the operator.

1.4.3.7 In the case of large or turbojet aircraft under multiple States of Registry that are issued an Air Operator Certificate in accordance with Annex 6, Part I, the operator would be considered a service provider and treated as such with the SMS to be made acceptable to the State of the Operator.

SMS Acceptance

1.4.3.8 Many service providers have approvals from more than one State or conduct operations in more than one State. There is no Annex 19 requirement to oversee the SMS of a service provider that is outside of the State's responsibility. However, harmonization of SMS requirements does facilitate acceptance of SMS between States. Harmonization reduces oversight duplication and the need for service providers to comply with similar SMS obligations through (potentially) dissimilar requirements. States should be conscious of policies that increase the administrative and financial burden for certificate holders without adding significant safety value. Importantly, for service providers that do not benefit from common acceptance of basic certificate or approvals, the introduction of. SMS has exacerbated the situation. States should endeavour to achieve the benefits of implementation without imposing additional undue burden on service providers.

1.4.3.9 States are encouraged to apply the requirements equally when granting approvals to other States' service providers, without excessive technical, legal, and administrative burdens. Many service providers need additional resources for initial acceptance by multiple States, and to support periodic monitoring or audits from States who have accepted their SMS. Additional effort is also required when requirements vary, are interpreted differently or conflict.

1.4.3.10 Annex 19 provides SMS framework requirements. States transpose the requirements into the State's regulatory framework. The performance of any organizational system or process, in practice, depends on how the requirements are implemented. There are two major components involved with SMS equivalence and the implications of SMS acceptance among States.

1.4.3.11 The first component concerns the formal aspects of recognition or acceptance of SMS. Some States have addressed these though bi-lateral or multi-lateral agreements that involve a mixture of diplomatic, legal, and technical arrangements between States. In some cases the acceptance is mutual, but not in all circumstances.

1.4.3.12 The second component is technical equivalence. Technical equivalence can be divided into five areas:

1) **Common Requirements**. While not sufficient to establish equivalence, use of a common set of requirements provides structure and efficiency for the technical evaluations. These have been established in the various ICAO Annexes.

2) **Implementation Expectations**. Each State identifies specific expectations for processes, programmes, methods, and tools for the other authority to demonstrate implementation and performance.

3) **Acceptance Methodology**. Methods States use to evaluate how processes and management capabilities vary between States. This is usually a function of the State's oversight system (CE-6, Licensing, certification, authorization and approval obligations).

4) **Performance Measurement**. The methodology used by each State to measure safety performance of certificated and approved organizations is aimed at improving the State's understanding of the performance potential and status of each organizations.

5) **Monitoring Policies and Methods**. Monitoring is essential to assure the performance status of organizations and their SMSs. This is an aspect of the State's surveillance obligations. Each State must develop an understanding and confidence in the methods used by another authority to oversee their SMSs. This supports acceptance or recognition the SMSs.

1.4.3.13 Annex 19 requires service providers to implement SMS. The SMS regulations that the State promulgates must be in accordance with Annex 19. Service provider's SMS must be made acceptable to the relevant State authority. Service providers are expected to conduct a gap analysis and develop a workable implementation plan (including approval by the State as an planned task). SMS implementations are generally conducted in three or four stages. Early, collaborative between the service provider and the State authorities will likely lead to smoother development and approval process. For information about safety management system implementation, see Part III, Chapter 2, SMS Implementation.

Acceptance of SPIs and SPTs

1.4.3.14 Service providers' proposed SPIs are reviewed and accepted by the relevant State regulatory organization as part of the SMS acceptance. States might consider planning the acceptance of a service provider's SPIs later in the implementation process. This is especially practical for service providers at initial certification as they have insufficient data to develop meaningful indications. The regulator may be satisfied that the proposed SPIs are appropriate and pertinent to the individual service provider's aviation activities. Some of the service provider's SPIs and SPTs may link to the State SPIs and SPTs for measuring and monitoring the ALoSP. This need not be the case for all SPIs and SPTs. More information on safety performance measurement is found in Part II, Chapter 2.

1.4.3.15 The acceptance of the service provider's SPTs may be addressed after the SPIs have been monitored over a period of time. This will establish a baseline performance. It may be based on targets established at the State, regional or global level. Achievement of State SPTs will require the coordination of safety risk mitigation actions with the service provider.

One SMS across multiple service providers

1.4.3.16 Organizations with multiple service provider certifications may choose to include them all under the scope of one SMS to capitalize on the benefits of SMS and better address interface aspects. The State regulator should consider the following when assessing the SMS of these parent organizations or the implementation of SMS requirements for service providers which are included in the scope of a wider SMS:

1) Ensure that SMS monitoring policies and processes are consistently applied throughout the State, in particular where inspectors from different organizations within the regulator are responsible for the oversight and monitoring of different service providers.

    a. There should be evidence of management commitment for the consistent interpretation of regulations and application of oversight and monitoring.

b. All oversight and monitoring personnel should be provided standardized training; ideally the training courses should include participants from different disciplines.

c. Where there are different oversight and monitoring organizations, common policies, procedures, and auditing tools need to be developed and implemented.

d. There should be consistent and frequent communication between the responsible inspectors assigned to each service provider.

e. Mechanisms should be in place to monitor the degree of standardization of the oversight and monitoring activities and any issues identified should be addressed.

f. Recognition that the service provider's activities may be addressed by the SMS at the corporate ('parent') level. This may include activities that require SMS and activities that are not within the applicability of Annex 19.

g. Ensure that the parent organization has documented:

i. its policies and procedures on how safety data and safety information is shared, communications are relayed, decisions are made, and resources are allocated across the different activity areas and, where applicable, with different regulatory authorities;

ii. the roles and responsibilities associated with its SMS and the accountability framework for the SMS; and

iii. the organizational structure and interfaces between different systems and activities in its system description.

2) Ensure awareness that parent organizations holding multiple certificates - some of which include certificates from foreign regulators - may elect to implement one SMS across the multiple service providers.

a. Recognize that the scope of an SMS is clearly defined in the system description and details the individual activities. The service provider can demonstrate the compatible between their SMS processes and the corporate SMS.

b. Be aware that when the parent organization holds both domestic and international approvals, this scenario can induce additional challenges such as the acceptance of the SMS by different regulatory authorities. An agreement should be made with the other regulatory authorities on how oversight and monitoring will be shared, delegated or maintained separately (duplicated) where arrangements for SMS acceptance have not yet been established.

Integrated Management Systems

1.4.3.17 When assessing service providers having integrated their SMS with other management systems, regulator should consider:

1) Drafting a policy that clarifies the scope of their authority. They may not be responsible for oversight of the related management systems.

2) The resources necessary to assess and monitor an integrated management system. This could include staff with appropriate expertise, processes, procedures and tools.

1.4.3.18 There are benefits for the service provider to integrate the SMS with other management system. The integration should be completed to the satisfaction of the CAA, and in a way that the CAA can effectively 'see' and monitor the SMS.

1.4.3.19 Guidance for service provider implementing SMS as part of an integrated management system is available in Part III, Chapter 2.

1.4.4 Accident and incident investigation

1.4.4.1 The Accident and Incident Investigation Authority (AIIA) must be functionally independent from any other organization. Independence from the Civil Aviation Authority (CAA) of the State is of particular importance. The interests of the CAA could conflict with the tasks entrusted to the AIIA. The rationale for the independence of this function from those of other organizations is that accident causation can be linked to regulatory or SSP-related factors. Also, such independence enhances the viability of the AIIA and avoids real or perceived conflicts of interest.

1.4.4.2 The accident investigation process has a pivotal role in the SSP. It enables the State to identify contributing factors and any possible failure within the aviation system, and generate the necessary countermeasures to prevent recurrence. This activity contributes to the continuous improvement of aviation safety by providing discovering active failures and contributing factors of accidents/incidents and provides reports on lessons learned from analysis of events. This can support development of corrective actions decisions and corresponding allocation of resources and may identify necessary improvements to the aviation system. Refer to ICAO Annex 13 and related guidance.

1.4.4.3 There are many safety occurrences that do not require an official investigation in accordance with Annex 13. These occurrences and identified hazards may be indicative of systemic problems. These problems can be revealed and remedied by a safety investigation lead by the service provider. For information about service provider safety investigations, refer to Part III, Chapter 2.

1.4.5 Hazard identification and safety risk assessment

General Guidance

1.4.5.1 One of the most important roles of aviation authorities is to identify hazards and emerging trends across the aviation system. This is often achieved by analyzing safety data aggregated from multiple sectors. The level of complexity and sophistication of a State's SRM process will vary based on the size, maturity, and complexity of the aviation system in the State. General guidance on the SRM process can be found in Part I, Chapter 2.

1.4.5.2 Collection of internal and external safety data and safety information is essential to achieving an effective SSP. As less complex aviation systems may produce limited data. In this case collection and exchange of external data should be a priority. External data is available from other contracting States, such as: investigation reports, annual safety reports (including information and analysis on incidents), safety alerts, safety bulletins, safety studies, etc. At a regional level, ICAO groups (e.g., RASGs, PIRGs, etc.) may be good sources of safety information. The State's SDCPS should include procedures for the submission of accident and incident reports to ICAO, which will facilitate global safety information collection and sharing. See Part II, Chapter 1 for additional information about safety data and safety information protection.

1.4.5.3 The primary goal of SRM is to identify and control the potential consequences of hazards using the available safety data. The principles for SRM are the same for States and service providers. Service provider SRM information is available in Part III, Chapter 2.

1.4.5.4 Service providers have access to their own safety data. States have access to safety data from multiple service providers. Therefore, the State implementing common taxonomies to classify safety data it collects will greatly improve the effectiveness of the State SRM process. This also allows data gathered from multiple sources across different aviation sectors to be analysed more efficiently. The data analysis process inputs and outputs are depicted in Figure 17.

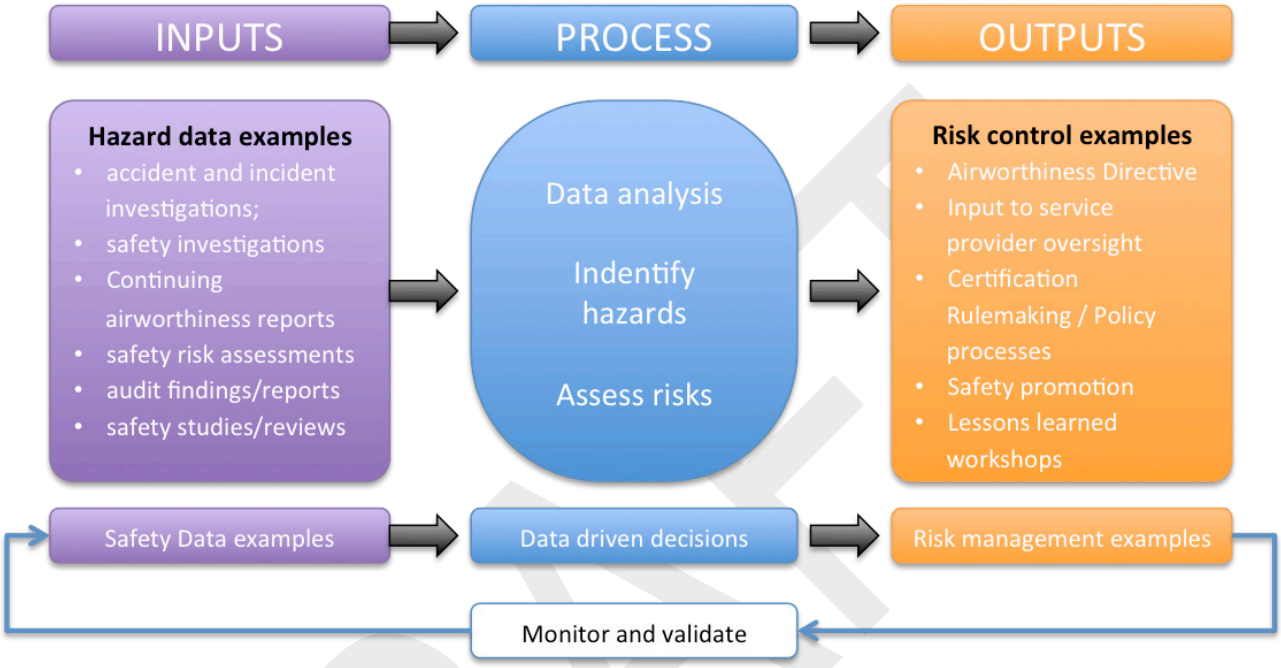


Figure 107: Data-driven analysis process

1.4.5.5 Inputs can be received from any part of the aviation system, including: accident and incident investigations; service provider safety investigations; continuing airworthiness reports; safety risk assessments; audit findings and audit reports; and safety studies and reviews.

1.4.5.6 When necessary, outputs or safety risk controls are applied to eliminate the hazard or reduce the level of safety risk to an acceptable level. A few of the many mitigation options available to the State include: Airworthiness Directives; providing input to refined oversight and monitoring of the service provider(s); amendments to certification, rulemaking or safety policies; safety promotion programme; facilitation of lessons learned workshops. The chosen action will obviously depend on the severity and type of issue being addressed. For more information about the data driven decision-making process, refer to Part II, Chapter 3.

Hazard Identification

1.4.5.7 Hazard identification is predicated on collection of representative data. It may be appropriate to combine or aggregate data from multiple sectors to ensure a comprehensive understanding of each hazard. The process depicted in Figure 17 is equally valid for reactive or proactive hazard identification. Analyzing the hazards identified during an incident or accident investigations is an example of a reactive methodology. A proactive one might include hazards identified during audits or inspections, or from mandatory reports. It could include being alerted to early signs of safety performance degradation from day-by-day system reliability monitoring.

1.4.5.8 Hazards exist at all levels in the State's aviation system. Accidents or incidents occur when hazards interact with certain triggering factors. As a result, hazards should be identified before they lead to accidents, incidents or other safety related occurrences.

1.4.5.9 States are encouraged to appoint an individual or team to gather, aggregate and analyse available data. The State safety analyst should analyze data to identify and document potential hazards as well as corresponding effects or consequences. The level of detail required in the hazard identification process depends on the complexity of the aviation process being considered.

1.4.5.10 To ensure effective hazard identification, a systematic process should be developed which includes the following elements:

a) Access to the data sources necessary to support the management of safety risk in the State;

b) Safety analysis team with appropriate analytical skills and operational experience, and training and experience in a variety of hazard analysis techniques; and

c) Hazard analysis tool(s), appropriate for the data being collected (or will be collected) and the scope of aviation activities in the State.

Hazard Identification Triggers

1.4.5.11 There are many situations where hazard identification process should be initiated. Some of the major ones are:

a) **System Design**: Hazard identification starts before the beginning of operations with a detailed description of the particular aviation system and its environment. The safety analysis team identifies the various potential hazards associated with the system as well as impacts to other interfacing systems.

b) **System Change**: Hazard identification starts before introducing a change in the system (operational or organizational) and includes a detailed description of the particular change to the aviation system. The safety analysis team then identifies the potential hazards associated with the proposed change as well as impacts to other interfacing systems.

c) **On Demand and Continuous Monitoring**: Hazard identification is applied to existing systems in operation. Data monitoring is used to detect changes in the hazard situation. For example, hazard manifestation may be more frequent or more severe than anticipated, or the agreed mitigation strategies are less effective than expected. Continuous monitoring and analysis can be established with notification thresholds based on a set of critical items of interest.

Safety Risk Assessment

1.4.5.12 General guidance on safety risk assessment can be found in Part I, Chapter 2. It should be noted that safety risk can be viewed and controlled across an aviation sector or a region.

1.4.5.13 There are many different tools to analyse data and use different safety risk modelling approaches. When selecting or developing their own safety risk assessment processes, States should ensure that the process works well for their environment.

1.4.6 Management of safety risks

1.4.6.1 Guidance on resolution of safety issues (CE-8) can be found in Doc 9734, Part A.

1.4.6.2 The objective of the management of safety risks is to ensure safety risks are controlled and an acceptable level of safety performance is achieved. The appropriate State aviation authority develops, documents, and recommends appropriate safety risk mitigation or safety risk control strategies. Examples include: direct intervention with a service provider, implementing additional policies or regulations; issuing operational directives or influencing through safety promotional activities.

1.4.6.3 As a next step an evaluation of each proposed safety risk control should be performed. Ideal safety risk control candidates are cost effective, easy to perform, quickly implemented, completely effective, and do not introduce unintended consequences. Since most situations do not meet these ideals, candidate safety risk controls should be evaluated and selected based on balancing the attributes of effectiveness, cost, timeliness of implementation, and complexity. Once safety risk controls have been selected and implemented, they should be monitored and validated to ensure that the intended goals have been achieved.

1.4.6.4 Many of the safety risk controls require action by service provider(s). States should direct the service provider(s) to accomplish effective implementation. State may need to monitor the effectiveness of the safety risk controls and their impact on service provider's - and collectively - State's safety performance. Safety risk mitigation approaches are outlined in Part I, Chapter 2.

1.5 COMPONENT 3: STATE SAFETY ASSURANCE

1.5.1 Introduction to State safety assurance

1.5.1.1 Safety assurance activities aim to assure the State that their functions are achieving their intended objectives and SPTs. Service providers are required to implement safety assurance process, as part of their SMS, that provide each service provider with assurance that their safety processes are functioning effectively and they are on target to achieve their safety objectives. Similarly, State safety assurance, as part of their SSP, provide the State with assurance that its safety processes are functioning effectively and the State is on target to achieve its safety objectives via the collective efforts of the State's aviation industry.

1.5.1.2 Surveillance activities and safety data/information collection, analysis, sharing and exchange mechanisms ensure that regulatory safety risk controls are appropriately integrated into a service provider's SMS, that they are being practiced as designed, and the regulatory controls are having the intended effect on SRM. States can collect aviation safety data/information from numerous sources, including through surveillance processes and safety reporting programmes. This data should be analyzed at various levels, and should be used to make data driven decisions regarding surveillance activities and safety in the State's aviation system.

1.5.2 Surveillance obligations

Guidance on Surveillance obligations (CE-7) related to compliance monitoring can be found in Doc 9734, Part A.

Prioritizing surveillance activities

1.5.2.1 A safety risk-based surveillance (SRBS) approach enables prioritization and allocation of State's safety management resources commensurate with the safety risk profile of each service provider. States gain experience and familiarity with each service provider by monitoring the steadily developing maturity of their safety assurance process; in particular, their management of safety performance. Over time the State will accumulate an evidentiary picture of the service provider's safety abilities, particularly their management of safety risk. The State may choose to amend the scope and/or frequency of surveillance as their confidence and evidence of the service provider's safety capability grows.

1.5.2.2 SRBS is most appropriate for organizations with a mature SMS. SRBS may also be applicable to organizations where SMS has not yet been implemented. The foundation of effective SRBS is sufficient reliable and meaningful data. Without reliable and meaningful data it is difficult to defend adjustments to the surveillance scope or frequency.

1.5.2.3 States should develop or reinforce their data management capabilities to ensure they have reliable and comprehensive data upon which to make data-driven decisions. Individual sector safety risk analyses may also allow the State to evaluate common safety risks that affect multiple service providers with similar types of operations (for example, short-haul airlines). This facilitates safety risk ranking among service providers within a specific aviation sector or across sectors, and supports the allocation of surveillance resources to sectors or activities with greatest safety effect.

1.5.2.4 Analyses at the sector level allows the State to view the aviation system in context: how the parts contribute to the whole. It empowers the State to identify which sector(s) will benefit from higher levels of support or intervention, and which sectors are the best candidates for a collaborative approach. This gives the State assurance that regulation across the aviation system is commensurate and targeted at the areas with greatest need. It is easier

to identify where changes to specific regulations are needed to achieve maximum regulatory effectiveness while ensuring minimal interference.

1.5.2.5 SRBS involves on-going interactions between the State and the aviation community beyond compliance-based audits and inspections. An SRBS approach uses the safety risk profile of the service provider to adapt its surveillance activities. The output of internal reviews, analyses and decision-making within the service provider's system becomes a targeted action plan addressing key safety risks and the mitigations that effectively address them. The analyses from both the State and the service provider define priority areas of safety concern, and outline the most effective means of addressing them.

1.5.2.6 Importantly, safety risk-based surveillance may not necessarily reduce the amount of surveillance conducted or the resources, the quality of the surveillance and the quality of the interaction between the regulator and the service provider will however be greatly improved.

Service provider organizational safety risk profiles

1.5.2.7 States may wish to develop organizational safety risk profiles that are consistent across each aviation sector to support the process of modifying the scope and frequency of their surveillance activities. Such tools should aim to capture and aggregate information that should already be available for service providers and may include factors such as:

a) The financial health of the organization;

b) Number of years in operation;

c) Turnover rate of the key personnel such as the accountable executive and safety manager;

d) Competence and performance of the accountable executive;

e) Competence and performance of the safety manager; (for more information about accountable executive or safety manager competence, see Part III, chapter 2)

f) Results of previous audits;

g) Timely and effective resolution of previous findings;

h) Measures of relative level of activity (exposure to safety risk);

i) Indicators of the relative scope and complexity of the activities being performed;

j) Maturity of the hazard identification and safety risk assessment process; and

k) Measures of safety performance from State safety data analysis and performance monitoring activities.

1.5.2.8 An example of a process that can be used to modify the scope or frequency of the surveillance of a service provider is shown in Figure 18.

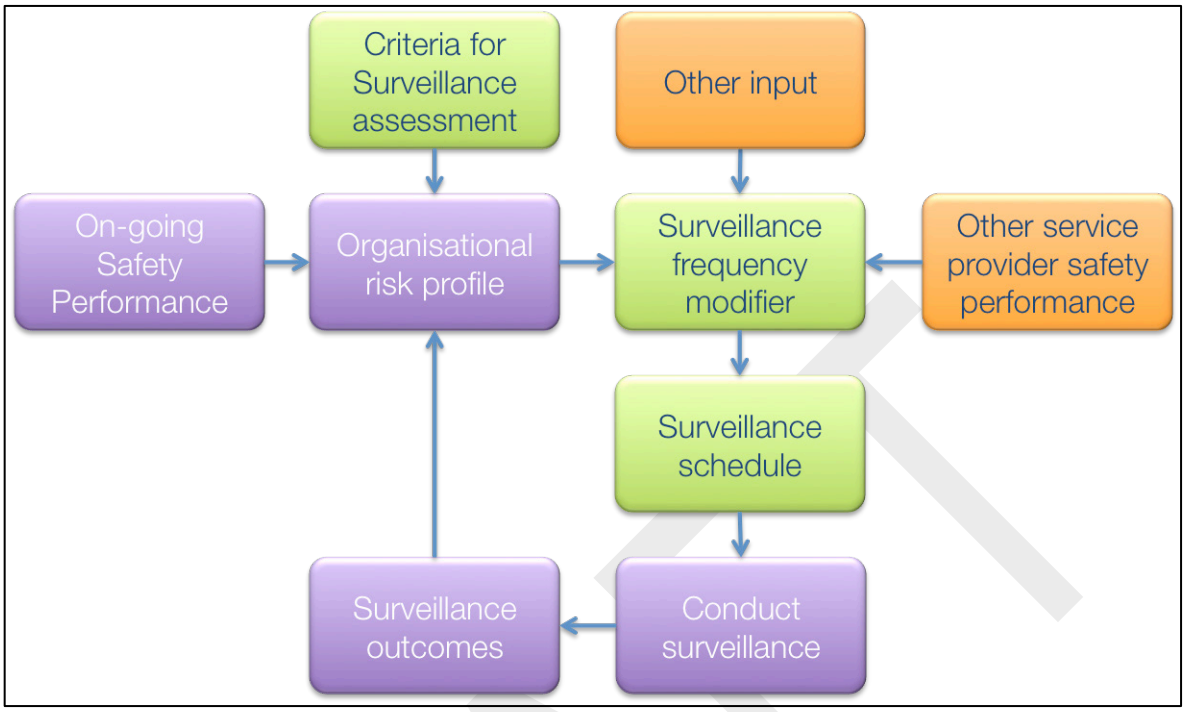


Figure 118: Safety data and safety risk based surveillance concept

Monitoring a service provider's safety performance

1.5.2.9 The State should periodically review each service provider's SPIs and SPTs. The review should take into consideration the performance and effectiveness of each SPI and SPT. The review may indicate a need to make adjustments to support the continuous safety improvement.

1.5.3 State safety performance

1.5.3.1 For general information on safety performance management, refer to Part II, Chapter 2.

Acceptable level of safety performance

1.5.3.2 State safety management responsibilities contained in Annex 19, Chapter 3, include the obligation by the State to establish and maintain an SSP that is commensurate with the size and complexity of the State's civil aviation system. Annex 19, 3.4.2.1 also requires States to shall establish the acceptable level of safety performance (ALoSP) to be achieved through their SSP.

1.5.3.3 Establishing and, most importantly, achieving the ALoSP is the ultimate outcome sought by the State through its SSP. The role of the State in the management of its safety performance should therefore be clearly understood. Part II, Chapter 2 discusses the basic concepts regarding safety performance management, as they apply to both the State and service provider organizations. This section focuses on the management of safety performance by of State. The ALoSP for the State should be agreed by a group of senior managers that represent the various aviation authorities involved in the SSP.

General concepts

1.5.3.4 The notion of ALoSP complements the traditional approach to safety oversight with a performance-based approach focused on measuring and monitoring the safety performance in the State. ALoSP does not replace safety oversight activities to assure regulatory compliance. On the contrary, it complements the existing compliance-based oversight regime. Specific safety performance management metrics (safety objectives, SPIs, SPTs, and alerts if appropriate) are necessary to express ALoSP in quantitative terms.

1.5.3.5 State criteria for defining ALoSP may vary depending on the context of each State aviation system. Within these criteria, the complexity of the aviation system is a paramount consideration. The criteria are also highly dependent on the maturity of the State safety oversight system. The more complex the State aviation system and the more mature its safety oversight system are, the more challenging it is to define the criteria for ALoSP.

1.5.3.6 Under an SSP, the primary focus of safety performance management by the State should be based upon two considerations: 1) the reduction of low-probability but high-severity events, thus preserving life and property; and 2) compliance with ICAO SARPs. ALoSP, once established, is the consensus within the State of the expected level of safety performance that its aviation system should deliver and includes the aggregate safety achievements that the State expects service providers under its authority to attain.

Establishing the ALoSP

1.5.3.7 The diagram in Figure 19 outlines the concept of ALoSP with the building blocks highlighted described in the subsequent paragraphs. For a description of the development of a State safety risk profile and the definition of safety objectives see paragraphs below.

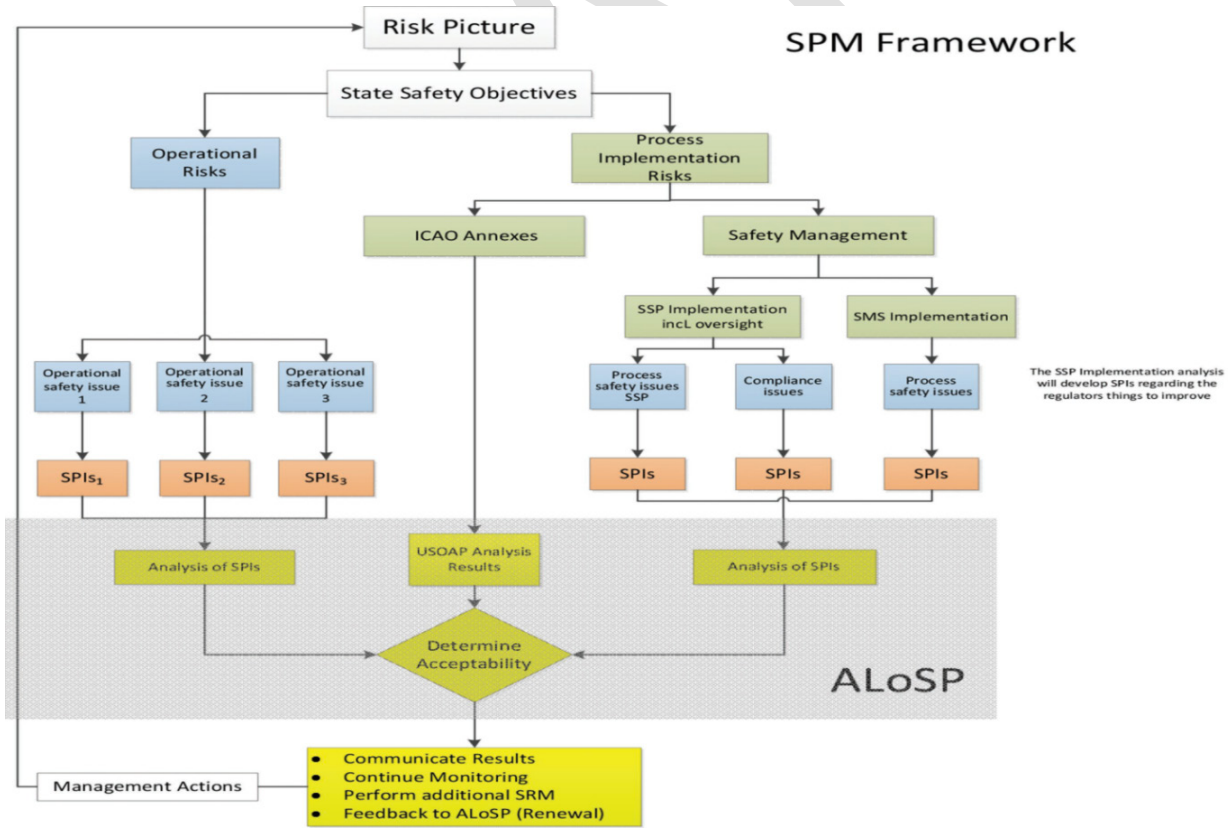


Figure 129: Acceptable level of safety performance

Safety performance indicators and safety performance targets

1.5.3.8 State safety performance management focuses on monitoring and measuring how well safety risks are being managed through mitigations implemented by the State. Part II, Chapter 2 discusses the monitoring and measurement conducted by reference to SPIs. Meaningful SPIs serve to highlight conditions that can be used to identify how a safety risk is being controlled. Effective SPIs should reflect the specific operational environment and contribute to safety risk mitigation decisions.

1.5.3.9 The monitoring / measurement strategy should include a set of SPIs that encompass all areas of the aviation system for which the State is responsible, and should reflect both outcomes (e.g. accidents, incidents, regulatory violations) as well as activities (operations where the safety risk mitigations in place performed as expected). This combination allows safety performance to be evaluated by not only what does not work (i.e. outcomes), but also with considerations of what works (i.e. activities where safety risk mitigations produced the results expected). In practical terms, this approach encompasses the consideration of SPIs reflecting two distinct types of safety risks: operational safety risk and process implementation safety risk.

1) Operational safety risks, depicted on the left-hand side of the diagram, focus on conditions that could lead to an unwanted outcome. These are the conditions associated with accidents, incidents, failures and defects. Operational safety risk is essentially a by-product of the delivery of services. For this reason, SPIs focused on operational safety risk will be mostly linked – indirectly – to service providers' SMS.

2) These SPIs reflect mainly operational safety issues identified by the SRM process of a service provider's SMS. The State's SRM process may also be used as an input, reflecting operational safety issues across the State aviation system derived from aggregation of service provider operational safety risk SPIs. There will be frequently a one-to-many relationship between an operational safety issue and related SPIs. That is, one operational safety issues may be indicated by several SPIs.

3) Process implementation safety risks (depicted on the right-hand side of the diagram) focuses on the means and resources necessary for operational safety risk to be managed. Management of safety risk from a process implementation perspective starts with the evaluation of ICAO SARPs implementation status (safety-related national laws and regulations), the implementation of SMS processes within the industry, and the implementation of SSP at the State level (which includes effective oversight and monitoring of the industry). If improvements in any of the above are necessary, the activities to achieve them should be planned, implemented and monitored, and adequate resources should be allocated for these activities. SPIs are then developed that allow tracking of the planning, implementation and/or effectiveness of the changes.

4) SPIs focused on 'process implementation safety risk' provide the State an alternative means other than strict compliance to monitor the adequacy of SMS institutional arrangement and implementation of SRM/SA processes by service providers. These SPIs may also be established by reference to needed improvements, as indicated by USOAP analyses and SSP continuous improvement activities. The results of USOAP audits, aggregation of SMS evaluations, and SSP continuous improvement information determine potential areas for improvement. These should be prioritized according to greatest benefit. This will contribute to improvement in the State aviation system's safety performance.

   These SPIs should be distinct from operational safety risk SPIs.

1.5.3.10 SPIs for both the operational and process implementation safety risks become a key part of the State's safety assurance process. The aggregation of operational safety risks SPIs and process implementation safety risk SPIs broadens the feedback source for the maintenance of an accurate State safety risk picture and pertinent safety objectives for the SSP.

Periodic review of Safety Performance Indicators

1.5.3.11 A periodic review is essential once the State SPIs are established. Establishing the initial safety risk picture is a planning activity that is accomplished using an informed projection, based on historical data. However, the aviation system is dynamic and constantly changing. New safety issues may arise, processes within the State may change, and so on. Periodic review of State operational safety issues and processes aids updating and refining the safety management priorities, and it guides effective allocation of resources to manage the operational safety risks associated with emerging safety issues. A modified safety risk picture may result in new or revised safety objectives, and the identification of new operational safety issues.

1.5.3.12 The periodic review of the ALoSP should focus on:

a) Identifying critical safety issues within aviation sectors, ensuring inclusion of SPIs that allow safety performance management in these areas;

b) Identifying SPTs that define the safety performance level to be maintained or the desired improvement to be achieved for relevant SPI in each sector, with a view to enhance safety performance management throughout the entire aviation system of the State;

c) Identifying alerts (if appropriate) that indicate actual or developing safety performance trends; and

d) Reviewing SPIs to determine whether modifications or additions to existing SPIs, SPTs and alerts (if appropriate) are needed to achieve the agreed ALoSP.

1.5.3.13 Another result of the periodic review of the safety risk picture is a better understand of the nature of each operational safety issue in as much detail as the data allows, by considering not only hazards and their potential consequences at all levels of the State aviation system, but also how State processes (licensing, certification, approval, surveillance and so forth) contribute to SRM. Each operational safety issue is broken down, through safety risk evaluation, to understand the actions necessary to mitigate associated safety risk, as well as the contribution of State processes to safety risk mitigation, or its lack thereof. These actions are monitored through SPIs to measure their effectiveness.

1.5.3.14 Improving safety performance of operational safety risk tends to be reactive, while improving safety performance of implementation safety risk tends to be proactive. Improving State processes that better support management of safety risk enables better identification and control of hazards before they manifest as negative outcomes.

1.5.3.15 The senior management team responsible for the original agreement of the ALoSP should also be responsible for determining whether the ALoSP remains appropriate. Analysis of the State's performance against expectations set for individual SPIs and SPTs, as well as trends of the safety performance over time, provide an indication of the level of achievement of ALoSP.

1.5.3.16 Not meeting all the established SPTs does not necessarily mean that ALoSP has not been achieved. A deeper evaluation may be required before a determination can be made about the circumstances that resulted in the SPTs not being met.

Considerations for Implementation of ALoSP

1.5.3.17 The implementation of ALoSP may be a daunting task for a State. Progressive ALoSP development is proposed to assist development and alleviate workload. It progresses in three steps. At every step, it is essential not to lose sight that the development of ALoSP, particularly their choice of SPIs. These should take into consideration the complexity, size and maturity of the State aviation system.

1.5.3.18 It is important to note that the proposed three-step approach is only a proposal. States are not bound to implement ALoSP in this manner.

Step one – Initial ALoSP

1.5.3.19 During early SSP implementation stages, States may not have enough safety data or enough safety data management experience to establish detailed and domain-specific SPIs that support the development of a quantitative and process oriented ALoSP (i.e. based on monitoring and measurement of operational interactions and/or routine activities). Therefore, the ALoSP when initially implemented may include SPIs developed on the basis of qualitative information and outcomes (i.e. monitoring and measurement of high-level State processes and low-probability but high-severity events).

1.5.3.20 Examples of SPIs focussed on high-level State processes might include regulatory / non-compliance outcomes (e.g. ICAO USOAP EIs by audit area). Examples of low probability but high severity events include SPIs developed based on parameters such as accident rates, serious incident rates and serious safety issues.

Step Two – Intermediate ALoSP

1.5.3.21 Progress towards quantitative and process oriented ALoSP will likely develop gradually, as safety data management capabilities (i.e. safety data collection, analysis and storage) are developed by the State. During this step the State will need a mechanism to liaison with service providers for the development of realistic SMS SPIs, SPTs and, if applicable, alerts. These will be used to evaluate service providers' safety performance.

1.5.3.22 While SMS SPIs will be service provider specific, the aggregation of SMS SPIs have to be adopted by the State to monitor and measure the safety performance of the specific aviation sectors (e.g., the number of runway incursions per established number of operations in the State).

Step Three – Mature ALoSP

1.5.3.23 After developing safety data management experience, States will develop State level specific, detailed and quantitative SPIs. Mature State SPI development may follow both a top-down and a bottom-up approach:

1) **Top-down**. The State identifies "most-wanted" safety issues and areas of identified higher safety risk (common areas of high safety risk across aviation sectors or specific key safety risk areas), and establish SPIs that reflect the safety issues and areas of identified higher safety risk.

2) **Bottom-up**. Service providers may take into consideration State ALoSP to develop consistent SMS SPIs which feedback into the State ALoSP. SMS SPIs supporting the SSP SPIs should be discussed and accepted by the State. States should conduct periodic (or on-continuous) monitoring of the SPIs, looking for undesirable trends, SPT alert breaches and SPTs achievement.

1.5.4 Management of change: State perspective

1.5.4.1 Annex 19 does not explicitly require a State to establish formal activities for the management of change under the SSP. However, changes are an ever-present fact in the contemporary aviation system. Whenever changes are introduced into a system, the established safety risk picture of the system will change. Changes may introduce hazards that may impact the effectiveness of existing defences. This could result in new risk or changes to existing safety risks. States should evaluate and manage the impact of change in their aviation systems.

1.5.4.2 An SSP should develop procedures to assess the impact of changes at a State level. The procedures should allow a State to proactively identify the safety impact of change in the aviation system before they are implemented, and plan and execute proposed changes in a structured way.

1.5.4.3 The management of change means simply engaging the SSP SRM process. Whenever changes are planned, the State should analyse the impact of the change on the existing system and then using the existing SRM

process to analyse, assess and if appropriate mitigate any new or changes to existing safety risks. No operation should take place in a changed system or operational context until a safety risks are evaluated.

1.5.4.4 A State will face two types of change under its SSP: organizational change (for example, reallocation of responsibilities or restructuring within State aviation authorities) and operational change (for example, a change in airspace usage). The management of change under SSP should focus on those changes that could have a significant impact on the State's ability to fulfil its legal obligations (process change) and on the State safety management capabilities (which might include a combination of process and operational change).

1.5.4.5 Examples of changes with potential for significant impact to the safety risks of the State include, but are not limited to:

a) Reorganization of State aviation authorities (including downsizing);

b) Changes in the SSP processes, including changes in methodology such as SRBS, SRM and safety assurance processes.

c) Changes in the regulatory environment, such as changes in existing State safety policies, programmes, and regulations;

d) Changes in the operational environment, such as introduction of new technologies, changes in infrastructure, equipment and services;

e) Rapidly changing industry (expanding, contracting, morphing) and its potential impact on the State oversight and performance monitoring capabilities.

1.5.4.6 Communicating the changes is fundamental to the effectiveness of the management of change. It is essential that effected personnel within the State and affected service provider are well aware of the change, its timing and impacts.

1.6 COMPONENT 4: STATE SAFETY PROMOTION

1.6.1 Introduction to State safety promotion

1.6.1.1 From a State perspective, the need to implement internal and external State safety promotion action is established in Annex 19 as one of the components in States' safety management responsibilities. Internally, CAAs and other aviation authorities involved with the SSP should establish mechanisms to provide relevant safety information to its employees to support the development of a culture that fosters an effective and efficient SSP. The communication of its safety policies, safety plans, as well as other important SSP documentation can also improve awareness and collaboration among their staff, so that safety management processes put in place by States remain effective.

1.6.1.2 The improvement of safety performance within a State or a specific aviation sector is highly dependent on its safety culture. Actions related to the management of safety tend to be more effective when the organisation as a positive safety culture. When visibly supported by upper- and middle management, front-line employees tend to feel a sense of shared responsibilities towards achieving their safety objectives.

1.6.1.3 Among other actions for the improvement of safety culture within an aviation system, the need for communication stands out for its importance. By constantly communicating its priorities, best practices, risks that standout in a particular operation, a State can foster a positive safety culture and achieve its safety objectives, be it among the professionals of CAAs or service providers. Further details on safety culture can be found in Part I, Chapter 3.

1.6.1.4 Once employees embrace and understand their responsibilities towards safety performance, it is expected they will actively seek means and information that can be used for effectively accomplishing their responsibilities towards a safe aviation. This is where safety promotion plays a vital role in safety management. Externally, the establishment of communication channels with service providers, should enable the sharing of lessons learned, best practices, SPIs and the provision of information on specific safety risks. This should support the implementation of safety management practices within service providers, supporting the development of a positive

safety culture among them. Also, the establishment of routine communication efforts with service providers may increase general awareness on aviation safety issues and encourage further collaboration in identifying safety enhancement initiatives and achieving safety objectives.

1.6.1.5 As States make decisions or take actions to improve aviation safety, e.g., establishing regulations or implementing changes to surveillance methods, it is also important they communicate it internally as well as externally. This can strengthen the way the whole aviation community perceive the State's commitment to achieving State safety objectives as well as increase their support to the effective implementation of the SSP.

1.6.1.6 Many resources and tools are available to support States in establishing their safety promotion actions. One way of structuring the many promotion actions a State can adopt is establishing a communications plan. Such plan could include, at a minimum, the mapping of interested members of the aviation community, the messages and information conveyed to each of its groups and the means this information will be transmitted. The communication plan may also act as a roadmap supporting the CAA to effectively develop the capability and channels to communicate with these internal and external audiences. This can be instrumental to States building a safety culture as well as in providing the necessary data and tools required by successful safety management, both from States' perspective as well as service providers'.

1.6.1.7 If some information can be communicated through more informal bulletins and posts using social media, others can be better addressed in dedicated meetings or seminars. It is the role of the State to implement the adequate safety promotion channels and media they believe will achieve best results in developing a positive safety culture within the State and ultimately achieve an effective SSP and a safer civil aviation system within the State.

1.6.2 Internal communication and dissemination of information

1.6.2.1 When addressing safety promotion, it is important that State aviation authorities, establish the means to develop a positive safety culture among their personnel. Sharing information can help them in getting personnel buy-in for the implementation of changes to oversight methodologies or strategies, as well as in assessing relevance of observed facts to the overall safety picture of a State.

Note. — *Safety information from voluntary safety reporting systems shall be protected, unless a principle of protection applies. This can be extended to safety information from a mandatory reporting system. Please see Part II, Chapter 1 for more details on the protection of safety data, safety information and related sources.*

1.6.2.2 Safety promotion actions and publications can also improve coordination and collaboration among different organizations involved with safety oversight within a State. The SSP document and its associated State safety and enforcement policies are fundamental to achieving the integration of training, communication and the dissemination of related information. State regulatory organizations responsible for the different aviation sectors as well as other independent administrative entities such as the Accident and Incident Investigation Authority should have an integrated approach to their respective roles in State safety promotion. It is important to ensure that there are dedicated safety communication channel between entities, particularly with the State aviation authority responsible for coordinating the implementation and maintenance of the SSP.

1.6.2.3 From an operational perspective, it is important that SSP operational strategies, including harmonized SMS requirements and monitoring of the respective service providers should be shared, communicated and coordinated amongst the State aviation authorities. An open communication channel may avoid the creation of conflicting SMS requirements or acceptance criteria for different aviation sectors.

1.6.2.4 Examples of information States should address in their internal communication and dissemination include:

a) SSP documentation, policies, and procedures;

b) SPIs;

c) Sector safety performance information;

d) Sector organizational safety risks profiles;

e) Communication of system safety responsibility;

f) Lessons learned from accidents and incidents; and

g) Concepts and best practices of safety management.

1.6.2.5 There is a particularly important need for open lines of safety communication when service providers are approved by more than one State.

1.6.2.6 There are several means State organizations may adopt to convey safety communication internally, such as newsletters, bulletins, leaflets, publications, seminars, meetings, training, websites, mailing lists, publications on social media, discussions in collaboration groups, among others.

1.6.2.7 However, when assessing which type of media will be used to convey the different messages the organization may need to assess which one is more appropriate to each message and its targeted audience. SSP documents may be posted on a website that is readily available to personnel whenever they are needed. Other information such as lessons-learned and best practices may be more suitable for a periodic bulletin or newsletter.

1.6.2.8 Establishing campaigns to address a particular concern or hazard using multiple media may be very effective in increasing awareness to the issue and changing personnel attitude.

1.6.3 External communication and dissemination of safety information

1.6.3.1 The State should establish appropriate communication platforms or media to facilitate SMS implementation and improve system-wide safety culture.

1.6.3.2 Whenever communicating and disseminating safety information externally with the aviation industry, in addition to the items presented in the previous section, States should also consider including:

a) Guidance material for the implementation of SMS;

b) Importance of reporting;

c) Identification of available safety training for the aviation community;

d) Promote the exchange of safety information with and amongst service providers; and

e) Promote the exchange of safety information between States.

1.6.3.3 The State's SSP documentation and its related safety and enforcement policies should also be made available to service providers as appropriate.

1.6.3.4 Essentially, the same support media used for internal communications can be used externally as long as the content is useful for both audiences. For external communication, however, special attention may be given to solutions that reach larger audiences such as social media, mailing list bulletins, seminars, creating industry communities for the exchange of safety information, thus multiplying the messages' outreach.

1.6.3.5 States should promote the establishment of safety information sharing or exchange networks among the aviation community, unless national law provides otherwise.

1.7 SSP IMPLEMENTATION

1.7.1 Introduction to SSP implementation

As with any major project implementation exercise, SSP implementation involves many tasks and subtasks to be completed within a set time frame. The number of tasks, as well as the scope of each task, is dependent upon the maturity of the State's safety oversight system. In most States several organizations and entities are involved in the development and implementation of an SSP. Development of a plan for the implementation process is therefore crucial. This chapter lays out the steps from the prerequisites for the implementation, the gap analysis and implementation planning on to the assessment of the maturity of an SSP.

1.7.2 Prerequisites for SSP implementation

1.7.2.1 There are several ICAO initiatives that support and mandate the implementation of an SSP by the States. The GASP objectives call for States to progressively implement effective safety oversight systems, State safety programmes and safety management capabilities necessary to support future aviation systems. The ICAO Universal Safety Oversight Audit Programme (USOAP) results, expressed as a percentage of effective implementation (EI) of the eight critical elements of a safety oversight system, have been used as an indicator of the maturity of a State's safety oversight system and a State's readiness to implement SSP. In reality, the situation in each State is different and the most effective path to achieving SSP implementation will vary greatly between States. Therefore, the description of a State's system (see 1.7.3) and gap analysis (see 1.7.4) are necessary steps to an efficient and effective implementation (see 1.7.5) of an SSP.

1.7.2.2 Essential criteria before starting with SSP implementation:

a) **Senior management commitment**: It is essential for the senior management of all the State aviation authorities to demonstrate their commitment to the effective implementation of SSP. The senior management are responsible for managing the overall safety within the State. They are responsible for weighing safety risks against resources, setting priorities and allocating resources. The rest of the organization takes its cue from the actions of senior management. If senior management is committed to safety management, and their actions match their words, implementation is likely to be successful and the full benefits of an SSP can be obtained.

b) **Capability to conduct safety oversight of service providers**: Aviation service providers are expected to meet all requirements promulgated by the State, including the implementation of SMS. The State carries out its licensing, certification, authorization and/or approval, and surveillance obligations to ensure that service providers meet State requirements to their satisfaction.

c) **Appropriate enforcement policy**: According to Annex 19, Chapter 3, the State enforcement policy allows a service provider to deal with / resolve events involving safety deviations and minor violations internally, within the context of its SMS, and includes provisions for the authority to deal with events involving gross negligence and wilful deviations through established enforcement procedures.

1.7.2.3 States should also have the basic capabilities and capacity to:

a) Implement regulations that address ICAO Annexes;

b) Oversee their aviation industries through a consistent and adequate set of processes and programs;

c) Perform effective accident and incident investigations; and

d) Maintain an adequate and competent workforce.

1.7.3 State's civil aviation system description and considerations of scalability

1.7.3.1 The understanding of the size and complexity of a State's aviation system and the interactions between the elements is a fundamental precursor to planning the SSP. State are compelled to comply with the requirements of Annex 19, Chapter 3. How the requirements are met will depend on the size and complexity of the aviation system. More information about scalability can be found in Part I, Chapter 1.

1.7.3.2 The SSP will also have regards for the number of service providers in each aviation domain, their size and complexity and regional environment. For States with limited service providers, developing regional partnerships with other States or through the RSOOs and sharing lessons learned and safety risk information will minimise the impact while maximising the benefits of SSP implementation.

1.7.3.3 The State should describe the aviation system and the various State aviation authorities in a civil aviation system description. This should include an overview of organizational structures and interfaces. This is part of the SSP implementation planning process. Such a review should include a description of the following:

a) the structure of the existing aviation regulatory framework, including the various State aviation authorities;

b) safety management roles and accountabilities of the various regulatory organizations;

c) platform or mechanism for coordination of the SSP amongst the organizations; and

d) an internal review mechanism at the State level and within each organization.

1.7.4 SSP gap analysis and implementation plan

SSP Gap Analysis

1.7.4.1 Before developing an SSP implementation plan, a gap analysis of existing State structures and processes against the ICAO SSP components is needed to assess the existence and maturity of the respective SSP elements at a high level. The elements or processes identified as requiring action as a result of the gap analysis will form the basis of the SSP implementation plan.

1.7.4.2 Ideally, the gap analysis will include a review of the USOAP protocol questions that are considered to be prerequisites for each element. In particular if a State has any unresolved USOAP findings related to issues that are linked to effective SSP implementation (e.g. mandatory reporting systems), resolving these should be the first step to any SSP implementation plan.

SSP implementation plan

1.7.4.3 The objective of the implementation process is to achieve progressive enhancement of a State's existing safety oversight and safety management processes. The appropriate tasks / subtasks are prioritized and documented in an action plan to allow for progressive implementation. An SSP implementation plan, together with the development of an SSP top-level (exposition) document, provides the foundation for a State to begin its journey toward effective implementation of its SSP and the continuous improvement of its safety performance. These two key documents should be made readily accessible to all relevant personnel within the organization to facilitate awareness of the SSP and the plans for its implementation.

1.7.5 SSP Maturity Assessment

Background and Purpose

1.7.5.1 The assessment of the SSP should be conducted using a tool that reflects ICAO SARPs and guidance material, developed by the State to meet its needs. The tool should be used by States to perform their own internal audits for the continuous improvement of the SSP as well as by ICAO and other external entities, as appropriate. The tool should be based on a series of questions or expectations that can be used by a State to assess the effectiveness of the SSP. It requires an interaction with all interested members of the aviation community, including face-to-face discussions and interviews with a cross-section of people as part of the assessment. The tool should be flexible and provide for the State to use the tool for its own purposes based on the size and complexity of the State's aviation system.

Assessment

1.7.5.2 Once the basic aspects of the SSP are put in place, an initial assessment of the documentation can be conducted that focuses on assessing whether the expectations of compliance and performance are present and suitable. Evidence should be collected to assess whether the expectations were met. Finally, an assessment should be made to determine if an expectation is being met effectively. Effectiveness is achieved when the outcome produces the desired result each time. A team with appropriate SSP competence and technical expertise normally conducts the assessment and collects the evidence. It is important to structure the assessment in a way that allows interaction with a number of people at different levels of the organization to determine how effective aspects are throughout the organization. For example, determining the extent that the safety policy has been promulgated and understood by staff will require interaction with a cross-section of personnel.

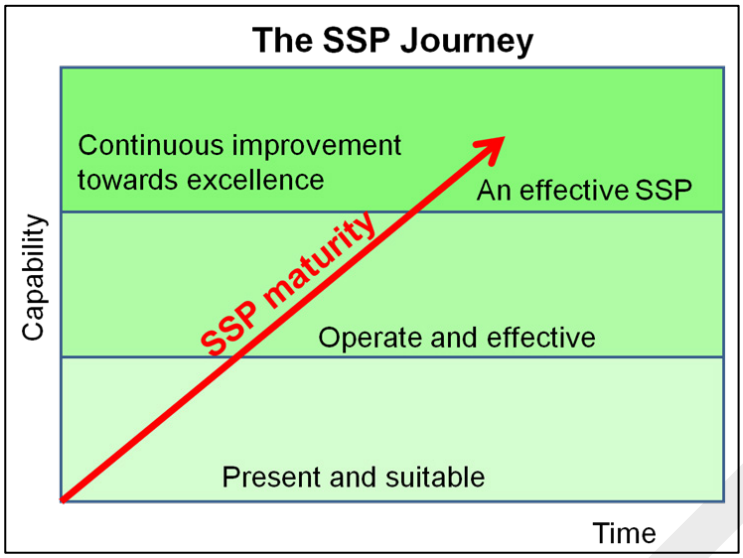


Figure20: SSP Journey (ref: SM ICG SSP Assessment Tool)

On-going Monitoring and Continuous Improvement

1.7.5.3 For on-going monitoring and continuous improvement, the State may utilize the same tool to assess the effectiveness of its SSP, identify changes to its aviation system, and continuously improve the processes within its SSP. For most States, SSP will take time to implement and several years to mature to a level where all the elements are working effectively. The following diagram shows the different levels of SSP maturity as a State implements and develops its SSP.

1.7.5.4 An SSP assessment can be carried out at various stages, looking initially for the presence and suitability of key elements. At a later stage, the SSP can be assessed to understand how well it is operating and how effective it is at achieving its objectives. States can continue to perform assessments periodically to support the continuous improvement towards safety performance excellence.

2. Chapter
SAFETY MANAGEMENT SYSTEMS

2.1 INTRODUCTION

2.1.1 Introduction to safety management systems

This chapter provides additional details on the Safety Management System (SMS) framework in Annex 19 and guidance on the implementation of SMS. The purpose of an SMS is to provide a systematic approach to managing safety. It is designed to continuously improve safety performance by identifying hazards, collecting and analysing data and continuously assessing safety risks. The SMS seeks to proactively mitigate safety risks before they result in aviation accidents and incidents. It can provide an opportunity to manage the organisation's activities in a more disciplined way and to have a greater understanding of the organisation's contribution to the safe operation of aircraft. This will enable the organisation to prioritise safety risks and more effectively manage its resources.

2.1.2 SMS framework

2.1.2.1 Annex 19 provides a standardized framework to enable a consistent approach to safety management. All elements of the SMS framework apply regardless of the organisation's size and complexity. However, the SMS should be tailored to the organisation and its activities.

2.1.2.2 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.

2.1.2.3 A high-level summary of each component is provided, followed by the text from the SMS framework for each element. General guidance and implementation strategies for each element are then presented.

2.1.2.4 International General Aviation operators should determine the SMS criteria established by the State of Registry for their aircraft and ensure that their SMS is acceptable to the State of Registry. They should enquire with the State of Registry whether they may use an industry code of practice to facilitate the acceptability of their SMS.

2.1.2.5 It is important to note that Operators of large or turbojet aircraft under multiple States of Registry with an Air Operator Certificate (AOC) issued in accordance with Annex 6, Part I, are considered to be service providers; therefore, the SMS shall be made acceptable to the State of the Operator.

2.2 COMPONENT 1: SAFETY POLICY AND OBJECTIVES

2.2.1 Introduction to safety policy and objectives

2.2.1.1 This component focuses on how the organisation creates the right environment for an effective SMS. This includes the safety policy and objectives that sets out senior management's commitment regarding safety and the organisational structure to support that commitment.

2.2.1.2 Management commitment and safety leadership is key to the implementation of an effective SMS. Management commitment is declared through the safety policy and by establishing safety objectives and these will promote the desired safety culture. Management decision-making and allocation of resources demonstrates the management commitment to safety. Management decisions and actions should always be consistent with the safety policy to cultivate a positive safety culture

2.2.1.3 Safety Policy Development: Senior management should develop and endorse the safety policy, which is signed by the accountable executive. In developing the safety policy, senior management should consult with the key safety personnel, and where appropriate, staff representative bodies (employee forums, trade unions, for example). Consultation will ensure that the safety policy and stated objectives are relevant to all staff. It will generate a sense of shared responsibility for the safety culture in the organisation.

2.2.2 Management commitment

2.2.2.1 Visible endorsement of the Safety Policy: the senior management and the accountable executive should visibly endorse the safety policy. 'Visible endorsement' refers to making management's active support of the safety policy visible to the rest of the organization. This can be done through communication of management's support for safety goals and objectives and through alignment of the organization's activities to the safety policy.

2.2.2.2 Communication of the Safety Policy: Once the safety policy has been developed there is a management responsibility to communicate the safety policy throughout the organisation to ensure that all personnel understand and work in accordance with the safety policy. The senior management team should periodically review the safety policy to ensure it remains current. It should also be updated when there is a change in the accountable executive

2.2.2.3 Safety Policy contents: The safety policy should reflect the organization's commitment regarding safety. It should include a commitment to:

- continuous improvement in the level of safety performance;
- promote and to maintain a positive safety culture within the organization. Further information on how to promote a positive safety culture can be found in chapter 4.
- comply with all applicable regulatory requirements;
- provide the necessary resources to deliver a safe product or service;
- ensure safety is a primary responsibility of all managers; and
- ensure that the safety policy is understood, implemented and maintained at all levels.

2.2.2.4 The safety policy should also include reference to the safety reporting system, encouraging people to report safety issues and the disciplinary policy that would be applied to personnel involved in safety events or who raise safety reports.

2.2.2.5 The disciplinary policy is used to determine whether an error or rule breaking has occurred so that the organisation can determine whether any disciplinary action should be taken. Therefore, it is essential to ensure that persons responsible for making that determination have the necessary technical expertise to fully consider the context related to the event to ensure that the persons involved are treated fairly.

2.2.2.6 Protection of Safety Reporting data: A policy to appropriately protect safety reporting data, as well as the reporters of such data, can have a significant positive effect on the reporting culture. 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.

2.2.2.7 Safety Objectives: As part of the development of the Safety Policy the service provider should also establish Safety Objectives. Safety objectives should define what the service provider hopes to achieve in respect of safety outcomes. Safety objectives should be short, high-level statements of the safety priorities and should reflect the organisation's safety policy. Safety objectives should also address the organisation's most significant safety risks. Safety Objectives may be included as part of the Safety Policy or separately. This will require establishment of:

a) safety objectives that define what the organization intends to achieve in terms of safety management; and

b) safety performance indicators (SPIs) and safety performance targets (SPTs) to monitor the achievement of these safety objectives.

2.2.2.8 Safety objectives should be established before the setting of SPIs. This allows the safety performance of the organisation to be measured against its safety policies and objectives. The safety performance achieved is an indication of organizational behaviour and is also a measure of the effectiveness of the SMS.

2.2.3 Introduction to safety policy and objectives

2.2.3.1 The accountable executive is the person who has ultimate authority over the safe operation of the organisation. Typically known as the Chief Executive Officer (CEO), their role is to establish and promote the safety policies that instil safety as a core organizational value. They should have the authority to make decisions on behalf of the organisation over the control of resources including financial and human resources. This includes being responsible for ensuring appropriate actions are taken to address safety issues and safety risks, as well as responding to accidents and incidents.

2.2.3.2 Identifying the accountable executive: By requiring that the service provider identify the accountable executive, the responsibility for the overall safety performance is placed at a level in the organization having the authority to take action to ensure that the SMS is effective. Defining the specific safety accountabilities of all members of the management team clarifies their role in the SMS and how they can contribute towards a positive safety culture. These safety responsibilities, accountabilities and authorities should be documented and communicated throughout the organization.,. Additionally, 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.*

2.2.3.3 There should be a single accountable executive for the SMS that may apply to several different approvals that are all part of the same legal entity. Where this is not possible, individual accountable executives should be indented for each organisation approval and clear lines of accountability defined. Where there are multiple accountable executives, it is important for the coordination required between them to be clearly identified.

2.2.3.4 There may be challenges in identifying the most appropriate person to act as the accountable executive especially in large complex organisations with multiple approvals. It is important the person selected is organisational situated at the highest level of the organisation. This will ensure that the right strategic safety decisions are made.

2.2.3.5 The role of the accountable executive: They are required to report, explain and justify the actions (or inactions) of the organisation. Depending on the size and complexity of the organisation, the accountable executive is usually responsible and answerable to the Board and, through them, to the organisation and the aviation community. The same requirements apply regardless of whether the approval certificate is granted to a public or privately owned organisation.

2.2.3.6 One of the most effective ways the accountable executive can be involved, and seen to be involved, is by leading the highest-level safety meetings. They are ultimately responsible for the safety of the organisation, so it makes sense that they are visibly engaged during regular executive safety meetings. Being available for these meetings allows them to:

a) review the organisation's safety objectives and monitor achievement of its safety targets;

b) stay up to date on the safety performance of the business;

c) make timely safety decisions;

d) allocate the appropriate resources;

e) hold managers accountable for safety responsibilities, performance and implementation timelines; and,

f) most importantly, be seen by managers and staff as a person who is interested in, and in charge of, safety.

2.2.3.7 The accountable executive is often not involved in the day-to-day activities of the organisation or the problems faced in the workplace. The accountable executive will often delegate safety management responsibility to the senior management team and other key safety personnel. This is appropriate. Importantly, the accountable executive can delegate responsibility for day-to-day operation of the SMS but cannot delegate accountability for the system and important safety risk decisions. For example, the accountable executive cannot delegate:

- Assuring safety policies are appropriate and communicated;
- Assuring necessary allocation of resources - financing, personnel, training, acquisition, etc.; and
- Setting of the acceptable safety risk limits and resourcing of necessary controls.

2.2.3.8 It is appropriate for the accountable executive to have the following safety accountabilities:

a) to provide sufficient financial and human resources for the proper implementation of an effective SMS;

b) for the promotion of a positive safety culture.

c) to establish and promote the safety policy;

d) for the establishment of the organization's safety objectives;

e) for ensuring the SMS is properly implemented and performing to requirements;

f) continuous improvement of the SMS.

2.2.3.9 The accountable executive should ensure that there is an appropriate organisational structure to manage and operate the SMS.

2.2.3.10 The accountable executive's authorities include, but are not limited to:

a) having final authority for the resolution of all safety issues; and

b) final authority over operations under the certificate/approval of the organization including the authority to stop the operation or activity.

2.2.3.11 Authorities: 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 role, a management position or at a safety committee level.

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

2.2.3.13 Safety Responsibilities: Safety management should be everyone's responsibility and therefore everyone needs to know what their responsibilities and accountabilities are. By defining accountabilities for all personnel involved in safety-related duties this will support the delivery of safe products and operations. To the extent possible, the safety responsibilities of all personnel - management and staff - should focus on the staff member's contribution to the safety performance of the organization (the organizational safety outcomes), rather the individual's safety tasks (the individual safety inputs). 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.

2.2.3.14 Documentation of Accountability, authorities and responsibilities: All accountabilities, responsibilities and authorities should be defined and documented in the SMS documentation. They should also 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 (described in the next section).

2.2.3.15 Lines of safety accountability: How the lines of safety accountability throughout the organization are defined will depend on the type and complexity of the organisation, and their preferred communication methods. Typically, the safety accountabilities and responsibilities will be reflected in organisational structure charts, documents that define the departmental responsibilities and personnel job or role descriptions.

2.2.3.16 Conflicts of interest should be avoided wherever possible between a staff member's safety responsibilities and other organisational responsibilities. Further, service providers should thoughtfully appoint their SMS accountabilities and responsibilities to minimise overlap and/or gaps in safety accountability and responsibility.

2.2.3.17 Accountability and responsibilities in respect or external organizations: It important to recognise that a service provider is responsible for the safety performance of external organizations where there is an SMS interface. The service provider is likely to be held accountable for the safety performance of products or services provided by external organisations in supporting its activities even if they 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 organisations that contribute to the safe delivery of their product or services.

2.2.4 Appointment of key safety personnel

2.2.4.1 The safety manager functions: The appointment of a competent person or persons fulfilling the role of safety manager is key to the effective implementation and functioning of the SMS. The safety manager may be identified by different titles, but for the purposes of this manual the generic term safety manager is used and is intended to refer to the function, not necessarily to an individual. 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.

2.2.4.2 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 members of the aviation community. The safety manager's functions include, but are not necessarily limited to:

a) upon initial implementation, 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 SMS documentation and records;

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 product and service delivery; and

i) coordinating and communicating (on behalf of the accountable executive) with the State's CAA and other State authorities as necessary on issues relating to safety.

2.2.4.3 Safety Manager selection: 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 retained 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 aim to avoid conflicts of interest with other - potentially conflicting - organisation priorities. 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 operational role and their ability to determine the effectiveness of their own safety risk mitigations.

2.2.4.4 In addition, 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.

2.2.4.5 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

2.2.4.6 Additional staff depending upon the size nature and complexity of the organization may support the safety manager. The safety manager and supporting staff are responsible for ensuring that safety data is collected and analysed in a timely manner and the related safety information is distributed appropriately within the organization such that safety risk decisions and controls, as necessary, can be made. The distribution of safety information is an important step in the SRM process. This information should be used by the organization to define and implement safety risk mitigations, as necessary

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

2.2.4.8 Highest level Safety Committee: Additionally, a function of the safety manager is to assess the effectiveness of any mitigation strategies used to achieve the safety objectives of the organization. This can be done

through a safety committee such as the 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 may include the accountable executive and senior management with the following functions:

a) monitors the effectiveness of the SMS;

b) monitors that any necessary safety risk control 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 declared organization priority of safety management; and

e) promotion of safety across the organisation.

2.2.4.9 Supporting Safety Committees: 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) oversees 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 in a timely manner; and

e) reviews the effectiveness of the safety risk controls.

2.2.5 Coordination of emergency response planning

2.2.5.1 Coordination of the emergency response plan (ERP) (SMS Element 1.4) applies only to those service providers required to establish and maintain an emergency response plan. Annex 19 does not establish a standard requiring the creation or development of emergency response planning. Emergency response planning requirements applicable to specific service providers are established in the relevant ICAO Annexes and may use different terms for provisions related to dealing with emergency situations.

2.2.5.2 The purpose of the ERP: Emergency response planning provides a systematic approach to managing the service provider's activities in the aftermath of a significant unplanned event or during an on-going emergency situation. The overall objective is the safe continuation of operations and the return to normal operations as soon as possible. This should ensure that there is 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 documents actions to be taken by all responsible personnel during an emergency situation. This includes the means to coordinate efforts necessary to cope with the emergency. The ERP should be easily accessible to the appropriate key personnel as well as to the coordinating external organisations.

2.2.5.3 Emergency situations: By its nature, an emergency is a sudden, unplanned situation or event requiring immediate action. Therefore, "coordination of emergency response planning" refers to planning for activities that take place within a limited period of time during which an unplanned aviation operational emergency situation exists. An ERP is essentially 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.

2.2.5.4 Coordination of the ERP: Most emergencies will require coordinated action between different organisations. This will require co-ordination with other service providers and with other external organisations such as non-aviation related emergency services. This co-ordination should be tested as part of the periodic testing of the ERP.

2.2.6 SMS Documentation

2.2.6.1 The SMS Manual: The SMS documentation should include a top-level “SMS manual”, which describes the organization’s SMS policies, processes and procedures. Such a document facilitates the organization’s internal administration, communication and maintenance of the SMS to help personnel understand how the organizations SMS works and how the safety policy and objectives will be met. It should be unique and written to reflect the day to day safety management activities and in way that its is easily understood by personnel throughout the organisation The documentation should include a system description that provides the boundaries of the SMS and helps to distinguish between policy, processes, procedures and requirements while defining how they are all linked to the safety policy and objectives.

2.2.6.2 The SMS Manual also serves as the organization’s SMS communication (declaration) to the relevant authority (CAA) 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 sufficient. This SMS document will need to be kept up to date, and where significant amendments are intended or made, they may require CAA agreement where necessary.

2.2.6.3 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.

2.2.6.4 SMS Operational Records: Another aspect of SMS documentation is the compilation and maintenance of operational records substantiating the existence and on-going 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 retained in line with existing retention periods. Typical SMS operational records should include:

a) hazards register and hazard/safety reports;

b) safety performance indicators (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 process) and

i) Gap analysis to support implementation plan.

2.3 COMPONENT 2: SAFETY RISK MANAGEMENT

2.3.1 Introduction to safety risk management

2.3.1.1 Service providers should ensure that they are managing the safety risks they are faced with. This process is known as safety risk management (SRM) and includes hazard identification, safety risk assessment and safety risk mitigation.

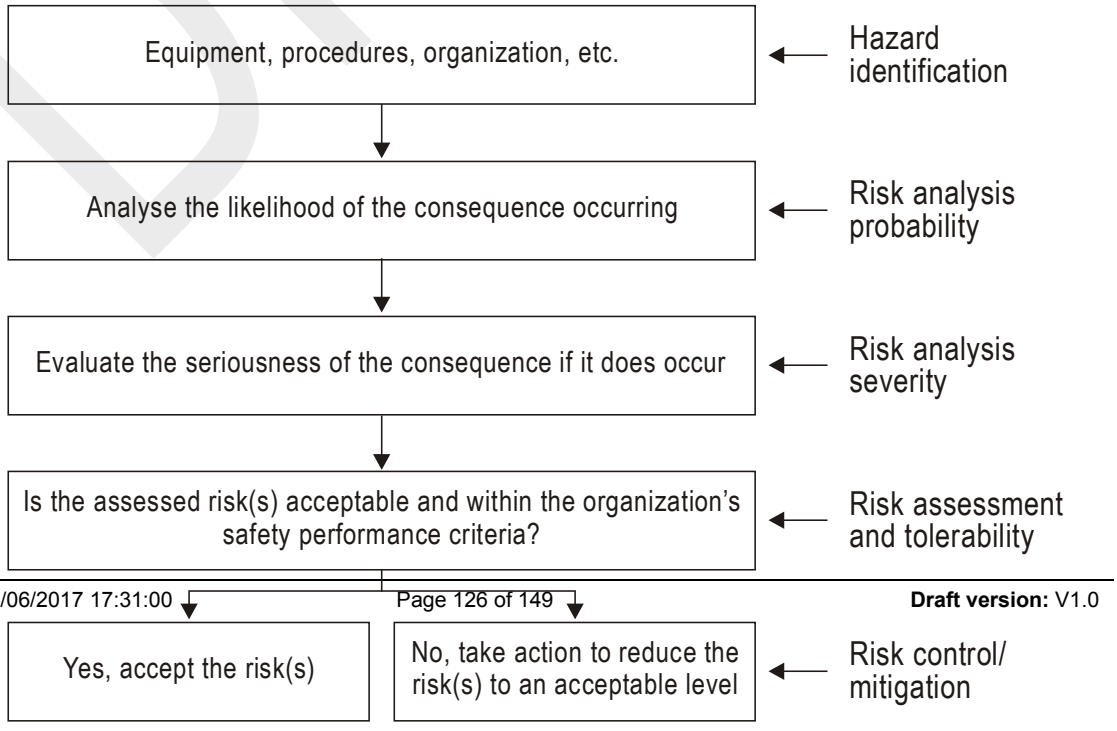
2.3.1.2 The SRM process systematically identifies hazards that exist within the context of the delivery of its products or services. Hazards may be the result of systems that are deficient in their design, technical function, human interface or interactions with other processes and systems. They may 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 during the lifecycle of the operation or activity.

2.3.1.3 Understanding the system and its operating environment is also essential for the achievement of high safety performance. Having a detailed system description that defines the system and its interfaces will help this. Hazards may be identified throughout the operational life cycle from internal and external sources and safety risk assessments and safety risk mitigations will need to be continuously reviewed to ensure they remain current.

Detailed guidance on hazard identification and safety risk assessment procedures is addressed in Part I, Chapter 2.

2.3.2 Hazard identification

2.3.2.1 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 the operation and activities. This includes equipment, facilities and systems. Any aviation safety-related hazard identified and controlled is a positive for the operation. It is important to also consider hazards that may exist as a result of the SMS interfaces with external organizations.



Sources for Hazard Identification

2.3.2.2 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; this uses observational techniques to monitor the day to day operations and activities (e.g. Line Orientated Safety Audits)

b) automated monitoring systems; this uses automated recording systems to monitor parameters that can be analysed such as Flight Data Monitoring.

c) voluntary and mandatory reporting systems; this provides everyone including staff working in external organisations with the opportunity to report hazards and other safety issues to the organization

d) audits; these can be used to identify hazards in the task or process being audited. These should also be co-ordinated with organisational changes to identify hazards related to the implementation of the change.

e) feedback from training; Where training is interactive (two way) this can facilitate the identification of new hazards from the training participants.

f) safety investigations; Hazards identified in internal safety investigation and follow-up reports on accidents/incidents.

2.3.2.3 Examples of external data sources for hazard identification include:

a) aviation accident reports; reviewing accident reports can be a useful source of hazard data. This may be related to accidents in the same State or to a similar aircraft type, region or operational environment.

b) State mandatory and voluntary safety reporting systems; Some States provide summaries of the safety reports they receive from service providers.

c) State oversight audits and third party audits; External audits can sometimes identify hazards. These may be documented clearly as an unidentified hazard or captured less obviously within an audit finding.

d) Trade associations and information exchange systems. Many trade associations and industry groups are able to share safety data that may include hazards.

2.3.2.4 One of the main sources of hazard identification is through the safety reporting system. Safety reporting systems are a valuable source of hazard identification as well as providing useful safety information. They normally consist of:

a) mandatory safety reporting systems; and

b) voluntary safety reporting systems.

2.3.2.5 Mandatory safety reporting systems require the reporting of certain types of events (e.g. serious incidents, runway incursions). This State is responsible for defining the reporting criteria and scope of reportable occurrences that the service provider should follow. Mandatory reporting systems tend to collect more information related to significant events that could lead to an aircraft accident.

2.3.2.6 Voluntary safety reporting systems allow for the reporting of information related to hazards, near misses or errors that are not considered to be mandatory to report. These can provide valuable information to the State and service provider on lower consequence events. It is important for State aviation organizations and Service providers to provide an appropriate reporting policy to encourage people to use the reporting system. 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 should 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.

2.3.2.7 Voluntary safety reporting systems should be confidential, requiring that any identifying information about the reporter is known only to “gatekeepers” in order to allow for follow-up action. The “gatekeepers” should be kept to a limited number and restricted to the safety manager and anyone 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 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.

2.3.2.8 Responsibilities for reporting hazards: Personnel at all levels and across all disciplines should be encouraged to identify and report hazards and other safety issues through the safety reporting system. 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 maximises the likelihood of staff engagement. Everyone should be made aware of the benefits of safety reporting and what should be reported.

2.3.2.9 Reporting system feedback: 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.

2.3.2.10 Filtering of safety reports: Where there are a large number of safety reports there may be a need to filter reports as they are entered into the reporting system. This may involve an initial safety risk assessment to determine whether further investigation or what level of investigation is required.

2.3.2.11 Safety reports are often filtered through the use of a taxonomy. Filtering this 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 needs to be forced into the closest category, which may not accurately capture the type of hazard. Some States and international trade associations have developed taxonomies that could be used.

2.3.2.12 Hazard identification workshops: Other methods for the identification of hazards may include the use of workshops or meetings in which subject matter experts conduct detailed analysis scenarios. These sessions require a range of experienced operational and technical personnel and are managed by a facilitator. Existing safety committee meetings could be used for such activities. The same group may also be used to assess corresponding safety risks.

Investigation of hazards

2.3.2.13 Hazard identification should be continuous and as part of the service provider's on-going activities. A number of conditions trigger more in-depth hazard identification activities and may include:

a) instances where the organization experiences an unexplained increase in aviation safety-related events or regulatory non-compliance; and

b) significant changes to the organization or its activities.

2.3.2.14 Documentation of Hazards: Once hazards have been identified along with potential consequences they should be documented. This will then be used for the safety risk assessment processes.

2.3.2.15 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.

2.3.3 Safety Investigation

2.3.3.1 Investigations of safety incidents carried out by the service provider to provide an additional source of hazard identification. The primary objective of the safety investigation is to understand what happened, and how to prevent similar events occurring. This is achieved through careful and methodical examination of the event and to apply the lessons learned to reduce the probability and/or consequence of future recurrences. Safety investigations are an integral part of the service provider's SMS.

2.3.3.2 There are many safety occurrences that do not warrant official investigations by the State. These occurrences and identified hazards may be indicative of systemic problems. These problems can be revealed and remedied by a safety investigation lead by the service provider.

2.3.3.3 Effective safety management systems depend on quality investigations to analyse incidents and safety hazards and report findings and recommendations to improve safety in the operating environment. Annex 19 Chapter 8 section 2.2 - Safety risk assessment and mitigation states… "The service provider shall develop and maintain a process that ensures analysis, assessment and control of the safety risks associated with identified hazards."

2.3.3.4 Investigation of safety incidents and hazards are an essential ingredient of the overall risk management process in aviation. It performs a key role in reactive risk management. The benefits of conducting a safety investigation, include:

- gaining a better understanding of the events leading up to the occurrence;
- identifying contributing human, technical and organisational factors;
- identifying hazards and conduct risk assessments;
- making recommendations to reduce or eliminate unacceptable risks; and
- identifying lessons learnt that should be shared with the appropriate members of the aviation community.

Investigation triggers

2.3.3.5 The investigation process is usually triggered by a notification (report) submitted in accordance with the established safety reporting systems. But not all incidents or hazards can or should be investigated. The trigger to conduct an investigation and its extent should depend on the actual or potential consequences of the incident or hazard. Incidents 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. The triggers guide the safety investigation decisions – what to investigate and the scope of the investigation. Trigger considerations could include:

- Regulatory or organisational requirements;
- Safety value to be gained;
- Opportunity for safety action to be taken;
- Risks associated with not investigating;
- Contribution to targeted safety programs;
- Identified trends;
- Training benefit; and
- Resources availability.

Establish an investigation team

2.3.3.6 If an investigation is to commence, the first action will be to appoint 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.

2.3.3.7 Service provider safety investigators are ideally organisationally independent from the area associated with the incident or identified hazard. Better results will be obtained if the investigator(s) are knowledgeable (trained) and skilled (experienced) in 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, pragmatisms and lateral thinking.

Information collection

2.3.3.8 Collection of factual information that is pertinent to the situation is the first practical step in the process. It is best to use a structured approach when collecting information. A useful starting point is to ask:

- What was being attempted when the incident occurred?
- Had it worked before? How?
- Why didn't it work this time?
- When did the situation start to diverge from normal? Why?

2.3.3.9 Consider the involvement of any of the following elements in the incident or hazard: organisation, people, equipment, policies, procedures and interactions between the elements.

2.3.3.10 Often the best place to start is at the scene of the situation - if there is one. Begin by recording volatile information: equipment and people's position, switches and relative positions, environmental conditions. Conduct interviews early in the information collection process. Start with the people most involved in the situation, and work out from there.

2.3.3.11 A large amount of information will normally be collected before an incident or hazard is understood. It is vital that the collected information and its sources are protected. This is necessary for regulatory reasons (ref. chapter five for details), because of the trust involved, and to ensure the continued availability of information for future investigations.

Analysis

2.3.3.12 Analyse the collected information to assess the safety risk and provide explanation of the technical, human and operational factors. Analysis aims to identify underlying factors and issues. To ask and answer the questions why and how the occurrence happened or hazards exists. It enables the drawing of conclusions and identification of safety actions to eliminate or mitigate safety risks. The investigation analysis should look beyond the obvious causes and aim to identify the contributory factors, some of which may be related to weaknesses in the system's defences or other organisational issues.

2.3.3.13 There are many ways the collected information can be analysed. Typical investigations will include analysis of: the timeline of events, the systems within which the event/hazard occurred, the performance of the humans involved, and the safety risks that the event or hazard possess to the present operation.

- **Timeline analysis**: is an analysis of key events, decisions, participants, equipment, and changes in order of events from normal to undesired.
- **System analysis**: Works backwards through the Reason Model, analysing the absent or failed defences, situations and tasks and local and organisational conditions.
- **Human Performance analysis**: is an analysis of the capabilities and limitations of the humans in the system; their performance, any errors or violations, how breakdowns in human performance may have contributed to the occurrence or hazards, and how this relates to any human performance limitations. Many good HP diagnostic tools are available. See the HF manual for details.
- **Safety risk analysis**: is an analysis of the degree of safety risk the incident or hazard poses to the immediate situation and/or the entire operation. This helps with report writing and prioritisation of actions.

Safety investigation reporting

2.3.3.14 For maximum effectiveness, a report of the 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 organisation and the effectiveness of future safety initiatives.

2.3.3.15 The investigation report aims to:

- Communicate the facts of the incident or hazard;
- Present compelling, well-considered, well-supported arguments for safety improvements to persuade those who have the authority to implement the safety recommendations
- Inform effected people more broadly; and
- Result in positive organisational change.

2.3.3.16 Safety recommendations are the main product of the safety investigation report. Clearly defined findings and recommendations that eliminate or mitigate safety deficiencies is the objective of the investigation. To be effective the safety investigation report should:

- Use standard formats and language; either company standard and/or the ICAO Annex 13 suggested format;
- To convey the facts of the subject to readers in a succinct, clear, unambiguous and well-organised manner; and
- Be concise, objective, supported by evidence, non-emotive, accurate, and tactful and include appropriate references to other documents.

Accident investigations

2.3.3.17 There is a clear distinction between accident investigations and safety investigations. Investigation of accidents and serious incidents are the responsibility of the State, as defined in Annex 13. This type of information is essential to disseminate lessons learned from accidents. Safety investigations that are conducted by service providers are not required under Annex 13, but rather Annex 19. This is not to say that a locally initiated investigation of an aircraft accident should be discouraged. Service providers may well initiate their own investigation in parallel with the State's investigation with the aim of maintaining or improving safety of their operation.

2.3.4 Safety risk assessment and mitigation

2.3.4.1 Safety risk assessment methods and models: The service provider needs to develop a safety risk assessment model and procedures that allows it to assess the safety risk in a consistent and systematic approach. This should include a method that will help determine what safety risks are acceptable or unacceptable and to prioritise actions.

2.3.4.2 Part II, Chapter 2 provides more details on SRM tools but these may need to be reviewed and customized to ensure they are suitable for the service provider’s operating environment. As the SMS matures the service provider may find more sophisticated approaches that better reflect the needs of their operation. The service provider and CAA should agree on chosen methodology.

2.3.4.3 Advanced safety risk management approaches: There are more sophisticated approaches to safety risk classification available. These may be more suitable if the service provider is experienced with safety management or operating in a high-risk environment. These sophisticated approaches are not included in this Manual. The ICAO website has more information on SRM and examples of other processes, along with advantages and disadvantages of each approach.

2.3.4.4 Qualitative safety risk assessments: Safety risk assessments sometimes have to use qualitative data (expert judgement) rather than quantitative data as there may be limited data available. Employing the safety risk matrix allows the user to express the safety risk(s) associated with the identified hazard in a quantitatively (data related to quantities, measured and noted with numbers) 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.

2.3.4.5 The safety risk assessment process should use whatever safety data and safety information is available and may also involve the judgement of subject matter experts. Once safety risks have been assessed, the service provider will engage in a decision making process to determine the need to implement appropriate safety risk controls.

2.3.4.6 A local safety committee may 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, with the necessary authority to provide the appropriate resources.

2.3.4.7 How service provider's prioritises safety risk assessment and safety risk control adoption is their decision. As a guide, the service provider need to satisfy themselves that their chosen prioritisation 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."

2.3.4.8 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 ensure that practical safety risk mitigation are considered. A determination of any unintended consequences, particularly the introduction of new hazards, should be made prior to the implementation of any safety risk control.

2.3.4.9 Monitoring or safety risk mitigations: Once the safety risk control has been agreed and implemented, any associated changes in the safety performance provides feedback on the effectiveness of the safety risk control. This is necessary to verify the integrity, efficiency and effectiveness of the new safety risk controls under the new operational conditions.

2.3.4.10 Safety risk Management Documentation: 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 that they can be tracked and monitored. This SRM documentation becomes a source of safety knowledge to be used as reference in organizational safety decision-making processes. This safety knowledge provides material for safety trend analyses as well as for safety training and communication. It can also be useful information for the internal audit activities to assess whether safety risk controls and actions have been taken.

2.4 COMPONENT 3: SAFETY ASSURANCE

2.4.1 Introduction to safety assurance

2.4.1.1 Safety assurance assesses the effectiveness of the SMS, including the effectiveness of the safety risk controls. It should provide confidence that safety risks are being managed and controlled to acceptable levels. This should ensure appropriate actions have been taken, that internal processes are effective and that safety objectives are met.

2.4.1.2 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.

2.4.1.3 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 should lead to continuous improvement of the SMS.

2.4.2 Safety assurance

2.4.2.1 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 often the application of a safety risk control does not always result in managing the safety risk as originally intended. This will help identify whether the right safety risk control was selected and may result in applying a different safety risk control strategy.

Internal audit

2.4.2.2 Internal audit process: This is used to assess the effectiveness of the SMS and identify areas for potential improvement of the SMS. Effectiveness is achieved when the organization routinely monitors the SMS to identify potential areas of improvement and the outcomes of this process lead to improvements to SMS.

2.4.2.3 Most aviation safety regulations are generic safety risk controls that have been established at a State level. Therefore, ensuring compliance with the regulations through the internal audit process should be a fundamental part of safety assurance.

2.4.2.4 It is also necessary to ensure that any safety risk controls are effectively implemented and monitored. Where non-conformances and other issues are identified the causes and contributing factors should be investigated and analysed. The main focus of the internal auditing is on the policies, processes and procedures that provide the safety risk controls.

2.4.2.5 Internal audits are most effective when they are conducted by persons or departments that are independent of the functions being audited conduct internal audits. Such audits should provide the accountable executive, as well as senior management with feedback on the status of:

a) compliance with regulations;

b) compliance with policies, processes and procedures;

c) the effectiveness of safety risk controls;

d) the effectiveness of corrective actions; and

e) the effectiveness of the SMS.

2.4.2.6 In some organizations it may not be possible to ensure an appropriate level of independence for the internal audit. In such cases, the organization may consider making use of external auditors (e.g. independent auditors or auditors from another organization).

2.4.2.7 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 safety risk controls implemented. Internal audits should identify non-compliance with regulations and policies, processes and procedures. They can also identify system deficiencies, lack of effectiveness of safety risk controls, and opportunities for improvement.

2.4.2.8 Assessing for compliance and effectiveness are both essential to achieve its safety objectives. The internal audit process can be used to determine both compliance and effectiveness. The following questions can be used to assess compliance and effectiveness of each process/procedure:

Determining Compliance

- ✓ Does the required process exist?
- ✓ Is it documented (inputs, activities, interfaces and outputs defined)?
- ✓ Does it meet requirements (the criteria)?
- ✓ Is it in use?
- ✓ Are all affected personnel following it consistently?
- ✓ Are the defined outputs being produced?
- ✓ Have process changes been documented and implemented?

Assessing Effectiveness

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

2.4.2.9 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 root cause(s) and contributing factors for any non-compliance should feed into the service provider's SRM processes.

2.4.2.10 The outputs 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.

2.4.2.11 External Monitoring: Civil aviation authorities 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 of opportunities to improve their SMS.

2.4.3 Safety Performance Monitoring

2.4.3.1 Safety performance monitoring is conducted through the collection of data and information from a variety of sources typically available to an organization. Data availability to support informed decision-making is one of the most important inputs 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.

2.4.3.2 Safety performance monitoring and measurement should be conducted observing some basic principles. This requires the organization to define:

- Safety objectives, which reflect the strategic achievements or desired outcomes related to safety concerns specific to the organization's operational context;
- Safety performance indicators (SPIs), which are the tactical parameters related to the safety objectives, and therefore are the reference for data collection; and
- Safety performance targets (SPTs) are also tactical parameters, which are the milestones used to monitor progress towards the achievement of the safety objectives.

2.4.3.3 Service providers will gain a more complete and realistic picture of the organization's safety performance if SPIs and SPTs encompass a wide spectrum of indicators. This should include:

- low-probability/high-consequence events
  (e.g. accidents and serious incidents);
- high-probability/lower-consequence events
  (e.g. uneventful operational events, non-conformance reports, deviations etc.): and
- process performance
  (e.g. training, system improvements and report processing).

2.4.3.4 SPIs should be used to measure the performance of the SMS and the operational safety performance of the service provider. SPIs will require the monitoring of data and information from various sources including the safety reporting system. SPIs should be specific to the individual service provider and be linked to the safety objectives already established.

2.4.3.5 Meaningful SPIs: The service provider should consider what safety data and information they have available and how reliable that information is in establishing useful SPIs. Selection of meaningful safety performance indicators should consider the following:

a) Measure the right thing; its important to measure what is important rather what is easy to measure. Start by looking at the safety objectives, as there should be SPIs linked to them. Also consider what the biggest safety issues and safety risks are and whether SPIs can be established that are linked to them.

b) Availability of data; there will not always be data available or it may not be the right data related to what the service provider wants to measure. This may require changing the data being requested. 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 different service providers

c) Reliability of the data; it should also be recognised that the data may be either unreliable because of its subjective nature or because it is not a complete data set. Use of safety reports should recognise that not everything will get reported.

d) Common industry SPIs; It may be useful to agree common SPIs with similar organizations so that comparisons can be made between organisations. The regulator or industry associations may enable these.

2.4.3.6 SPTs and alert levels: 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 it should be recognised that they can also drive the wrong behaviours. Individuals and department may become too focused on achieving the target that they lose sight of what the target was intended to achieve. In such cases it may be more appropriate just to monitor the SPI for trends.

2.4.3.7 Data and information sources: The following activities can be used to monitor and measure safety performance:

a) Safety studies are analyses used to gain a deeper understanding of safety issues or to understand an adverse trend in safety performance.

b) Safety data analysis uses the safety reporting data to analyse it for common issues or trends that might indicate that further investigation or understanding is needed.

c) 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.

d) Audits focus on the integrity of the organization’s SMS and its supporting systems, providing an evaluation of the effectiveness of safety risk controls and monitoring compliance with safety regulations. Such 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.

e) Safety investigations are conducted for certain reportable safety events to identify new hazards or weakness in existing safety risk controls. External accident and incident reports may also raise internal concerns that need to be investigated.

f) Operational data collection systems such as Flight Data Analysis, Radar information can provide useful data of events and operational performance.

2.4.3.8 The development of SPI should be linked to the safety objectives and be based on the analysis of available data. The monitoring and measurement process involves the use of selected safety performance indicators, corresponding SPTs and alert levels.

2.4.3.9 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.

2.4.3.10 Primarily, safety performance monitoring and measurement provides a means to verify the effectiveness of safety risk controls. In addition, they provides a measure of the integrity and effectiveness of SMS processes and activities.

2.4.3.11 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.

2.4.4 Management of change

Drivers for change

2.4.4.1 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; and

c) changes to the organization's operating environment.

d) changes to the SMS interfaces with external organizations.

e) external changes from regulatory changes, economic changes and emerging risks.

2.4.4.2 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 whenever change occurs. Such hazards should be identified so and related safety risks assessed and controlled as defined in the organization's existing hazard identification / SRM procedures.

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

a) Criticality. What is the critical nature of the change? This should consider not only the impact on the organisation's activities but the impact on external organisations 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 organisations.

c) Availability of safety performance data and information. What data and information is available that can be used to help in the analysis of the change.

2.4.4.4 Small incremental changes can accumulate, that require amendments to the system description. Therefore the system description should be regularly reviewed to determine their continued validity.

2.4.4.5 The service provider should define when the formal change process is used as there will be some minor changes that may not justify having a formal change management activity. Typical changes that should be considered are:

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

g) Physical changes (a new facility, a new base, aerodrome layout changes etc.)

2.4.4.6 The service provider should consider the impact of the change on its staff. This could affect the way the change is acceptable by those people affected. Communicating and engaging with staff at the earliest opportunity will improve the way that the change is accepted and implemented.

2.4.4.7 The change management process should include the following activities to implement and effective change:

a) **understanding and defining the change:** This should include a description of the change and why it is being implemented.

b) **understanding and defining who and what it will affect:** This may be individuals within the organisation, other departments or external people and other organisations. This may also impact on equipment, systems and processes. This may include reviewing the system description and any interfaces with other organisations. This is also the opportunity to determine who should be involved in the change process.

c) **identifying any hazards/issues relates to the change and carry out a safety risk assessment:** This should identify any hazards related to the change. This should also review the impact on existing hazards and safety risk assessments that may be effected by the change. This step should use the existing organisation's SRM processes.

d) **development of an action plan:** This should define what is to be done, by whom and by when. There should be a clear plan on how the change will be implemented and who will be responsible for actions with agreed timescales.

e) **change sign off:** This is to confirm that the change is safe to implement. The individual with overall responsibility and authority for implementing the change should sign this off.

f) **assurance plan:** Determine what follow up action is needed? This should consider how the change will be communicated and whether additional activities such as audits are needed during the change and after the change has taken place. Amy assumptions made will need to be verified and validated.

2.4.5 Continuous improvement

2.4.5.1 Continuous improvement is measured through the monitoring of an organization's safety performance and is related to the effectiveness of the SMS. Continuous improvement is further supported by safety assurance activities that include the verification and follow up of actions and the internal audit processes. It should be recognised that maintaining and continuously improving the SMS is an on-going journey as the organization itself and the operational environment will be constantly changing.

2.4.5.2 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.

2.4.5.3 Service providers should strive to implement a variety of methods to determine SMS effectiveness and this should not be based only on SPIs. Determining SMS effectiveness requires different methods to measure outputs as well as outcomes of the processes, and assess the information gathered through these activities. Such methods may include:

a) Audits; this would include internal audits and audits carried out by external organisations

b) Assessments; this would include assessments of safety culture and SMS effectiveness

c) Monitoring of occurrences: This would monitor the recurrence of safety events including accidents and incidents as well as errors and rule breaking situations.

d) Safety surveys; staff surveys including cultural surveys can provide useful feedback on how engaged personnel are with the SMS and an indicator of the safety culture of the organization

e) Management reviews: This is an opportunity to look at all the available safety performance information to look at the overall trends and whether the safety objectives are being achieved. It is important that Senior Management are challenging in their review of 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; this may be part of the management review but looks at trends and where the data is available to compare with other service providers or State and global data etc.

g) Addressing lessons learnt; the SMS should be identifying lessons learnt from the safety reporting system and safety investigations and these should leading to safety improvements being implemented

2.4.5.4 A key part of continuous improvement is to use the information gathered above for management for action to address ineffectiveness and decisions to continuously improve the SMS. This will lead to safety issues being identified earlier and managed before they become bad events.

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

2.5 COMPONENT 4: SAFETY PROMOTION

2.5.1 Introduction to safety promotion

2.5.1.1 Safety promotion encourages a positive safety culture and helps to enable achievement of the service provider's safety objectives. This is achieved through the combination of technical competence that is continually enhanced through training and education, effective communications and information sharing. Competence is the ability of an individual to do a job properly by having the appropriate knowledge, skill, attitude and behaviours. Senior management provides the safety leadership to promote the safety culture throughout an organization..

2.5.1.2 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.

2.5.1.3 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 organisation and the enabling of "bottom-up" communication, that encourages open and constructive feedback from operational personnel.

2.5.2 Training and education

2.5.2.1 Safety Training Programme: The safety manager is responsible for ensuring that there is a suitable safety training programme in place. This includes the provision of appropriate safety information relevant to specific safety issues encountered by the organization. The provision of training and education to appropriate staff, 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 safety 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 .

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

2.5.2.3 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 organisation's safety committees will be higher than personnel directly in product or service delivery. Whereas for those personnel who are not directly involved in

the operations may just need some familiarisation training about the organisation's SMS. The important point is that it is more efficient and more effective to customise training to the attributes and needs of each audience group.

2.5.3 Training needs analysis

2.5.3.1 For most organizations a formal Training Needs Analysis is beneficial to ensure there is a clear understanding of the operation, the safety duties of the personnel and the available training. A typical TNA will include the following steps:

a) conduct an audience analysis. Identify, for each staff member, their relationship with the SMS and 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 (refer to Section on Interfaces);

b) Identify the knowledge and competencies needed to perform each safety duty.

c) Conduct an analysis to ascertain the gap between the current safety skill and knowledge across the workforce and those needed to effectively perform the allocated safety duties.

d) Identify the most appropriate skills and knowledge development approach for each audience group with the aim of developing a training programme appropriate to each individual's involvement in the SMS (Annex 19 4.1.2). The training programme should also have regard for on-going maintenance of safety knowledge and competency. The need will typically be met through recurrent training.

2.5.3.2 Training delivery: The method of training delivery should also be considered so that it appropriate to the individual and the availability of training facilities. Whilst the chosen method of training delivery is important, it is more important that personnel are competent to perform their SMS duties. The competencies of any trainers that are delivering safety training should also be assessed as this will have a significant impact on the effectiveness of the training delivery. The safety training programme should also specify responsibilities for development of training content and scheduling as well as training and competency records management.

2.5.3.3 SMS Duties: In determining who should be trained the service provider will need to determine which personnel have SMS duties. This goes beyond people working in the safety office as most people working in a service provider have some direct or in-direct impact on aviation safety and therefore have some SMS duties. This would apply to any personnel directly involved in the delivery of the products and services or those personnel involved in the organisation's safety committees. In addition, some administrative and support personnel still have some limited SMS duties as their work may still have an indirect impact on aviation safety and would still need some SMS training.

2.5.3.4 The service provider should identify the SMS duties of personnel and this should be used to scope the safety training programme and ensure each individual receive training aligned with their involvement with the 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.

2.5.3.5 Senior Management training: There should be specific safety training for the accountable executive and senior managers that include the following topics:

a) the importance of compliance with national and organizational safety requirements

b) Management Commitment

c) allocation of resources

d) promotion of the Safety Policy and the SMS

e) promotion of a positive safety culture

f) effective inter-departmental safety communication

g) safety objective, SPTs and alert levels

h) the disciplinary policy.

2.5.3.6 Maintaining Competency: The main purpose of the safety training programme is to ensure that personnel at all level of the organisation maintain their competence to fulfil their safety roles. Therefore it is important that the service provider should regularly review the competencies of their staff as these do change over time.

2.5.4 Safety communications

2.5.4.1 Communication Strategy: 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 an unacceptable level of safety risk. This could be from safety information gathered from internal or external sources such as lessons learnt 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 regarding 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 2 way and it is important that all personnel communicate safety issues to the organization through the safety reporting system.

f) provide feedback to personnel submitting safety reports on what actions have been taken to address any concerns identified.

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

2.5.4.3 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 .

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

2.6 IMPLEMENTATION PLANNING

2.6.1 System description

2.6.1.1 Why we need a system description: A system description will help identify the organisational processes including any interfaces to define the scope of the SMS. This exercise 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 activities so that SRM and safety assurance (SA) can be applied effectively.

2.6.1.2 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 these 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.

2.6.1.3 What is a system description?:The system description is a summary of the organizations processes and activities that is covered by the SMS. It includes interfaces within the organization, as well as interfaces with other external organizations that contribute to the safe delivery of services.

2.6.1.4 When considering a system description, it is important to understand what a “system” is in the context of SMS. A ‘system’ is a set of things working together as parts of an interconnecting network. In an SMS, it’s 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” actually is a system of systems, which may also be viewed as a system with subsystems. These systems and their interactions with one another constitute 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.

2.6.1.5 An overview of the system description and the SMS interfaces should be included in the SMS documentation. A system description need not be a lengthy or complex document. It may comprise bulleted lists or references to policy or procedural instructions. A graphic depiction, such as a process flow chart or annotated organization chart, may be sufficient for some organizations. An organization should use a method and format that works for that organization and its personnel.

2.6.1.6 Developing a system description: 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 the 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.

2.6.1.7 Business processes that do not affect aviation safety do not need to be included in the system description. However, a service provider should diligently consider whether any particular business process might affect aviation safety. For example, decision making with regard to information technology or personnel hiring policies might affect the capability of the organization to effectively manage aviation safety risk. Both the service provider and regulator understand exactly which parts of the organization and its processes and procedures are included in the SMS when the system is clearly described.

2.6.1.8 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.

2.6.2 Interface management

It is important to recognise that the safety risks faced by the service provider are affected by various interfaces. These interfaces can be internal (e.g. between operations and maintenance or finance, human resources or legal departments). The interface can also be 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.

2.6.3 Identification of SMS Interfaces

2.6.3.1 Initially service providers should concentrate on the interfaces in relation to its business activities. The identification of these interfaces should start with a review of the system description that sets out the scope of the SMS and should include internal and external interfaces.

2.6.3.2 **Error! Reference source not found.** depicts an example of how a service provider could map out the different organizations it interacts with to identify any SMS interfaces.

2.6.3.3 The objective of this review is to produce a comprehensive list of all the interfaces. The rationale for this exercise being that there may be SMS interfaces which an organization is not necessarily fully aware of. There may be interfaces where there is not a formal agreement such as the organization that supplies power or maintains the facilities.

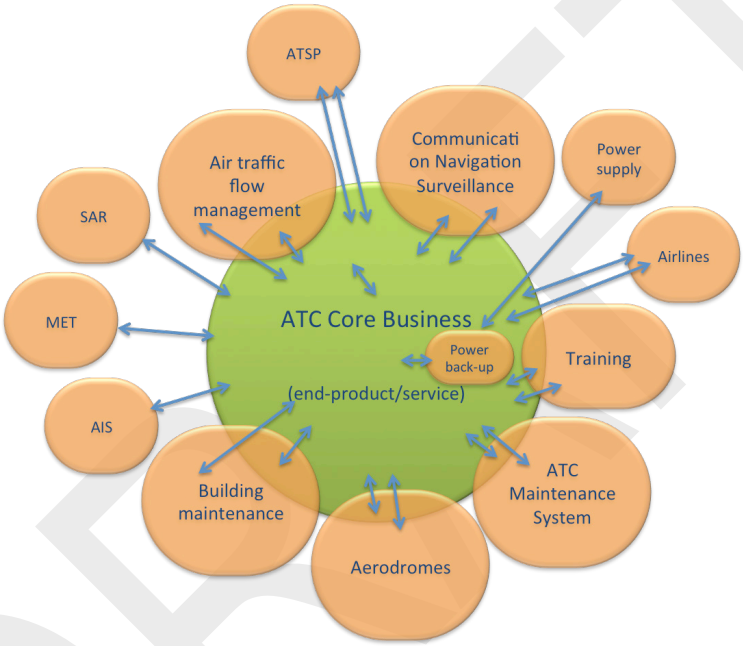


Figure21: Example service provider map interacts with SMS interfaces

2.6.3.4 It is important to recognise that some of the internal interfaces are with business areas not directly associated with safety such as marketing, finance, legal and human resources. These business areas can impact safety as they make decisions related to internal resources and investment as well as agreement and contracts with external organisations.

2.6.3.5 Once the SMS interfaces have been identified the service provider should consider the critical nature of the interface. This will enable the service provider to prioritise the management of the more critical interfaces. Things to consider are:

a) what is being provided;

b) why the service 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.

Assessing safety impact of interfaces

2.6.3.6 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.

2.6.3.7 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. Either the service provider or the external organization may carry out the safety risk control.

2.6.3.8 It is also important to recognise 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.).

Managing and monitoring interfaces

2.6.3.9 The service provider is ultimately 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 they 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 the associated impacts should be communicated to the relevant organisations.

2.6.3.10 There may be challenges for the service provider's capability to manage safety risks associated with the interfaces such as:

a) One organisations safety risk controls are not compatible with the other organisation;

b) willingness of both organizations to accept that their own processes and procedures may have to change;

c) Insufficient resources or technical expertise available to manage and monitor the interface; and

d) Number and location of interfaces.

2.6.3.11 Coordination between interfacing organisations: It is important to recognise the need for coordination between the organizations involved in the interface. Effective coordination should include:

a) clarification of each organization's roles and responsibilities;

b) agreement of decisions regarding the actions to be taken; e.g. safety risk control actions and timescales;

c) identification of what safety information needs to be shared and communicated;

d) how and when co-ordination should take place (task-force, regular meetings, ad-hoc or dedicated meetings); and

e) agreeing on win-win solutions that do not impair the SMS effectiveness.

2.6.3.12 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 small 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. This can also allow transfer of knowledge and of working practices that could improve the effectiveness of the SMS of either organization.

2.6.4 SMS Scalability

2.6.4.1 The following provides some considerations for SMS implementation according to the size and complexity of the organization:

a) Organizational structure and availability of resources; and

b) Size and Complexity considerations.

2.6.4.2 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 organisational 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.

Safety risk considerations

2.6.4.3 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 very small organizations may be involved in activities that may entail significant aviation safety risks. Therefore, safety management capability should be commensurate with safety risk having to be managed.

Safety data and information and its analysis

2.6.4.4 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 expertise. This may be more qualitative than quantitative but will help identify the safety risk picture for the service provider. Collaborating with other service providers or industry associations can be helpful, since these may have data that one small 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.

2.6.4.5 For service providers with many interactions and interfaces they will need to consider how they gather safety data and information from multiple organisations. This may result in large volumes of data being collected and subsequently collated and analysed. 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.

2.6.5 Integration of management systems

2.6.5.1 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 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 has multiple approvals it may choose to implement a single management system to cover all off its activities. The service provider should decide the best means to integrate or segregate its SMS to suit its business or organizational needs.

2.6.5.2 A typical integrated management system may include a:

a) quality management system (QMS);

b) safety management system (SMS);

c) security management system (SecMS);

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 (FRMS).

2.6.5.3 A service provider may choose to integrate these management systems based on their unique requirements. Risk management processes and internal audit processes are essential features of most of these management systems. It should be recognised 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.

2.6.5.4 A service provider may hold may also consider applying the SMS to other areas that do not have a current regulatory requirement for an SMS. Alternatively, there may be situations where an individual SMS for each type of aviation activity is preferred. 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.

Benefits and challenges of management system integration

2.6.5.5 Integrating the different areas under a single management system will improve efficiency by:

a) Reducing duplication and overlapping of processes and resources.

b) Reducing potentially conflicting responsibilities and relationships.

c) Considering the wider impacts of risks and opportunities across all activities

d) Allowing effective monitoring and management of performance across all activities

2.6.5.6 Possible challenges of management system integration are:

a) Transitioning existing systems into the new integrated system without disruption to the existing business activities.

b) Existing systems may have different functional managers that resist the integration that could result in management conflicts.

c) There may be resistance to change for those staff impacted by the integration as this will require greater cooperation and coordination.

d) These may also have an impact on the overall safety culture within the organisation as there may be different cultures in respect of each system that create conflicts

e) Regulations may prevent such an integration or the different regulators and standards bodies may have diverging expectations on how their requirements should be met.

f) 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.

2.6.5.7 To maximise 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

2.6.6 SMS and QMS integration

2.6.6.1 Some service providers have both a Quality Management System (QMS) and a Safety Management System and these are sometimes integrated into a single management system. 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.

2.6.6.2 QMS and SMS are complementary. QMS is focused on compliance with prescriptive regulations and requirements to meet customer expectations and contractual obligations. SMS is focused on managing safety risks and safety performance. 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 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) use similar tools, such as:

- root cause analysis,
- statistical trend analysis
- system and process analysis
- internal auditing and assessments,
- performance monitoring, and
- management reviews.

2.6.6.3 The SMS focuses on:

- Identification of safety-related hazards facing the organization
- Assessment of the associated safety risk
- Implementation of effective safety risk controls to mitigate safety risks,
- Measuring safety performance
- Maintaining an appropriate resource allocation to meet safety performance requirements

2.6.6.4 The QMS focuses on:

- Compliance with regulations and requirements,
- Consistency in the delivery of products and services,
- Meeting the specified performance standards,
- A feedback loop to assure delivery of products and services that are “fit for purpose” and free of defects or errors

2.6.6.5 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-compliances should also be analysed and addressed.

2.6.6.6 Even with such differences safety and quality practitioners are essentially focused on the same goal of providing safe and reliable products and services to customers. Both are trained on the various analysis methods including root-cause analysis.

2.6.6.7 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 weakness in safety risk controls;

c) a QMS may anticipate 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.

2.6.6.8 The existence of an effective QMS will create a good basis for the implementation of SMS as the service provider will already be familiar with a number of elements and tools that are also relevant to SMS. It would already have documented its main policies and procedures to a certain standard.

2.6.6.9 However, aviation organizations should be conscious of the difference in nature of QMS, which usually draws management's attention to the business related performance metrics. Whereas the SMS requires a focus on

SRM and safety performance metrics. The QMS usually audit process outputs only for variance to make adjustments to meet the specifications. The SMS requires a broader perspective, including not only process outputs, but also unwanted events and hazards, with investigations and safety risk analyses looking into causal and contributing factors from all influencing sources.

2.6.6.10 In conclusion, in an integrated management system with unified goals and decision making considering 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.

Implementation strategy for management system integration

2.6.6.11 To maximise the benefits of integration and address the related challenges senior management commitment and leadership are essential to manage the change effectively. It is also recommended to identify the person who has overall responsibility for the integrated management system.

2.6.6.12 Service providers should consider that different 'cultures' may exist within the different management systems (e.g. aviation safety culture versus occupational health and safety culture). Promoting a common safety policy as well as joint safety training and communication sessions for staff may contribute to fostering a positive, corporate safety culture.

2.6.6.13 Service providers should assess the benefits and challenges of integrating management system processes across all activity areas, including common tools and procedures. This may include developing:

a) a single reporting system;

b) common tools and processes for the sharing of safety data and information across all activities;

c) common procedures for SRM addressing all activities;

d) consistent internal safety investigation procedures for all areas;

e) a common management of change procedure;

f) a common internal audit procedure;

g) common control procedures for suppliers and contracted activities;

h) common procedures for performance monitoring considering all activities; and

i) a common disciplinary policy

2.6.6.14 Service providers implementing SMS on the basis of their QMS may opt to appoint distinct managers for safety management and for quality management (or the internal audit process). In this case, it may be required to designate one of the individual managers as the 'lead manager' to ensure a direct line of responsibility and accountability is maintained for effective reporting of non-conformities and safety risks to the accountable executive and as inputs to the SRM processes. It is important to clarify the lines of responsibilities and relationships with other senior managers. This would ensure the accountable executive has an overall view regarding safety and regulatory compliance and supports the identification of systemic issues. This would also support follow-up of both corrective and safety risk mitigation actions. Besides, identification of the individual fulfilling the role of 'lead manager' for safety and quality (or the internal audit process) would support the regulator in its oversight and monitoring activities.

Note.— *The 'lead manager' may be the person (or group of persons) with overall responsibility for the integrated management system.*

2.6.7 SMS Gap analysis and implementation

2.6.7.1 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. Service providers may already have 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 SMS.

2.6.7.2 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; such as a implementing a reporting system should come before establishing a data analysis system; and

f) the existing safety culture.

2.6.7.3 The SMS implementation plan should be developed in consultation with the accountable executive and other senior managers. The SMS implementation plan should include who is responsible for the actions along with timelines. The plan should address coordination with external organizations or contractors where applicable.

2.6.7.4 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.

2.6.7.5 Both the State and the service provider should recognise 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.