สำนักงานการบินพลเรือนแห่งประเทศไทย
The Civil Aviation Authority of Thailand

Guidance Material for ATS Safety Management System (SMS)

CAAT-GM-ANS-ATSMS

Revision: 03

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Approved by

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0. Introduction

0.1 Background

Thailand, as a contracting State to the Convention of International Civil Aviation, has an obligation to the international community to ensure that the Civil Aviation activities under its jurisdiction comply with the Standards and Recommended Practices contained in the Annexes to the Convention.

In accordance with the Air Navigation Act B.E.2497 (Amendment No. 14) B.E.2562, the Civil Aviation Authority of Thailand (hereinafter 'CAAT') has been appointed to carry out tasks aimed at ensuring the safe and efficient operation of Service Providers in Thailand. More specifically, the Requirement of the Civil Aviation Authority of Thailand No. 25 (RCAAT No. 25) on the Application for and Issuance of Air Navigation Services Certificate, Air Navigation Service Providers are required to obtain Certification in order to provide air navigation services in Thailand. The ATSP shall submit technical documentation relating to Safety Management System according to item 7(6) of RCAAT No.25 in certification application process.

This Guidance Material contains guidelines concerning Air Traffic Service Providers to meet the requirements and standards set forth in RCAAT No.25 and Manual of standard (CAAT-ANS-MOSATS). The Guidance Material provided by advisory material for Air Traffic Service Providers, including the checklists, is not legal advice, is not a substitute for individual advice, and may not be applicable to everyone's situation.

Amendments to this Guidance Material will be notified through www.caat.or.th.

0.2 Purpose

The 'Guidance Material for ATS Safety Management System' is issued by the CAAT and contain information about recommendations acceptable to the CAAT.

The purpose of this Guidance Material is to provide general guidance and principles to implement an Air Traffic Services Safety Management System (SMS) to Air Traffic Service Providers and applicants on the certification application process to comply with the provision of the Air Navigation Act and the Regulation.

It should be clearly understood that this document has no legal status. It is intended to provide recommendations and guidance to illustrate a means but not necessarily the only means of complying with the regulations, or to explain certain regulatory requirements by providing interpretative and explanatory material applicability (is subjected to).

'ATS SMS Initial Implementation and Evaluation Checklist' in Appendix A of this Guidance Material should be used by the ATSP to evaluate their current SMS compliance and it will be required by CAAT to submit the completed checklist before issuing an approval or certificate.

0.3 Applicability (is subjected to)

This Guidance Material is applicable to the applicants for the provision of air traffic services whose certification corresponds to the CAAT in accordance with section 15 chapter 1/2 of the Air Navigation Act B.E. 2497 (Amendment No. 14) B.E.2562, the Requirement of Civil Aviation Authority of Thailand No. 25 (RCAAT No. 25) on the Application for and Issuance of Air Navigation Services Certificate and CAAT Rules on Manual of Standard ATM:ATS B.E.2563 with Manual of Standard Air Traffic Management Services: Air Traffic Services (CAAT-ANS-MOSATS).

0.4 Effective Date

The 'Guidance Material for ATS Safety Management System' Revision 03 is effective at 29 December 2022.

0.5 Reference Documentation

0.5.1 Civil Aviation Authority of Thailand Emergency Decree B.E.2558

a) Chapter 1, Part 1, Section 7 and 8, CAAT's functions;
b) Chapter 1, Part 2, Section 37, CAAT's oversight obligations;
c) Chapter 2, Section 21/1, SSP and SMS;

0.5.2 Air Navigation Act B.E. 2497 Amendment No. 14 B.E.2562 (ANA (No.14) B.E.2562) Chapter 1/1 and Chapter 1/2;

0.5.3 Requirement of CAAT No.25 on the Application for and Issuance of Air Navigation Services Certificate (RCAAT No. 25);

0.5.4 Requirement of CAAT No.22 on Civil Aviation Occurrence Reporting (RCAAT No. 22);

0.5.5 Notification of CAAT on State Safety Program B.E.2562 with State Safety Program;

0.5.6 Notification of CAAT on the Specification of the Juristic Person, Validity and Other Duties of the Air Navigation Service Certification Holder;

0.5.7 Regulation of CAAT No. 17 on Air Traffic Management Services: Air Traffic Services Standards (R2CAAT No. 17);

0.5.8 Rule of CAAT on Manual of Standards of Air Traffic Management Services: Air Traffic Services Standards;

0.5.9 Rule of the CAAT on Operations Manual of Air Traffic Management Services: Air Traffic Services;

0.5.10 ICAO Annex 11 – Air Traffic Services;

0.5.11 ICAO Annex 19 – Safety Management;

0.5.12 ICAO Doc 4444 – Air Traffic Management; and

0.5.13 ICAO Doc 9859 – Safety Management Manual.

1. Organization Requirements for Air Traffic Services Provider

1.1 Introduction

1.1.1 Safety management seeks to proactively mitigate safety risks before they result in aviation accidents and incidents. Through the implementation of safety management, states and service Providers can manage their safety activities in a more disciplined, integrative and focused manner. Possessing a clear understanding of its role and contribution to safe operations enables a state, and its aviation industry, service provider to prioritize actions to address safety risks and more effectively manage its resources for the optimal benefit of aviation safety.

1.1.2 Globally, ICAO sets the standard for aviation safety management. Thailand, as an ICAO member state, must ensure ATSP(s) implement an 'Acceptable Safety Management System'. CAAT reflects these through RCAAT No.25 and R2CAAT No. 17 and Rule of CAAT on Manual of Standards of Air Traffic Management Services: Air Traffic Services Standards, requiring ATSP(s) to develop and implement Safety Management System (SMS), as identified in Annex 19 — Safety Management, to continuously improve safety performance by identifying hazards, collecting and analyzing data, and continuously assessing and managing safety risks. More information on the implementation of SMS may be found in Guidance.

1.1.3 Each ATSP is difference, SMS(s) are designed to be tailored to meet the specific needs of each ATSPs. All components and all elements of SMS are interconnected and interdependent and necessary to function effectively. It is important that SMS requirements are not implemented only in a prescriptive manner. The traditional prescriptive requirements are to be complemented with performance-based approach.

1.1.4 Safety cannot be achieved by simply introducing rules or directives concerning the procedures to be followed be followed by operational employees; it encompasses most of the activities of the organization. For this reason, safety management should start from senior management, and the effects on safety should be examined at all levels of the organization.

1.2 ICAO Framework Components of SMS

1.2.1 There are 4 major components and 12 elements as the minimum requirements for SMS implementation:

a) Safety Policy and Objectives:

- Management commitment;
- Safety accountability and responsibilities;
- Appointment of key safety personnel;
- Coordination of emergency response planning; and
- SMS documentation.

b) Safety Risk Management:

- Hazard identification; and
- Safety risk assessment.

c) Safety Assurance:

- Safety performance monitoring and measurement;
- The management of change; and
- Continuous improvement of the SMS.

d) Safety Promotion:

- Training and education; and
- Safety communication.

NOTE: *Reference may also be made to ICAO SMM Doc 9859 for any additional guidance where appropriate.*

1.2.2 According to ICAO, a SMS is an organized approach to managing safety, including the necessary organizational structures. As with all management systems, its involves goal setting, planning, documentation and the measuring of performance goals. Its involves:

a) adopting scientifically based, risk-management methods;
b) systematic monitoring of safety performance;
c) creating a non-punitive work environment which encourages hazard and error reporting;
d) senior management commitment to pursue safety as vigorously as financial results;
e) adopting safe practices and safety reason learned;
f) stringent use of checklist and briefings to ensure consistence application of standard operating procedures (SOPs)
g) integrating human factors in safety training to improve error management skills.

1.3 Safety Management System Manual (SMS Manual)

1.3.1 The SMS manual is the key instrument for communicating the approach to safety for the ATSP. The SMS manual should document all aspects of safety management, including but not limited to the:

a) scope of the SMS;
b) details of each of elements as specified in 1.2.1

1.3.2 The SMS manual may be contained in (one of) the manual(s) of the ATSP.

1.4 Safety Management System and Fatigue Risk Management System Compared

1.4.1 Fatigue Risk Management System (FRMS) is a safety management approach dealing with the risks imposed by fatigue, so there are similarities between the components of an SMS and FRMS.

1.4.2 FRMS is increasingly being adopted by ATSP used to control the risk of fatigue-related accidents and incidents. The FRMS is simply a component of the overall SMS and includes control such as:

a) policy and procedures – documents hot fatigue risk is managed and by whom;
b) evaluation and review – measure program effectiveness and recommended improvements;
c) audit – assesses operational compliance with the fatigue program policy, procedures documents and ongoing legislative requirements;
d) record keeping – provides documented evidence of fatigue risk management and is one element of an evaluation and review process;
e) education and training – trains individual employees and stakeholders to manage fatigue risk competently;
f) communication and consultation – communicates and coordinates information about fatigue.

1.4.3 The FRMS allow the ATSP to go beyond prescribed limits. With the FRMS, the ATSP should do more to manage fatigue than would reasonably be expected by using SMS.

1.4.4 Where an ATSP already has sufficiently mature SMS processes in place, it should not be necessary for them to develop entirely new processes to implement FRMS. Rather, the ATSP can build upon the organization's existing SMS processes to address the added requirements of an FRMS.

NOTE 1: *The detailed information on the required components of an FRMS provided in ICAO Doc 9966 – Manual for the Oversight of Fatigue Management Approaches and Fatigue Management Guide for Air Traffic Service Providers.*

NOTE 2: *Guidance Material for ATS Fatigue Risk Management System (CAAT-GM-ANS-ATSFM) is available in CAAT website (https://www.caat.or.th/th/archives/69561)*

2. Safety Policy and Objectives

2.1 Introduction

2.1.1 Safety Policy

A safety policy outlines what the organization will do to manage safety. The safety policy is a reminder of 'how the ATSP provides the air traffic services around here'

2.1.2 Safety Objectives

The safety objectives are what the ATSP is going to do. The ATSP should state an intended outcome.

2.2 Management Commitment

2.2.1 Safety Policy

a) The commitment of an organization's top management (those who direct and control the organization at the highest level) towards safety, safety practices and safety oversight will determine how business is conducted from a safety standpoint. The safety culture of the company underpins the entire safety achievement of the organization and is crucial to its success. The ideal safety culture is one that is supportive of the staff and systems of work, recognizes that errors will be made and that it is not apportionment of blame that will resolve the problems. Therefore, the supportive culture will encourage open reporting, seek to learn from its failures and be just in dealing with those involved. Punitive action must not follow automatically from the open acknowledgement of human error. However, it must be made clear that indemnity will not be guaranteed where there has been gross negligence. The front line defense is that operating staff must not accept unsafe behavior from their peers.

b) The safety policy should be developed and endorsed by senior management, and is to be signed by the accountable executive. Key safety personnel, and where appropriate, staff representative bodies (employee forums, trade unions) should be consulted in the development of the safety policy and safety objectives to promote a sense of shared responsibility.

c) To reflect the organization's commitment to safety, the safety policy should:

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

d) the safety policy should state that the purpose of safety reporting and internal investigations is to improve safety, not to apportion blame to individuals.

e) The ATSP may combine the safety policy with the organizational policy which collectively constituting a policy regard to safety, quality, and security of its services.

f) Senior management should:

- continually promote the safety policy to all personnel and demonstrate their commitment to it;
- provide necessary human and financial resources for its implementation; and
- establish safety objectives and performance standards.

g) The achievement of the policies can be implemented through suitable organizational arrangements and management systems. These provide the focus for all staffs to enact their management's policies. The administrative arrangements that are in place for quality management should be used to provide the audit and follow-up process required by safety management.

2.2.2 Safety Objective

a) Taking due account of its safety policy, an ATSP shall establish safety objectives to define what it aims to achieve in respect of safety outcomes. The safety objectives shall:

- form the basis for safety performance monitoring and measurement.;
- reflect the service provider's commitment to maintain or continuously improve the overall effectiveness of the SMS;
- be communicated throughout the organization; and
- be periodically reviewed to ensure they remain relevant and appropriate to the service provider.

b) The safety objective are board's directions that help to establish specific safety goals or desired targets for relevant aspects of the organization's safety vision, senior management commitment, realistic safety milestones and desired results. The ATSP should make them clear and review them regularly.

c) The safety objectives should be "**SMART**" – in other words they should be:

- **S**pecific;
- **M**easurable;
- **A**chievable;
- **R**ealistic and have a specified;
- **T**imeframe within which they are to be achieved.

NOTE: *If the combination of safety objectives, SPIs and SPTs working together are realistic and achievable (SMART), it allows the organization more effectively demonstrate its safety performance.*

2.3 Safety Accountabilities and Responsibilities

2.3.1 Accountable Executive

a) The ATSP should:

- identify the accountable executive who, irrespective of other functions, is accountable on behalf of the organization for the implementation and maintenance of an effective SMS;
- clearly define lines of safety accountability throughout the organization, including a direct accountability for safety on the part of senior management;

NOTE: *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.*

- identify the responsibilities of all members of management, irrespective of other functions, as well as of employees, with respect to the safety performance of the organization;
- document and communicate safety accountability, responsibilities and authorities throughout the organization; and
- define the levels of management with authority to make decisions regarding safety risk tolerability.

b) In the case where the SMS applies to several different certificates, authorizations or approvals that are all part of the same legal entity, there should be a single accountable executive. Where this is not possible, individual accountable executives should be identified for each organizational certificate, authorization or approval and clear lines of accountability defined; it is also important to identify how their safety accountabilities will be coordinated.

c) For complexity ATSP, the SMS of the ATSP should ensure that:

- everyone involved in the safety aspects of the provision of air traffic services has an individual safety responsibility for their own actions;
- managers should be responsible for the safety performance of their respective departments or divisions; and
- the top management of the provider carries an overall safety responsibility.

2.3.2 Safety Manager

a) The SMS of the ATSP should encompass safety by including a safety manager in the organizational structure.

b) The safety manager should act as the focal point and be responsible for the development, administration and maintenance of an effective SMS. He or she should be independent of line management, and accountable directly to the highest organizational level.

c) The role of the safety manager should, as a minimum, be to:

- ensure that hazard identification, risk analysis and management are undertaken in accordance with the SMS processes;
- monitor the implementation of actions taken to mitigate risks;
- provide periodic reports on safety performance;
- ensure maintenance of safety management documentation;
- ensure that there is safety management training available and that it meets acceptable standards;
- provide advice on safety matters; and
- monitor initiation and follow-up of internal occurrence/accident investigations.

d) The safety manager should have:

- adequate practical experience and expertise in ATS or a similar area;
- adequate knowledge of safety and quality management;
- undertaken safety management and accident investigation training;
- adequate knowledge of the working methods and operating procedures;

- comprehensive knowledge of the applicable requirements in the area of ATS; and respect of the organization.

e) Depending on the size of the ATSP and the nature and complexity of their activities, the safety manager may be assisted by additional safety personnel in the performance of all the safety-management-related tasks.

f) Regardless of the organizational set-up, it is important that the safety manager remains the unique focal point as regards the development, administration and maintenance of the ATSP's SMS.

g) In the case of a non-complex ATSP, the function of the safety manager could be combined with another function within the organization provided that sufficient independence is guaranteed.

2.3.3 Safety Action Group

a) For complexity ATSP, a safety action group may be established as a standing group or as an ad hoc group to assist or act on behalf of the safety review board. More than one safety action group may be established depending on the scope of the task and the specific expertise required.

b) The safety action group should report to and take strategic direction from the safety review board and should comprise managers, supervisors and personnel from operational areas.

c) The safety action group should:

- monitor operational safety;
- resolve identified risks;
- assess the impact on safety of operational changes; and
- ensure that safety actions are implemented within agreed timescales.

d) The safety action group should review the effectiveness of previous safety recommendations and safety promotion.

2.3.4 Safety Review Board

a) The SMS of the complex ATSP should encompass safety by including a safety review board in the organizational structure.

b) The safety review board should be a high-level committee that considers matters of strategic safety in support of the accountable executive's safety accountability.

c) The board should be chaired by the accountable executive and composed of heads of functional areas.

d) The safety review board should, as a minimum:

- monitor safety performance against safety policy and objectives;
- ensure that any safety action is taken in a timely manner; and
- monitor the effectiveness of the air traffic services provider's SMS processes

e) The safety review board should ensure that appropriate resources are allocated to achieve the planned safety performance.

f) The safety manager or any other relevant person may attend, as appropriate, safety review board meetings. He or she may communicate to the accountable executive all information, as necessary, to allow decision-making based on safety data.

2.3.5 Safety Accountability and Responsibilities

a) The term “accountability” refers to obligations which cannot be delegated. The term “responsibilities” refers to functions and activities which may be delegated.

b) Successful handling of safety matters is a line responsibility, requiring the active participation of all levels of management and supervision. This should be reflected in the structure of the company and in published safety accountabilities.

c) The ATSP should clearly define lines of safety accountability throughout the organization, including a direct accountability for safety on the part of senior management. ATSP should document and communicate safety responsibilities, accountabilities and authorities throughout the organization. The company should stress to all employees their individual and collective responsibilities and accountabilities for safety performance. Top-level accountabilities may not be delegated, but should be cascaded throughout the organization so that all aspects of aviation safety are covered without gaps.

NOTE: *The company should define, document, and communicate – with the aid of organizational diagrams where appropriate – responsibilities, accountabilities, and authorities*

d) The ATSP should identify the accountabilities of all members of management, irrespective of other functions, as well as of employees, with respect to the safety performance of the SMS.

e) The ATSP should define the levels of management with authority to make decisions regarding safety risk tolerability.

f) Lines of safety accountability throughout the organization and how they are defined will depend on the type and complexity of the organization, and their preferred communication methods. Typically, the safety accountabilities and responsibilities will be reflected in organizational charts, documents defining departmental responsibilities, and personnel job or role descriptions.

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

2.4 Appointment of Key Safety Personnel

2.4.1 The ATSP should appoint a competent person or persons to fulfil the role of safety manager is essential to an effectively implemented and functioning SMS. The safety manager may be identified by different titles. The generic term, “safety manager” is used and refers to the function, not necessarily to the individual.

NOTE: *Depending on the size of the service provider and the complexity of its aviation products or services, the responsibilities for the implementation and maintenance of the SMS may be assigned to one or more persons, fulfilling the role of safety manager, as their sole function or combined with other duties, provided these do not result in any conflicts of interest.*

2.4.2 In the case of a non-complex ATSP, the function of the safety manager could be combined with another function within the organization provided that sufficient independence is guaranteed.

2.5 Coordination and Emergency Planning

2.5.1 An emergency response plan (ERP) is an integral part of ATSP's SMS, to be activated if there is an accident or major in-flight incident and other aviation emergencies. The ERP sets out what the ATSP will do in the case of emergency and importantly, how the ATSP return to normal operations.

2.5.2 The ATSP is required to establish and maintain an ERP for accidents and incidents in aircraft operations and other aviation emergencies shall ensure that the emergency response plan is properly coordinated with the emergency response plans of those organizations it must interface with during the provision of its products and services. It lists procedures for:

a) orderly and efficient transition from normal to emergency operations;
b) delegation of emergency authority;
c) assignment of emergency responsibilities to specific individuals;
d) authorization by key personnel for actions mandated by the plan;
e) emergency procedures;
f) control the notification of outside agencies and coordination of efforts to handle the emergency;
g) nominated channels and center of communications;
h) safe continuation of operations, or return to normal operations, as soon as possible; and
i) planned and coordinated action to manage and minimize the risk associated with an accident/incident.

NOTE: *In addition, methods for communicating with the public in the event of a major incident should be covered in the plan.*

2.5.3 The emergency response plan should:

a) reflect the nature and complexity of the activities performed by the ATSP;
b) ensure an orderly and safe transition from normal to emergency operations;
c) ensure safe continuation of operations or return to normal operations as soon as practicable; and
d) ensure coordination with the ERPs of other organizations, where appropriate.

2.5.4 ATSP shall establish detailed of aircraft emergencies, irregular operation and ATS contingency procedures for air traffic services personnel as followed in accordance with MOS-ATS.

2.5.5 For emergencies occurring at the aerodrome or in its surroundings, the plan shall be aligned with the aerodrome ERP and be coordinated with the aerodrome operator.

2.5.6 The ATSP can either document the ERP in a separate manual, incorporate it into ATSP's organization's SMS manual, or combination of both. As long as, in an emergency, key personnel know where to find emergency procedures information.

2.5.7 The ATSP may find it effective to have relatively stable information (ERP policies, roles and responsibilities, succession plans, training requirements, etc.) in SMS manual and put response information required immediately (such as procedures, checklists, phone number, locations, etc.) in separate, easily accessible booklets.

2.5.8 Once the plans have been formulated, it is important to ensure that staffs are adequately trained in the procedures that will be employed in the event of an accident or serious incident. Plans should be rehearsed regularly, both to familiarize staff and to reveal any problems. There should also be routine testing of emergency systems and all testing, training and rehearsals shall be recorded with action taken if deficiencies are identified during practices. A preliminary post-activation review (PAR) report should be completed within 30 working days following completion of testing or resumption of normal operations. A more comprehensive report shall be completed and forwarded to CAAT in any case where an air safety incident investigation related to the pre-activation or activation of the plan has been conducted, or as otherwise determined by CAAT.

2.5.9 Doing periodic desktop exercises, as well as live exercises where and when appropriate, will help to make sure ERP works and is current. The ATSP shall review the plan regularly and update it where necessary.

NOTE:

1. *The Plan shall be tested in desktop exercises, where necessary including telephone or web-based conference facilities, at least once per year;*
2. *ATC simulation testing of the plan should occur at least once per year or when necessary, and whenever required by the CAAT;*
3. *A full review of the Plan shall be conducted at least once per 2 years. Provisions for the review of airspace, ATS route, co-ordination and communications details of the Plan* shall be included in relevant ATS airspace, data and facility implementation plans.

2.5.10 The more ATSP prepare and test not only will be better prepared in an emergency, but coordination and organizational coordination will also improve. Such exercises are also valuable for developing more effective relationships with local and relevant stakeholders.

2.6 SMS Documentation

2.6.1 The ATSP shall develop and maintain SMS operational records as part of its SMS documentation. Depending on the size of the ATSP and the complexity of its aviation products or services, the SMS manual and SMS operational records may be in the form of stand-alone documents or may be integrated with other organizational documents (or documentation) maintained by the service provider. The ATSP should make this clear, so the staff have simple, effective access to detailed information about safety management procedures.

2.6.2 Minimum SMS components to be documented:

Component	***Element***
Safety policy, objectives and planning	- *Management commitment and responsibility;* - *Safety accountabilities of managers;* - *Appointment of key personnel;* - *SMS implementation plan;* - *Coordination of the emergency response plan;* - *Documentation:* *a) describes the SMS;* *b) is regularly reviewed and updated;* *c) is available to all personnel* *d) details where and how any other SMS-related records are kept;* *e) has a table of contents.*
Safety risk management	- *Hazard identification processes;* - *Risk assessment, including safety assessment of changes to the functional system, and mitigation processes.*

Component	*Element*
Safety assurance	- *Safety performance monitoring and measurement;* - *Internal safety investigations;* - *Management of change;* - *Continuous improvement processes.*
Safety promotion	- *Safety communication;* - *Training and education.*

2.6.3 SMS operational records (safety records) should be maintained and retained include but not limited to:

a) certificates;
b) limited certificates;
c) declarations;
d) safety policy;
e) safety accountabilities/responsibilities;
f) safety occurrences;
g) emergency responds plan;
h) SMS documentation;
i) training and competence;
j) occurrence reports;
k) safety risk assessments including safety assessment of changes to the functional system; and
l) determination of either complex or non-complex organization.

2.6.4 The ATSP's documentation should reflex the intent and processes of the SMS, the ATSP will probably to update SMS manual.

2.6.5 To make it easy to use and understand, the ATSP should keep SMS manual concise and to the point. Any information that expected to change regularly (e.g. names of personnel with specific safety responsibilities) should be presented as annexes/ appendices at the back of the manual.

2.6.6 The ATSP shall ensure the amended and distributed SMS document are controlled and authorized person will distribute the document to all places where they will be needed and that old or obsoleted versions are removed/replaced.

3. Safety Risk Management

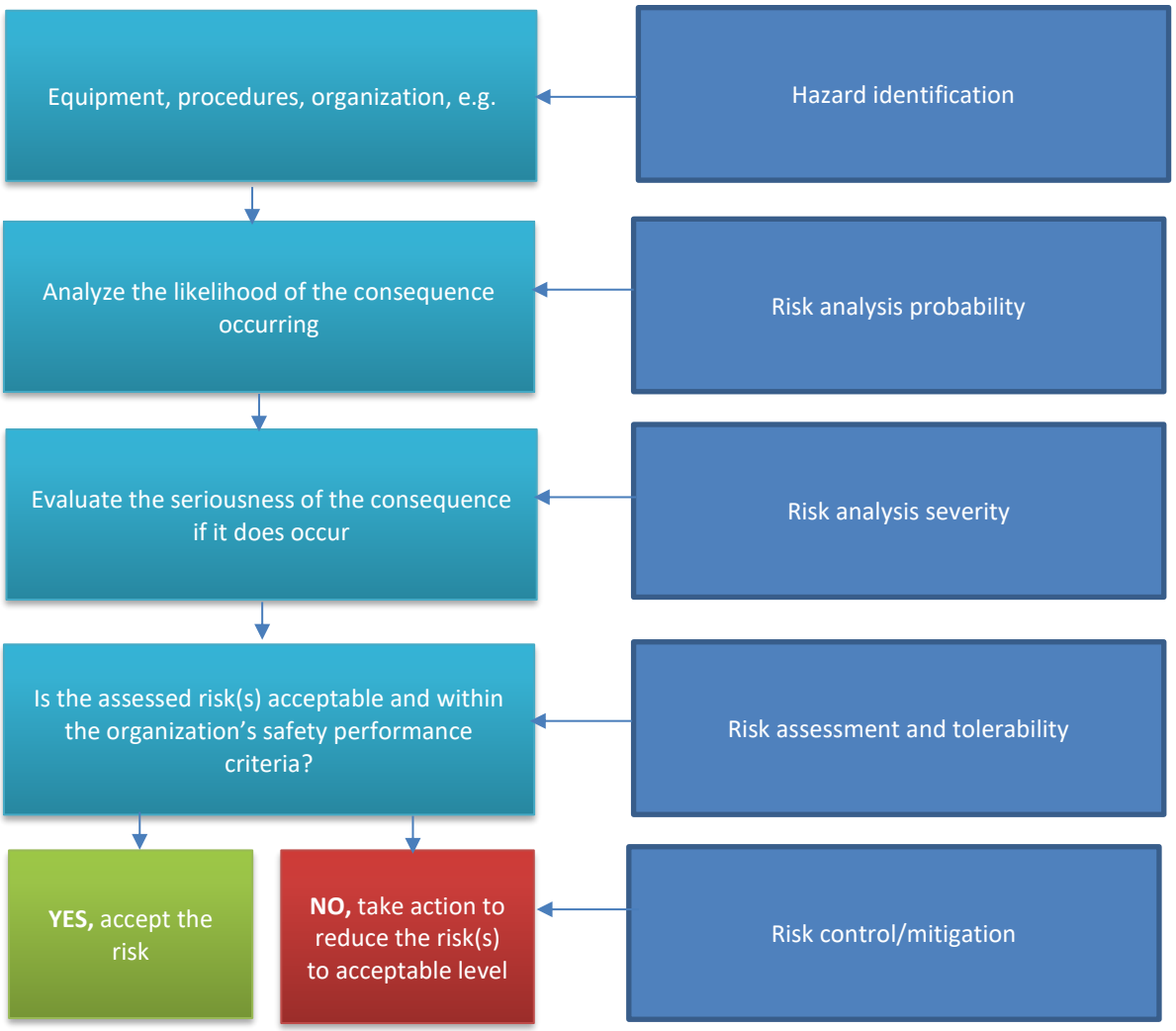
3.1 Introduction

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

3.1.2 SRM is a key component of an SMS and involves 2 fundamental safety-related activities:

a) identifying safety hazards; and
b) assessing the risk and mitigating them (reducing the potential of those risks to cause harm).

3.1.3 SRM is an integral component of safety management and involves 5 essential steps:



3.1.4 To achieve this, 7 simple steps are suggested:

a) communicate and consult;
b) identify safety hazards across operations that could harm people, equipment, property or the environment;
c) rank the likelihood and severity of these hazards
d) identify the current defenses/controls in place to manage them;
e) evaluate the effectiveness of each defense/control;
f) identify additional defenses/controls where required; and
g) record all this information in a hazard register.

3.1.5 After completing this, ATSP should have the following:

a) a list of safety hazards identified by employees, ranked in order of importance;
b) a list of current controls/defenses in place to manage these hazards;
c) a list of further controls/defenses required to improve safety across the operation;
d) staff involvement in identifying safety deficiencies and priority areas for improved risk management.

3.2 Hazard Identification

3.2.1 A hazard is anything that could cause harm, damage or injury, or have negative consequence, such as bad weather, mountainous terrain, FOD, lack of emergency equipment, high workload/fatigue or use of alcohol and other drugs. There are many ways of identifying hazards and quantifying risks, but to do it successfully the ATSP have to think laterally, unencumbered by past ideas and experiences. Operational hazard can be obvious such as lack of training, or they may be subtle, such as the insidious effects of long-term fatigue.

3.2.2 The ATSP should ensure that hazard identification:

a) targets complete coverage of any condition, event, or circumstance related to the change, which could, individually or in combination, induce a harm effect;
b) has been performed by personnel trained and competent for this task; and
c) need only include hazards that are generally considered as credible.

3.2.3 The ATSP may use a combination of tools and techniques. There are several useful methods of identifying hazards:

a) brainstorming sessions – small discussion groups meet to generate idea in a non-judgment way;
b) expert judgment;
c) literature search;
d) formal review of standards, procedures and systems;
e) staff surveys or questionnaires;
f) one person standing back form the operation and monitoring it critically and objectively;
g) internal or external safety assessments;
h) hazard reporting systems;
i) queries of accident and incident databases;
j) use of conceptual models (such as: SHELL model, Reason's accident causation model).

3.2.4 Up to complexity of organization, for small ATSP with only a few staff, may apply discipline and make the time to examine all facts of the operations and identify any applicable safety hazards. For larger organizations, setting up the discussion groups with as many staff and the line managers as possible is a good way of identifying hazards. The group discussions will also encourage staff to become more actively involved in establishing or improving SMS.

3.2.5 Sources of hazard

a) Hazards introduced by failures or nominal operations of the ATM/ANS functional systems may include the following factors and processes:

- design factors, including equipment, procedural and task design;
- operating practices, including the application of procedures under actual operating conditions and the unwritten ways of operating;
- communications, including means, terminology, order, timing and language and including human–human, human–machine and machine–machine communications;
- installation issues;
- equipment and infrastructure, including failures, outages, error tolerances, nuisance alerts, defect defense systems and delays; and
- human performance, including restrictions due to fatigue and medical conditions, and physical limitations, when considered relevant to the change assessment.

b) Hazards introduced in the context in which the ATM/ANS functional system operates may include the following factors and processes:

- wrong, insufficient or delayed information and inadequate services delivered by third parties;
- personnel factors, including working conditions, company policies for and actual practice of recruitment, training and allocation of resources, when considered relevant to the change;
- organizational factors, including the incompatibility of production and safety goals, the allocation of resources, operating pressures and the safety culture;
- work environment factors such as ambient noise, temperature, lighting, annoyance, ergonomics and the quality of man–machine interfaces; and
- external threats such as fire, electromagnetic interference and sources of distraction, when considered relevant to the change.

c) The hazards introduced in the context in which the ATM/ANS services are delivered may include the following factors and processes:

- errors, failures, non-compliance and misunderstandings between the airborne and ground domains;
- traffic complexity, including traffic growth, fleet mix and different types of traffic, when considered relevant to the change;
- wrong, insufficient or delayed information delivered by third parties;
- inadequate service provisioning by third parties; and
- external physical factors, including terrain, weather phenomena, volcanoes and animal behavior, when considered relevant to the change.

3.2.6 The ATSP should have the processes in place to ensure identified hazards are dealt with in a timely manner, and the results of any actions are fed back to staffs.

3.3 Risk Assessment and Mitigation

3.3.1 The safety assessment should be conducted by the ATSP itself. It may also be carried out by another organization, on its behalf, provided that the responsibility for the safety assessment remains with the ATSP.

3.3.2 Rank and assess the severity of the safety hazards

a) Assess the hazards critically. Factors to consider are the likelihood (how often the hazard might result in a safety occurrence) and the severity (how bad the outcome would be) of any consequences. For example, a serious in-flight fire might be an unlikely occurrence, but it would be catastrophic if it were to occur. It would rank above a bird strike which, although much more likely to occur, tends to be less severe. Keep the process simple and get global views about how significant an issue the hazard really is, in the context of all the hazards identified.

b) Risk analysis

- When a risk assessment of a set of hazards is executed, in terms of risk:
    - the frequency or probability of the occurrence of the hazard should be determined;
    - the possible sequences of events from the occurrence of a hazardous event to the occurrence of an accident, which may be referred to as accident trajectories, should be identified. The contributing factors and circumstances that distinguish the different trajectories from one another should also be identified, as should any mitigations between a hazardous event and the associated accident;
    - the potential harmful effects of the accident, including those resulting from a simultaneous occurrence of a combination of hazards, should be identified;
    - the severity of these harmful effects should be assessed, using a defined severity scheme; and
    - the risk of the potential harmful effects of all the accidents, given the occurrence of the hazard, should be determined, taking into account the probabilities that the mitigations may fail as well as succeed, and that particular accident trajectories will be followed when particular contributing factors and circumstances occur.

c) Severity schemes.

- The severity determination should take place according to a severity classification scheme. The purpose of a severity classification scheme is to facilitate the management and control of risk. The sum of the probabilities of all the accidents assigned to a severity class multiplied by the value that is related to the severity class, is the risk associated with that class. If the value that represents severity for all classes is scalar, then the total risk is the sum of the risks in each severity class.
- Single-risk value severity schemes. Such schemes use a single severity category to represent harm to humans. Other categories representing other kinds of harm e.g. damage to aircraft and loss of separation, may be present but do not represent harm to humans. In these circumstances, risk analysis would actually be reduced to frequency/probability analysis.
- Multiple-risk value severity schemes. Multiple-risk value severity schemes, which use a number of severity categories to classify different levels of harm, facilitate the management and control of risk in a number of ways. At the simplest level, the distribution of accidents across the severity classes gives a picture of whether the risk profile of a system is well balanced. For example, many accidents in the top and bottom severity classes with few in between suggests an imbalance in risk, perhaps due to an undue amount of attention having been paid to some

types of accident at the expense of others. More detailed management and control of risk includes:

- severity classes may be used as the basis for reporting accident statistics.
- severity classes combined with frequency (or probability) classes can be used to define criteria for decision-making regarding risk acceptance.
- the total risk associated with one or more severity classes can be managed and controlled. For example, the sum of the risk from all severity classes represents the total risk and may be used as a basis for making decisions about changes.
- Similarly, the risk associated with accident types of different levels of severity can be compared. For example, comparing runway infringement accidents with low speed taxiway accidents would allow an organization to focus their efforts on mitigating the accident type with greatest risk.

d) The ATSP should coordinate its severity scheme(s) when performing multi-actor changes to ensure adequate assessment.

e) For Identification of severity/consequence of the event. the ATSP need to be clear about what might cause harm for each hazard by identifying groups of people (e.g. flight crew, ATCO). The ATSP should identify what might occur and possible reasons (root causes) of the hazards. Take into account any current mitigation measures and assess the severity in terms of the worst possible realistic scenario.

f) Example for Safety risk probability table, safety risk severity table, safety risk matric is contained in ICAO Doc 9859 – Safety Management Manual. The level of detail and complexity of tables and matrices should be adapted to particular needs and complexities of each organization. It should also be noted that organization might include both qualitative and qualitative criteria.

3.3.3 Identify the controls/defenses in place to manage the hazards

a) Once the ATSP list of hazards and rank their order of risk, the ATSP shall identify possible defenses (hazard controls) against them. This step should provide a list of current controls/defenses against each hazard: some controls will defend against multiple hazards.

b) Risk mitigation may be achieved in the following ways:

- an improvement of the performance of a functional subsystem;
- an additional change of the ATM/ANS functional system;
- an improvement of the ATSP delivered by third parties;
- a change in the physical environment; or
- any combination of the above-mentioned methods

c) To avoid accidents and incidents, any organization should have multiple layers of controls or defense. However, controls are never foolproof. The operations manuals for ATCO are only as effective as those who are follow them. The ATSP should regularly identify what defenses they have to contain recognized safety hazards as an early warning safety system.

3.3.4 Assess the effectiveness of the current controls/defences.

a) The ATSP can determine how effective a hazard control by asking ‘How effective is each hazard control/defence. Would the control prevent the occurrence? (i.e. does it remove the hazard?) or just minimize the likelihood or the consequence? That ASTP will then have a list of effective controls, as well as a list of which controls need improvement.

3.3.5 Identify further controls/defences required

a) The ATSP should examine each hazard and its control(s) to determine whether the risk is adequately managed or controlled. If it is, the operation can continue. If not, consider how to improve the hazard control, or to remove or avoid the hazard entirely.

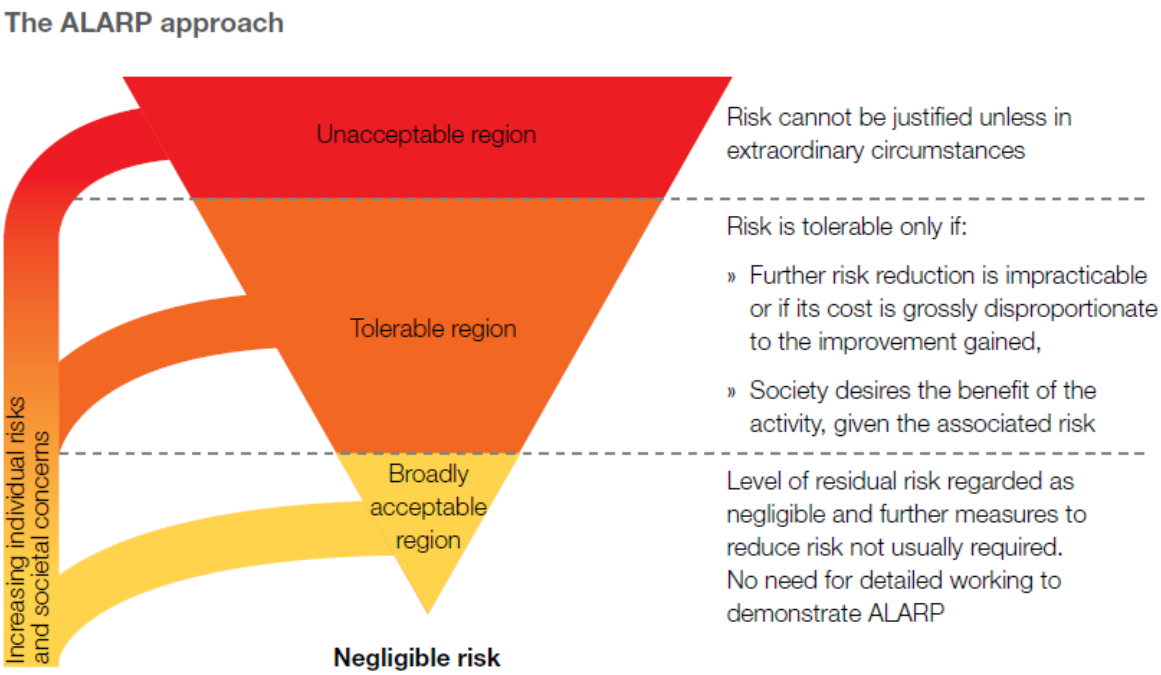
b) Where risk is concerned, there is no such thing as absolute safety. Risk management is often based on the concept of "As Low As Reasonably Practicable" or "ALARP". There is wide acceptance that not all risk can be eliminated. There are practical limits to how far that industry and the community will go in paying to reduce adverse risks.

c) The ATSP should manage the risk to a point of ALARP – as low as reasonably practicable. The ATSP should consider/apply all possible means of mitigation until the cost of mitigation is grossly disproportionate to the benefit obtain.

d) The ALARP principle and cost benefit analysis:

- All efforts should be made to reduce risks to the lowest level possible until a point is reached at which the cost of introducing further safety measures significantly outweighs the safe benefit.
- A risk should be tolerated only if it can be demonstrated that there is a clear benefit in doing so (i.e. there is a compelling operational need in the organization).

e) The ALARP principle identifies 3 categories of risk:



4. Safety Assurance

4.1 Introduction

4.1.1 Safety assurance activities are at core of SMS. SMS includes systematic and ongoing monitoring and recording of the safety performance, as well as evaluating the safety management processes and practices. The SMS assurance capability assures each service provider that their safety processes are functioning effectively, and they are on target to achieve their safety objectives.

4.1.2 Safety assurance activities such as audits, observations and monitoring of SPIs can help to expose activities that are “practically drifting”. Analysing the safety information to find out why the drift is happening helps to mitigate the safety risks. The closer to the beginning of the operational deployment that practical drift is identified, the easier it is for the organization to intervene.

4.1.3 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.

4.1.4 Safety assurance activities should include the development and implementation of actions taken in response to any identified issues having a potential safety impact. These actions continuously improve the performance of the service provider’s SMS. Therefore, under scope of ATSP, Safety assurance is comprised of 3 elements including:

a) safety performance monitoring and measurement,

b) the management of change, and

c) continuous improvement of the SMS.

4.2 Safety Performance Management

4.2.1 There are 7 critical issues that ATSPs should be considered for improved and maintained safety performance management including:

a) Safety performance indicators (SPIs) linked to the organization's safety objectives have been defined, promulgated, and are being monitored and analysed for trends;
b) Risk mitigations and controls are being verified/audited to confirm they are working and effective;
c) Safety assurance takes into account activities carried out by all directly contracted organization;
d) Responsibilities and accountability for ensuring compliance with safety regulations are defined and applicable requirement are clearly identified in organization manuals and procedures;
e) There is an internal audit programme including details of the schedule of audits and procedures for audits, reporting, follow up, and records;
f) Responsibilities and accountabilities for the internal audit process are defined and there is a person or group of persons with responsibilities for internal audits with direct access to the Accountable Manager;
g) After an audit, there is appropriate analysis of causal factors and corrective/preventive actions are taken.

4.2.2 Defining of Safety Performance Indicators (SPIs)

a) SPIs are used to measure operational safety performance of the ATSP and the performance of their SMS. SPIs rely on the monitoring of data and information from

various sources including the safety reporting system. They should be specific to the individual service provider and be linked to the safety objectives already established.

***NOTE**: The guidance for establishing SPIs, SPTs, setting alert and trigger has been specified in ICAO Doc9859 – Safety Management Manual.*

b) It is vital for ATSPs to identify SPIs and SPTs, as well as establish the process for monitoring and measuring the performance which appropriate to their size and complexity of the organization. As SPIs and SPTs can be used as the key data for further improvement of safety performance of specific operation unit, therefore, it is highly recommended that ATSPs should identify area of responsibility and its nature of operation. The clear scope of operation will benefit the ATSPs for designing appropriate SMS and identify key safety areas that need to be improved or maintained through specific SPIs and SPTs. As mentioned above, each ATS unit shall establish and develop the process for specify their own SPIs and SPTs that suitable to safety issues or safety concerned based on their working nature.

c) SPIs can be categorized into two main categories namely lagging and leading SPIs which can be subdivided into three main types as shown in below table.

Low probability/ high severity lagging SPI	SPI to measure the outcomes/consequence, events that have already occurred, that have low probability to occur but have high severity of its consequence (accident or serious incident) *Example:* ○ *ATSP monthly/quarterly FIR serious incident rate – involving any aircraft (e.g. per 100 000 flight movement);*
High probability/ low severity lagging SPI	SPI to measure the outcomes/consequence that have high probability to occur but have low severity of its consequence (precursor indicator) *Example:* ○ *ATSP monthly/quarterly FIR lost of incident rate – involving any aircraft (e.g. per 100 000 flight movement);* ○ *ATSP monthly/quarterly FIR TCAS RA incident rate – involving any aircraft (e.g. per 100 000 flight movement);* ○ *ATSP monthly/quarterly FIR level bust incident rate – involving any aircraft (e.g. per 100 000 flight movement);*
Leading SPI	SPI to monitor and measure conditions that have the potential to become or to contribute to a specific outcome. Also known as "activity or process SPIs." *Example:* ○ *ATSP internal QMS/SMS annual audit LEI% or findings rate (findings per audit)*

d) For a more accurate and useful indication of safety performance, lagging SPIs measuring both "low probability/high severity" events and "high probability/low severity" events should be combined with leading SPIs. ATSP should establish SPIs which pertinent to the ATSP's aviation activities, consistent with other service providers of the same sector/category and congruent with Thailand SSP aggregate safety indicators for the service provider sector/category.

e) The contents of each SPI should include:

- a description of what the SPI measures;

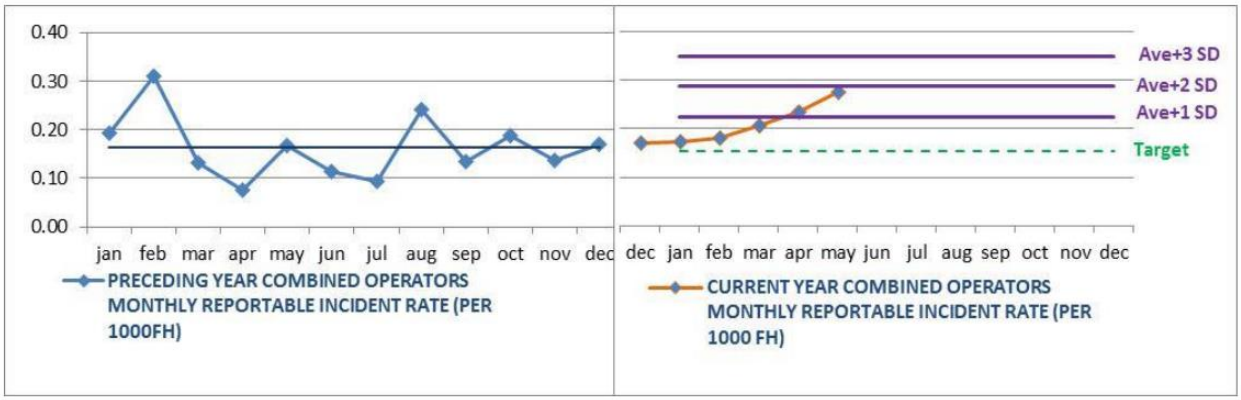
- the purpose of the SPI (what it is intended to manage and who it is intended to inform);
- the units of measurement and any requirements for its calculation;
- who is responsible for collecting, validating, monitoring, reporting and acting on the SPI (these may be staff from different parts of the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

4.2.3 Setting Safety Performance Targets (SPTs)

a) SPTs define short-term and medium-term safety performance management desired achievements. SPTs setting should take into consideration factors such as the prevailing level of safety risk, safety risk tolerability, as well as expectations regarding the safety of the particular aviation sector. The setting SPTs should be determined after considering what is realistically achievable for the associated aviation sector and recent performance of the particular SPI, where historical trend data is available.

b) Historical data points (historical performance) are basis for targeted improvement level to be achieved within a specified period and setting or defining unacceptable alert trend levels.

c) Target setting is a less structured process than Alert setting. It is essentially a desired or planned percentage improvement over the preceding period's Average occurrence rate. The Target level is represented by the dotted line in Figure below.



This Target level is meant to be compared with the current monitoring period's Average value (which is to be calculated at the end of the current monitoring period). If the current period's Average value should be below (better) than this Target line (preceding year's Average) then the Target performance has been achieved. If the current period's Average is above (worse) than the Target line, then the Target has not been achieved. There should be an objective rationale for determining the Target quantum of a given SPI, whether it should be 1%, 5% or 10%. Primarily, it should be correlated to the nature, scope and aggressiveness of actions taken or planned with regard to the purpose of improving the safety and reliability performance of the operational process underlying that SPI.

4.2.4 Setting Alert and Trigger

a) an alert level is fundamentally the caution light or alarm bell of a Safety Performance Indicator (SPI). Its common safety metrics terminology is called "Out of Control Criteria (OCC). Breaching an Alert level implies that a data set has trended into an abnormal/undesirable region (in relation to its historical performance). In the case of a safety (occurrences) indicator it would mean an abnormal escalation of the occurrence type being tracked, implying a high risk situation of subsequent "out of control" occurrence rates. The determination of such an Alert boundary or level is associated

with the recent historical data trending behaviour of the same indicator. The rationale for this is to ensure that a safety indicator's current Alert setting has taken into consideration its own recent historical performance or behaviour. The historical data performance is specifically measured by means of two characteristics of the historical data set:

- Average value, and
- Standard Deviation (SD) value

b) An Alert (abnormal/ unacceptable trend) is indicated if ANY of the conditions below are met for the current monitoring period:

- Any single point is above [Average + 3 SD] line
- 2 (or more) consecutive points are above [Average + 2 SD] line
- 3 (or more) consecutive points are above Average + 1 SD] line

c) Armed with such a package of three complementary alert levels, a safety indicator is poised to trigger a genuine Alert condition based on valid statistical criteria. It will effectively capture any sudden (single data point) high risk spike as well as any sustained high occurrence rate deviations, which are equally unacceptable.

d) Alert and Target settings are based on a SPI's recent historical behaviour. With this rationale in mind, it is apparent that Alert level and Target settings should be updated between appropriate monitoring periods. This would be especially important where there has been significant change in the volatility of past data sets (Higher SD value will result in bigger margins in-between Alert lines and vice versa). Theoretically, Alert level and Target settings can be recalculated at the end of each monitoring period, say yearly. However, this may not be the case, depending on factors as the number of data points per monitoring period and the volatility of those data points. Any major operational environment changes such as new equipment or additional service providers may deserve a review of Alert levels, Targets or even SPI validity. In any case, the validity of Alert levels.

4.3 Safety Performance Monitoring and Measurement

4.3.1 Introduction

a) Measurements of safety performance at individual service provider levels are essential for effective safety management. If safety is expressed in terms of controlling safety risks to an acceptable level, it follows that safety performance measures must relate to how well risks are being controlled by the responsible service providers.

b) The combination of internal audits and the establishment and monitoring of SPIs are required in order to verify the safety performance and validate the effectiveness of safety risk controls.

4.3.2 Independent Safety Oversight Process (Internal audit).

a) An internal audit process is one means to monitor compliance with safety regulations, the foundation upon which SMS is built, and assess the effectiveness of these safety risk controls and the SMS.

b) An independent oversight program is much like a Quality Assurance program, but is focused on the safe performance of the process under review rather than simple compliance. It is necessary for the staff doing the safety oversight to have an understanding of the process under review, be qualified to carry out the function, whilst being fully independent of it during the audit.

c) Internal audits are performed to assess the effectiveness of the SMS and identify areas for potential improvement. Ensuring compliance with the regulations through the internal audit is a principle aspect of safety assurance.

d) Internal audits are most effective when conducted by persons or departments independent of the functions being audited. Such audits should provide the accountable executive and senior management with feedback on the status of:
- compliance with regulations;
- compliance with policies, processes and procedures;
- the effectiveness of safety risk controls;
- he effectiveness of corrective actions; and
- the effectiveness of the SMS.

e) Some organizations cannot ensure appropriate independence of an internal audit, in such cases, the ATSP should consider engaging external auditors (e.g. independent auditors or auditors from another organization).

f) Planning of internal audits should take into account the safety criticality of the processes, the results of previous audits and assessments (from all sources), and the implemented safety risk controls. Internal audits should identify non-compliance with regulations and policies, processes and procedures. They should also identify system deficiencies, lack of effectiveness of safety risk controls and opportunities for improvement.

g) Assessing for compliance and effectiveness are both essential to achieving safety performance. The internal audit process can be used to determine both compliance and effectiveness.

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

4.3.3 Monitoring of SPIs

a) Safety performance monitoring and measurement should be conducted observing some basic principles. The safety performance achieved is an indication of organizational behavior and is also a measure of the effectiveness of the SMS. This requires the organization to define:
- safety objectives, which should be established first to reflect the strategic achievements or desired outcomes related to safety concerns specific to the organization's operational context;
- SPIs, which are tactical parameters related to the safety objectives and therefore are the reference for data collection; and
- SPTs, which are also tactical parameters used to monitor progress towards the achievement of the safety objectives.

b) A safety performance monitoring program appropriate to the organization is established and maintained. Follow up actions to an alert should be set. Safety performance indicators are normally reviewed by a scheduled Safety Review Committee or appropriate platform. Where an Alert has been triggered for any given indicator, an enquiry or investigation should be conducted to explain or determine the reason for the Alert condition. The Safety Office concerned would preferably have anticipated the Committee's enquiry and should be prepared to account for the Alert level breach. This may involve prior liaison with service providers or operational areas concerned.

c) There is a logical connection between a safety indicator Alert mechanism and an organisation's occurrence investigation as well as Hazard Identification and Risk Mitigation (HIRM) processes. Where a SPI pertaining to certain type or category of incident has triggered an Alert, it implies that there is an abnormally high occurrence of that type or category of incidents. In order to arrest such an abnormal incident rate, necessary analysis of all the relevant incidents' records (such as incident notification or incident investigation reports) would be necessary. This is to identify potential issues such as significant recurrence of a particular incident type (whether due to one particular equipment or the same series of equipment), or that there was a series of multiple (connected or unconnected) incidents for that period concerned. The evaluation of such occurrence investigation reports can also determine if adequate and effective corrective actions have indeed been taken or recommended by the relevant investigators to address the causes of those incidents, and hence ensure their non-recurrence. If investigations performed are not sufficiently thorough to address root cause or latent conditions, then recurrence of the same incident type can be expected. Thus, there is a connection between inadequate incident investigation processes and subsequent sustained high incident rates, because actions taken or recommended from previous investigations were off the mark or did not address underlying issues or hazards.

d) Where there should be any hazards identified in the course of incident investigation records review, and found to have been inadequately addressed, this can then bring in the organisation's HIRM process. Thus in an SSP-SMS environment, there should be a constant connection between its safety performance monitoring, occurrence investigation and HIRM processes.

e) In the case of a lower consequence SPI, a triggered Alert would imply that there is a high likelihood of seeing a subsequent Alert in its related higher consequence SPIs. This would invariably be so, if no timely and effective corrective actions were taken in relation to the lower consequence SPI's Alert.

f) Once safety objectives have been set then SPIs can be established. SPIs can be used to measure the performance of the SMS and the operational safety performance. SPIs will require the monitoring of data from various sources such as;

- occurrences and events;
- safety reports;
- safety reviews including trend analysis;
- audits;
- surveys;
- internal safety investigations.

g) Types of monitoring depend on the complexity of the organization. Safety performance can be monitored by:

- establishing an effective hazard and occurrence reporting system;
- front-line supervisors monitor and reporting day-to-day activities;

- doing regular or daily inspections (formal or informal) of all safety-critical areas;
- using safety surveys to canvass the staff's views about safety;
- systematically reviewing and following up on all reports of identified safety issues;
- systematically capturing daily performance data;
- regular operational audits, both internal and external; or
- regularly communicating safety results to all personnel.

h) Data availability to support informed decision-making is one of the most important aspects of the SMS. Using this data for safety performance monitoring and measurement are essential activities that generate the information necessary for safety risk decision-making.

i) The ATSP should establish systems are in place to ensure feedback on safety performance, is received and the data is analyzed. Safety performance monitoring is conducted through the collection of safety data and safety information from a variety of sources typically available to an organization.

j) As historical safety performance of ATSPs can influence CAAT's decisions about determining ALoSP for next coming year, therefore, It is essential that ATSPs should annually submit the data and information related to safety performance to CAAT. The required information including but not limited to:

- Package SPIs and its target setting
- Statistical Alarm bell (out of control criteria) which based on SPI's preceding period's data performance
- Measures for coping with uncontrol criteria
- Results Monitoring for abnormal trends

4.3.4 Formal Safety Review Process.

a) There are two distinct functions within the SMS. First, there should be a formal board (e.g. Safety Review Board (SRB)) to ensure that the SMS functions correctly, so that all risks are properly addressed in a timely manner. Second, there should be a body to support the risk assessment process (e.g. Safety Action Group (SAG)) and other safety-related tasks. The first body should be at top management level: the second would lie in the line manager's area.

b) The SRB is the company's highest-level internal safety-related meeting and should be chaired by the accountable executive and include the safety manager. Safety performance and achievements are periodically reviewed and the results of safety and quality audits and monitoring programs are addressed. The Board is established to ensure that the objectives and specified actions in the safety plan are achieved in a timely manner. Consideration may be given to any issues that are blocking progress. The allocation of resources, commitment for new initiatives and the establishment of a clear safety policy are issues that may also be resolved.

c) The SAGs comprise a representative selection of the line management and supervisory staff of all sections of the company (not only operations and maintenance, but also other disciplines, such as financial and commercial). In a large organization there may be more than one SAG. These groups should meet periodically to support the line with the assessment of risks faced by the company and to suggest methods of mitigation. They should also support the systematic review of safety-related standards and procedures used in the organization. The working of the group should be facilitated, but not directed, by the safety manager. This group should be used to provide experienced advice on the major aviation safety issues.

d) The requirement and scope of SAG safety reviews should include at least issues specified in ICAO PANS-ATM Doc4444, 2.5.

4.3.5 Internal Safety Investigation.

a) The ATSP should review all reported event/hazards and decide which ones should be investigated, and how thoroughly. The ATSP need to have a clear policy, stating that the purpose of internal investigation is to find systematic causes and implement corrective actions, not to blame individuals. If ATSP use the principles of a positive safety culture, internal investigation should state this.

NOTE: *The internal safety investigation shall meet the requirements set forth in RCAAT No.22*

b) Accountability for the management of internal safety investigations and the investigation process should be documented in SMS. The documentation should be:

- scope of the investigation;
- who will investigate, including specialist assistance if required;
- recording the investigation findings for follow-up trend analysis, and who is responsible for this;
- a timeframe for completion.

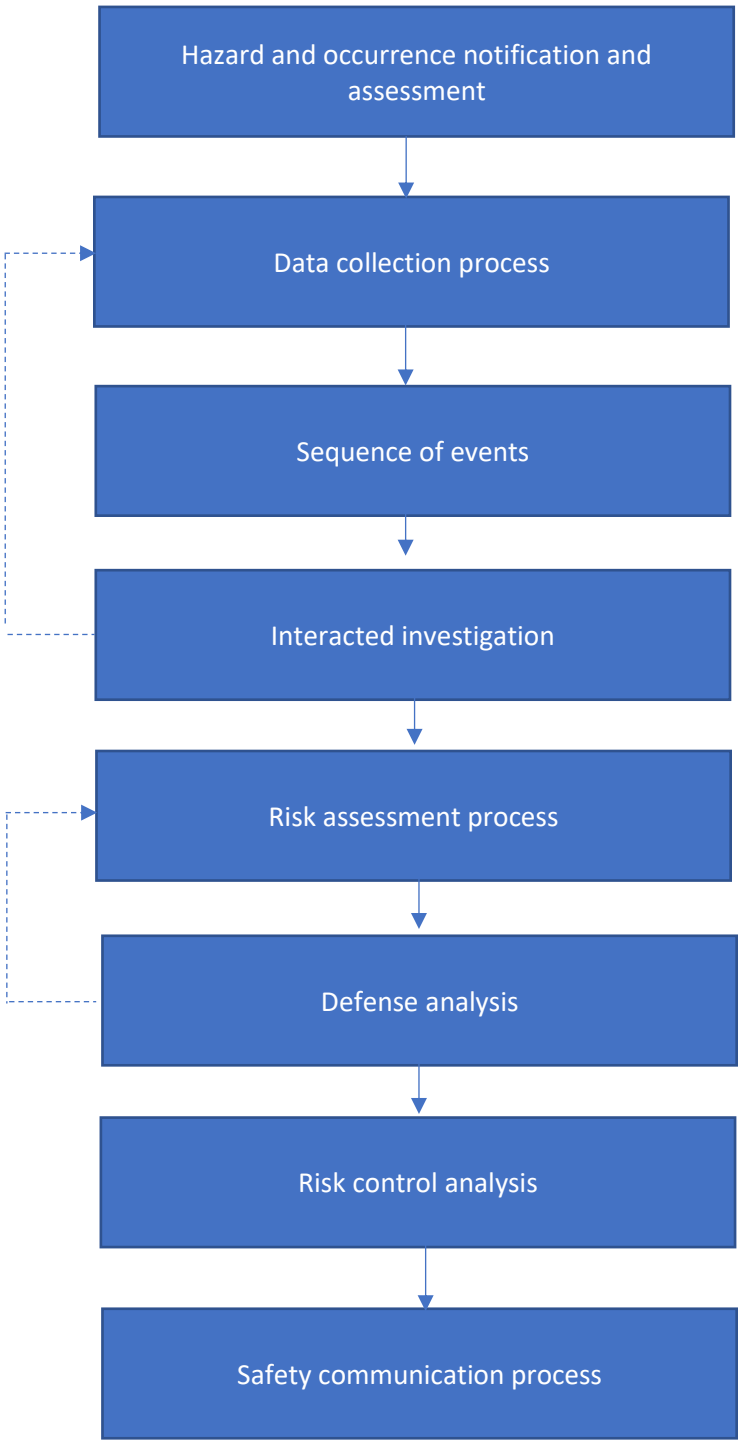
c) The extent of the investigation will depend on the actual and potential consequences of the event or hazard. The ATSP can determine this through an initial risk assessment. Reports that demonstrate a high potential should be investigated in greater depth than those with low potential.

d) The investigative process should be comprehensive and should attempt to address the factors contributing to the event, rather than simply focusing on the event itself – the active failure. A more detailed analysis is usually required to establish the organizational factors that contributed to the event.

e) The ATSP should ensure that key operational staff are properly trained to conduct safety investigations and have appropriate support.

f) The output, identified safety issues, should be disseminated throughout the organization, along with publishing of lessons learned from these identified safety issues.

g) Internal safety investigation process:



4.4 The Management of Change

4.4.6 General

a) Change within organization can create hazards which can affect the safety of its operations. However, while the changes need to be made effectively and efficiently, main focus should be on implementing them safely. A change introduced to improve safety may introduce safety risks elsewhere – change invariably creates the potential for intended consequences.

b) The procedures that manage changes to functional system shall include:

- the identification and notification of proposed change, including project/change implementation plan;
- the identification of the scope of change, i.e. the identification of what parts of the functional system are to be changed or are affected by the change;
- the assessment and assurance of the change;
- the temporary procedures during transition period (if needed); and
- The approval of the change.

c) The management of change in SMS only applies to hazard identification and risk assessment related to safety of operations. Other potential risk factors (such as the inability to sustain business growth) should be considered, as while they are additional to the scope of SMS change management, they may affect operational safety.

d) The establishment of the monitoring criteria to ensure that the change will remain acceptable as long as it is in operation (acceptable safe for the ATSP). The monitoring of the changed system is part of the activities related to the management system of the ATSP. It is not covered by the change management procedures themselves.

e) Large-scale changes, such as major infrastructure projects or organizational restructures, should be managed as stand-alone projects, with safety validation documentation forming part of the project safety plan. The project safety plan will be evolutionary document. For example, it may initially set out assumptions and replace these with more factual information as it becomes available. Similarly, the project safety plan may initially set out the risk assessment methodology and findings, later incorporating the safety requirements.

f) The need for organizational change can results from many difference triggers. These include:

- the appointment of new senior managers or a new management team;
- changes in customer requirements or expectations;
- changes in work environment;
- an inadequate skills and knowledge base, leading to new training programs;
- poor performance;
- new technology;
- new ideas about how to do things better;
- new contracts;
- recognition of operational problems, leading to a reallocation of responsibilities;
- regulatory or procedural change;
- relocation or expansion;
- staff changeover; or
- change in contractors, or bringing on new contractors.

g) Whether change is to be brought about through new projects, or through modifications to operating procedures, it will involve risks. There is very strong link between change management and risk management – the two processes support each other and should be used together.

4.4.7 Scope of Change

a) The description of the elements being changed includes the nature, functionality, location, performance, maintenance tasks, training and responsibilities of these elements, where applicable. The description of interfaces and interactions, between machines and between humans and machines, should include communication means, e.g. language, phraseology, protocol, format, order and timing and

transmission means, where applicable. In addition, it includes the description of the context in which they operate.

b) There are two main aspects to consider in evaluating the scope of a change:

- The interactions within the changed functional system.
- The interactions within the changing functional system, i.e. those that occur during transitions from the current functional system to the changed functional system. During such transitions, components are replaced/installed in the functional system. These installation activities are interactions within the changing functional system and are to be included within the scope of the change. The identification of changed interactions is necessary in order to identify the scope of the change because any changed behavior in the system comes about via a changed interaction. Changed interaction happens via an interaction at an interface of the functional system and the context in which it operates. Consequently, identification of both interfaces and interactions is needed to be sure that all interactions have identified interfaces and all interfaces have identified interactions. From this, all interactions and interfaces that will be changed can be identified.

4.4.8 The ATSP needs to make sure that the method is appropriate for the change and produces (either individually or in combination) a valid (necessary and sufficient) set of hazards. This may be aided by drawing up a list of the functions associated with part of the functional system being changed. The ATSP needs to make sure their personnel that use these techniques are appropriately trained to apply these methods and techniques.

4.4.9 A safety assessment needs to be performed when a change affects a part of the functional system managed by the ATSP and that is being used in the provision of its air traffic services, including for activities potential hazardous to civil aircraft. The safety assessment or the way it is conducted does not depend on whether the change is a result of a business decision or a decision to improve safety. And that appropriate risk mitigation measures are implemented.

4.4.10 If the change modifies the way people interact with the rest of the functional system, then a training might be required before the change becomes operational. Care should be taken when training operational staff before the change is operational, as the training may change the behavior of the operational staff when they interact with the existing functional system before any other part of the change is made, and so may have to be treated as a transitional stage of the change. For example, as a result of training, air traffic controllers (ATCOs) may come to expect information or alerts to be presented differently. People may also need refreshment training periodically in order to ensure that their performance does not degrade over time. The training needed before operation forms part of the design of the change, while the refreshment training is part of the maintenance of the functional system after the change is in operation.

4.4.11 Notification of Changes to a Functional System

a) a change should be notified as soon as the data is available. The decision to review a change by CAAT will be based, in the most circumstances, on the notification data. Exceptions to this are cases where CAAT is not familiar with the type of change or the complexity of the change requires a more thorough consideration.

b) early and accurate notification facilities the interactions between the provider and CAAT and, thus, maximize the likelihood of introducing a change into service in due time and according to the service provider's initial schedule when CAAT has decided to review an assurance case. Therefore, it is advisable that the change description is completed as soon as possible and contains the following data:

- purpose of the change;
- reasons for the change;
- place of implementation;
- implementation plan;
- new/modified functions/services brought about by the change;
- high-level identification of the constituents of the function system being changed, and what is modified in their functionality;
- consequence of the change, i.e. the harmful effects of the hazards associated with the change;
- safety assessment including risk control/mitigation process for eliminating or reducing identified risks with progress/evidences;
- details of temporary procedures during transition period (if needed); and
- additional information (if requested).

c) The information may expedite the decision whether to review or not the proposed change, because it will allow the CAAT to gain complete knowledge of the change and, consequently, reduces the need for additional information. However, lack of some of this data should not delay the service provider's submission of the notification if to do so is likely to impede the introduction of the change. It should be noted that early interaction with CAAT may help to complete the missing data.

d) The ATSP should take into account that an early, clear and accurate change notification will assist CAAT in making decision to review or not the change and may prevent any inconvenience such as:

- CAAT having to ask for more information about the change in order to make its decision;
- CAAT deciding to review a change unnecessarily because the notification is not clear enough; or
- the delay in CAAT deciding whether to review a change, caused by the lake of information, having an impact on the proposed date of entry into service.

e) It is recognized that the understanding of the change will improve as the change processes and the interaction between CAAT and the ATSP strengthens. The ATSP should notify the CAAT when the information previously missing becomes available. When additional information is supplied at the request of CAAT, then no update of the notification is required.

f) For the ATSPs, the consequences of the change should be expressed in terms of the harmful effects of the change, i.e. the effects of the hazards associated with safety risks. These could be the result of a preliminary safety assessment, if available, or an early hazard analysis that concentrates on the service level effects.

g) The point of contact provides a focal point for CAAT to contact when seeking complementary information about the change when required. The aim is to improve communications between the ATSP and CAAT about the change.

h) All notified changes should be unambiguously identified. The ATSP should agree with CAAT a means of referencing so as to associated a unique identifier to a given notified change.

i) For routine changes, the notification to CAAT may be done in a simpler manner, e.g. using forms less detailed or notifying these changes collectively after being implemented at regular periods of times agreed between the ATSP and CAAT. The ATSP should coordinate with CAAT so as to reach a common agreement on these types of changes that may not be reviewed by CAAT. The list of such changes should be documented and formalized. The formalized agreement becomes part of the

ATSP's change management procedures. consequently, the list will be reviewed by the CAAT as part of the audits it performs.

4.4.12 Safety Assessment Methods of Change to the Functional System.

a) The ATSP can use a standard safety assessment method or it can use its own safety assessment method to assist with structuring the process. However, the application of a method is not a guarantee of the quality of the results. It is therefore not sufficient for a safety case to claim that the assurance provided is adequate due to compliance with a standard or method.

b) In all cases, the ATSP should make sure to involve staff or their representative in the process. They will have useful information about how the work is done that will make risk assessments more thorough and effective.

c) The ATSP shall ensure that the safety assessment method is adequate for the change being assessed and that the assumptions inherent in the use of the method are recognized and accommodated appropriately.

d) The ATSP should ensure that hazard identification:

- targets complete cover of any condition event, or circumstance related to the change, which could, individually or in combination, induce a harmful effect;
- has been performed by personnel trained and competent for this task; and
- need only include hazards that are generally considered as credible.

e) Hazard to be identified. The following hazards should be identified:

- new hazards, i.e. those introduced by the change relating to the:
  - failure of the functional system; and
  - normal operation of the functional system; and
- already existing hazards that are affected by the change and are related to:
  - the existing parts of the functional system; and
  - hazards outside the functional system, for example, those inherent to aviation.

f) Outcome of risk assessment

- The purpose of risk evaluation is to evaluate the risk of the change and to compare that against the safety criteria with the following outcomes in mind:
  - a possible (desired) outcome is that the assessed risk satisfies the safety criteria. This implies that the change is assessed as sufficiently safe to implement.
  - another possible outcome is that the assessed risk does not satisfy the safety criteria. This might lead to the decision to refine the risk analysis, to the decision to add mitigating means, or to the decision to abandon the change.
- Where possible sequences of events, contributing factors and circumstances are excluded in order to simplify the risk estimate, which may be necessary to make the estimate of risks feasible, arguments and evidence justifying this should be provided in the safety case. This may result in increasing the uncertainty of the risk estimations.
- The risk assessment can take several forms, even within the safety assessment of a single change, depending on the nature of the risk analysis and the safety criteria:

g) Verification activities of the risk assessment

- The ATSP should ensure that verification activities of the safety assessment process include verification that:
    - the full scope of the change is addressed throughout the whole assessment process, i.e. all the elements of the functional system or environment of operation that are changed and those unchanged elements that depend upon them and on which they depend are identified;
    - the way the service behaves complies with and does not contradict any applicable requirements placed on the changed service or the conditions attached to the provider certificate;
    - the specification of the way the service behaves is complete and correct;
    - the specification of the operational context is complete and correct;
    - the risk analysis is complete; and
    - the implementation, to the intended degree of confidence, corresponds to that design and behaves only as specified in the given operational context.

4.4.13 Safety Requirement

a) The following non-exhaustive list contains examples of safety requirements the specify:
- for equipment, the complete behavior, in terms of functions, accuracy, timing, order, format, capacity, resource usage, robustness to abnormal conditions, overload tolerance, availability, reliability, confidence and integrity;

  NOTE: *The complete behavior is limited to the scope of the change. Safety requirements should only apply to the parts of a system affected by the change. In other words, if parts of a system can be isolated from each other and only some parts are affected by the change, then these are the only parts that are of concern.*

- for people, their performance in terms of tasks (e.g. accuracy, response times, acceptable workload, reliability, confidence, skills, and knowledge in relation to their tasks);
- for procedures, the circumstances for their enactment, the resources needed to perform the procedure (i.e. people and equipment), the sequence of actions to be performed and the timing and accuracy of the actions; and
- interactions between all parts of the system.

4.4.14 Safety Case

a) The SMS documentation identifies the changes (including human factors issues) that required formal risk management process. The ATSP should ensure that assurance documented in a safety case, including argument and supporting evidence, of the achievement and maintenance of safety. In essence there is a “burden of proof” on ATSP to show that acceptable levels of safety are and continue to be achieved.

b) The development of a safety case is not an alternative to carrying out a safety assessment. It is a means of structuring and documenting a summary of the results of a safety assessment, and other activities (e.g. simulations, surveys etc.), in a way that a reader can readily follow the logical reasoning as to why a change (or ongoing service) can be considered safe.

c) Safety case types. Safety cases may come in many forms, but most can be thought of as falling into one of the 2 categories, as follows:

- **Unit safety case (USC):** Those that are used to demonstrate the safety of an on-going service. The ATSP may decide to produce and maintain a Unit Safety Case in order to show that on-going, day-to-day operations are safe and that they will remain so indefinitely. An USC would include typically and priority safety assessment, together with the results of safety audits, surveys and operational monitoring.
- **Project safety case (PSC):** Those that are used to demonstrate the safety of a substantial change to that service. The ATSP may also decide to produce a PSC when a particular substantial change to an existing safety-related service/systems to be undertaken. A PSC would normally consider only those risks created or modified by the change and rely on an assumption (or evidence from the corresponding USC) that the pre-change situation is at least tolerably safe.

d) The safety case should include, at least:
- what the safety case is trying to demonstrate - this should be directly related to the claim that the subject of the safety case is acceptably safe;
- why is the Safety Case being written and for whom;
- a description of the system/change and its operational/physical environment, sufficient only to explain what the Safety Case addresses and for the reader to understand the remainder of the Safety Case;
- for PSC, the justification for introducing the change (and therefore potentially for incurring some risk);
- a reasoned and well-structured Safety Argument, showing how the aim is satisfied;
- supporting safety evidence to substantiate the Safety Argument;
- all assumptions, outstanding safety issues, and any limitations or restrictions on the operation of the system;
- a simple statement to the effect that the Aim has been satisfied, subject to the stated caveats.

4.4.15 Training of Changes to the Functional System

a) If the change modifies the way people interact with the rest of the functional system, then a training will be required before the change becomes operational. Care should be taken when training operational staff before the change is operational, as the training may change the behavior of the operational staff when they interact with the existing functional system before any other part of the change is made, and so may have to be treated as a transitional stage of the change.
b) For example, as a result of training, air traffic controllers (ATCOs) may come to expect information or alerts to be presented differently.
c) People may also need refreshment training periodically in order to ensure that their performance does not degrade over time. The training needed before operation forms part of the design of the change, while the refreshment training is part of the maintenance of the functional system after the change is in operation.

4.4.16 Monitoring of Introduced Change

a) The ATSP should ensure that within the safety assessment process for a change, the monitoring criteria, that are to be used to demonstrate that the safety case remains valid during the operation of the changed functional system, are identified and documented.
b) Monitoring is intended to maintain confidence in the safety case during operation of the changed functional system.

4.4.17 Post Implementation

a) The ATSP should establish and maintain procedures to ensure that adequate provision is made for post-implementation monitoring at least 30 working days to verify that the defined level of safety continues to be met. The post-implementation report should be sent to CAAT, if requested.

4.5 Continuous Improvement of the SMS

4.5.1 The ATSP should monitor and assess its SMS processes to maintain or continuously improve the overall effectiveness of the SMS.

4.5.2 The ATSP can measure and review what have been doing, and improve on areas where SMS is not effective. The review should look at all parts of the SMS to make sure they are still relevant and applicable. The ATSP needs to outline how you are going to review each element of the SMS – safety policy and objectives; safety risk management; safety assurance; and safety promotion - in the SMS manual.

4.5.3 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.

4.5.4 SMS effectiveness should not be based solely on SPIs; ATSP should aim to implement a variety of methods to determine its effectiveness, measure outputs as well as outcomes of the processes, and assess the information gathered through these activities. Such methods may include:

a) audits; this includes internal audits and audits carried out by other organizations;
b) assessments; includes assessments of safety culture and SMS effectiveness
c) monitoring of occurrences: monitor the recurrence of safety events including accidents and incidents as well as errors and rule-breaking situations;
d) safety surveys; including cultural surveys providing useful feedback on staff engagement with the SMS. It may also provide an indicator of the safety culture of the organization;
e) management reviews; examine whether the safety objectives are being achieved by the organization and are an opportunity to look at all the available safety performance information to identify overall trends. It is important that senior management review the effectiveness of the SMS. This may be carried out as one of the functions of the highest-level safety committee;
f) evaluation of SPIs and SPTs; possibly as part of the management review. It considers trends and, when appropriate data is available, can be compared to other service providers or State or global data;
g) addressing lessons learnt; from safety reporting systems and service provider safety investigations. These should lead to safety improvements being implemented.

4.5.5 For complex ATSP, the ATSP should continuously improve the effectiveness of its SMS by:

a) developing and maintaining a formal process to identify the causes of substandard performance of the SMS;
b) establishing one or more mechanisms to determine the implications of substandard performance of the SMS;
c) establishing one or more mechanisms to eliminate or mitigate the causes of substandard performance of the SMS; and
d) developing and maintaining a process for the proactive evaluation of facilities, equipment, documentation, processes and procedures (through internal audits, surveys, etc.).

4.5.6 For complex ATSP;

a) Substandard performance of the SMS can manifest itself in two ways.

- Firstly, where the SMS processes themselves do not fit their purpose (e.g. not adequately enabling the ATSP to identify, manage and mitigate hazards and their associated risks) resulting in the safety performance of the service being impacted in a negative way.
- Secondly, where the SMS processes fit their purpose, but are not applied correctly or adequately by the personnel whose safety accountabilities and responsibilities are discharged through the application of the SMS. Personnel who have safety accountabilities and responsibilities are considered an essential part of the effectiveness of the SMS and viewed as part of the SMS.

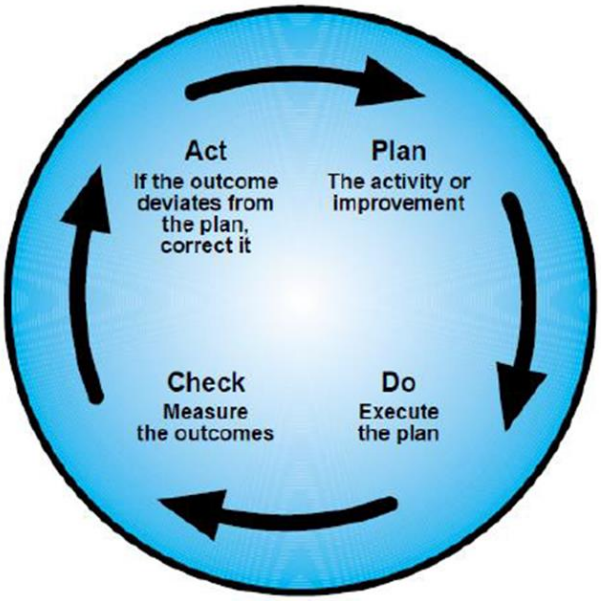
b) Therefore, by detecting substandard performance of the SMS, the air traffic services provider can take action to improve the SMS processes themselves or to improve the application of the SMS processes by those with safety accountabilities and responsibilities resulting in an improvement to the safety performance.

c) Continuous improvement of the effectiveness of the safety management processes can be achieved through:

- proactive and reactive evaluations of facilities, equipment, documentation, processes and procedures through safety audits and surveys; and
- reactive evaluations in order to verify the effectiveness of the system for control and mitigation of risks.

d) As with safety performance monitoring, the continuous improvement of the SMS lends itself to a process that can be summarized as:

- identify where there are potential weaknesses or opportunities for improvement;
- identify what goes right and disseminate as best practice;
- identify what can be done to tackle weaknesses or lead to improvement;
- set performance standards for the actions identified;
- monitor performance against the standards;
- take corrective actions to improve performance; and
- repeat the process by using the continuous improvement model below:



e) Taking into account that the SMS is being required to manage safety, it can be assumed that by continuously improving the effectiveness of the SMS, ATS providers should be able to better manage and mitigate, and ultimately control the safety risks associated with the provisions of their services.

4.5.7 Small organizations should review the SMS at least once a year to ensure that:

a) the SMS continues to meet its core safety objectives;
b) safety performance is monitored against objectives;
c) identified hazards are addressed in a timely and appropriate manner.

4.5.8 A practical way for small organizations to maintain a focus on improvement is to network with other operators and share information and good ideas to try.

4.5.9 For larger organizations, more formal periodic reviews are conducted by the safety committee. For example:

a) reporting on the effectiveness of management of change activities and issues;
b) reporting on safety training performance;
c) evaluation of facilities, equipment, documentation and procedures through safety audits and surveys; and
d) continued tracking of safety culture change or maturity level.

5. Safety Promotion

5.1 Introduction

5.1.1 Safety promotion is an important part of an SMS, setting the tone for the organization, and helping to build a robust safety culture. Safety promotion also helps to foster improved safety performance by communicating lesson learned, broader safety information and the distribution of the SMS manual and safety procedures in the organization.

5.1.2 Safety promotion is divided into 2 elements: training & education and safety communication. Both are vital to the ongoing success of the SMS. ATSP's staffs need to be trained and competent to perform their roles in the SMS, and need strong lines of communication at all stages of the SMS implementation and maintenance.

5.1.3 Third-party contractors can add to the organization's SMS by reporting any hazards etc. through the hazard reporting system. It also shows management's commitment to an effective SMS. The quality and effectiveness of training significantly influence the attitude and professionalism the staffs will demonstrate everyday.

5.2 Training and Education

5.2.1 All personnel shall receive safety training as appropriate for their safety responsibilities.

5.2.2 Adequate records of all safety training provided shall be kept.

5.2.3 The scope of the safety training program shall fit the needs and complexity of the organization and shall be appropriate to each individual's involvement in the SMS.

5.2.4 As the beginning to implement the SMS, the ATSP should identify what training operational safety-critical personnel need by doing a 'Training Needs Analysis' (TNA) to save time and money by ensuring that ATSP is teaching the right things to the right people, and using the best training methods in the most efficient order. The results of TNA will also help to reduce unnecessary training.

5.2.5 For the larger organization may do own training in-house.

5.2.6 Most smaller organization might prefer to contract external trainers for their SMS training. However, it is still valuable to understand what process these external providers should follow, and what you require.

5.2.7 The safety training program may consist of self-instruction (e.g. newsletters, flight safety magazines), classroom training, e-learning or similar training provided by training organizations.

5.3 Safety Communication

5.3.1 The ATSP shall establish effective communication about safety matters that:

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

5.3.2 Regular meetings with personnel where information, actions and procedures are discussed, may be used to communicate safety matters.

6. Human Factors

6.1 Introduction

6.1.1 The term human factors refer to the wide range of issues that affect how people perform tasks in their work and non-work environments. The study of human factors involves applying scientific knowledge about the human capabilities and limitations so that there is the best possible fit between people and the systems in which they operate. Human factors are the social and personal skills (for example are communication and decision making) which component technical skills, and are important for safe and efficient aviation.

6.1.2 The primary focus of any human factors initiative is to improve safety and efficiency by reducing and managing human error made by individuals and organizations.

6.2 Human Factors Training

6.2.1 The human factors training programs are often referred to as “Team Resource Management (TRM) training for ATCO.

6.2.2 Human factors training should focus squarely on providing aviation safety-critical personnel with non-technical skill to manage the prevention/consequences of human error. This implies that making error is normal and expected. The consequences of error are just as important as the cause(s).

6.2.3 Non-technical skills are the decision making and social skill that complement technical skills. However, maintaining situation awareness is a non-technical skill.

6.2.4 The ATSP should continue to develop staff’s non-technical skill as a priority. Non-technical skills are one of primary defenses in reducing errors.

6.2.5 Main categories and elements of non-technical skills.

Non-technical skill categories	Elements
Managing fatigue	- *Identifying symptoms of fatigue;* - *Recognizing effects of fatigue;* - *Implementing fatigue-coping strategies.*
Managing stress	- *Identifying symptoms of stress;* - *Recognizing effects of stress;* - *Implementing stress coping strategies.*
Alcohol and other drugs	- *Recognizing the effects of alcohol and other drugs use;* - *Identifying risk factors and symptoms of alcohol and other drugs use;* - *Implementing strategies to maintain fitness for duty;* - *Awareness of alcohol and other drugs testing.*
Team-based cooperation and coordination	- *Supporting others;* - *Solving conflicts;* - *Exchanging information;* - *Coordinating activities.*
Decision making	- *Defining the problem;* - *Considering options;* - *Selecting and implementing operations;* - *Reviewing the outcome.*
Situation awareness	- *Gathering information;* - *Interpreting information;* - *Anticipating future states;* - *(or simply asking: ‘what has happened?’; ‘what is happening?’; ‘what might happen?’)*

Communication	- *Sending information clearly and concisely;* - *Including context and intent during information exchange;* - *Receiving information, especially by listening;* - *Identifying and addressing barriers to communication.*
Leadership and followership	- *Using authority;* - *Maintaining standards;* - *Planning and prioritizing;* - *Managing workload and resources.*

6.3 Errors and Error Management

6.3.1 Human factors is a field of scientific knowledge drawing from established disciplines such as ergonomics, physiology, psychology and engineering. Human error is really the outcome or consequence of our human performance limitations.

6.3.2 Some general organizational strategies to contain errors (reducing their potential for catastrophic consequences) and prevent errors (trying to avoid them occurring in the first place) are in the table below:

Containment strategies:

Error containment	Sample strategies
Formalize acknowledgement that error are 'normal'	- *Policy signed by the accountable executive stating the reporting errors;* - *Safety investigation procedures acknowledging difference between intentional and unintentional errors.*
Conduct regular systematic analysis to identify common errors and build stronger defenses	- *Periodic staff discussion groups to identify errors and ways to manage them;* - *Task analysis to identify error potential and effectiveness of current controls.*
Identify risk of potential errors through normal operations behavioral observation programs	- *Independent peer-on-peer confidential observation program;* - *Safety mentoring and coaching program to identify task-specific potential errors.*
Identify potential single-point failures (high risk) and build stronger defenses	- *Road testing of procedures to identify ease of comprehension prior to roll out;* - *Ensure critical job roles have backup to avoid over-reliance on individual.*
Include the concept of shared mental models in team-based training initiatives	- *Focus on good operational examples of situation awareness and threat and error management in recurrent TRM training;* - *Focus on good examples of error capture at shift handover at regular toolbox task;* - *Use shift handover as an opportunity for team problem solving, where the incoming shift, with fresh eyes, may help to resolve any issues which have occurred during the outgoing shift.*

Error prevention strategies:

Error prevention	Sample strategies
Reinforce the stringent use of checklist to combat memory limitations	- *Establish 'non-negotiable' policy that states checklists, not memory always to be used;* - *Regular use of industry-based examples via safety alerts demonstrating the perishable nature of memory and potential outcomes.*
Standardize and simplify procedures	- *Establish a technical committee that meets regularly to identify opportunities to rationalize procedures;* - *Ensure correction actions from safety investigations do not always rely on procedural changes.*
Identify jobs and tasks that are at risk of fatigue proofing strategies	- *Focused fatigue countermeasures (e.g. breaks, staff backup' supervisory monitoring, etc.) on those jobs that are safety critical;* - *Proactively identify fatigue-producing rosters through staff feedback.*
Use hazard or near-miss reporting systems to identify error management lessons	- *Establish formal policy statement: 'a failure to report is a violation';* - *Regular feedback to staff via newsletter or safety meeting of near-miss examples reported.*
Decrease reliance on personal vigilance via the strategic use of automation/technology	- *Regular industry benchmarking to identify 'smart technology' to complement human operator.*

6.4 Relationship Between Human Factors and SMS

6.4.1 Integrating human factors (HF into SMS is importance: without good HF program, safety management becomes difficult. It is unlikely that SMS will achieve its full potential for improving safety performance without a full understanding and application of HF principles by all staff to support a positive safety culture.

6.4.2 The ATSP can demonstrate integration of HF in SMS by including consideration of the following (as minimum):

a) hazard identification, and risk assessment and mitigation;
b) management of change;
c) training of operational staff;
d) job and task design;
e) safety reporting and data analysis; and
f) incident/accident investigation.

6.4.3 Integrating human factors into hazard identification and reduction

a) Hazard identification program can reveal potential or actual errors and their underlying causes.

6.4.4 Management of Change

a) Any major change within organization has the potential to introduce or increase human factors issues. For example, changes in machinery, equipment, technology, procedures, work organization or work processes are all likely to affect performance and cause distractions.
b) Carefully consider the magnitude of change: how safety-critical is it? What is its potential impact on human performance? Consider human factors issues especially during the transition period of the change.

6.4.5 Design Systems and Equipment

a) Poorly thought-out equipment design can have a major impact on the performance of staff, and ATSP should ensure that there is good fit between the equipment and those using it.
b) The design of equipment such as displays and control systems, signals and warnings, as well as automated systems, may involve significant human factors risks.

6.4.6 Training of Operational Staff

a) Before training operational staff in non-technical skills, do a training needs analysis, so that ATSP should know which error management measures to target to which groups (individuals and/or teams)
b) Training requirements to consider are included in:
   - understanding the role of human performance in accident prevention and causation;
   - safety culture, safety accountability and the role of safety reporting outline;
   - the responsibilities of management and employees in developing, implementing, operating and maintaining an SMS;
   - crisis management and emergency response planning;
   - safety promotion;
   - communication skills; and
   - specialized training or familiarization in, for example,
     - Team Resource Management (TRM);
     - Treat and Error Management (TEM);
     - Fatigue Risk Management System (FRMS); and
     - Line Operations Safety Audit (LOSA)

6.4.7 Task and Job Design

a) Task and job design can significantly affect human performance. Tasks involving excessive time pressure, a complex sequence of operations, relying overly on memory, or that are physically or mentally fatiguing, are likely to negatively affect performance.
b) Task design is essentially about task matching – make sure that tasks and activities are appropriate and suited to a person's capabilities, limitations and personal needs.

6.4.8 Safety Reporting Systems and Data Analysis

a) ATSP's safety reporting system should not only collect information about notifiable occurrences and incidents, but also hazards, near-misses and errors that otherwise might have gone unnoticed
b) The ATSP endure staff are aware of, and know how to report, even the most minor events to help avert more serious incidents. Systems to encourage open reporting based on thrust, acceptance and motivation include:
   - non-punitive, confidential hazard and incident reporting system;
   - formal and informal meetings to discuss safety concerns;
   - feedback from management about action taken as a result of hazard and incident reports or safety meeting.

6.4.9 Incident/Accident Investigation

a) The ATSP should make sure that internal investigation procedures detail clearly how human factors considerations are included. The main purpose of investigating an accident or incident is to understand what happened, how it happened, and why it happened, to prevent similar events in the future. Use a model (such as Reason's model) or framework for investigations and consider human error, both at the individual and organizational levels.

b) The investigators need to be trained in basic human factors concept and design procedures to be able to establish which human performance factors might have contributed to the event.

6.5 Responsibility of ATSP with Regard to the Problematic Use of Psychoactive Substances by ATCO

6.5.10 Introduction

a) Psychoactive substances considered in this document are: Alcohol, opioids, cannabinoids, sedatives and hypnotics, cocaine, other psychostimulants, hallucinogens, and volatile solvents, whereas caffeine and tobacco are excluded.

b) Problematic use of substances or problematic substance use is the use of one or more psychoactive substances by aviation personnel in a way that:

- constitutes a direct hazard to the user or endangers the lives, health, or welfare of others; and/or
- causes or worsens an occupational, social, mental, or physical problem or disorder.

6.5.11 The Air Traffic Controllers' problematic Substance Use Policy

NOTE 1: *Guidance for the development and implementation of policy, procedures, training and education programs is contained in ICAO Doc 9654 'Manual on Prevention of Problematic Use of Substances in the Aviation Workplace'.*

NOTE 2: *Scientific material proposed as guidance for information and education programs on stress may be found in the EUROCONTROL document 'Human Factors Module — Stress', edition 1.0 of 15 March 1996.*

6.5.12 Third Party Assistance to ATCOs

a) The ATSP may employ third-party assistance. Such assistance should be made freely available to air traffic controllers who are dependent on psychoactive substances.

6.5.13 Procedure for Detection of Cases of Problematic Use of Psychoactive Substances

a) The objective, transparent and non-discriminatory procedure should specify:

- the mechanisms and responsibilities for its initiation;
- its applicability in terms of timing and locations;
- the person(s)/body responsible for testing the individual;
- the testing process;
- thresholds for psychoactive substances;
- the process to be followed in case of detection of problematic use of psychoactive substances by an air traffic controller; and
- the appeal process.

6.6 Stress

6.6.1 Stress Management Policy

a) The air traffic controllers' stress management policy should:

- declare the commitment to proactively and systematically monitor and manage stress, and describe the expected benefits for the safety of operations;
- be signed by the accountable executive;
- reflect organizational commitments regarding the implementation of a critical incident stress management program;
- be communicated, with visible endorsement, throughout the ATSP;
- include the commitment to:
  - provide appropriate resources;
  - consider the best practices;
  - enforce stress management program(s) as a responsibility of managers, staff involved in stress management and air traffic controllers;
- be periodically reviewed to ensure it remains relevant and appropriate.

b) The ATSP should establish and implement

- procedures for critical incident stress management;
- principles and procedures to enable stress reporting;
- principles and procedures for occurrence investigation and analysis to consider stress as contributing factor; and
- method(s) for the identification and management of the effect of air traffic controllers' stress on the safety of operations.

6.6.2 Impact of Stress on Air Traffic Controllers' performance of Air Traffic Control Tasks.

a) Any source of stress has the potential to create unique subjective experiences in different individuals, and these may be positive or negative experiences or something in between.

6.6.3 Negative Experiences of Stress

a) There is a number of ways in which stress experienced by ATCOs can be manifested in the performance of air traffic control tasks. Some of these are:

- difficulty in concentrating and reduced vigilance — easily distracted;
- errors, omissions, mistakes, incorrect actions, poor judgment and memory;
- tendency to cut corners, skip items and look for the easiest way out;
- either slowness (due to lack of interest) or hyperactivity (due to adrenaline);
- focusing on easily manageable details while ignoring serious threats;
- tendency to pass responsibility on to others;
- fixation on single issues or even a mental block;
- unwillingness to make decisions — decisions are postponed or take longer to be made;
- fewer plans and backup plans are made.
- increase in risk-taking, leading to an increase in the number of violations, especially when frustrated with failures;
- excessively hurried actions — due to adrenaline and alertness level, there is a tendency to act very quickly even when there is no time pressure. Hurried actions increase the chance of errors;
- In cases of significantly high stress, a controller will often:
  - return to old procedures that may no longer be applicable, appropriate or safe;

- use non-standard phraseology when communicating;
- return to the use of one's native language; and/or
- look for items in a place where they used to be, but are no longer located.

But, in general terms, performance of tasks decreases due to the detrimental effects that high levels of stress can have on perception, awareness, decision-making and judgement. In the longer term, health and well-being may also be compromised, leading to decreased performance of air traffic controllers.

6.6.4 Mitigation of Stress in the Individual and the Organization.

a) The ATSP have a duty to take care of their employees and the customers of their services. They should aim at mitigating the negative effects of stress. This is best achieved by ensuring that a range of preventative measures as well as countermeasures are in place. These include:

- adoption of a stress policy and/or a critical incident stress management policy within the organization;
- completion of regular risk assessment of sources of occupational stress and its effects on individuals and operations;
- employee stress level monitoring;
- adoption of stress intervention/mitigation/prevention practices and, where the organization identifies a source of stress, use of a stress team/committee;
- stress management training for all levels of employees;
- education and prevention programs on stress; and
- staff support mechanisms (e.g. peer counselling, professional support from health practitioners, critical incident stress management (CISM) programs);
- adequate rostering allowing time to evacuate stress; and
- promotion of sports or relaxation activities.

6.6.5 Critical Incident Stress Management.

a) The purpose of critical incident stress management (CISM) programs is to prepare an organization for the potential aftermath of an incident. These programs come in a number of different forms, but have the added benefit of providing education on the effects of stress, how stress affects performance and stress management, even when the incident is relatively minor and perhaps personal to the individual.

6.7 Fatigue

6.7.1 Fatigue Management Policy

a) The air traffic controllers' fatigue risk management policy should:

- The air traffic controllers' fatigue management policy should:
  - declare the commitment to proactively and systematically monitor and manage fatigue and describe the expected benefits for the safety of operations;
  - be signed by the accountable executive;
  - address the mitigation of the operational impact of air traffic controllers' fatigue;
  - be communicated, with visible endorsement, throughout the ATSP;
  - include a commitment to: consider the best practices, provide appropriate resources, and enforce fatigue management as a responsibility of managers, staff involved in fatigue management procedures and air traffic controllers;
  - be periodically reviewed to ensure it remains relevant and appropriate.

NOTE: *Guidance material on fatigue and its effects on safety-relevant aviation professionals may be found in ICAO Doc 9966 'Manual for the Oversight of Fatigue Management*

Approaches' and CANSO/ICAO/IFATCA Fatigue Management Guide for Air Traffic Service Providers.

6.7.2 Information Program

a) Information programs may consist of lectures, leaflets, posters, CDs, and any other informative material to raise the awareness of the effects of fatigue on the individuals and on air traffic control service provision, and to advise on the need and the means to manage it. When choosing the most appropriate information program and the medium, the air traffic control service provider should evaluate the level of awareness of its staff of fatigue management, the type of operations (e.g. single-person operations, nightshifts), and the periodicity of human factors training in the scope of refresher training.

6.8 ATCOS' Rostering System

6.8.1 Structure and Values of the Rostering System

a) The selection and the regular revision of an appropriate structure and of appropriate values of the rostering system, and which fit the intended operations, should be based upon:

- scientific principles;
- data gathered by the ATSP; and
- best practices.

b) Additional guidance concerning the involvement of air traffic controllers in the definition of rostering systems is available in CANSO/ICAO/IFATCA Fatigue Management Guide for Air Traffic Service Providers.

7. Forms

7.1 ATS SMS Initial Implementation and Evaluation Checklist (CAAT-ANS-TM-108)

For submission ATS SMS for approval, a completed statement of compliance in ATS SMS Initial Implementation and Evaluation Checklist (CAAT-ANS-TM-108) must be submitted by the ATSP. The referenced checklist is available in CAAT website (https://www.caat.or.th/th/archives/category/license-certification-th)