CAR SMS

SAFETY MANAGEMENT SYSTEM (SMS)

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FOREWORD

This regulation specifies the requirements to be met by organisations listed under SMS.GEN.001 a) for the establishment of safety management systems. The purpose of an SMS is to provide organisations with a systematic approach to managing safety. It is designed to continuously improve safety performance through the identification of hazards, the collection and analysis of safety data and safety information, and the continuous assessment of safety risks and mitigations.

The SMS seeks to proactively mitigate safety risks before they result in aviation accidents and incidents. It allows organisations to effectively manage their activities, safety performance and resources, while gaining a greater understanding of their contribution to aviation safety. An effective SMS demonstrates to the GCAA, the ability of the concerned organisation to manage safety risks.

(a) The first component of the SMS framework focuses on creating an environment where safety management can be effective. It is founded on a safety policy and objectives that set out senior management's commitment to safety, its goals and the supporting organisational structure.

~~(b)~~ The second component is SRM process which systematically identifies hazards that exist or may exist within the context of the delivery of its products or services.

(c) The third component requires organisations develop and maintain the means to verify the safety performance of the organisation and to validate the effectiveness of safety risk controls.

(d) The fourth component is about safety promotion which encourages a positive safety culture and helps achieve the organisation's safety objectives through the combination of technical competence that is continually enhanced through training and education, effective communication, and information-sharing. Senior management provides the leadership to promote the safety culture throughout an organisation.

HISTORY RECORD

Issue	Subject(s)	Date of Applicability
Issue 06 10 March 2022	New issue following NPA 2019-03 and related CRD.	1st April 2023
Issue 06 (CORRECTED)	Typo and format review	26 February 2026

PART 1: GENERAL REQUIREMENTS

SMS.GEN.001 GENERAL REQUIREMENTS

(a) Organisations approved/certified, in accordance with the following CARs, shall develop, implement and maintain an SMS as prescribed by this CAR:

(1) CAR Part II Chapter 9 (CAR-ORA) and CAR Part III Chapter 8 (CAR-AARA) for training organisations operating aircraft;

(2) CAR Part IV Operations Regulation (CAR-AIR OPS Part ORO) for air operators; including:

i. the CAR M organisation falling under the AOC/AOA; and

ii. any maintenance activities when conducted by a:

A. UAE based maintenance organisation with rating other than those specified under 1)a)3); or

B. Maintenance organisation based outside UAE.

(3) CAR Part V CAR 145 for UAE based CAR 145 organisations holding Class A or B ratings;

(4) CAR Part V CAR 21 (Subparts F, G or J) for UAE based organisations involved in the design and production of complete aircraft;

(5) CAR Part VIII Air Navigation Regulations;

(6) CAR Part IX Aerodrome Regulations.

(b) When an organisation holds more than one approval/certificate issued under the scopes listed under 1a)1) to 1a)6) above, its SMS shall be integrated to cover all approval certificates it holds.

(c) The SMS shall be acceptable to the GCAA.

(d) The SMS shall be commensurate with the size of the organisation and the nature and complexity of its activities, taking into account the hazards and associated risks inherent in these activities.

GM1 SMS.GEN.001 (a) GENERAL REQUIREMENTS

APPENDIX 1 contains the necessary definitions to implement this CAR.

GM2 SMS.GEN.001 (a) GENERAL REQUIREMENTS

The establishment of an SMS requires time and should follow a phased approach. APPENDIX 6 provides guidance to facilitate SMS implementation.

As part of its surveillance system, the GCAA will evaluate the effectiveness of the SMS by the conduct of regular SMS evaluation using GTF-SMS-002a and GTF-SMS-002b. These forms may as well be used by organisations to verify effective implementation of their SMS.

GM SMS.GEN.001 (a)(2) GENERAL REQUIREMENTS

In lieu of the requirement prescribed under PART 2. FRAMEWORK FOR SMS, other than commercial air transport operators may determine the SMS requirements for the aircraft they are operating provided it is acceptable to the State of Registry. When UAE is the State of Registry, the use of an industry code of practice, such as ISO 31000 standards applied to aviation activities, may be permitted.

GM SMS.GEN.001 (b) GENERAL REQUIREMENTS

Organisations with multiple approvals/certifications need to ensure the following when assessing one SMS covering multiple approvals/certifications:

(a) SMS monitoring policies and processes are consistently applied throughout the organisation;

(b) The following elements are documented:

(1) its policies and procedures for how safety data and safety information are shared, communications are relayed, decisions are made, and resources are allocated across the different activity areas and, where applicable, with different regulatory authorities;

(2) the organisational structure and interfaces between different systems and activities in its system description.

(3) the scope of an SMS is clearly defined in the system description and details the individual activities.

GM SMS.GEN.001 (d) GENERAL REQUIREMENTS

It is important to realise that there is no ‘one size fits all’ in terms of SMS development and implementation; what is important is to develop an SMS that works for each organisation and is effective. It is expected that each organisation will implement an SMS that works for its unique situation, defining for itself how it intends to go about fulfilling the fundamental requirements for an effective SMS.

AMC SMS.GEN.001 (d) GENERAL REQUIREMENTS

(a) The organisation should prepare a system description to identify its organisational structures, processes, and business arrangements that it considers important to the safety management functions.

(b) Based on the system description, the organisation should identify or develop policy, processes, and procedures that establish its own means to comply with safety management requirements. Regardless of the organisation's size and complexity, all elements of the SMS framework should apply.

(c) The following considerations may be used to determine that an SMS is commensurate with size and complexity:

(1) availability of resources (including the committees and specific safety specialists as needed);

(2) interfaces with external organisations;

(3) operating environment (mountainous terrain, offshore operations, etc.);

(4) number of types of operations (passenger operations, cargo, aerial work, Emergency Medical Services, etc.);

(5) scopes of approvals;

(6) number of approvals/certificates it holds;

(7) fleet complexity —number of aircraft or aircraft types;

(8) number of locations (bases);

(9) maintenance —number of ratings, types of product ratings, specialized work, technologies employed, number of customers and sub-contractors;

(10) types of products and parts designed/manufactured;

(11) number of aircraft movements (aerodromes and Air Navigation Service Providers (ANSPs);

(12) surrounding terrain and levels of equipment at aerodromes;

(13) density and complexity of traffic for ANSPs;

(14) extent of contracted activities; and

(15) number of runways and taxiways at aerodromes.

PART 2: FRAMEWORK FOR SMS

SUBPART 1: SAFETY POLICY AND OBJECTIVES

SECTION 1: MANAGEMENT COMMITMENT

SMS.SPO.001 Safety Policy

The organisation shall develop, document, implement and maintain up to date a safety policy.

GM to SMS.SPO.001 Safety Policy

(a) Management commitment and safety leadership is key to the implementation of an effective SMS and is asserted through the safety policy and the establishment of safety objectives.

(b) Management commitment to safety is demonstrated through management decision-making and allocation of resources; these decisions and actions should always be consistent with the safety policy and objectives to cultivate a positive safety culture.

(c) Management commitment to an effective disciplinary policy is effective to determine whether an error or violation or negligence has occurred so that the organisation can establish whether any disciplinary action should be taken. Decision Tree for Determining Culpability of Unsafe Acts (from James Reason) may be used as a means for facilitating that determination.

AMC to SMS.SPO.001 Safety Policy

The Safety Policy should:

(a) reflect organisational commitment regarding safety as a primary responsibility of all managers, including the continuous improvement of the level of safety performance, the compliance with all the regulatory requirements and the promotion of a positive safety culture (APPENDIX 2 contains Guidance for developing, maintaining and monitoring a Safety Culture);

(b) include a clear statement about the provision of the necessary resources for the implementation of the safety policy and achievement of the safety objectives;

(c) promote a positive reporting safety culture to encourage the reporting of safety issues (APPENDIX 3 contains means for protecting safety data, information and related sources);

(d) clearly indicate which types of behaviours are unacceptable related to the organisation's aviation activities and include the circumstances under which disciplinary action would not apply;

(e) be signed by the Accountable Manager;

(f) be communicated, with visible endorsement by the senior management and Accountable Manager, throughout the organisation to ensure all personnel understand and work in accordance with the safety policy;

(g) be periodically reviewed to ensure it remains relevant and appropriate to the organisation, in accordance with the periodic cycle established in the SMS Manual, based on inputs from safety analyses (PART 2 SUBPART 2); and in response to major changes in the operation, top risks or environment (e.g. a change in the accountable manager should require its review);

(h) be, during its development, reviewed by key safety personnel, and where appropriate, staff representative bodies to promote a sense of shared responsibility; and

(i) be embedded into all SMS processes, including safety promotion activities (Refer to PART 2 SUBPART 4).

SMS.SPO.005 Safety Objectives

(a) The organisation shall develop, document, implement and maintain up to date safety objectives with due consideration to its safety policy.

(b) The safety objectives shall:

(1) form the basis for safety performance monitoring and measurement as required by SMS.SA.001 ;

(2) reflect the organisation's commitment to maintain and continuously improve the overall effectiveness of the SMS;

(3) be communicated throughout the organisation; and

(4) be periodically reviewed to ensure they remain relevant and appropriate to the organisation.

GM to SMS.SPO.005 Safety Objectives

(a) Safety objectives provide direction to the organisation's activities and should therefore be consistent with the safety policy that sets out the organisation's high-level safety commitment. Safety objectives are also useful to communicate safety priorities to personnel and the aviation community as a whole.

(b) Establishing safety objectives provides strategic direction for the safety performance management process and provides a sound basis for safety related decision-making. The management of safety performance should be a primary consideration when amending policies or processes, or allocating the organisation's resources in pursuit of improving safety performance.

(c) Safety objectives may be:

(1) process-oriented: stated in terms of safe behaviours expected from operational personnel or the performance of actions implemented by the organisation to manage safety risk; or

(2) outcome-oriented: encompass actions and trends regarding containment of accidents or operational losses.

Examples of safety objectives	
process-oriented	a) Increase safety reporting levels b) improve voluntary reporting c) hold x number of safety meetings d) improvement in average meeting attendance rate e) increase average score of safety culture survey f) increase hazard reporting g) train employees on hazard identification
outcome-oriented	a) Reduce rate of adverse apron safety events. (high-level) b) Reduce the annual number of adverse apron safety events from the previous year c) reduce the number of fatigue incidents

(d) Safety objectives on their own do not have to be specific, measurable, achievable, relevant and timely (SMART) (George T. Doran, 1981), provided the safety objectives and accompanying SPIs and SPTs form a package that allows an organisation to demonstrate whether it is maintaining or improving its safety performance.

(e) Safety Objectives should be defined and established after answering the following questions regarding safety management:

(1) what are the organisation's top safety risks? Derived from a review of aviation accident and incident data as well as emerging risks.

(2) what does the organisation want to achieve in terms of safety and what are the top safety risks that need to be addressed?

AMC to SMS.SPO.005 Safety Objectives

Safety Objectives should:

(a) define what an organisation hopes to achieve in terms of safety (considering the organisation's most significant risks);

(b) reflect the safety policy;

(c) include a mix of both process-oriented and outcome-oriented objectives to provide enough coverage and direction for the SPIs and SPTs;

(d) be a statement of a desired outcome included in the safety policy or documented separately;

(e) be short, high level statements of the organisation's safety priorities;

(f) be, during its development, reviewed by key safety personnel, and where appropriate, staff representative bodies to promote a sense of shared responsibility; and

(g) be embedded into all SMS processes, including safety promotion activities (Refer to PART 2 SUBPART 4)

(h) be reviewed and updated:

(1) to ensure they are up to date and appropriate with the organisation's safety risks periodically, in accordance with the periodic cycle established in the SMS Manual;

(2) based on inputs from safety analyses (PART 2 SUBPART 2); and

(3) in response to major changes in the operation, top risks or environment (e.g. a change in the accountable manager should require its review).

SECTION 2: SAFETY ACCOUNTABILITIES AND RESPONSIBILITIES

SMS.SPO.010 Safety accountabilities and responsibilities

The organisation shall:

(a) appoint an Accountable Manager who, irrespective of other functions, is accountable on behalf of the organisation for the implementation and maintenance of an effective SMS to ensure safety performance of internal and external organisations supporting their activities;

(b) clearly define lines of safety accountability throughout the organisation, including a direct accountability for safety on the Accountable Manager;

(c) 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 organisation;

(d) document and communicate safety accountabilities, responsibilities and authorities throughout the organisation; and

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

GM to SMS.SPO.010 (a) Safety accountabilities and responsibilities

(a) There might be challenges for the organisation to identify the most appropriate person to be appointed as "accountable manager", especially in large complex organisations with multiple entities and multiple certificates, authorizations or approvals; and

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

AMC1 to SMS.SPO.010 (a) Safety accountabilities and responsibilities

The accountable Manager should:

(a) be the person who has ultimate authority over the safe operation of the organisation;

(b) be organisationally situated at the highest level of the organisation, thus ensuring the right strategic safety decisions are made and the SMS is effective.

AMC2 to SMS.SPO.010 (a) Safety accountabilities and responsibilities

Because organisations may be held accountable for the safety performance of products or services provided by external organisations supporting its activities, irrespective of the external organisations are or are not required to have an SMS, the SMS should:

(a) produce a comprehensive list of all interfaces. The rationale for this exercise is that there may be SMS interfaces which an organisation is not necessarily fully aware of. There may be interfaces where there are no formal arrangements in place;

(b) ensure interfaces are defined within the system description which is included in the SMS documentation. The "system" is a collection of systems both internal and external, and along with the interactions with one another create sources of hazards and contribute to the control of safety risks. An organisation will gain more control over these risks related to the interfaces if relationships are identified;

(c) assess their relative criticality. This enables the organisation to prioritise the management of the more critical interfaces, and their potential safety risks. Things to consider are:

(1) what is being provided;

(2) why it is needed;

(3) whether the organisations involved has an SMS or another management system in place; and

(4) whether the interface involves the sharing of safety data / information.

(d) manage and monitor interfaces to ensure the safe provision of products and services. Any hazard related to interfaces should be identified and associated safety risk assessments completed. Based on the risks identified, the other organisation should be involved while determining and undertaking the appropriate safety risk control.

(e) establish formal agreements to ensure the interfaces are managed effectively and remain up to date and relevant. These agreements should be able to address the following challenges associated with interface:

(1) when organisation's safety risk controls are not compatible with other organisation's;

(2) willingness of both organisations to accept changes to their own processes and procedures;

(3) insufficient resources or technical expertise available to manage and monitor the interface; and

(4) number and location of interfaces.

(f) ensure effective coordination with the organisation to:

(1) clarify each organisation's roles and responsibilities,

(2) agree on actions to be taken,

(3) identify safety information that needs to be shared and communicated,

(4) agree on how and when coordination should take place, and

(5) most importantly agree on solutions that benefit both organisations without impairing the effectiveness of the SMS.

(g) ensure all safety issues or safety risks related to the interfaces are documented and made accessible to each organisation for sharing and review. This will allow the sharing of lessons learned and the pooling of safety data that will be valuable for both organisations. Operational safety benefits may be achieved through an enhancement of safety reached by each organisation as the result of shared ownership of safety risks and responsibility.

GM to SMS.SPO.010 (b) and (c) Safety accountabilities and responsibilities

(a) Within the context of this regulation, "accountability" refers to an obligation that may not be delegated.

(b) "Responsibility" refers to functions and activities that may be delegated. For example, the accountability for implementation and maintenance of an effective SMS can never be delegated by the Accountable Manager. However, the Accountable Manager may elect to delegate some of his responsibilities to other personnel.

(c) The safety responsibilities should focus on the staff member's contribution to the safety performance of the organisation (the organisational safety outcomes). The management of safety is a core function; as such every senior manager has a degree of involvement in the operation of the SMS.

AMC to SMS.SPO.010 (b) Safety accountabilities and responsibilities

(a) Accountabilities and responsibilities of all personnel, management and staff, involved in safety-related duties supporting the delivery of safe products and operations should be clearly defined.

(b) The accountable manager’s authorities include, but are not limited to:

(1) the authority to make decisions on behalf of the organisation

(2) having final authority for the resolution of all safety issues; and

(3) having final authority over operations under the certificate, authorisation or approval of the organisation, including the authority to stop the operation or activity.

(c) Although responsibility for the day-to-day operation of the SMS can be delegated, the accountable manager cannot delegate accountability for the system nor can decisions regarding safety risks be delegated. The following safety accountabilities cannot be delegated:

(1) ensuring safety policy and safety objectives are established, appropriate and communicated;

(2) ensuring necessary allocation of resources (financing, personnel, training, acquisition);

(3) ensuring that the acceptable safety risk limits are set (the SRB may help setting these limits);

(4) resourcing of necessary controls;

(5) promoting a positive safety culture (See APPENDIX 2);

(6) ensuring appropriate actions are taken to address safety issues and safety risks;

(7) ensuring accidents and incidents are responded;

(8) ensuring the SMS is properly implemented and performing to requirements; and

(9) ensuring the continuous improvement of the SMS.

AMC to SMS.SPO.010 (d) Safety accountabilities and responsibilities

All accountabilities, responsibilities and authorities of the Accountable Manager and all members of management should:

(a) be stated in the organisation’s SMS Manual which includes applicable Organisational charts;

(b) be integral components of each individual’s job description;

(c) be communicated throughout the organisation;

(d) be determined with due consideration of type, size and complexity of the organisation;

(e) be allocated with due consideration of how a member will interface with the others. The organisation should aim to avoid conflicts of interest between individual' safety responsibilities and their other organisational responsibilities. They should allocate their SMS accountabilities and responsibilities, in a way that minimizes any overlaps and/or gaps; and

(f) include allocation of the human, technical, financial or other resources necessary for the effective and efficient performance.

GM to SMS.SPO.010 (e) Safety accountabilities and responsibilities

The authority of acceptability of risks and of making safety risk tolerability decisions may be assigned to an individual, a management position or a committee. A lower level manager (or management group) may be authorized to make tolerability decisions up to a certain level. Risk levels that exceed the manager's authority should be escalated for consideration to a higher management level with greater authority.

SECTION 3: MECHANISMS FOR EFFECTIVE SMS IMPLEMENTATION AND MAINTENANCE

SMS.SPO.015 Post Holder SMS

(a) The Accountable Manager shall appoint a person, acting as post holder SMS, who is responsible for the implementation and maintenance of an effective Safety Management System. The Post Holder SMS shall be accepted by the GCAA.

(b) The appointed person shall have direct access to the Accountable Manager to ensure that the Accountable Manager is kept properly informed on safety matters.

GM to SMS.SPO.015 (a) Post Holder SMS

Appointment of a competent person to fulfil the role of PH SMS is essential to an effectively implemented and functioning SMS.

AMC to SMS.SPO.015 (a) Post Holder SMS

(a) The responsibilities for the implementation and maintenance of the SMS cannot be assigned to more than one person, however the organisation may assign or maybe required to assign more persons to support the PH SMS in his/her role, in particular when the size of the organisation or the complexity of its aviation products or services requires it. Those persons may support the PH SMS as their sole function or combined with other duties, provided these do not result in any conflicts of interest.

(b) The Post Holder SMS should hold a senior management position.

(c) The PH SMS should not be directly involved in the product or service delivery but should have a working knowledge of these. The appointment should also consider potential conflicts of interest with other tasks and functions. Such conflicts of interest could include:

(1) competition for funding (e.g. financial manager being the safety manager);

(2) conflicting priorities for resources; and

(3) where the PH SMS has an operational role and the ability to assess the SMS effectiveness of the operational activities the PH SMS is involved in.

(d) The post holder SMS should be competent enough to understand the systems that support operations or the product/service provided; his/her competencies should include, but not be limited to, the following:

(1) safety management experience;

(2) operational experience related to the product or service provided by the organisation;

(3) analytical and problem-solving skills;

(4) oral and written communications skills; and

(5) an understanding of human factors.

(e) Depending on organisation's size and complexity (since some functions may be fulfilled by a group of persons), functions of the post holder SMS should include, but are not limited to:

(1) manage the SMS implementation plan on behalf of the accountable manager (upon initial implementation);

(2) perform/facilitate hazard identification and safety risk analysis;

(3) monitor corrective actions and evaluate their results, if not delegated to a SRB;

(4) provide periodic reports on the organisation's safety performance;

(5) maintain SMS documentation and records;

(6) plan, facilitate staff safety training and education programme and ensure there is a suitable safety training and education programme in place;

(7) ensure that lessons learnt from investigations and case histories or experiences, both internally and from other organisations, are distributed;

(8) provide independent advice on safety matters;

(9) monitor safety concerns in the aviation industry and their perceived impact on the organisation's operations aimed at product and service delivery;

(10) coordinate and communicate safety issues within the organisation as well as with external organisations (including the GCAA and other State authorities as necessary) on issues relating to safety; and

(11) monitor the Safety Data Collection and Processes Systems (**SDCPS**) to ensure prompt collection and analysis of safety data and appropriate distribution within the organisation of related safety information such that safety risk decisions and controls, as necessary, can be made.

GM to SMS.SPO.015 (b) Post Holder SMS

The Accountable Manager retains the ultimate accountability for the effective SMS; direct access should enable the Accountable Manager to ensure he/she remains informed of day-to-day safety risk or issues that would help him/her to discharge his/her accountabilities. This link is essential and as such the PH SMS should realise the potential consequence of not complying with this responsibility.

SMS.SPO.020 Safety Review Board

(a) Organisations shall establish and maintain a Safety Review Board (SRB) to support the SMS functions across the organisation.

(b) The SRB shall be commensurate with the size, complexity and nature of the organisation's operations.

GM to SMS.SPO.020 (a) Safety Review Board

(a) SRB is a high-level committee that considers matters of strategic safety importance in support of the Accountable Manager's safety accountability. Such committee could take the name of SRB or equivalent.

(b) The SRB provides the platform to achieve the objectives of resource allocation and to assess the effectiveness and efficiency of risk mitigation strategies. The SRB may support the AM to:

(1) review safety objectives;

(2) monitor safety performance and the achievement of safety targets;

(3) make timely safety decisions;

(4) allocate appropriate resources;

(5) hold managers accountable for safety responsibilities, performance and implementation timelines; and

(6) be seen by all personnel as an executive who is interested in, and in charge of, safety.

AMC to SMS.SPO.020 (a) Safety Review Board

(a) The SRB is chaired by the Accountable Manager and composed of senior managers, including line managers responsible for functional areas as well as those from relevant administrative departments.

(b) The Post Holder SMS should participate in the SRB.

(c) The SRB should meet periodically.

(d) The SRB should:

(1) monitor the effectiveness of the SMS;

(2) Provide strategic directions to improve safety performance.

(3) monitor that any necessary corrective action is taken in a timely manner;

(4) monitor safety performance against the organisation ‘s safety policy and objectives;

(5) monitor the effectiveness of the organisation’s safety management processes which support the declared corporate priority of safety management as another core business process;

(6) monitor the effectiveness of the safety supervision of subcontracted operations;

(7) ensure that appropriate resources are allocated to achieve safety performance~~;~~

(8) monitor the overall effectiveness of safety risk mitigation strategies; and

(9) monitor the effectiveness of the organisation’s safety management processes which support:

i. the safety priorities of the organisation; and

ii. promotion of safety across the organisation.

SMS.SPO.025 Safety Action Group(s)

Organisations may need to establish and maintain Safety Action Group(s) to achieve the safety strategies established by the SRB.

AMC to SMS.SPO.025 Safety Action Group(s)

(a) Departmental SAGs should be required when, at minimum, there is a need to:

(1) monitor operational safety performance within their functional areas of the organisation and ensure that appropriate SRM activities are carried out;

(2) review available safety data and identify the implementation of appropriate safety risk control strategies and ensure employee feedback is provided;

(3) assess the safety impact related to the introduction of operational changes or new technologies;

(4) coordinate the implementation of any actions related to safety risk controls and ensure that actions are taken promptly;

(5) monitor safety promotion activities as necessary to increase awareness of safety issues among relevant employees, and to ensure that employees are provided appropriate opportunities to participate in safety management activities;

(6) review the effectiveness of specific safety risk controls; and

(7) implement specific issues in accordance with the strategies developed by the SRB.

(b) When established, a SAG:

(1) may be established as a standing group or as an ad hoc group;

(2) Should normally be composed of line managers and front-line personnel;

(3) should normally be chaired by a designated line manager; and

(4) should take direction from and report to the SRB.

SECTION 4: COORDINATION OF EMERGENCY RESPONSE PLANNING

SMS.SPO.030 Coordination of emergency response planning

Organisations required to establish and maintain an emergency response plan shall ensure that their emergency response plan is properly coordinated with the emergency response plans of those organisations it must interface with during the provision of its products and services.

GM1 to SMS.SPO.030 Coordination of emergency response planning

(a) "Required" means that the safe delivery of products or services of an organisation can be compromised by a situation of emergency (e.g. accidents and incidents in aircraft operations and other aviation emergencies).

(b) Current common safety management best practices within the aviation industry include the need for the establishment and maintenance of an emergency response plan by aircraft operators, air navigation services providers and aerodromes operators. In general, these references stress the need for these systems to guarantee that there is an orderly, safe and efficient transition from normal to emergency operations, and back to normal operations.

GM2 to SMS.SPO.030 Coordination of emergency response planning

The ERP should address foreseeable emergencies as identified through the SMS and include mitigating actions, processes and controls to effectively manage aviation-related emergencies.

AMC to SMS.SPO.030 Coordination of emergency response planning

(a) The ERP should be documented in the format of a manual or directly integrated into the SMS Manual. If the Emergency Response Plan is documented in a separate document, it should be cross-linked to SMS manual.

(b) It should reflect the size, nature and complexity of the activities performed by the organisation.

(c) An ERP manual should be developed as per Appendix 5.

SECTION 5: SMS DOCUMENTATION

SMS.SPO.035 SMS Documentation

(a) The organisation shall develop and maintain up to date SMS Manual endorsed by the Accountable Manager to show compliance with this CAR.

(b) The SMS Manual and its changes shall be accepted by the GCAA unless the change is minor.

GM to SMS.SPO.035 (a) SMS Documentation

(a) The SMS manual may be a stand-alone document, or it may be integrated with other organisational documents (or documentation) maintained by the organisation.

(b) Where details of the organisation's SMS processes are already addressed in existing documents, appropriate cross-referencing to such documents is enough.

AMC to SMS.SPO.035 (a) SMS Documentation

The SMS manual should:

(a) define the organisation's approach to the management as established by the organisation's safety policy and in accordance with the requirements of this CAR;

(b) describe the organisation's management system with assigned accountabilities, responsibilities and authorities, SMS policies, processes and procedures to facilitate the organisation's internal administration, communication and maintenance of the SMS.

(c) be designed in a manner that helps personnel to understand how the organisation's SMS functions, and how the safety policy and objectives will be met;

(d) help clarify the relationship between the various policies, processes, procedures and practices, and define how these link to the organisation's safety policy and objectives.

(e) be adapted and written to address the day-to-day safety management activities that can be easily understood by personnel throughout the organisation.

(f) be structured as per APPENDIX 8, which also provides more details.

AMC to SMS.SPO.035 (b) SMS Documentation

(a) The organisation should define in its SMS manual the changes that require acceptance by the GCAA before they are implemented.

(b) Minor changes are those that will not affect the acceptance of the organisation's SMS. It is left to the organisation to classify changes.

(c) For example, the following are minor changes,

(1) Changes in the means of safety communications;

(2) Typo corrections.

(d) For example, the following are not minor changes:

(1) Change to Accountable Manager or PH SMS, unless both persons have been already accepted by the GCAA;

(2) Changes to Organisations chart that affect reporting lines or Accountable Manager's accountabilities;

(3) Changes due to re-allocation of accountabilities, responsibilities, or authorities.

SECTION 6: SMS OPERATIONAL RECORDS

SMS.SPO.040 SMS-operational record

The organisation shall develop and maintain up to date all SMS-operational records as part of its SMS documentation.

GM to SMS.SPO.040 SMS-operational record

SMS-operational records aims at substantiating the existence and ongoing operation of the SMS. Operational records are the outputs of the SMS processes and procedures such as the SRM and safety assurance activities. SMS operational records may be in the form of stand-alone documents or may be integrated with other organisational documents (or documentation) maintained by the organisation

AMC1 to SMS.SPO.040 SMS-operational record

SMS operational records related to Safety Management System should include but are not limited to:

(a) hazards register and hazard/safety reports;

(b) Safety Performance Indicators, targets and related charts;

(c) record of completed or in-progress safety assessments (the results of the assessment of the potential adverse consequences or outcome of each hazard should be as per APPENDIX 10);

(d) SMS internal review or audit records;

(e) records of SMS/safety training records and safety promotion records;

(f) SMS/safety committee meeting minutes (such as SRB, SAGs);

(g) SMS implementation plan including gap analysis (during implementation process); and

(h) Gap analysis to support implementation plan.

AMC2 to SMS.SPO.040 SMS-operational record

SMS operational records should be designed with due consideration of the following:

(a) The format of the records should be specified in the organisation's procedures.

(b) Records should be stored in a manner that ensures protection from damage, alteration, and theft.

(c) The record keeping system should ensure that all records are accessible whenever needed and records should be organised in a way that ensures traceability throughout the required retention period. The period should be sufficient enough to enable to demonstrate to the organisation and to the GCAA that the SMS is functioning, operating and maturing adequately.

(d) Paper systems should use robust material which can withstand normal handling and filing. Computer systems should have at least one backup system which should be updated within 24 hours of any new entry. Computer systems should include safeguards against the ability of unauthorised personnel to alter the data.

(e) All computer hardware used to ensure data backup should be stored in a different location from that containing the working data, and in an environment that ensures they remain in good condition. When hardware or software changes take place, special care should be taken that all necessary data continues to be accessible at least through the full period specified in the relevant provision. In the absence of such indication, all records should be kept for a minimum period of 5 years.

(f) The records should remain legible throughout the required retention period. The retention period starts when the record has been created or last amended.

SUBPART 2: SAFETY RISK MANAGEMENT

SMS.SRM.001 Hazard Identification

(a) The organisation shall develop, document, implement and maintain up to date a process that collects, records, identifies, acts and feedbacks on hazards associated with its aviation products or services.

(b) The hazard identification process shall use a combination of reactive and proactive methods.

GM to SMS.SRM.001 (a) Hazard Identification

One of the main sources for identifying hazards is the safety reporting systems, especially the voluntary safety reporting system. The mandatory system is normally used for incidents that have occurred, whereas the voluntary system provides an additional reporting channel for potential safety issues such as hazards, errors, or other human factors related issues. They can provide valuable information to the organisation on lower consequence events.

Appendices 4a and 4b provide guidance to enhance hazard identification and safety investigations, respectively.

AMC1 to SMS.SRM.001 (a) Hazard Identification

The required process should:

(a) determine what safety data and safety information it must collect to support the safety performance management process and make safety decisions;

(b) collect and store safety data that come from different sources, both internal and external

(c) clearly define the responsibilities for the identification of hazards for the entire chain of services within the system (including external organisation), without gaps or overlaps;

(d) ensure the organisations is knowledgeable about the safety risks induced by the activities of their contractor(s);

(e) document the sources that will be used for hazard identification;

(f) ensure the protection to safety data, safety information and related sources in accordance with Appendix 3;

(g) be systematically conducted on all sources employed and where possible, be carried out as a joint exercise with the interfacing organisations;

(h) ensure effective coordination among departments or divisions is necessary to streamline efforts for reporting and collecting safety data to avoid duplication; and

(i) document hazards and their potential consequences and ideally categorise safety data using taxonomies and supporting definitions so that the data can be captured and stored using meaningful terms (i.e. it would help identifying potential or emerging risks).

AMC2 to SMS.SRM.001 (a) Hazard Identification

Internal safety reporting systems should:

(a) facilitate the collection and evaluation of errors, near-misses, and hazards reported internally;

(b) ensure corrective and preventive actions are taken internally to address any safety issues and hazards;

(c) ensure feedback to the organisation's safety training, whilst maintaining appropriate confidentiality;

(d) provide feedback to the reporter on what decisions or actions have been taken to ensure his/her support to the internal reporting system and disseminate the results to other relevant parties. This helps to promote a positive safety culture and encourage future reporting;

(e) have appropriate protections and a non-punitive approach which encourage safety reporting within a system that clearly indicates which types of behaviours are unacceptable;

(f) be confidential (at least for voluntary safety reporting systems);

(g) be accessible to personnel at all levels and across all disciplines (including at the SMS interfaces and external organisations supporting the activities). Depending on the situation, a paper-based, web-based or desktop form can be used. Having multiple entry methods available maximizes the likelihood of staff engagement;

(h) be promoted to ensure that everyone is made aware of the benefits of safety reporting and what should be reported;

(i) use a taxonomy, or a classification system, as much as practicable;

(j) record all identified hazards and their potential consequences;

(k) use a structured decision-making approach with defined criteria points to initiate an investigation, including occurrences and hazards considered to have a high-risk potential;

(l) allow the effective application of the investigation process to:

(1) identify factors contributing to occurrences to reduce the likelihood of reoccurrence and severity;

(2) identify adverse trends;

(3) identify those reports which require further investigation; and

(4) conclude with clearly defined findings, all root causes, including any technical, organisational, managerial, or human factors issues, and any other contributing factors relating to the event and recommendations that eliminate or mitigate safety deficiencies.

GM to SMS.SRM.001 (b) Hazard Identification

(a) Depending on the hazard identification sources and the approach to hazard identification, two groups of methods for identifying hazards can be defined:

(1) Reactive hazard identification methods - hazards are recognised through trend monitoring and investigation of safety occurrences. Incidents and accidents are clear indicators of systems' deficiencies and should be therefore investigated to determine the hazards that played role in that event.

(2) Proactive hazard identification methods - hazards are identified analysing systems' performance and functions for intrinsic threats and potential failures. The most commonly applied proactive methods are the safety surveys, operational safety audits, safety monitoring and safety assessments. Other methods, such as Flight Data Analysis (FDA), specifically designed to track normal operations (trends), and Line Operations Safety Audit (LOSA) and Normal Operations Safety Survey (NOSS) designed to capture real life strategies (i.e. human performance), play an important role in proactive hazard identification.

(b) According to the Future Aviation Safety Team (FAST) three complementary approaches should be used to identify hazards that affect safety of the global aviation system:

(1) The "Historic" approach is based on accident and incident investigation and analysis. It uses proven investigative techniques to discover all facts pertinent to a past aviation incident or accident, and thus identify opportunities for improvements meant to avoid future, similar accidents.

(2) The "Diagnostic" approach is targeted at identifying accident pre-cursors within the larger collections of information in various aviation safety reporting systems. There are many diagnostic processes being developed for application to the global aviation system.

(3) A "Predictive" approach is aimed at discovering future hazards that could result as a consequence of future changes inside or outside the global aviation system, and then initiating mitigating action before the hazard is introduced. predictive hazard identification informs design processes so that the hazards can be eliminated from the future, avoided in the future, or mitigated in the future.

SMS.SRM.005 Safety Risk Assessment and Mitigations

(a) The organisation shall develop, document, implement and maintain up to date a process that ensures analysis, assessment, and control of the safety risks associated with identified hazards.

(b) The organisation shall:

(1) provide Accountable Manager, person or group of persons and organisations that are involved in the organisation' SMS with safety analysis reports appropriate to the level of accountabilities, responsibilities and authorities they have;

(2) demonstrate its commitment for safety information sharing and exchange; and

(3) employ data-driven decision-making methods for the management of its safety performance.

GM to SMS.SRM.005 (a) Safety Risk Assessment and Mitigations

APPENDIX 4a and 4c contain more guidance for safety risk assessment and safety analysis.

AMC to SMS.SRM.005 (a) Safety Risk Assessment and Mitigations

The organisation should:

(a) appoint a person or a group of persons to gather, aggregate and analyse available data. The safety analyst should analyse data to identify and document potential hazards as well as corresponding effects or consequences;

(b) develop a safety risk assessment model and procedures which will allow a consistent and systematic approach for the assessment of safety risks. This should include a method that will help determine what safety risks are acceptable or unacceptable and to prioritise actions with associated authorities;

(c) clearly define the responsibilities for the management of associated safety risks for the entire chain of services within the system (including external organisation), without gaps or overlaps;

(d) once safety risks have been assessed, engage in a data-driven decision-making process to determine the safety priorities and what safety risk controls are needed. The prioritisation process should be designed in a manner to:

(1) assess and control highest safety risks; assessment of the safety risks should be in terms of probability and severity (refer to Appendix 4c). The tolerability of safety risk should be based on the organisation's safety policy and objectives, and within the authorities provided in the SMS Manual;

(2) allocate resources to highest safety risks;

(3) effectively maintain or improve safety;

(4) achieve the stated and agreed safety objectives and SPIs/SPTs; and

(5) satisfy regulatory requirements with regards to control of safety risks.

(e) involve the "end users" and subject matter experts in determining appropriate safety risk controls to maximize the practicality of safety risk chosen mitigations;

(f) document SRM outputs;

(g) establish procedures for developing and implementing corrective actions/mitigations. These should result in a specific corrective action plan that addresses the following:

(1) Development and proposal of the corrective action;

(2) Analysis and final approval level of the corrective action, including who is responsible for approval of the corrective action;

(3) Who will implement the corrective action;

(4) How the responsible person will implement the corrective action;

(5) When the corrective action completion due date is;

(6) Who will evaluate the outcome and how, including identification of data requiring collection, awareness of the possibility of unintended consequences, and events that should trigger a response;

(7) Who will monitor the status of the corrective action and how;

(8) Reporting the status of the corrective action (to whom, with what frequency).

(h) assess each safety risk mitigation measure decided from the following perspectives:

(1) Effectiveness: The extent to which the measure reduces or eliminates the safety risk. Effectiveness can be determined in terms of the technical, training and procedural defences that can reduce or eliminate safety risks.

(2) Cost/benefit: The extent to which the perceived benefits of the mitigation outweigh the costs.

(3) Practicality: The extent to which the mitigation is implementable and appropriate in terms of available technology, financial and administrative resources etc.

(4) Acceptability: The extent to which the stakeholder willingly adopts and embraces the measure.

(5) Enforceability: The extent to which compliance with new operating procedures can be monitored.

(6) Durability: The extent to which the measure will be sustainable and effective.

(7) Residual safety risks: The degree of safety risk that remains subsequent to the implementation of the initial mitigation, and which may necessitate additional risk control measures.

(8) Unintended consequences: The introduction of new hazards and related safety risks associated with the implementation of any mitigation alternative.

(9) Time. Time required for the implementation of the safety risk mitigation alternative.

(i) ensure that the effective implementation of all above mentioned processes, including evidences of its day by day proper implementation, should be available and used in the internal organisation quality assurance process, with the aim to accomplish its utmost objectives; and

(j) review and customize periodically SRM tools to ensure they are suitable for the organisation's operating environment.

GM1 to SMS.SRM.005 (b)(1) Safety Risk Assessment and Mitigations

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

(a) take immediate corrective actions;

(b) implement safety risk-based surveillance;

(c) define or refine safety policy or safety objectives;

(d) define or refine SPIs;

(e) define or refine SPTs;

(f) set SPI triggers;

(g) promote safety; and

(h) conduct further safety risk assessment.

GM2 to SMS.SRM.005 (b)(1) Safety Risk Assessment and Mitigations

(a) The results of data analysis should support the collection and analysis process since they may reveal that more and better data must be collected and analysed in support of the actions and decisions that the organisation needs to take. Reporting of analysis results may determine further requirements for data to be collected.

(b) Safety analysis results may be presented in several ways; the following are some examples:

(1) Imminent safety alerts: for the transmittal to GCAA, or organisations of safety hazards with potential outcomes that could be catastrophic, and which require immediate actions.

(2) Safety analysis reports: usually present quantitative and qualitative information with a clear description of the degree and source of the uncertainty involved in the analysis findings. These reports may also include relevant safety recommendations.

(3) Safety conferences: for GCAA and organisations to share safety information and safety analysis results that can promote collaborative initiatives.

GM3 to SMS.SRM.005 (b)(1) Safety Risk Assessment and Mitigations

(a) Visualization tools such as charts, graphs, images and dashboards should be employed since they are simple yet effective means of presenting results of data analysis.

(b) The safety performance of the organisation should be demonstrable and should clearly indicate to all interested parties that safety is being managed effectively. One approach to demonstrating this is through a "safety dashboard", which is a visual representation that enables senior executives, managers, and safety professionals a quick and easy way to view the organisation's safety performance.

(c) In addition to a real time display of the organisation's SPIs and SPTs, dashboards may also include information relating to category, cause and severity of specific hazards. Ideally, the information presented on the dashboard can be customized to display the information required to support the decision-making at varying levels of the organisation. The use of triggers is useful for providing basic visuals to highlight if there are any issues to be addressed for a specific indicator. Analysts and decision makers may appreciate the ability to configure the dashboard to display their top indicators as well as a feature which allows them to delve deeper into the metrics.

AMC to SMS.SRM.005 (b)(1) Safety Risk Assessment and Mitigations

(a) The results of a safety analysis should be made available to aviation safety stakeholders in a way that can be easily understood;

(b) The results of a safety analysis should be presented with the targeted audience, such as organisational decision makers, external organisations, in mind.

(c) Recommendations should be translated into action plans, decisions and priorities that decision makers in the organisation must consider and, if possible, it should outlined who needs to do what about the analysis results and by when.

GM to SMS.SRM.005 (b)(2) Safety Risk Assessment and Mitigations

(a) Safety can be further improved when safety information is shared or exchanged. It ensures a consistent, data-driven and transparent response to safety concerns at the global, national and organisational levels. Sharing of safety information refers to giving, while exchange refers to giving and receiving in return.

(b) SAFETY INFORMATION SHARING AND EXCHANGE networks are numerous and the following means an organisation could use to build their own capability via:

(1) Various Consultative Committee or other safety promotion activities established by the GCAA

(2) Trade Association networking platform (e.g. IATA, CANSO, ACI);

(3) ICAO RASG;

(4) ICAO Safety Management Implementation (SMI) website;

(5) Direct communication with GCAA (for time being using regulations@gcaa.gov.ae until an exchange platform within GCAA website is built).

AMC to SMS.SRM.005 (b)(2) Safety Risk Assessment and Mitigations

(a) Organisations should establish safety information sharing or exchange networks among users of the aviation system, and facilitate the sharing and exchange of safety information. The level of protection and conditions under which safety information will be shared or exchanged must be consistent with Appendix 3.

(b) Organisations should share safety information with other organisations or GCAA or other States, as soon as possible if, in the analysis of the information contained in its SDCPS, safety matters that may be of interest to others are identified.

GM to SMS.SRM.005 (b)(3) Safety Risk Assessment and Mitigations

APPENDIX 12a contains more guidance on what is and how helpful a D3M process could be.

APPENDIX 12b contains a mean to design a D3M process.

SUBPART 3: SAFETY ASSURANCE

SMS.SA.001 Safety Performance Monitoring and Measurement

(a) The organisation shall develop, document, implement and maintain up to date appropriate means to:

(1) verify the safety performance of the organisation; and

(2) validate the effectiveness of safety risk controls.

(b) The actual safety performance shall be regularly provided to the GCAA in a form and manner established by the GCAA.

GM to SMS.SA.001(a) Safety Performance Monitoring and Measurement

(a) Safety assurance consists of processes and activities undertaken by the organisation to determine whether the SMS is operating according to expectations and requirements. Such process helps the organisation to continually monitor its internal processes as well as its operating environment to detect changes or deviations (the application of the safety risk controls does not always achieve the intended results) that may introduce emerging safety risks or the degradation of existing risk controls. Additionally, Safety Assurance will help identify whether the right safety risk control was selected or the application of a different safety risk control strategy may be required. Such changes or deviations should then be addressed through the SRM process.

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

GM1 to SMS.SA.001(a)(1) Safety Performance Monitoring and Measurement

Safety performance management helps the organisation to answer the four most important questions regarding safety management:

(a) What are the organisation's top safety risks? Derived from a review of aviation accident and incident data as well as predictive analysis to identify and define emerging risks.

(b) What does the organisation want to achieve in terms of safety and what are the top safety risks that need to be addressed? The organisation's safety objectives.

(c) How will the organisation know if it is making progress toward its safety objectives? Through SPIs, SPTs and, if practicable, safety triggers.

(d) What safety data and safety information are needed to make informed safety decisions? Including the allocation of the organisation's resources. Through an evolving SDCPS and safety data analysis.

GM2 to SMS.SA.001(a)(1) Safety Performance Monitoring and Measurement

Appendices 7a, 7b and 7c provide more guidance for defining appropriate, SPIs, SPTs, alerts and their continuous refinements.

GM3 to SMS.SA.001(a)(1) Safety Performance Monitoring and Measurement

Additionally, to establishment of SPIs/SPTs, organisation should aim at implementing other means to verify, monitor and measure safety performance. The following activities may be considered:

(a) Safety studies are analyses to gain a deeper understanding of safety issues or better understand a trend in safety performance;

(b) Safety data analysis uses the safety reporting data to uncover common issues or trends that might warrant further investigation;

(c) Safety surveys examine procedures or processes related to a specific operation. Safety surveys may involve the use of checklists, questionnaires and informal confidential interviews. Safety surveys generally provide qualitative information. This may require validation via data collection to determine if corrective action is required. Nonetheless, surveys may provide an inexpensive and valuable source of safety information.

(d) Safety audits focus on assessing the integrity of the organisation's SMS and supporting systems. Safety audits can also be used to evaluate the effectiveness of installed safety risk controls or to monitor compliance with safety regulations. Ensuring independence and objectivity is a challenge for safety audits. Independence and objectivity can be achieved by engaging external entities or internal audits with protections in place - policies, procedures, roles, and communication protocols.

(e) Findings and recommendations from safety investigations can provide useful safety information that can be analysed against other collected safety data.

(f) Operational data collection systems such as FDA, radar information can provide useful data of events and operational performance.

AMC1 to SMS.SA.001(a)(1) Safety Performance Monitoring and Measurement

The established process should:

(a) monitor the established safety objectives to ensure that they remain appropriate and up to date with the organisation's safety policy and priorities;

(b) select and define SPIs, which are tactical parameters related to the safety objectives;

(c) set and define SPTs, if appropriate, which are also tactical parameters used to monitor progress towards the achievement of the safety objectives. When SPTs are established, they should be realistic, context specific and achievable when considering the resources available to the organisation and the associated aviation sector; and

(d) include a process of acceptance of SPIs, SPTs and the associated alert levels required by the GCAA after it has been demonstrated that they are appropriate with:

1) the established safety objectives;

2) the analysis of data that is available or obtainable; and

3) the size and complexity of the organisation; and

(e) monitor the performance of established SPIs, SPTs, and associated alert levels to identify abnormal changes in safety performance;

(f) include means to update safety objectives, refine SPIs and SPTs and periodically review the appropriateness of SPIs and SPTs.

AMC2 to SMS.SA.001(a)(1) Safety Performance Monitoring and Measurement

INITIAL ACCEPTANCE

(a) The organisation should propose SPIs for review and acceptance by the GCAA as part of the initial acceptance of the SMS;

(b) The GCAA might consider planning the acceptance of SPIs later in the implementation process. This is especially practical for organisations at initial certification as they often do not have enough data to develop meaningful indications;

(c) The acceptance of the SPTs may be addressed after the SPIs have been monitored over a period of time. This establishes the baseline performance. It may be based on targets established at the national, regional or global level;

(d) The initial acceptance of SPIs, SPTs, associated alert levels and corrective action plans are appropriate and pertinent to the organisation's aviation activities prior to acceptance;

(e) The acceptance should be between the GCAA Principal Inspector and the organisation. The GCAA Principal Inspector will review the proposed SPIs, SPTs, alert levels and corrective action plans to ensure that:

(1) they are appropriate, and relevant to the scope and complexity of the specific operational context;

(2) their development has used the appropriate measuring matrix and is dependent on the size and complexity of the organisation; and

(3) consistent with the UAE National Aviation Safety Priorities.

CONTINUOUS ACCEPTANCE

The organisation should on a quarterly basis demonstrate to the GCAA that the SPIs, SPTs, associated alert levels and corrective action plan are appropriate and pertinent to the organisation's aviation activities, and any required change should be notified immediately for continuous acceptance of the SPI/SPTs/Alert Levels/Corrective Action Plans.

GM to SMS.SA.001(a)(2) Safety Performance Monitoring and Measurement

The internal audit process can be used to determine both compliance and effectiveness. The following questions can be asked to assess compliance and effectiveness of each process or procedure:

(a) Determining compliance

(1) Does the required process or procedure exist?

(2) Is the process or procedure documented (inputs, activities, interfaces and outputs defined)?

(3) Does the process or procedure meet requirements (criteria)?

(4) Is the process or procedure being used?

(5) Are all affected personnel following the process or procedure consistently?

(6) Are the defined outputs being produced?

(7) Has a process or procedure change been documented and implemented?

(b) Assessing effectiveness

(1) Do users understand the process or procedure?

(2) Is the purpose of the process or procedure being achieved consistently?

(3) Are the results of the process or procedure what the "customer" asked for?

(4) Is the process or procedure regularly reviewed?

(5) Is a safety risk assessment conducted when there are changes to the process or procedure?

(6) Have process or procedure improvements resulted in the expected benefits?

AMC to SMS.SA.001(a)(2) Safety Performance Monitoring and Measurement

(a) Internal audits should be conducted to assess and provide the accountable manager and senior management with feedback on the status of:

(1) compliance with GCAA CARs;

(2) compliance with policies, processes and procedures;

(3) the effectiveness of safety risk controls;

(4) the effectiveness and implementation status of corrective actions;

(5) the effectiveness of the SMS; and

(6) opportunities for improvement.

(b) Internal audits should be conducted by persons or departments independent of the functions being audited (using internal auditor or engaging external auditors).

(c) 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.

(d) The results from analysis of cause(s) and contributing factors for any non-compliance should feed into the organisation's SRM processes.

GM to SMS.SA.001(b) Safety Performance Monitoring and Measurement

In order to perform the Quarterly Review in an effective manner, the following should be considered as a minimum:

(a) The accuracy of data to support the SPI performance calculations;

(b) The accuracy of the calculations, the outputs should be verified from the actual data source;

(c) Alert level breaches and immediate notifications with action taken, this must be verified and supported by evidence;

(d) Continued relevance and effectiveness of the agreed action plans, sometimes it may be necessary to modify the action plans due to changes in the operating environment affecting the SPIs performance;

(e) Any repetitive alert level breaches to determine the reasons for the failure of existing action plans to control the breach;

(f) Accuracy of the investigation for root cause, by verifying that the root cause analysis for an alert level breach is accurate and the corrective action taken relevant to it so that it results in an effective control of the unacceptable performance;

(g) Status of implementation of Corrective Actions for past alert level breaches, in addition to proactive action plans implemented to achieve the intended Safety Performance Targets; and

(h) Review of effectiveness of the corrective actions against the current quarter performance of the SPI.

AMC1 to SMS.SA.001(b) Safety Performance Monitoring and Measurement

For the GCAA to establish and monitor the State Acceptable Level of Safety Performance (ALoSP), organisations should submit flight hours, engine hours, cycles, number of movements and other required

information to the GCAA. Form GCAA GTF-SMS-005 should be provided by mid-month of the following month for organisations operating aircraft (i.e., regulated by CAR-OPS 1 and 3 and CAR-ORA).

AMC2 to SMS.SA.001(b) Safety Performance Monitoring and Measurement

(a) Safety performance measurement, actual performance reports are submitted by raising a Change Request on Q-Pulse similar to the submission for acceptance of a revised SMS Manual (Refer to Q-Pulse User Manual section 8. Manual Approval).

(b) Each actual performance report shall include previous tri-annual Term (T) Reports of the specific calendar year. The latest term report should be maintained at the beginning of the whole report.

(c) The third term (T3) actual performance report (generally submitted during the month of January) must also include the SPIs/SPTs/Alert Levels that have been agreed for the upcoming year.

(d) Following the submission, no further action nor acceptance is expected from the submitter or GCAA unless an adjustment is required to ensure that agreed initial objectives can be achieved. If an adjustment is required, then the report must include a Corrective Action Plan, otherwise the submission will be considered void.

(e) If an alert level or a target has been breached, reporting shall be made immediately to the respective Principal Inspector/s.

(f) Organisations having an SMS covering more than one approval certificate must submit a single comprehensive report that covers the performance parameters pertaining to all of the approval certificates.

(g) The agreed safety performance of an organisation's SMS should be periodically reviewed to ensure it remains relevant and appropriate to the organisation. To facilitate this monitoring, the organisation should provide the GCAA with the actual safety performance for every one third of year (n) as per the following schedule:

Safety Performance Monitoring (SPM) Reports of YEAR (n)	**Due date for SPM submission to the Principal Inspector**	**Due date for "face-to-face" review with the Principal Inspector**
Tri-annual SPM Report for Term 1 (Jan-Apr) of YEAR (n)	No later than 15th of May of YEAR (n)	No later than 31st of May of YEAR (n)
Tri-annual SPM Report for Term 2 (May-Aug) of YEAR (n)	No later than 15th of September of YEAR (n)	No later than 30th of September of YEAR (n)

Tri-annual SPM Report for Term 3 (Sep-Dec) of YEAR (n)	No later than 15th of January of YEAR (n+1)	No later than 31st of January of YEAR (n+1)

SMS.SA.005 Management of Change

The organisation shall develop, document, implement and maintain up to date a process to:

(a) identify changes which may affect the level of safety risk associated with its aviation products or services; and

(b) identify and manage the safety risks that may arise from those changes.

GM to SMS.SA.005 Management of Change

(a) Small incremental changes often go unnoticed, but the cumulative effect can be considerable. Changes, large and small, might affect the organisation's safety performance. Unless properly managed, changes in organisational structure, facilities, scope of work/approval, personnel, documentation, policies and procedures, etc., may result in the inadvertent introduction of new hazards, exposing the organisation to new or increased risk.

(b) Management of change provides principles and a structured framework for managing all aspects of the change. Disciplined application of change management can maximise the effectiveness of the change, engage staff, and minimise the risks inherent in change.

(c) Change may affect the effectiveness of existing safety risk controls. In addition, new hazards and related safety risks may be inadvertently introduced into an operation when change occurs. Hazards should be identified and related safety risks assessed and controlled as defined in the organisation's existing hazard identification or SRM procedures.

(d) The change also has the potential to introduce new, or exacerbate pre-existing, human factors issues. For example, changes in machinery, equipment, technology, procedures, work organisation, or work processes are likely to affect performance.

(e) Organisations experience changes due to a number of factors including, but not limited to:

(1) organisational expansion or contraction;

(2) business improvements that impact safety; these may result in changes to internal systems, processes or procedures that support the safe delivery of the products and services;

(3) changes to the organisation's operating environment;

(4) changes to the SMS interfaces with external organisations;

(5) external regulatory changes, economic changes and emerging risks;

(6) organisational restructuring;

(7) acquisition of new technology or equipment;

(8) new aircraft type included in the approval;

(9) additional aircraft or equipment of the same or similar type;

(10) significant changes in personnel (affecting key personnel and/or large numbers of personnel, high turnover);

(11) new or amended regulations, procedures or SMS processes including changes in methodology such as SRM and safety assurance processes;

(12) competition;

(13) customer base;

(14) security;

(15) financial status;

(16) new schedule(s), location(s), type(s) of maintenance, and/or operational procedures;

(17) the generation or alteration of maintenance data;

(18) change of a safety significant subcontractor; and

(19) changes to risk control, policy, etc.

(f) The organisation's management of change process should take into account the following considerations:

(1) Criticality. How critical is the change? The organisation should consider the impact on their organisation's activities, and the impact on other organisations and the aviation system.

(2) Availability of subject matter experts. It is important that key members of the aviation community are involved in the change management activities; this may include individuals from external organisations.

(3) Availability of safety performance data and information. What data and information is available that can be used to give information on the situation and enable analysis of the change?

AMC to SMS.SA.005 Management of Change

The organisation should:

(a) establish a process aiming at identifying external and internal changes that may have an adverse effect on safety before implementation and then aiming at defining the changes that would require a comprehensive management of change process; At least, the following changes should trigger the comprehensive management of change process; others may trigger a lighter management of change process (since there should always be a proactive consideration for safety implications, regardless of the magnitude of change, large or small):

(1) introduction of new technology or equipment;

(2) changes in the operating environment;

(3) changes in key personnel;

(4) significant changes in staffing levels;

(5) changes in safety regulatory requirements;

(6) significant restructuring of the organisation; and

(7) physical changes (new facility or base, aerodrome layout changes etc.).

(b) establish a management of change process which includes the following activities:

(1) understand and define the change; this should include a description of the change and why it is being implemented. This activity should assist the organisation to evaluate the criticality of the change by assessing the impact on its activities, and the impact on other organisations and the aviation system.

(2) understand and define who and what it will affect; this may be individuals within the organisation, other departments or external people or organisations. Equipment, systems and processes may also be impacted. A review of the system description and organisations' interfaces may be needed. This is an opportunity to determine who should be involved in the change. Changes might affect risk controls already in place to mitigate other risks, and therefore change could increase risks in areas that are not immediately obvious;

(3) identify hazards related to the change and carry out a safety risk assessment; this should identify any hazards directly related to the change. The impact on existing hazards and safety risk controls that may be affected by the change should also be reviewed. This activity should use the existing organisation's SRM processes since it is intended to collect data and information that can be used to give information on the situation and enable analysis of the change;

(4) develop an action plan; this should define what is to be done, by whom and when. There should be a clear plan describing how the change will be implemented and who will be responsible for which actions, and the sequencing and scheduling of each task. For example, early communication and engagement with affected personnel will normally improve the way the change is perceived and implemented;

(5) sign off on the change; this is to confirm that the change is safe to implement. The individual with overall responsibility and authority for implementing the change should sign the change plan; and

(6) assurance plan; this is to determine what follow-up action is needed. Consider how the change will be communicated and whether additional activities (such as audits) are needed during or after the change. Any assumptions made need to be tested.

SMS.SA.010 Continuous Improvement of the SMS

The organisation shall develop, document, implement and maintain up to date a process aiming at monitoring, assessing and continuously improving the SMS processes and activities.

GM to SMS.SA.010 Continuous Improvement of the SMS

SMS effectiveness should not be based solely on SPIs; the organisation 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.

The continuous improvement process should aim at measuring outputs as well as outcomes of the SMS processes, and then assess the information gathered through these activities to identify opportunities for maintaining or continuously improving the overall effectiveness of the SMS.

AMC to SMS.SA.010 Continuous Improvement of the SMS

(a) The internal evaluation process should evaluate safety management functions, policymaking, safety risk management, safety assurance and safety promotion throughout the organisation and include feedback provided to the accountable manager and senior management with highlight of opportunities for improvement.

(b) This process may include the following methods:

(1) Audits; this includes internal audits and audits carried out by other organisations.

(2) Assessments; includes assessments of safety culture and SMS effectiveness.

(3) Monitoring of occurrences: monitor the recurrence of safety events including accidents and incidents as well as errors and rule-breaking situations.

(4) 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 organisation.

(5) Management reviews; examine whether the safety objectives are being achieved by the organisation 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.

(6) Evaluation of SPIs and SPTs; possibly as part of the management review. It considers trends and, when appropriate data are available, can be compared to other organisations or global data.

(7) Addressing lessons learnt; from safety reporting systems and organisation safety investigations. These should lead to safety improvements being implemented.

SUBPART 4: SAFETY PROMOTION

SMS.SP.001 Training and education

(a) The organisation shall develop, document, implement and maintain up to date a safety training and education programme that ensures that all safety-related personnel are trained and competent to perform their duties and that facilitates effective two-way communication throughout all levels of the organisation.

(b) The scope of the safety training and education programme shall be appropriate to the individual's safety accountabilities, responsibilities, and authorities within the organisation.

GM1 to SMS.SP.001(a) Training and education

(a) Safety promotion encourages a positive safety culture and helps achieve the organisation's safety objectives through the combination of technical competence that is continually enhanced through training and education, effective communication, and information-sharing. Senior management provides the leadership to promote the safety culture throughout an organisation.

(b) Effective safety management cannot be achieved solely by mandate or strict adherence to policies and procedures. Safety promotion affects both individual and organisational behaviour, and supplements the organisation's policies, procedures and processes, providing a value system that supports safety efforts.

(c) Effective two-way communication includes clear strategic direction from the top of the organisation and the enabling of "bottom-up" communication that encourages open and constructive feedback from all personnel.

GM2 to SMS.SP.001(a) Training and education

(a) Competency is an observable, measurable set of skills, knowledge, abilities, behaviours, and other characteristics that individuals exhibit as they successfully perform work functions. Competencies are typically required at different levels of proficiency depending on the work roles or occupational function.

(b) Competence can be assessed at the completion of training by written, oral, or demonstration tests, and then measured periodically during the performance of that individual's work by way of periodic evaluations or supervisor/management observations.

AMC to SMS.SP.001(a) Training and education

The Safety training and education programme should at minimum include:

(a) the list of staff who should be trained and to what depth. considering whether it is valuable to extend the analysis to staff in external interfacing organisations;

(b) a policy for initial safety training and education course for Accountable Manager, Post Holders, managers/supervisors and all other safety related personnel.

(c) A policy for the staff's ongoing safety knowledge and competency needs; these needs will typically be met through a recurrent training and education programme. For example, recurrent safety training and education should focus on changes to the SMS policies, objectives, processes and procedures, and should highlight any lessons learned or specific safety issues relevant to the organisation;

(d) A policy to ensure each staff has access to up-to-date safety information to fulfil safety responsibilities and can, on voluntary basis, request additional training

(e) the appropriate method for training delivery including competent trainers whose commitment, teaching skills and safety management expertise will have a significant impact on the effectiveness of the training delivered;

(f) a process, with clear responsibilities, for:

(1) the development and maintenance of training and education content based on the international best practices and SMS's outputs and outcomes;

(2) the scheduling of training activities;

(3) the periodical review of the training and education programme; and

(4) ensuring that personnel, at all levels of the organisation, maintain their competency to fulfil their safety roles;

therefore competencies of personnel should be reviewed on a regular basis.

GM to SMS.SP.001(b) Training and education

When conducting a Training Needs Analysis (TNA), the following should be considered:

(a) A typical TNA will normally start by conducting an audience analysis, which usually includes the following:

(1) Giving particular attention to safety duties, identify by groups how staff will interact with the safety management processes, inputs and outputs - in particular with safety duties to identify similar learning needs. This information should be available from the position/role descriptions. Normally groupings of individuals will start to emerge that have similar learning needs;

(2) Identify the knowledge and competencies needed to perform safety duties required by each staff grouping;

(3) Identify the gap between current safety skill and knowledge across the workforce and those needed to effectively perform the allocated safety duties; and

(4) Identify the most appropriate skills and knowledge development approach for each group with the aim of developing a training programme appropriate to each individual or group's involvement in safety management.

(b) Safety training and education curricula which should, at minimum, include the following elements at a level as determined by the TNA:

(1) SMS regulation;

(2) organisational safety policies, goals and objectives;

(3) organisational roles and responsibilities related to safety;

(4) organisational SMS processes and procedures;

(5) hazard identification principles;

(6) safety risk management principles;

(7) safety reporting systems;

(8) organisational factors comprising technical and non-technical skills.

(9) human factors;

(10) safety management support (including evaluation and audit programmes); and

(11) lines of communication for dissemination of safety information.

(c) For example, hazard identification process should use qualified personnel to collect and store safety data and who possess an understanding of the system and its operating environment.

AMC to SMS.SP.001(b) Training and education

The training and education programme should:

(a) be tailored to the needs of the individual's role within the organisation and commensurate with the accountability, responsibilities and authorities the individual holds. The level and depth of training for managers involved in the organisation's safety committees will be more extensive than for personnel directly involved with delivery of the organisation's product or services:

(1) The safety training for the accountable manager, Post Holders and senior managers includes the following topics:

(i) specific awareness training for new accountable Manager and post holders on their SMS accountabilities, responsibilities and authorities;

(ii) importance of compliance with national and organisational safety requirements;

(iii) management commitment towards safety improvement and compliance, with the understanding of the SMS and its relationship to the organisation's overall business strategy;

(iv) allocation of resources;

(v) promotion of the safety policy, safety objectives and the SMS;

(vi) promotion of a positive safety culture;

(vii) effective interdepartmental safety communication;

(viii) establishment of safety objectives, SPTs and alert levels; and

(ix) disciplinary policy;

(2) Safety Department employees should be provided with more detailed SMS training to enhance their competence in safety risk assessment, system evaluation, system assessment, data mining, auditing, and inspections;

(3) Line managers may need to know the potential consequences of safety failures and system failure modes more so than operational personnel will.

(4) Operational personnel may only need an overview of safety management fundamentals for their operational department (e.g., instructions on how to identify and report safety concerns); where personnel not directly involved in the operations may require only a high level overview of the organisation's SMS;

(b) be developed using a formal Training Needs Analysis (TNA) to ensure a clear understanding of the operation, the safety duties of personnel and the available training.

SMS.SP.005 Safety Communication

The organisation shall develop, document, implement and maintain up to date an effective safety communication strategy of safety related data or information by the most appropriate method and with consideration to the individual's role within the organisation.

GM to SMS.SP.005 Safety Communication

SURVEYS

Surveys are an often overlooked method to promote two-way communication within the organisation. They are useful to assess the existing safety culture and identify areas for improvement, determine the impact of safety initiatives, check how the safety culture may have changed over time, or simply to increase awareness of safety issues. They may also serve secondarily as a training tool, particularly when personnel are not familiar with their role in the SMS environment. Prepared properly, surveys will generate awareness of the organisation's safety program, address and possibly reduce resistance to change, and provide a sense of management's commitment to safety.

SCALABILITY OF SAFETY COMMUNICATION

Smaller Organisations. Communicating safety considerations to employees will probably be simple and direct. For example, the company owner or the organisation could conduct regular all-hands/employee meetings, such as “hangar talk sessions.” Additionally, communication could include regular and periodic briefings to the employees, posting the status of safety issues on bulletin boards, emails to employees, and face-to-face meetings with division management teams.

Medium Organisations. Communication methods may be more structured than in smaller organisations. Safety information may be published throughout the company by printed or electronic means. Safety meetings are likely more structured and formal. Communication and feedback may be formalised in order to provide information to individual employees as well as organisation-wide information for cross-boundary issues and/or common hazards.

Larger Organisations. Communication is more likely to be formal and a tracking system may be used to ensure that the appropriate safety messages are delivered to the appropriate personnel. Information technology approaches, such as email broadcasts or intranet Web sites, may be considered to facilitate directing the flow of safety information and recording its accomplishment for evaluation and auditing purposes.

AMC to SMS.SP.005 Safety Communication

The Safety communication strategy should:

(a) apply to internal and external communications (i.e. be toward internal and external personnel);

(b) be clear, simple, practical and align with the safety policy and safety objectives;

(c) achieve, at minimum, the following objectives:

(1) ensure personnel are aware of the SMS to a degree commensurate with their positions in a timely manner;

(2) convey in a timely manner safety-critical information that could expose the organisation to safety risk;

(3) raise awareness of new safety risk controls and corrective actions and explain why particular safety actions are taken;

(4) provide information on new or amended safety policy, objectives and procedures and explain why they are introduced or changed to ensure the appropriate people are kept informed;

(5) promote a positive safety culture among their systems and interfaces;

(6) encourage personnel to identify and report hazards; and

(7) provide feedback to personnel submitting a safety report.

(d) be developed based on structured process that include the following four major components:

(1) Set communication goals

(i) Work with management to empower the communications function.

(ii) Work with stakeholders and secure their support.

(iii) Determine what is to be achieved keeping in mind the minimum objectives mentioned above.

(iv) Goals should be documented and measured by KPIs.

(v) Assess current communications to determine effectiveness, what is working and what is not, and what needs to be accomplished.

(vi) Integrate safety communication goals with organisational goals.

(2) Identify target audience (internal or external)

(i) Decide on the key messages that the audience needs to hear.

(ii) Use data and evidence to properly target a communication strategy.

(iii) Consider qualitative communication research such as focus groups, interviews and observation.

(iv) Where appropriate, analyse and assimilate stakeholder research.

(v) Employ quantitative communication research: content analysis, surveys, etc.

(vi) Frame messages relevant to the environment of the person receiving the communication.

(3) Develop a communication plan

(i) Include a schedule to execute your plan.

(ii) Identify responsibilities.

(iii) Consider any budget constraints.

(iv) Set timelines for deliverables.

(v) Anticipate obstacles.

(vi) Plan for emergencies.

(4) Identify communication channels

(i) Determine who will do the communicating.

(ii) Consider using the direct supervisor as the best person to communicate with frontline employees.

(iii) Consider that presentations from senior management may not have the intended effect.

(iv) Determine the channel or combination of channels a communication should be delivered such as: newsletters; surveys; presentations; training; videos; demonstrations; safety notices; safety awareness posters; lectures; workshops; and workplace safety oriented meetings between staff and the Accountable Manager or Senior Managers.

(v) Electronic communication may be suitable, particularly as a supplement to other methods.

(vi) Ensure consistency between each communication.

(vii) Written communication.

(viii) Internal discussion forums.

(e) include an evaluation system of its effectiveness, in particular assessed during internal audits or as part of SMS effectiveness assessments, by checking that personnel have received and more critically, understood distributed safety information.

PART 3: APPENDICES

APPENDIX 1: DEFINITIONS

(1) **Acceptable Level of Safety Performance (ALoSP):** The minimum level of safety performance of civil aviation in a State, as defined in its State safety programme, or of a organisation, as defined in its Safety Management System, expressed in terms of Safety Performance Targets and Safety Performance Indicators.

(2) **Alert Level:** An established level or criteria value outside of the normal operating range or out-of-control region that triggers a warning that an adjustment or evaluation is needed.

(3) **Consequence:** Actual or potential impact of a hazard that can be expressed qualitatively and/or quantitatively. More than one consequence may evolve from an event.

(4) **Corrective Action:** Action to eliminate the cause of or reduce the effects of a detected hazard or potentially hazardous situation in order to prevent its recurrence.

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

(6) **Error:** An action or inaction by an operational person that leads to deviations from organisational or the operational person's intentions or expectations.

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

(8) **Hazard Identification:** A process to establish a list of hazards relevant to the activity and the causes/threats that could release them.

(9) **Human Factors:** Principles which apply to aeronautical design, certification, training, operations and maintenance and which seek safe interface between the human and other system components by proper consideration to human performance.

(10) **Human Performance**: Human Performance refers to how people perform their tasks. It represents the human contribution to system performance.

(11) **Investigation:** A process conducted for the purpose of accident prevention which includes the gathering and analysis of information, the drawing of conclusions, including the determination of causes and, when appropriate, the making of safety recommendations.

(12) **Just Culture.** A culture in which front line operators or others are not punished for actions, omissions or decisions taken by them that are commensurate with their experience and training, but where gross negligence, wilful violations and destructive acts are not tolerated.

(13) **Operational Personnel:** Personnel involved in aviation activities who are in a position to report safety information.

Note.- Such personnel include, but are not limited to: flight crews; air traffic controllers; aeronautical station operators; maintenance technicians; personnel of aircraft design and manufacturing organisations; cabin crews; flight dispatchers, apron personnel and ground handling personnel.

(14) **Preventive Action:** Pre-emptive action to eliminate or mitigate the potential cause or reduce the future consequence of a hazard.

(15) **Risk:** The predicted probability and severity of the consequences or outcomes of a hazard.

(16) **Risk Analysis:** Process whereby possible consequences of hazards are objectively characterized for their severity and probability. The process can be qualitative and/or quantitative.

(17) **Risk Assessment:** The identification, evaluation, and estimation of the level of risk.

(18) **Risk Control**: Activities that ensure that safety policies, procedures, and processes minimize the risk of an aviation accident or incident.

(19) **Risk Management:** An organisational function that assesses the organisation's system design and verifies that the system adequately controls risk. A formal risk management process describes a system, assesses hazards, analyses those hazards to evaluate the risk, and establishes controls to manage those risks.

(20) **Risk Mitigation:** The process of incorporating defences or preventive controls to lower the severity and/or likelihood of a hazard's projected consequence.

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

(22) **Safety Assessment:** Documentation that contains hazard descriptions, the related consequences, the assessed likelihood and severity of the safety risks, and required safety risk controls.

(23) **Safety Assurance:** Processes used to ensure risk controls developed under the risk management process achieve their intended objectives throughout the life cycle of a system. This process may also reveal hazards not previously identified and identify or assess the need for new risk control, as well as the need to eliminate or modify existing controls. This is one of the four components of SMS.

(24) **Safety Culture:** An enduring set of values, norms, attitudes, and practices within an organisation concerned with minimizing exposure of the workforce and the general public to dangerous or hazardous conditions. In a positive safety culture, a shared concern for, commitment to, and accountability for safety is promoted.

(25) **Safety Data Collection and Processes Systems (SDCPS):** A generic term used to refer to processing and reporting systems, databases and schemes for exchange of safety information and recorded information.

(26) **Safety Management System (SMS):** A systematic approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures.

(27) **Safety Performance Indicator**: A data-based parameter used for monitoring and assessing safety performance.

(28) **Safety Performance Target:** The planned or intended objective for Safety Performance Indicator(s) over a given period.

(29) **Safety Promotion:** A combination of safety culture, training, and information sharing activities that support the implementation and operation of an SMS in an organisation. This is one of the four components of SMS.

(30) **Safety Risk:** The predicted probability and severity of the consequences or outcomes of a hazard.

(31) **Safety Risk Management:** A process used to assess system design and verify that the system adequately controls risk. A formal risk management process describes a system, assesses hazards, analyses those hazards to evaluate the risk, and establishes controls to manage those risks. This is one of the four components of SMS.

(32) **Severity:** The extent of loss or harm associated with consequences of a hazard. An example of severity classification can be as follows:

(i) **Severity – Catastrophic:** Results in multiple fatalities and/or loss of the aircraft.

(ii) **Severity – Hazardous:** A large reduction in safety margins, physical distress, or workload such that organisations cannot be relied upon to perform their tasks accurately or completely. Serious injury or death to a small number of aircraft occupants, ground personnel, and/or general public. Major equipment damage.

(iii) **Severity – Major:** A significant reduction in safety margins and a reduction in the ability of organisations to cope with adverse operating conditions as a result of an increase in workload, significant discomfort, or conditions impairing their efficiency. Serious incident with physical distress to occupants of aircraft, injuries, and equipment damage.

(iv) **Severity – Minor:** Does not significantly reduce system safety and operator actions are well within their capabilities. May include slight reduction in safety margins, operating limitations, slight increase in workload, some physical discomfort, and/or minor equipment damage.

(v) **Severity – Negligible:** Little consequence. Has no effect on safety.

(33) **Training Needs Analysis:** The process of identifying skills gaps at the organisational level, group level, and individual level.

APPENDIX 2: SAFETY CULTURE

A safety culture is the natural consequence of having humans in the aviation system. Safety culture has been described as “how people behave in relation to safety and risk when no one is watching”. It is an expression of how safety is perceived, valued and prioritized by management and employees in an organisation, and is reflected in the extent to which individuals and groups are:

(a) aware of the risks and known hazards faced by the organisation and its activities;

(b) continuously behaving to preserve and enhance safety;

(c) able to access the resources required for safe operations;

(d) willing and able to adapt when facing safety issues;

(e) willing to communicate safety issues; and

(f) consistently assessing the safety related behaviours throughout the organisation and apply a “just culture” approach.

SMM ICAO Doc 9859 Chapter 3 contains additional means to:

(a) understand safety culture and its influence on safety reporting;

(b) develop a positive safety culture; and

(c) monitor safety culture

https://www.unitingaviation.com/publications/safetymanagementimplementation/content/#/lessons/5f1Sts26m5gP5vHF59OZqrBeWexVtEQ6

APPENDIX 3: SAFETY DATA AND SAFETY INFORMATION MANAGEMENT

1. Safety data and safety information management

Safety data and safety information management can be defined as the development, execution and supervision of plans, policies, programmes and practices that ensure the overall integrity, availability, usability, and protection of the safety data and safety information used by the organisation.

Safety data and safety information management which addresses the necessary functions will ensure that the organisation's safety data and safety information is collected, stored, analysed, retained and archived, as well as governed, protected and shared, as intended. Specifically, it should identify:

(a) what data will be collected;

(b) data definitions, taxonomy and formats;

(c) how the data will be collected, collated and integrated with other safety data and safety information sources;

(d) how the safety data and safety information will be stored, archived and backed up; for example, database structure, and, if an IT system, supporting architecture;

(e) how the safety data and safety information will be used;

(f) how the information is to be shared and exchanged with other parties;

(g) how the safety data and safety information will be protected, specific to the safety data and safety information type and source; and

(h) how quality will be measured and maintained.

Without clearly defined processes to produce safety information (i.e. Data governance), an organisation cannot achieve defensible, reliable, and consistent information upon which data-driven decisions are confidently made.

Data governance is the authority, control and decision-making over the processes and procedures that support an organisation's data management activities. It dictates how safety data and safety information are collected, analysed, used, shared and protected. Data governance ensures that the data management system(s) has the desired effect through the key characteristics of integrity, availability, usability and protection as described below:

(a) Integrity — Data integrity refers to the reliability of the sources, information, and events it contains. However, data integrity includes the maintenance and the assurance of the accuracy and consistency of data over its entire life-cycle. This is a critical aspect to the design, implementation and usage of the SDCPS when storing, processing, or retrieving the data.

(b) Availability — It should be clear who has permission to use or share the stored safety data and safety information. This has to take into account the agreement between the data/information owner and custodian. For the entities that are allowed to use the data, it should be clear how to gain access and how to process it. A variety of techniques exist to maximize data availability, including redundancy of storage locations and data access methods and tools.

(c) *Usability* — In order to maximize returns on safety data and safety information, it is important to also consider usability standards. Humans are continuously interacting and engaging with safety data and safety information as they are acquired. Organisations should minimize human error as automation applications are applied. Tools which can increase usability include data dictionaries and metadata repositories. As human interaction evolves towards big data applications and machine learning processes, it will become increasingly important to better understand human usability as it is applied to machines to minimize safety data and safety information miscalculations in the future.

(d) *Protection* — Organisations should ensure that safety data, safety information and related sources are afforded appropriate protection. For more information, refer to below in this Appendix.

2. Principles for the protection of safety data, safety information and related sources

It is important that the organisation provides appropriate protections to encourage people to report what they see or experience. For example, disciplinary action shall be waived for reports of errors. It should be clearly stated that reported information will be used solely to support the enhancement of safety. The intent is to promote an effective reporting culture and proactive identification of potential safety deficiencies.

Voluntary safety reporting systems should be confidential, requiring that any identifying information about the reporter is known only to the custodian to allow for follow-up action. The role of custodian should be kept to a few individuals, typically restricted to the PH SMS and personnel involved in the safety investigation. Maintaining confidentiality will help facilitate the disclosure of hazards leading to human error, without fear of retribution or embarrassment. Voluntary safety reports may be de-identified and archived once necessary follow-up actions are taken. De-identified reports can support future trending analyses to track the effectiveness of risk mitigation and to identify emerging hazards. More features on how to establish a voluntary reporting system could be found in AMC-57, which is the State voluntary reporting system.

A policy on the protection of safety data and safety information, as well as sources, can have a positive effect on the reporting culture. The organisation should allow for the de-identification and aggregation of reports to allow meaningful safety analyses to be conducted without having to implicate personnel or specific organisations.

(a) Principles of protection

(1) Organisations shall ensure that:

(i) safety data or safety information is protected and is not used for:

(A) disciplinary against employees;

(B) disclosure to the public; or

(C) any purposes other than maintaining or improving safety; and

(ii) related sources of safety data or safety information is protected[1];

unless a principle of exception applies.

(2) The principles of protection shall be applied in accordance with an established procedure.

(b) Principles of exception

(1) Safety data, safety information and related sources may be used for disciplinary against employees or be unprotected when the organisation:

(i) determines that there are facts and circumstances reasonably indicating that the occurrence may have been caused by an act or omission considered to be conduct constituting gross negligence, wilful misconduct or criminal activity;

(ii) after reviewing the safety data or safety information, determines that the proper administration of justice is necessary and that the benefits of logging an exception outweigh the adverse impact such exception is likely to have on the future collection and availability of safety data and safety information; or

(iii) after reviewing the safety data or safety information, determines that the principles of protection have an adverse impact on maintaining or improving safety2, and that the benefits of logging an exception outweigh the adverse impact such exception is likely to have on the future collection and availability of safety data and safety information.

(2) The principles of exception shall be applied in accordance with an established procedure.

[1] This provision does not supersede or cancel the right of the GCAA to be granted access to such data or information.
[2] Organisations are not prevented from using safety data or safety information to take any preventive, corrective or remedial action that is necessary to maintain or improve aviation safety.

APPENDIX 4a: HAZARD IDENTIFICATION

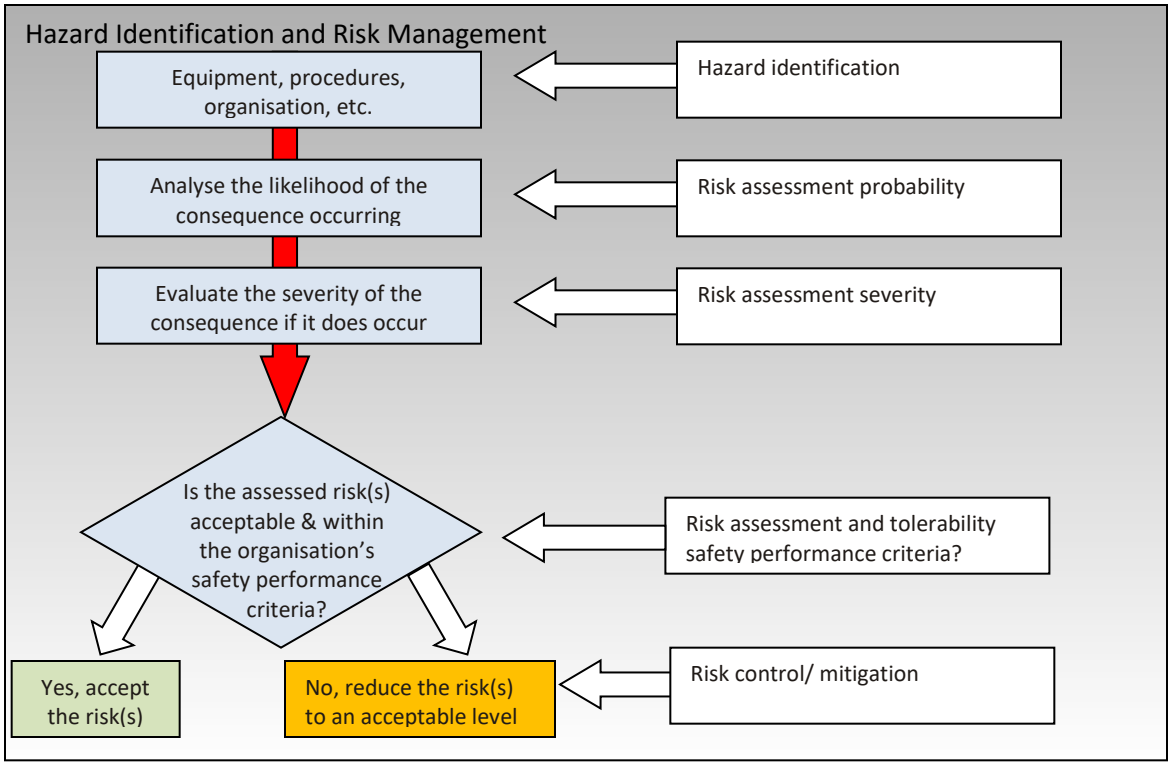
1. Overview of SRM and hazard identification

a) The SRM process aims at systematically identifying hazards that exist within the context of the delivery of the organisation's products or services.

b) Hazards may be the result of systems that are deficient in their design, technical function, human interface or interactions with other processes and systems. They may also result from a failure of existing processes or systems to adapt to changes in the organisations' operating environment. Careful analysis of these factors can often identify potential hazards at any point in the operation or activity life cycle.

c) Where an organisation with an SMS requirement contracts to an organisation not subject to SMS, the hazards and safety risks potentially introduced by the contractor should be addressed by the SMS of the organisation enabling integration between organisations to get a more accurate view of the safety risks and the organisation's achievement of its safety objectives. Hence, safety data and safety information that initially seems to be unrelated, may later turn out to be critical for identifying safety issues and supporting data-driven decision-making.

d) Following figure provides an overview of the hazard identification and its essential contribution with the safety risk management process of an organisation.



2. Sources of hazards

(a) Hazards exist at all levels in the organisation and are detectable through many sources.

(b) It is important to streamline the amount of safety data and safety information by identifying what specifically supports the effective management of safety within their organisation. The safety data

and safety information collected should support the reliable measure of the system's performance and the assessment of known risks, as well as the identification of emerging risks, within the scope of the organisation's activities.

(c) The safety data and safety information required will be influenced by the size and complexity of the organisation's activities.

(d) Internal hazard identification data sources may include:

(1) Normal operations monitoring; this uses observational techniques to monitor the day-to-day operations and activities such as line operations safety audit (LOSA) and Normal Operations Safety Survey (NOSS);

(2) Workshops or meetings in which subject matter experts conduct detailed analysis scenarios. These sessions benefit from the contributions of a range of experienced operational and technical personnel. Existing safety committee meetings (SRB, SAG, etc.) could be used for such activities; the same group may also be used to assess associated safety risks.

(3) Automated monitoring systems; this uses automated recording systems to monitor parameters that can be analysed such as flight data monitoring (FDM).

(4) Voluntary and mandatory safety reporting systems and other SDCPS; this provides everyone, including staff from external organisations, with opportunities to report hazards and other safety issues to the organisation.

(5) Safety surveys and audits; these can be used to identify hazards in the task or process being audited. These should also be coordinated with organisational changes to identify hazards related to the implementation of the change;

(6) Feedback from training; training that is interactive (two way) can facilitate identification of new hazards from participants; and

(7) Investigation and follow-up reports on accidents/incidents; hazards identified in internal safety investigation and follow-up reports on accidents/incidents.

(e) External data sources for hazard identification may include:

(1) Aviation accident reports; reviewing accident reports; this may be related to accidents in the UAE or to a similar aircraft type, geographical or operational environment.

(2) GCAA mandatory and voluntary safety reporting systems;

(3) GCAA oversight audits and third-party audits; external audits can sometimes identify hazards. These may be documented as an unidentified hazard or captured less obviously within an audit finding.

(4) Trade associations (e.g. ACI, IATA).Many trade associations and industry groups are able to share safety data that may include identified hazards.

(f) The following table could supplement the above lists of sources:

Approved training organizations • Mandatory occurrence reports • Voluntary reports • Risk assessment register • SPIs trend analysis • Training data • Quality assurance reports	**Air operators** • Mandatory occurrence reports • Voluntary reports • Flight data analysis (FDA) • Fatigue risk management system • Recorded data (flight data recorder, cockpit voice recorder, video, ambient, streamed data) • Risk assessment register • SPIs/trend analysis • Maintenance records • Internal audits • Reliability programme reports • Training records	**Approved Maintenance Organizations** • Mandatory occurrence reports • Voluntary reports • Risk assessment register • SPIs/trend analysis • Internal audits • Quality programme reports • Training records • Service difficulty reports (SDR) • In-service occurrence reports • Maintenance and operational experience reports • Service information reports (faults, malfunctions, defects) • Unapproved parts reports
Organizations responsible for type design or manufacture of aircraft, engines or propellers • Mandatory occurrence reports, voluntary reports, risk assessment register • SPIs/trend analysis • Internal audits • Service difficulty reports (SDR) • Maintenance and operational experience reports	**Air traffic services (ATS) providers** • Mandatory occurrence reports • Voluntary reports • Risk assessment register • SPIs/trend analysis • Internal audits • Special air-report (AIREPs) • Training records • Communication records	**Operators of certified aerodromes** • Mandatory occurrence reports • Voluntary reports • Risk assessment register • SPIs/trend analysis • Aerodromes safety report • Internal audits • Inspections of the movement area

(g) A consideration of hazards when reviewing accident or incident investigation reports is a good way to enhance the organisation's hazard identification system. This is particularly important when the organisation's safety culture is not yet mature enough to support effective voluntary safety reporting, or in small organisations with limited events or reports. An important source of specific hazards linked to operations and activities is from external sources such as ICAO, trade associations or other international bodies.

(h) The following factors should consider when identifying hazards:

(1) system description, including factors stemming from the existence of complex, (sub-) contract and other operational arrangements

(2) design factors, including equipment and task design;

(3) human performance limitations (e.g. physiological, psychological and cognitive);

(4) procedures and operating practices, including their documentation and checklists and their validation under actual operating conditions;

(5) communication factors, including media, terminology and language;

(6) organisational factors, such as those related to the recruitment, training and retention of personnel, the compatibility of production and safety goals, the allocation of resources, operating pressures and the corporate safety culture;

(7) factors related to the operational environment of the aviation system (e.g. ambient noise and vibration, temperature, lighting and the availability of protective equipment and clothing);

(8) regulatory oversight factors, including the applicability and enforceability of regulations and the certification of equipment, personnel and procedures;

(9) performance monitoring systems that can detect practical drift or operational deviations;

(10) human-machine interface factors; and

(11) factors related to the SMS interfaces, including with external organisations;

3. Hazard taxonomy or classification

(a) Safety reports are often filtered through the use of a taxonomy, or a classification system. Filtering information using a taxonomy can make it easier to identify common issues and trends.

(b) Hazard taxonomies are therefore especially important. Identification of a hazard is often the first step in the risk management process. Commencing with a commonly recognized language makes the safety data more meaningful, easier to classify and simpler to process. The structure of a hazard taxonomy may include a generic and specific component. Organisations should develop taxonomies that cover their type(s) of operations:

(1) The generic component allows users to capture the nature of a hazard with a view to aid in identification, analysis, and coding. A high-level taxonomy of hazards has been developed by the CICTT which classifies hazards in families of hazard types (Environmental, Technical, Organisational, and Human).

(2) The specific component adds precision to the hazard definition and context. This enables more detailed risk management processing. The following criteria may be helpful when formulating hazard definitions. When naming a hazard, it should be:

(i) clearly identifiable;

(ii) described in the desired (controlled) state; and

(iii) identified using accepted names.

(c) Common taxonomies may not always be available between databases (sources). In such a case, data mapping should be used to allow the standardization of safety data and safety information based on equivalency.

(d) On the other hand, the disadvantage of using a taxonomy is that sometimes the identified hazard does not fit cleanly into any of the defined categories. The challenge then is to use taxonomies with the appropriate degree of detail; specific enough that hazards are easy to allocate, yet generic enough that the hazards are valuable for analysis.

4. Hazard register

(a) Maintaining a register of identified hazards minimizes the likelihood that the organisation will lose sight of its known hazards. When hazards are identified, they can be compared with the known hazards in the register to see if the hazard has already been registered, and what action(s) were taken to mitigate it.

(b) Hazard registers are usually in a table format and typically include: the hazard, potential consequences, assessment of associated risks, identification date, hazard category, short description, when or where it applies, who identified it and what measure have been put in place to mitigate the risks.

(c) Refer to APPENDIX 9 for template.

5. Methods for enhancing hazard identification

The following publication by EASA provides guidance to enhance hazard identification processes:

https://www.easa.europa.eu/sites/default/files/dfu/ECASTSMSWG-GuidanceonHazardIdentification1.pdf.

APPENDIX 4b: SAFETY INVESTIGATION

1) Safety investigation triggers

(a) Hazard identification should be continuous and part of the organisation's ongoing activities. There may be a need to filter reports on entry when there are a large number of safety reports. This may involve an initial safety risk assessment to determine whether further investigation is necessary and what level of investigation is required.

(b) Effective safety management depends on quality investigations to analyse safety occurrences and safety hazards, and report findings and recommendations to improve safety in the operating environment.

(c) Some conditions may merit more detailed investigation. These may include:

(1) instances where the organisation experiences an unexplained increase in aviation safety-related events or regulatory non-compliance following on demand and continuous monitoring: Hazard identification is applied to existing systems in operation. Data monitoring is used to detect changes in the hazard situation. For example, hazard manifestation may be more frequent or more severe than expected, or the agreed mitigation strategies are less effective than expected. Continuous monitoring and analysis can be established with notification thresholds based on a set of critical items of interest; ; or

(2) significant changes to the organisation or its activities:

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

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

2) Safety investigation objectives and benefits

(a) Organisation's safety investigations are conducted by organisations as part of their SMS to support hazard identification and risk assessment processes. There are many safety occurrences that could provide a valuable source of hazard identification or identify weaknesses in risk controls. These problems might be revealed and remedied by a safety investigation led by the organisation.

(b) The primary objective of the organisation safety investigation is to understand what happened, and how to prevent similar situations from occurring in the future by eliminating or mitigating safety deficiencies. This is achieved through careful and methodical examination of the event and by applying the lessons learned to reduce the probability and/or consequence of future recurrences.

(c) Organisation safety investigations are an integral part of the organisation's SMS. Organisation investigations of safety occurrences and hazards are an essential activity of the overall risk management process in aviation. The benefits of conducting a safety investigation include:

(1) gaining a better understanding of the events leading up to the occurrence;

(2) identifying contributing human, technical and organisational factors;

(3) identifying hazards and conducting risk assessments;

(4) making recommendations to reduce or eliminate unacceptable risks; and

(5) identifying lessons learned that should be shared with the appropriate members of the aviation community.

3) Investigation criteria

(a) An organisation safety investigation is usually triggered by a notification (report) submitted through the safety reporting system.

(b) Not all occurrences or hazards can or should be investigated; the decision to conduct an investigation and its depth should depend on the actual or potential consequences of the occurrence or hazard. The following will guide the safety investigation decisions, what to investigate and the scope of the investigation. This could include:

(1) the severity or potential severity of the outcome

(2) regulatory or organisational requirements to carry out an investigation;

(3) safety value to be gained;

(4) opportunity for safety action to be taken;

(5) risks associated with not investigating;

(6) contribution to targeted safety programmes;

(7) identified trends; and

(8) training benefit.

4) Assigning an investigator

(a) If an investigation is to commence, the first action will be to appoint an investigator or where the resources are available, an investigation team with the required skills and expertise. The size of the

team and the expertise profile of its members depend on the nature and severity of the occurrence being investigated. The investigating team may require the assistance of other specialists. Often, a single person is assigned to carry out an internal investigation, with support from operations and safety office experts.

(b) Organisation safety investigators are ideally organisationally independent from the area associated with the occurrence or identified hazard. Better results will be obtained if the investigator(s) are knowledgeable (trained) and skilled (experienced) in organisation safety investigations. The investigators would ideally be chosen for the role because of their knowledge, skills and character traits, which should include: integrity, objectivity, logical thinking, pragmatism, and lateral thinking.

5) The investigation process

(a) The investigation should identify what happened and why it happened and this may require root cause analysis to be applied as part of the investigation (Refer to APPENDIX 10). Ideally, the people involved in the event should be interviewed as soon as possible after the event. The investigation should include:

(1) establishing timelines of key events, including the actions of the people involved;

(2) review of any policies and procedures related to the activities;

(3) review of any decisions made related to the event;

(4) identifying any risk controls that were in place that should have prevented the event occurring; and

(5) reviewing safety data for any previous or similar events.

(b) The safety investigation should focus on the identified hazards and safety risks and opportunities for improvement, not on blame or punishment. The way the investigation is conducted, and most importantly, how the report is written, will influence the likely safety impact, the future safety culture of the organisation, and the effectiveness of future safety initiatives.

6) Assessing human factor related risks

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

(1) contributing to an accident or incident through variable performance due to human limitations;

(2) anticipating and taking appropriate actions to avoid a hazardous situation: and

(3) solving problems, making decisions and taking actions to mitigate risks.

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

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

(1) human performance is highly variable, with a wide range of interacting influences internal and external to the individual. Many of the effects of the interaction between these influences are difficult, or impossible to predict; and

(2) the consequences of variable human performance will differ according to the task being performed and the context.

(d) This complicates how the probability and the severity of the risk is determined. Therefore, human factors expertise is valuable in the identification and assessment of safety risks.

7) Human factor in the system

(a) How people think about their responsibilities towards safety and how they interact with others to perform their tasks at work significantly affects their organisation's safety performance. Managing safety needs to address how people contribute, both positively and negatively, to organisational safety.

(b) Human factors is about: understanding the ways in which people interact with the world, their capabilities and limitations, and influencing human activity to improve the way people do their work. As a result, the consideration of human factors is an integral part of safety management, necessary to understand, identify and mitigate risks as well as to optimize the human contributions to organisational safety.

(c) The following are key ways in which safety management processes consider human factors:

(1) responsibilities of personnel with respect to safety management are clarified to ensure common understanding and expectations;

(2) personnel are provided with information by the organisation that:

(i) describes the expected behaviours in respect to the organisational processes and procedures;

(ii) describes what actions will be taken by the organisation in response to individual behaviours;

(3) human resourcing levels are monitored and adjusted to ensure there are enough individuals to meet operational demands;

(4) policies, processes and procedures are established to encourage safety reporting;

(5) safety data and safety information are analysed to allow consideration of those risks related to variable human performance and human limitations, with particular attention to any associated organisational and operational factors;

(6) policies, processes and procedures are developed that are clear, concise and workable, with the aim of:

(i) optimizing human performance;

(ii) preventing inadvertent errors;

(iii) reducing the unwanted consequences of variable human performance; the effectiveness of these are continually monitored during normal operations;

(7) ongoing monitoring of normal operations includes assessment of whether processes and procedures are followed and, when they are not followed, investigations are carried out to determine the cause;

(8) safety investigations include the assessment of contributing human factors, examining not only behaviours but reasons for such behaviours (context), with the understanding that in most cases people are doing their best to get the job done;

(9) management of change process includes consideration of the evolving tasks and roles of the human in the system;

(10) personnel are trained to ensure they are competent to perform their duties, the effectiveness of training is reviewed and training programmes are adapted to meet changing needs.

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

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

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

APPENDIX 4c: SAFETY RISK ASSESSMENT, TOLERABILITY AND MITIGATION STRATEGIES

1. Safety analysis

(a) Safety analysis is the process of applying statistical or other analytical techniques to check, examine, describe, transform, condense, evaluate and visualize safety data and safety information to discover useful information, suggest conclusions and support data-driven decision-making.

(b) Analysis helps organisations to generate actionable safety information in the form of statistics, graphs, maps, dashboards and presentations. Safety analysis is especially valuable for large and/or mature organisation with rich safety data.

(c) Safety analysis relies on the simultaneous application of statistics, computing and operations research. The result of a safety analysis should present the safety situation in ways that enable decision makers to make data-driven safety decisions.

(d) Safety data and safety information from the SDCPS and associated safety databases must be analysis and that end, organisations should consider the skills necessary to analyse safety information and decide whether this role, with appropriate training, should be an extension of an existing position or whether it would be more efficient to establish a new position, outsource the role, or use a hybrid of these approaches. The decision will be driven by the plans and circumstances of each organisations.

(e) In parallel with the human resourcing considerations, organisations should assess the existing software, and business and decision-making policies and processes. To be effective, the safety analysis should be integrated with the organisation's existing core tools, policies and processes. Once amalgamated, the ongoing development of safety intelligence should be seamless and part of the organisation's usual business practice.

(f) Safety data and safety information analysis can be conducted in many ways, some requiring more robust data and analytic capabilities than others. The use of suitable tools for analysis of safety data and safety information provides a more accurate understanding of the overall situation by examining the data in ways that reveal the existing relationships, connections, patterns and trends that exist within.

(g) An organisation may local safety committees to conduct safety risk assessments and safety risk control identification, as appropriate. In particular, for organisations that have operations in multiple locations with specific operating environments. Final decisions or control acceptance may be required from higher authorities so that the appropriate resources are provided.

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

(i) An organisation with a mature analysis capability is better able to:

(1) establish effective safety metrics;

(2) establish safety presentation capabilities (e.g. safety dashboard) for ready interpretation of safety information by decision makers;

(3) monitor safety performance of a given sector, organisation, system or process;

(4) highlight safety trends, safety targets;

(5) alert safety decision makers, based on safety triggers;

(6) identify factors that cause change;

(7) identify connections or "correlations" between or among various factors;

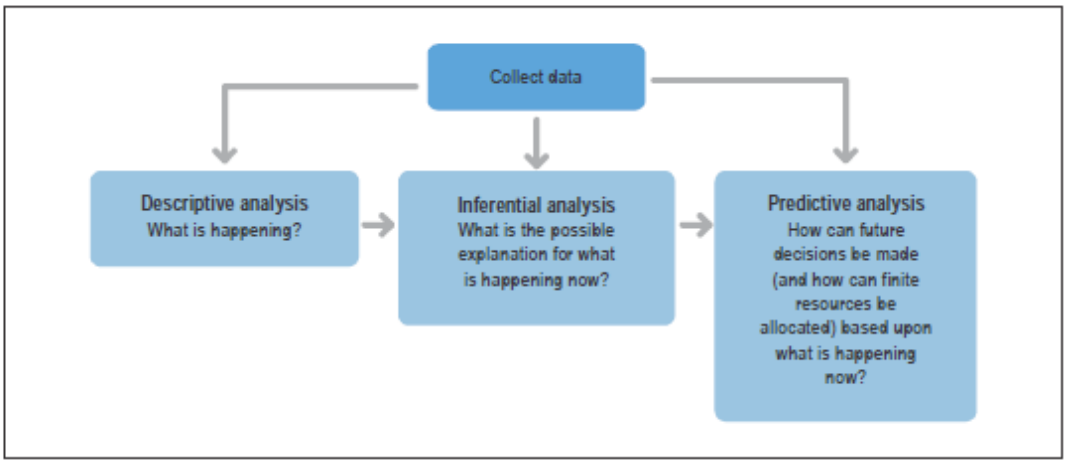
(8) test assumptions; and

(9) develop predictive modelling capabilities to prepare organisation for situations that may eventually occur (such as identifying emerging safety risks).

(j) Risk management methods such as BowTie, can be useful particularly in the implementation of mitigations and controls. APPENDIX 11 shows an example of the BowTie model.

2. Types of analysis

(a) Analysis of safety data and safety information also allows decision makers to help draw conclusions from the safety data. Common approaches include descriptive analysis (describing), inferential analysis (inferring) and predictive analysis (predicting), as illustrated in the following Figure.



Descriptive analysis

(a) Descriptive statistics are used to describe or summarize data in ways that are meaningful and useful. They help describe, show or summarize data in ways so patterns can emerge from the data and help to clearly define case studies, opportunities and challenges.

(b) Descriptive techniques provide information about the data; however, they do not allow users to make conclusions beyond the analysed data or to reach conclusions regarding any hypotheses about the data. They are just a way to describe the data.

(c) Descriptive statistics are helpful because if we simply presented the raw data, particularly in large quantities, it would be hard to visualize what the data is showing us. Descriptive statistics enable users to present and see the data in a more meaningful way, allowing simpler interpretation of the data. Tools such as tables and matrices, graphs and charts and even maps are examples of tools used for summarizing data.

(d) Descriptive statistics include measures of central tendency such as mean (average), median and mode, as well as measures of variability such as range, quartiles, minimum and maximum, frequency distributions, variance and standard deviation (SD). These summaries may either be the initial basis for describing the data as part of a more extensive statistical analysis or they may be sufficient in and of themselves for a particular investigation.

Inferential analysis

(e) Inferential (or inductive) statistics aim to use the data to learn about the larger population the sample of data represents. It is not always convenient or possible to examine each item of an entire population and to have access to a whole population.

(f) Inferential statistics are techniques that allow users of available data to make generalizations, inferences and conclusions about the population from which the samples were taken to describe trends. These include methods for estimating parameters, testing of statistical hypotheses, comparing the average performance of two groups on the same measure to identify differences or similarities, and identifying possible correlations and relationships among variables.

Predictive analysis

(a) Other types of analyses include probability or predictive analyses that extract information from historical and current data and use it to predict trends and behaviour patterns. The patterns found in the data help identify emerging risks and opportunities. Often the unknown event of interest is in the future, but predictive analysis can be applied to any type of unknown in the past, present or future. Predictive risk management allows organisations to identify safety issues and spot trends before they result in a:

(1) near-miss,

(2) incident, or

(3) accident.

(b) The core of predictive analysis relies on capturing relationships between variables from past occurrences and exploiting them to predict the unknown outcome.

(c) Some systems allow users to model different scenarios of risks or opportunities with different outcomes. This enables decision makers to assess the decisions they can make in the face of different unknown circumstances and to evaluate how they can effectively allocate limited resources to areas where the highest risks or best opportunities exist.

(d) Going from reactive to proactive, and finally to the predictive risk management phase in an aviation SMS takes:

1) many years of data collection efforts, and

2) strategic data management planning on the part of senior management.

(e) Once the SMS moves to predictive risk management processes, this does not mean the SMS will cease practicing reactive or proactive risk management strategies. After the SMS matures to the predictive phase, the organisation, with the help of employees and auditors, will continue to monitor the "systems" and respond either reactively or proactively, depending on any detected anomalies within the system.

(f) Mature SMS gradually achieve more "potential predictive capabilities" with collected data that management can use to spot trends and respond appropriately.

Combined analysis

(a) Various types of statistical analyses are interconnected and often conducted together. For example, an inferential technique may be the main tool used to draw conclusions regarding a set of data, but descriptive statistics are also usually used and presented. Also, outputs of inferential statistics are often used as the basis for predictive analysis.

(b) Analytical techniques can be applied to safety analysis in order to:

(1) identify the causes and contributing factors related to hazards and elements which are detrimental to the continuous improvement of aviation safety;

(2) examine areas for improvement and increase in the effectiveness of safety controls; and

(3) support ongoing monitoring of safety performance and trends.

3. Data caveats

(a) Before processing safety data and safety information, there are a number of important considerations such as data quality, aggregation, fusion, and filtering.

(b) Data quality: Data quality relates to data that is clean and fit for purpose. Data quality involves the following aspects:

(1) Cleanliness: Data cleansing is the process of detecting and correcting (or removing) corrupt or inaccurate records from a record set, table, or database and refers to identifying incomplete, incorrect, inaccurate or irrelevant parts of the data and then replacing, modifying, or deleting the dirty or coarse data;

(2) Relevance: Relevant data is data which meets the organisation's needs and represents their most important issues. An organisation should assess the relevance of data based on its needs and activities;

(3) Timeliness: Safety data and safety information timeliness is a function of its currency. Data used for decisions should reflect what is happening as close to real time as possible. Judgement is often required based on the volatility of the situation. For example, data collected two years ago on an aircraft type still operating the same route, with no significant changes, may provide a timely reflection of the situation. Whereas data collected one week ago on an aircraft type no longer in service may not provide a meaningful, timely reflection of the current reality; and

(4) Accuracy and correctness: Data accuracy refers to values that are correct and reflect the given scenario as described. Data inaccuracy commonly occurs when users enter the wrong value or make a typographical error. This problem can be overcome by having skilled and trained data entry personnel or by having components in the application such as spell check. Data values can become inaccurate over time, also known as "data decay". Movement is another cause of inaccurate data. As data is extracted, transformed and moved from one database to another, it may be altered to some extent, especially if the software is not robust.

(c) Aggregation of safety data and safety information:

(1) Data aggregation is when safety data and safety information is gathered and stored in the organisation's SDCPS and expressed in a summary form for analysis. To aggregate safety data and safety information is to collect them together, resulting in a larger data set. In the case of SDCPS, individual items of safety data are aggregated into a database without giving one piece of safety data precedence over another. A common aggregation purpose is to get information about a particular group or type of activity based on specific variables such as: location; fleet type; or professional group.

(2) Data aggregation can sometimes be helpful across multiple organisations or regions that do not have enough data to ensure proper de-identification (to protect the sources of the safety data and safety information), and to support analysis.

(d) Data fusion: Data fusion is the process of merging multiple safety data sets to produce more coherent, linked and useful safety data than that provided by any individual set of safety data. The integration of safety data sets followed by its reduction or replacement improves the reliability and usability of said data. Thus, for example, data from FDA systems of air operators could be merged with meteorological data and radar data to obtain a more useful data set for further processing.

(e) Filtering of safety data and safety information: Safety data filtering refers to a wide range of strategies or solutions for refining safety data sets. This means the data sets are refined into simply what the decision-maker needs, without including other data that can be repetitive, irrelevant or even sensitive. Different types of data filters can be used to generate reports or present the data in ways that facilitate communication.

4. Safety risk matrix

Safety risk probability is the likelihood that a safety consequence or outcome will occur. It is important to envisage a variety of scenarios so that all potential consequences can be considered. The following questions can assist in the determination of probability:

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

(b) What other equipment or components of the same type might have similar issues?

(c) What is the number of personnel following, or subject to, the procedures in question?

(d) What is the exposure of the hazard under consideration? For example, during what percentage of the operation is the equipment or activity in use?

Taking into consideration any factors that might underlie these questions will help when assessing the probability of the hazard consequences in any foreseeable scenario.

An occurrence is considered foreseeable if any reasonable person could have expected the kind of occurrence to have happened under the same circumstances. Identification of every conceivable or theoretically possible hazard is not possible. Therefore, good judgment is required to determine an appropriate level of detail in hazard identification. Organisations should exercise due diligence when identifying significant and reasonably foreseeable hazards related to their product or service.

Table 1 presents a typical safety risk probability classification table. It includes five categories to denote the probability related to an unsafe event or condition, the description of each category, and an assignment of a value to each category. This example uses qualitative terms; quantitative terms could be defined to provide a more accurate assessment. This will depend on the availability of appropriate safety data and the sophistication of the organisation and operation.

Table 1: Safety risk probability table

Risk Probability	Meaning	Value
Frequent	Likely to occur many times (has occurred frequently)	5
Occasional	Likely to occur sometimes (has occurred infrequently)	4
Remote	Unlikely to occur, but possible (has occurred rarely)	3

Improbable	Very unlikely to occur (not known to have occurred)	2
Extremely improbable	Almost inconceivable that the event will occur	1

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

(a) fatalities or serious injury which would occur as a result of:

(1) being in the aircraft;

(2) having direct contact with any part of the aircraft, including parts which have become detached from the aircraft; or

(3) having direct exposure to jet blast; and

(b) damage:

(1) damage or structural failure sustained by the aircraft which:

(i) adversely affects the structural strength, performance or flight characteristics of the aircraft;

(ii) would normally require major repair or replacement of the affected component;

(2) damage sustained by ATS or aerodrome equipment which:

(i) adversely affects the management of aircraft separation; or

(ii) adversely affects landing capability.

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

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

It is not uncommon for people to confuse hazards with their consequences. A consequence is an outcome that can be triggered by a hazard. For example, a runway excursion (overrun) is a potential consequence

related to the hazard of a contaminated runway. By clearly defining the hazard first, one can more readily identify possible consequences.

In the crosswind example above, an immediate outcome of the hazard could be loss of lateral control followed by a consequent runway excursion. The ultimate consequence could be an accident. The damaging potential of a hazard can materialize through one or many consequences. It is important that safety risk assessments identify all of the possible consequences. The most extreme consequence - loss of human life - should be differentiated from those that involve lesser consequences, such as: aircraft incidents; increased flight crew workload; or passenger discomfort.

The description of the consequences will inform the risk assessment and subsequent development and implementation of mitigations through prioritization and allocation of resources. Detailed and thorough hazard identification will lead to more accurate assessment of safety risks.

Table 2 presents a typical safety risk severity table. It includes five categories to denote the level of severity, the description of each category, and the assignment of a value to each category. As with the safety risk probability table, this table is an example only.

Table 2: example of safety risk severity

Severity	Meaning	Value
Catastrophic	• Aircraft / equipment destroyed • Multiple deaths	A
Hazardous	• A large reduction in safety margins, physical distress or a workload such that operational personnel cannot be relied upon to perform their tasks accurately or completely • Serious injury • Major equipment damage	B
Major	• A significant reduction in safety margins, a reduction in the ability of operational personnel to cope with adverse operating conditions as a result of an increase in workload or as a result of conditions impairing their efficiency	C

	• Serious incident • Injury to persons	
Minor	• Nuisance • Operating limitations • Use of emergency procedures • Minor incident	D
Negligible	• Few consequences	E

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

Table 3: Example safety risk matrix

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

Safety risk assessments sometimes have to use qualitative information (expert judgement) rather than quantitative data due to unavailability of data. Using the safety risk matrix allows the user to express the safety risk(s) associated with the identified hazard in a quantitative format. This enables direct magnitude comparison between identified safety risks. A qualitative safety risk assessment criterion such as “likely to occur” or “improbable” may be assigned to each identified safety risk where quantitative data is not available.

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

(a) the organisation’s exposure to the particular risk, i.e., reduce the probability component of the risk to an acceptable level;

(b) the severity of consequences related to the hazard, i.e., reduce the severity component of the risk to an acceptable level; or

(c) both the severity and probability so that the risk is managed to an acceptable level.

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

Table 4: Example of safety risk tolerability

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

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

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

(a) *Avoidance*: The operation or activity is cancelled or avoided because the safety risk exceeds the benefits of continuing the activity, thereby eliminating the safety risk entirely.

(b) *Reduction*: The frequency of the operation or activity is reduced, or action is taken to reduce the magnitude of the consequences of the safety risk.

(c) *Segregation*: Action is taken to isolate the effects of the consequences of the safety risk or build in redundancy to protect against them.

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

A safety risk mitigation strategy may involve one of the approaches described above or may include multiple approaches. It is important to consider the full range of possible control measures to find an optimal solution. The effectiveness of each alternative strategy must be evaluated before a decision is made. Corrective action should take into account any existing defences and their (in)ability to achieve an acceptable level of safety risk. This may result in a review of previous safety risk assessments that may have been impacted by the corrective action. Safety risk mitigations and controls will need to be verified/audited to ensure that they are effective. Another way to monitor the effectiveness of mitigations is through the use of SPIs.

APPENDIX 5: EMERGENCY RESPONSE PLAN MANUAL

(a) An ERP would normally be documented in the format of a manual that should set out the responsibilities, roles and actions of the various agencies and personnel involved in dealing with specific emergencies. The ERP may be directly integrated into the SMS Manual. If the Emergency Response Plan is documented in a separate document, it must be cross-linked to SMS manual.

(b) It should reflect the size, nature and complexity of the activities performed by the organisation.

(c) ERP manual should:

(1) ensure delegation of emergency authority;

(2) ensure authorisation by key personnel for actions contained in the plan;

(3) ensure coordination of efforts with other states and industry organisations to cope with the emergency;

(4) ensure that the responsibilities, roles and actions of various agencies and personnel involved in dealing with emergencies are defined and personnel trained;

(5) be periodically tested for the adequacy of the plan and the results reviewed to improve its effectiveness.

(6) ensure operations continue safely or return to normal operations as soon as practicable; it should include the period of time required to re-establish “normal” operations following the emergency

(7) address possible or likely emergency/crisis scenarios relating to the organisation’s aviation product or service deliveries, identified through the SMS including public health emergency or pandemic possibilities, as appropriate;

(8) include mitigating actions, processes and controls to effectively manage aviation-related emergencies;

(9) take into account considerations such as:

(i) governing policies;

(ii) organisation;

(iii) notifications;

(iv) initial response;

(v) additional assistance;

(vi) Crisis Management Centre (CMC);

(vii) records;

(viii) accident site;

(ix) news media;

(x) formal investigations;

(xi) family assistance;

(xii) post-critical incident stress counselling; and

(xiii) post-occurrence review; and

(10) be easily accessible to the appropriate key personnel as well as to the coordinating external organisations.

(a) An ERP should take account of such considerations as:

(1) Governing policies. The ERP should provide direction for responding to emergencies, such as governing laws and regulations for investigations, agreements with local authorities, company policies and priorities.

(2) Organisation. The ERP should outline management's intentions with respect to the responding organisations by:

(i) designating who will lead and who will be assigned to the response teams;

(ii) defining the roles and responsibilities of personnel assigned to the response teams;

(iii) clarifying the reporting lines of authority;

(iv) setting up an Emergency Management Centre (EMC);

(v) establishing procedures for receiving a large number of requests for information, especially during the first few days after a major accident;

(vi) designating the corporate spokesperson for dealing with the media;

(vii) defining what resources will be available, including financial authorities for immediate activities;

(viii) designating the company representative to any formal investigations undertaken by State officials;

(ix) defining a call-out plan for key personnel.

An organisational chart could be used to show organisational functions and communication relationships.

(3) Notifications. The plan should specify who in the organisation should be notified of an emergency, who will make external notifications and by what means. The notification needs of the following should be considered:

(i) management;

(ii) State authorities (search and rescue, the regulatory authority, the accident investigation board, etc.);

(iii) local emergency response services (aerodrome authorities, fire fighters, police, ambulance, medical agencies, etc.);

(iv) relatives of victims (a sensitive issue that, in many States, is handled by the police);

(v) company personnel;

(vi) media; and

(vii) legal, accounting, insurers, etc.

(4) Initial response. Depending on the circumstances, an initial response team may be dispatched to the accident or crisis site to augment local resources and oversee the organisation's interests. Factors to be considered for such a team include:

(i) Who should lead the initial response team?

(ii) Who should be included on the initial response team?

(iii) Who should speak for the organisation at the accident site?

(iv) What would be required by way of special equipment, clothing, documentation, transportation, accommodation, etc.?

(5) Additional assistance. Employees with appropriate training and experience can provide useful support during the preparation, exercising and updating of an organisation's ERP. Their expertise may be useful in planning and executing such tasks as:

(i) acting as passengers or customers in exercises;

(ii) handling survivors or external parties;

(iii) dealing with next of kin, authorities, etc.

(6) Emergency Management Centre (EMC). An EMC (normally on standby mode) may be established at the organisation's headquarters once the activation criteria have been met. In addition, a

command post (CP) may be established at or near the crisis site. The ERP should address how the following requirements are to be met:

(i) staffing (perhaps for 24 hours a day, 7 days per week, during the initial response period);

(ii) communications equipment (telephones, facsimile, Internet, etc.);

(iii) documentation requirements, maintenance of emergency activity logs;

(iv) impounding related company records;

(v) office furnishings and supplies; and

(vi) reference documents (such as emergency response checklists and procedures, company manuals, aerodrome emergency plans and telephone lists).

The services of a crisis centre may be contracted from an airline or other specialist organisation to look after the Organisation's interests in a crisis away from home base. Company personnel would normally supplement such a contracted centre as soon as possible.

(7) Records. In addition to the organisation's need to maintain logs of events and activities, the organisation will also be required to provide information to any State investigation team. The ERP should address the following types of information required by investigators:

(i) all relevant records about the product or service concerned;

(ii) lists of points of contact and any personnel associated with the occurrence;

(iii) notes of any interviews (and statements) with anyone associated with the event;

(iv) any photographic or other evidence.

(8) Accident site. For a major accident, representatives from many jurisdictions have legitimate reasons for accessing the site: for example, police; fire fighters; medics; aerodrome authorities; coroners (medical examining officers) to deal with fatalities; State accident investigators; relief agencies such as the Red Crescent and even the media. Although coordination of the activities of these stakeholders is the responsibility of the State's police and/or investigating authority, the Organisation should clarify the following aspects of activities at the accident site:

(i) nominating a senior company representative at the accident site if:

- at home base;
- away from home base;
- offshore or in a foreign State;

(ii) management of surviving victims;

(iii) the needs of the relatives of victims;

(iv) security of the wreckage;

(v) handling of human remains and personal property of the deceased;

(vi) preservation of evidence;

(vii) provision of assistance (as required) to the investigation authorities;

(viii) removal and disposal of the wreckage; etc.

(9) News media. How the company responds to the media may affect how well the company recovers from the event. Clear direction is required regarding, for example:

(i) what information is protected by statute (FDR data, CVR and ATC recordings, witness statements, etc.);

(ii) who may speak on behalf of the parent organisation at head office and at the accident site (public relations manager, chief executive officer or other senior executive, manager, owner);

(iii) prepared statements for immediate response to media queries;

(iv) what information may be released (what should be avoided);

(v) the timing and content of the company's initial statement;

(vi) provisions for regular updates to the media.

(10) Formal investigations. Guidance for company personnel dealing with State accident investigators and police should be provided.

(11) Family assistance. The ERP should also include guidance on the organisation's approach to assisting crisis victims or customer organisations. This guidance may include such things as:

(i) State requirements for the provision of assistance services;

(ii) travel and accommodation arrangements to visit the crisis site;

(iii) programme coordinator and point(s) of contact for victims/customers;

(iv) provision of up-to-date information;

(v) temporary assistance to victims or customers.

(12)Post-occurrence review. Direction should be provided to ensure that, following the emergency, key personnel carry out a full debrief and record all significant lessons learned which may result in amendments to the ERP and associated procedures.

(13)Any other additional elements specified in the following ICAO Documentation:

(i) Annex 14 – Aerodromes, Volume 1 – Aerodrome Design and Operations, Chapter 9;

(ii) Annex 19, Appendix 2, 1.4 – provision for coordination of interfacing procedures of organisations ERPs;

(iii) Doc 9137 - Airport Services Manual, Part 7 - Airport Emergency Planning;

(iv) Doc 9426 - Air Traffic Services Planning Manual; and

(v) Circular 285/AN166 – guidance on assistance to aircraft accident victims and their families.

APPENDIX 6: SMS IMPLEMENTATION PLAN

Establishing a solid foundation is essential to achieving effective safety management implementation. The following fundamentals should be present as the first steps in implementing SMS requirements:

(a) Senior management commitment: It is essential that senior management is committed to effective safety management implementation.

(b) Compliance with prescriptive requirements: Organisations should ensure that a mature safety compliance monitoring system is in place, including qualified technical personnel and they have processes in place to ensure continued compliance with the established prescriptive requirements.

(c) Disciplinary regime: Organisations should establish a disciplinary policy and frameworks to enable Organisations to manage and resolve deviations and minor violations.

(d) Safety information protection: Organisations should put in place a protective framework to ensure the continued availability of safety data and safety information.

Before implementing SMS, the following consideration should be included in the SMS:

(a) System description

The system description is a summary of the organisation's processes, activities and interfaces that need to be assessed for hazard identification and safety risk assessment that is covered by their safety system. It describes the aviation system, within which the organisation functions, and the various entities and authorities involved. It includes interfaces within the organisation, as well as interfaces with external organisations that contribute to the safe delivery of services. The system description provides a starting point to implement the SMS.

(b) Size and complexity considerations

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 a performance-based approach.

The system is designed to deliver the desired outcomes for each organisation without undue burden. SMS, well implemented, are intended to complement and enhance the organisation's existing systems and processes. Effective safety management will be achieved through thoughtful planning and implementation, ensuring each requirement is addressed in ways that fit the organisation's culture and operating environment.

(c) Interfaces

When organisations are considering implementing safety management it is important to consider the safety risks induced by interfacing entities. Interfaces can be internal (e.g. between operations and maintenance, or finance, human resources or legal departments), or they can be external (e.g. other contracted services). Organisations have greater control over any related safety risks when interfaces are identified and managed. Interfaces are defined as part of the system description.

(d) Interface safety impact assessment

Once an organisation has identified its interfaces, the safety risk posed by each interface should be assessed using the organisation's existing safety risk assessment processes. Based on the safety risks identified, the organisation may consider working with other organisations to determine an appropriate safety risk control strategy. Organisations working collaboratively may be able to identify more interface hazards; assessing any related safety risks and determining mutually appropriate controls. Collaboration is highly desirable because the safety risk perception may vary between organisations.

It is also important to recognize that each organisation involved is responsible for identifying and managing any identified hazards that affect its organisation. The criticality of the interface may differ for each organisation. Each organisation might reasonably apply different safety risk classifications and have different safety risk priorities (in terms of safety performance, resources, time).

(e) Monitoring and management of interfaces

Organisations are responsible for ongoing monitoring and management of their interfaces to ensure the safe provision of services. An effective approach to interface SRM is to establish formal agreements between interfacing organisations with clearly defined monitoring and management responsibilities. Documenting and sharing all interface safety issues, safety reports and lessons learned, as well as safety risks between interfacing organisations will ensure clear understanding. Sharing enables transfer of knowledge and working practices that could improve the safety effectiveness of each organisation.

Performing a gap analysis before embarking on the implementation of SMS will allow an organisation to identify the gap between the current organisational structures and processes, and those required for effective SMS operation.

Establishing and maintaining an SMS implementation plan provides a clear description of the resources, tasks and processes required, and an indicative timing and sequencing of key tasks and responsibilities.

The SMS Implementation Plan consists of four implementation phases with each phase associated with various elements (or sub-elements):

(a) **Phase 1:** The objective of Phase 1 of SMS implementation is to provide a blueprint of how the SMS requirements can be met and integrated into the organisation's control systems, as well as an accountability framework for the implementation of the SMS.

(b) **Phase 2:** The objective of Phase 2 is to implement essential safety management processes, while at the same time correcting potential deficiencies in existing safety management processes. Most organisations will have some basic safety management activities in place at different levels of implementation. This phase aims at consolidating existing activities and developing those which do not yet exist.

(c) **Phase 3:** The objective of Phase 3 is to establish safety risk management processes. Towards the end of Phase 3, the organisation will be ready to collect safety data and perform safety analyses based on information obtained through the various reporting systems.

(d) **Phase 4:** Phase 4 is the final phase of SMS implementation. This phase involves the mature implementation of safety risk management and safety assurance. In this phase operational safety assurance is assessed through the implementation of periodic monitoring, feedback and continuous corrective action to maintain the effectiveness of safety risk controls.

1) Phase 1	2) Phase 2	3) Phase 3	4) Phase 4
1. SMS Element PART 2, SUBPART 1, SECTION 1: a) identify the Accountable Manager; b) establish an SMS implementation team; c) define the scope of the SMS; d) perform an SMS gap analysis.	1. SMS Element PART 2, SUBPART 1, SECTION 1: a) establish the safety policy and objectives, 2. SMS Element PART 2, SUBPART 1, SECTION 2: a) define safety management responsibilities and accountabilities across relevant departments of the organisation;	1. SMS Element SMS.SRM.001: a) establish a voluntary hazard reporting procedure. 2. SMS Element SMS.SRM.005 : a) establish safety risk management procedures. 3. SMS Element SMS.SA.001:	1. SMS Element PART 2, SUBPART 1, SECTION 1: a) enhance the existing disciplinary procedure/ policy with due consideration of unintentional errors or mistakes from deliberate or gross violations. 2. SMS Element PART 2, SUBPART 1, SECTION 1:

2. SMS Element PART 2, SUBPART 1, SECTION 5*:* a) develop an SMS implementation plan. 3. SMS Element PART 2, SUBPART 1, SECTION 3: a) establish a key person/office responsible for the administration and maintenance of the SMS. 4. SMS Element SMS.SP.001: a) establish an SMS training programme for personnel, with priority for the SMS implementation team. 5. SMS Element SMS.SP.005: a) initiate SMS/safety communication channels.	b) establish an SMS/safety coordination mechanism/ committee; c) establish departmental/ divisional SAGs where applicable. 3. SMS Element PART 2, SUBPART 1, SECTION 4: a) establish an emergency response plan. 4. SMS Element PART 2, SUBPART 1, SECTION 5: a) initiate progressive development of an SMS document/manual and other supporting documentation.	a) establish occurrence reporting and investigation procedures; b) establish a safety data collection and processing system for high-consequence outcomes; c) develop high-consequence SPIs and associated targets and alert settings. 4. SMS Element SMS.SA.005: a) establish a management of change procedure that includes safety risk assessment. 5. SMS Element SMS.SA.010: a) establish an internal quality audit programme; b) establish an external quality audit programme.	a) integrate hazards identified from occurrence investigation reports with the voluntary hazard reporting system; b) integrate hazard identification and risk management procedures with the subcontractor's or customer's SMS where applicable. 3. SMS Element SMS.SA.001: a) enhance the safety data collection and processing system to include lower-consequence events; b) develop lower-consequence SPIs and associated targets/alert settings. 4. SMS Element SMS.SA.010: a) establish SMS audit programmes or integrate them into existing internal and external audit programmes; b) establish other operational SMS review/survey programmes where appropriate.

			5. SMS Element SMS.SP.001: a) ensure that the SMS training programme for all relevant personnel has been completed. 6. SMS Element SMS.SP.005: a) promote safety information sharing and exchange internally and externally.

Soon after the key components and elements of the SMS are implemented, periodic assessments should be conducted to monitor how effectively it is working. As the system matures, the organisation should seek assurance that it is operating as intended and is effective at achieving its stated safety objectives and targets. Safety management takes time to mature and the aim should be to maintain or continuously improve the safety performance of the organisation.

Section 9.7 of ICAO SMM Doc. 9859 contains more information to develop an implementation plan:

https://www.unitingaviation.com/publications/safetymanagementimplementation/content/#/lessons/W0Ia3XLhZ7fO0MudZfyn-6kXf4TcsY2_

APPENDIX 7a: UNDERSTANDING SAFETY PERFORMANCE INDICATOR (SPI)

1. Qualitative and quantitative indicators

(a) SPIs are used to help senior management know whether or not the organisation is likely to achieve its safety objective; they can be qualitative or quantitative. Quantitative indicators relate to measuring by the quantity, rather than its quality, whereas qualitative indicators are descriptive and measure by quality.

(b) Quantitative indicators should be preferred over qualitative indicators because they are more easily counted and compared. The choice of indicator depends on the availability of reliable data that can be measured quantitatively. Does the necessary evidence have to be in the form of comparable, generalizable data (quantitative), or a descriptive image of the safety situation (qualitative)?

(c) Each option, qualitative or quantitative, involves different kinds of SPIs, and requires a thoughtful SPI selection process. A combination of approaches is useful in many situations, and can solve many of the problems which may arise from adopting a single approach.

(d) An example of a qualitative indicator for an organisation could be the maturity of their SMS, or the assessment of the safety culture.

(e) Quantitative indicators can be expressed as a number (x incursions) or as a rate (x incursions per n movements). In some cases, a numerical expression will be sufficient. However, just using numbers may create a distorted impression of the actual safety situation if the level of activity fluctuates. For example, if air traffic control records three altitude busts in July and six in August, there may be great concern about the significant deterioration in safety performance. But August may have seen double the movements of July meaning the altitude busts per movement, or the rate, has decreased, not increased. This may or may not change the level of scrutiny, but it does provide another valuable piece of information that may be vital to data-driven safety decision-making.

(f) For this reason, where appropriate, SPIs should be reflected in terms of a relative rate to measure the performance level regardless of the level of activity. This provides a normalized measure of performance; whether the activity increases or decreases. As another example, an SPI could measure the number of runway incursions. But if there were fewer departures in the monitored period, the result could be misleading. A more accurate and valuable performance measure would be the number of runway incursions relative to the number of movements, e.g. x incursions per 1 000 movements.

2. Lagging indicators - general

(a) Lagging SPIs measure events that have already occurred. They are also referred to as “outcome-based SPIs” and are normally (but not always) the negative outcomes the organisation is aiming to avoid.

(b) Lagging SPIs help the organisation understand what has happened in the past and are useful for long-term trending. They can be used as a high-level indicator or as an indication of specific occurrence types or locations, such as “types of accidents per aircraft type”. Because lagging SPIs measure safety outcomes, they can measure the effectiveness of safety mitigations. They are effective at validating

the overall safety performance of the system. For example, monitoring the "number of ramp collisions per number of movements between vehicles following a redesign of ramp markings" provides a measure of the effectiveness of the new markings (assuming nothing else has changed). The reduction in collisions validates an improvement in the overall safety performance of the ramp system; which may be attributable to the change in question.

(c) Trends in lagging SPIs can be analysed to determine conditions existing in the system that should be addressed. Using the previous example, an increasing trend in ramp collisions per number of movements may have been what led to the identification of sub-standard ramp markings as a mitigation.

(d) Lagging SPIs are divided into two types:

(1) low probability/high severity (e.g. accidents and serious incidents): outcomes such as accidents or serious incidents. The low frequency of high severity outcomes means that aggregation of data (at industry segment level or regional level) may result in more meaningful analyses. An example of this type of lagging SPI would be "aircraft and/or engine damage due to bird strike" or:

(i) number of accidents per 1000 aircraft movements;

(ii) number of runway excursions/1000 landings;

(iii) number of ground collisions per aircraft movements;

(iv) number of runway excursions/1000 landings;

(v) number of hard landings/1000 movements.

(2) high probability/low severity (e.g. uneventful operational events, non-conformance reports, deviations etc.): outcomes that did not necessarily manifest themselves in a serious accident or incident, these are sometimes also referred to as precursor indicators. SPIs for high probability/low severity outcomes are primarily used to monitor specific safety issues and measure the effectiveness of existing safety risk mitigations. An example of this type of precursor SPI would be "bird radar detections", which indicates the level of bird activity rather than the amount of actual bird strikes or:

(i) number of unstabilised approaches/1000 landings;

(ii) number of incidents attributable to training per flight hours;

(iii) number of incidents/1000 flight hours;

(iv) number of technical failures with operational impact per aircraft movements.

3. Leading indicators - general

(a) Aviation safety measures have historically been biased towards SPIs that reflect "low probability/high severity" outcomes. This is understandable in that accidents and serious incidents are high profile events and are easy to count.

(b) Leading SPIs measure processes and inputs being implemented to improve or maintain safety. These are also known as "activity or process SPIs" as they monitor and measure conditions that have the potential to lead to or contribute to a specific outcome (e.g. training, system improvements and report processing).

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

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

(e) Examples of leading SPIs driving the development of organisational capabilities for proactive safety performance management include such things as "percentage of staff who have successfully completed safety training on time" or "frequency of bird scaring activities".

(f) Leading SPIs may also inform the organisation about how their operation copes with change, including changes in its operating environment. The focus will be either on anticipating weaknesses and vulnerabilities as a result of the change, or monitoring the performance after a change. An example of an SPI to monitor a change in operations would be "percentage of sites that have implemented procedure X". Other Examples:

(i) percentage of changes to Standard Operating Procedures that have been subject to hazard identification and safety risk management;

(ii) number of employees trained in hazard identification;

(iii) number of safety reports received per year;

(iv) number of non-compliances per audits planning cycle;

(v) number of organisational changes subjected to SRA per year;

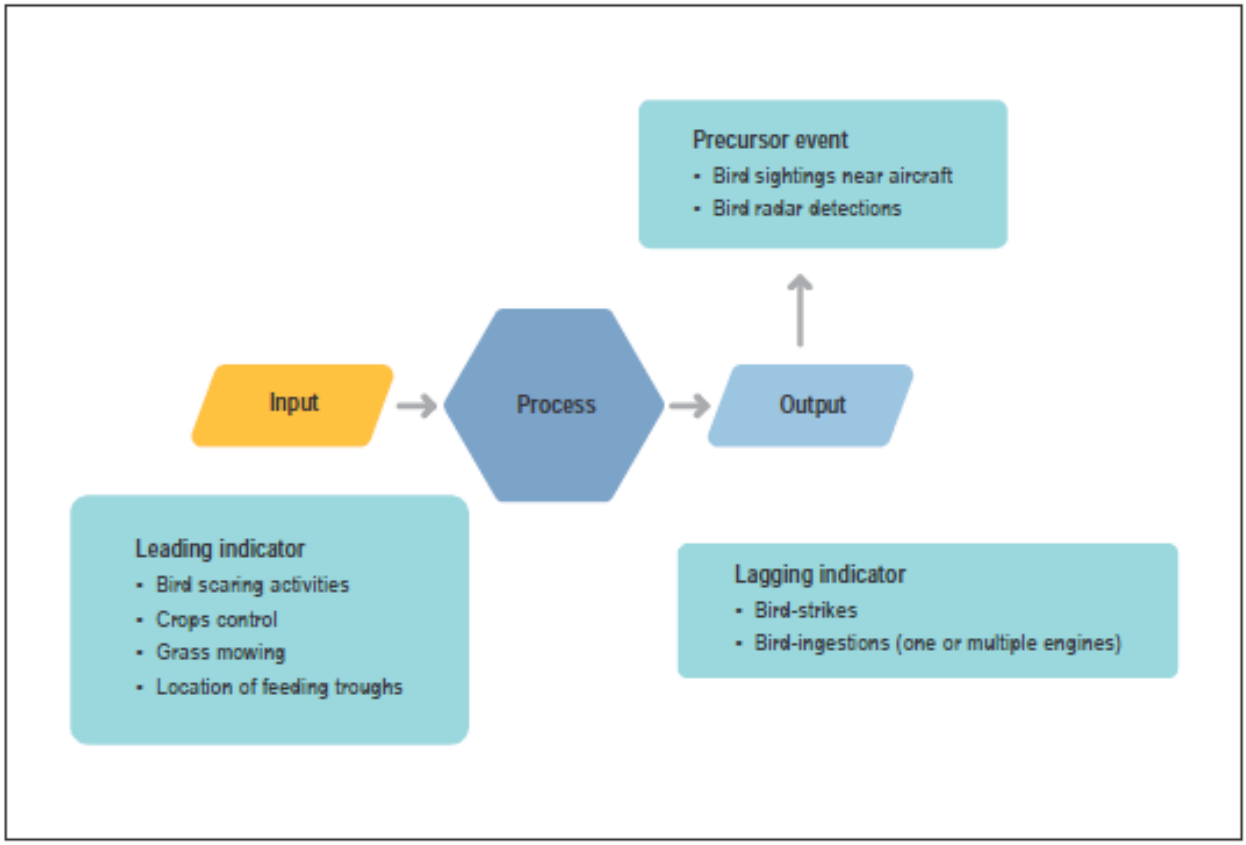
(vi) number of personnel trained in emergency response;

(vii) number of risk controls implemented through proactive hazard identification.

4. A combination of lagging and leading indicators: a more realistic picture

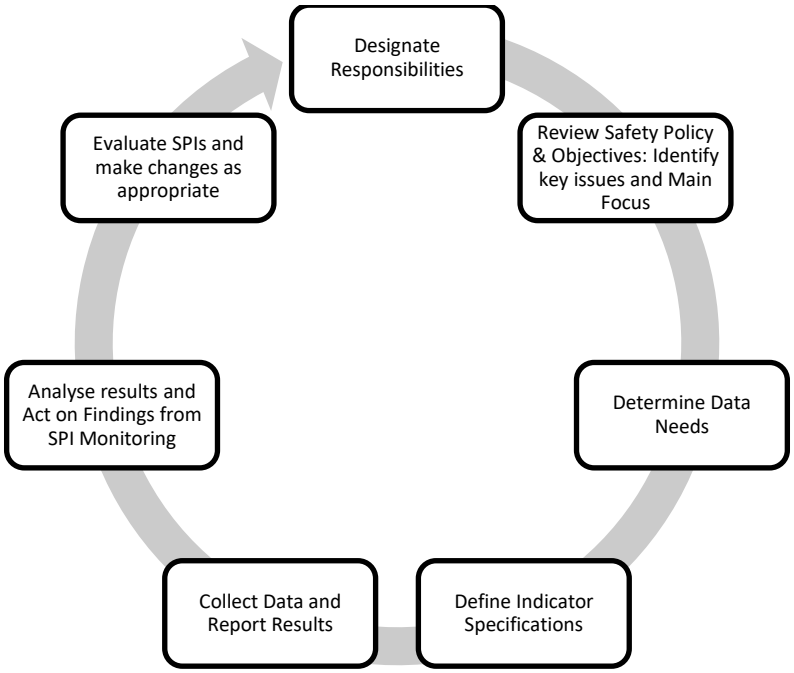
(a) For a more accurate and useful indication of safety performance, lagging SPIs, measuring both "low probability/high severity" events and "high probability/low severity" events should be combined with leading SPIs.

(b) The following Figure illustrates the concept of leading and lagging indicators that provide a more comprehensive and realistic picture of the organisation's safety performance.



5. Process for selecting, defining and refining SPIs

A typical process for developing a set of safety performance indicators should typically follow the 'Plan-Do-Check-Act' logic for continual improvement as shown in below Figure.



Designate responsibilities

The organisation must designate personnel with responsibilities for initiating the effective promotion and coordination of the introduction of the SPIs.

Review Safety Policy and Objectives-Identify key issues and main focus

Safety Policy and Objectives must be reviewed to identify the scope and focus of measurement, determine the safety actions and risk controls/barriers that would be suitable for the definition of operational SPIs.

Determine Data Needs

To be meaningful, performance measurement must be based on reliable and valid data. Therefore, all pertinent data and information available within the organisation must be identified and the need for any additional information determined. Information available through the internal audit/compliance monitoring system should also be considered.

Define indicator specifications

Each SPI must be accompanied by sufficient information on data sources, currency, accuracy, and any other pertinent details which enables any user to determine both the source and quality of the information, and place this indicator in the context necessary to interpret and manage it effectively.

Collect data and report results

Data sources, how data should be compiled, and what the reports will look like, as well as roles and responsibilities for collection and reporting, should be specified and documented. The presentation of results for each SPI should facilitate understanding of any deviations and identification of any important trends (e.g., scoreboards with traffic lights, histograms, linear graphs).

Analyse results and act on findings from SPI monitoring

The results obtained through the collection, analysis and interpretation of SPIs should be conveyed to management at regular intervals through the relevant safety committees to determine what actions are required to address deficiencies or to further improve the system. All staff should also be informed of the results as part the safety communication and promotion.

Evaluate SPIs and make changes as appropriate

The set of SPIs and their specifications, including the metrics and any defined targets, should be periodically reviewed and evaluated to consider:

1. Selecting and defining SPIs

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

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

(c) SPIs should be:

(1) related to the safety objective they aim to indicate: Determine the most appropriate SPIs that will show the organisation is on track to achieving its safety objectives. Also consider what are the most significant safety issues and safety risks faced by the organisation, and identify SPIs which will show effective control of these

(2) selected or developed based on available data or on reliable measurement: Is there data available which aligns with what the organisation wants to measure? If there isn't, there may be a need to establish additional data collection sources. For organisations with limited amounts of data, the pooling of data sets may also help to identify trends. Additionally, data may be unreliable either because of its subjectivity or because it is incomplete.

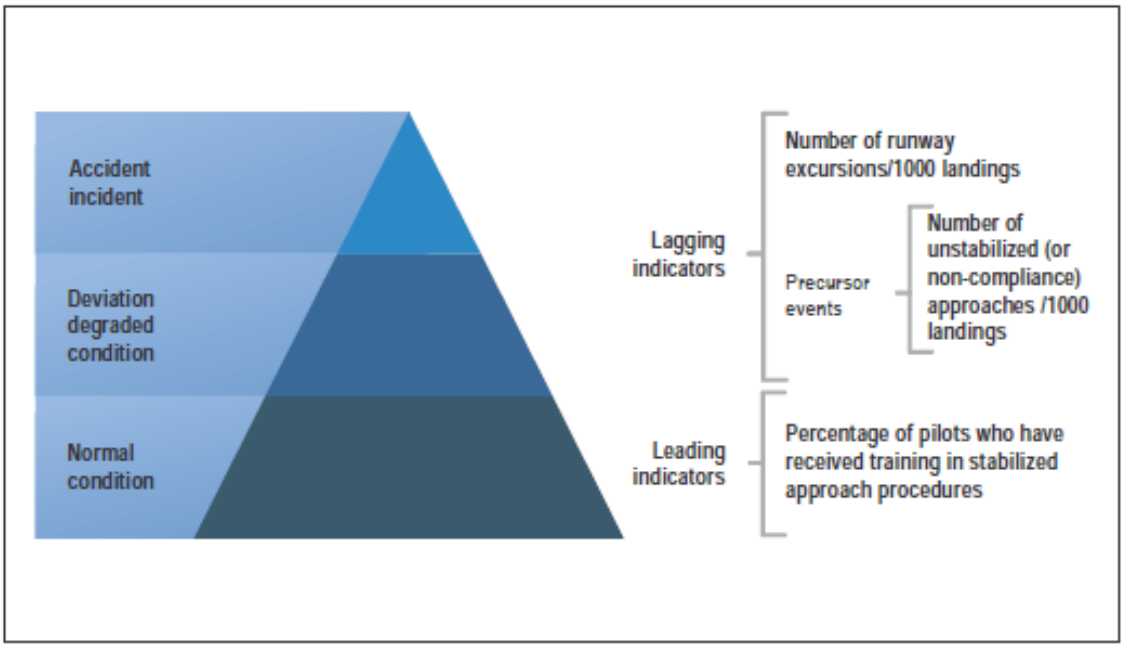
(3) sensitive to changes. Well defined to ensure sensitivity to changes in what it is measuring.

(4) understandable by those in charge with the responsibility of implementing/using them. Therefore, indicators should be simple enough to be easily and accurately communicated.

(5) realistic, by taking into account the possibilities and constraints of the organisation.

(6) common with other organisations: It may be useful to agree on common SPIs with similar organisations so that comparisons can be made between organisations.

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



(e) It is important to select SPIs that relate to the organisation's safety objectives. Having SPIs that are well defined and aligned will make it easier to identify SPTs, which will show the progress being made towards the attainment of safety objectives. This allows the organisation to assign resources for greatest safety effect by knowing precisely what is required, and when and how to act to achieve the planned safety performance. For example, an organisation has a safety objective of "reduce the

number of runway excursions by 50 per cent in three years" and an associated, well-aligned SPI of "number of runway excursions per million departures across all aerodromes". If the number of excursions drops initially when monitoring commences, but starts to climb again after twelve months, the organisation could choose to reallocate resources away from an area where, according to the SPIs, the safety objective is being easily achieved and towards the reduction of runway excursions to alleviate the undesirable trend.

(f) The contents of each SPI should include:

(1) a description of what the SPI measures;

(2) the purpose of the SPI (what it is intended to manage and who it is intended to inform);

(3) the units of measurement and any requirements for its calculation;

(4) who is responsible for collecting, validating, monitoring, reporting and acting on the SPI (these may be staff from different parts of the organisation);

(5) where or how the data should be collected; and

(6) the frequency of reporting, collecting, monitoring and analysis of the SPI data.

Example:

(1) SPI: Aircraft Ground Damage Events Rate

(2) Purpose: Damage to aircraft while on ground but not including bird-strikes.

(3) Unit: Number of occurrences per 100 000 Movements

(4) Responsibility: Manager Ground Operations

(5) Source of Data: Safety Reports

(6) Frequency: Monthly

(g) In the case of smaller organisations, simple/broader SPIs may be initially developed and narrow down some of these SPIs to help identify specific issues and trends as they gather more data. **Examples of simple SPIs:**

(1) events including structural damage, fire, explosion and so forth to equipment;

(2) events indicating circumstances that an accident nearly occurred;

(3) events in which damage to equipment was narrowly avoided;

(4) events in which operational personnel or stakeholders were fatally or seriously injured.

Refer to sections 9 and 10 of Appendix 7a for more examples.

2. Additional considerations for SPI selection

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

(b) Optimal spread of SPIs. A combination of SPIs that encompass the focus areas will help gain an insight to the organisation's overall safety performance and enable data-driven decision-making. They should be sufficiently comprehensive and reflect the scope, nature and complexity of the organisation's aviation activities. Typical scope of activities for an airline are:

(1) Flight Operations

(2) Training

(3) Ground Handling

(4) Cabin Safety

(5) Flight Dispatch

(6) Line Maintenance

(7) Base Maintenance

(8) Sub-contracted services

(9) Cadet Training

(10) Safety/Quality Management

(11) Provision of Air Traffic Services

(12) Aerodrome operations

(c) Clarity of SPIs. When selecting an SPI, it should be clear what is being measured and how often. SPIs with clear definitions aid understanding of results, avoid misinterpretation, and allow meaningful comparisons over time.

(d) Choosing valuable measures. It is imperative that useful SPIs are selected, not only ones which are easy to measure. It should be up to the organisation to decide what the most useful safety parameters are; those that guide the organisation to improve decision-making, safety performance management, and achievement of its safety objectives.

3. Example of how the Safety Objective, Safety Performance Target and SPI may be linked

Safety Objective:

Enhancement of the awareness of safety hazards in our operation.

Safety Performance Indicator:

Number of hazard reports received per employee per year.

Safety Performance Target:

Increase the number of hazard reports received by 20% compared to last year.

Where meaningful data is not available or when introducing a new SPI with no historical data available within the organisation (such as, initial incorporation of State SPIs), it must be noted that initial 1-2 cycles may not have quantifiable targets and may be replaced with ''Monitoring'' only.

The Alert Levels associated with the SPIs should be defined in such a manner that unacceptable performance or adverse trends can be detected and appropriate Corrective Actions implemented in a timely manner. The recommended method is the Standard Deviation Point (STDEVP) method described in ICAO Doc 9859 and CAR SMS. This method is advantageous over others as it is statistically driven and facilitates a graphical presentation to enhance situational awareness.

Using the STDEVP method, the alert levels for a new monitoring cycle should be based on the preceding cycle's performance, namely its data point average and standard deviation. The three alert levels are defined quantitatively by using the preceding period average and adding a variable multiple of the standard deviation (SD) such as; average+1SD, average+2SD and average+3SD.

Example:

Alert Level 1: 26.8/100 K Sectors

Alert Level 2: 40.0/100 K Sectors

Alert Level 3: 53.2/100 K Sectors

In the example in Figure 2 below, an alert (abnormal/unacceptable trend) is indicated if any of the conditions below are met for the current monitoring cycle:

(a) any single point is above the Alert Level 3 line;

(b) 2 consecutive points are above the Alert Level 2 line; or

(c) 3 consecutive points are above the Alert level 1 line.

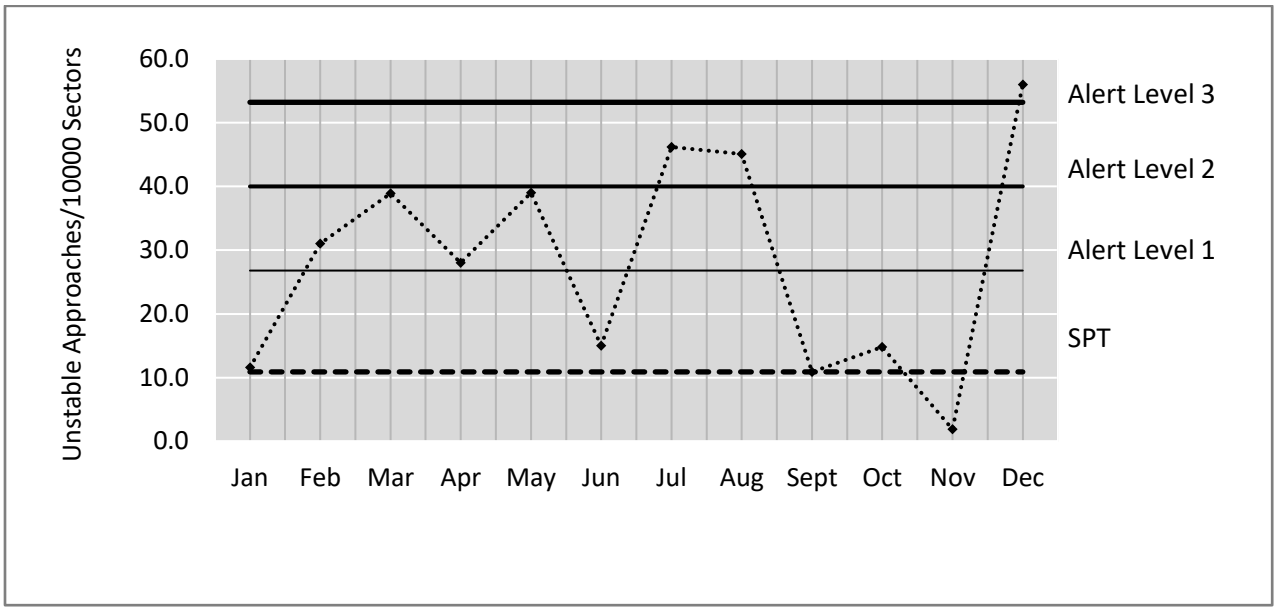


Figure 2: Alert Levels and Unacceptable Trend

4. Lagging indicators - examples

These examples show how alert levels and targets may be measured for various SPIs depending upon the organisation.

Air Operator

High-consequence indicators (occurrence/outcome-based)			*Lower-consequence indicators (event/activity-based)*		
Safety Performance Indicator	*Alert level criteria*	*Target level criteria*	*Safety Performance Indicator*	*Alert level criteria*	*Target level criteria*
Air operator individual fleet monthly serious incident rate (e.g. per 1000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator combined fleet monthly incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
Air operator combined fleet monthly serious incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration
Air operator engine IFSD incident rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator voluntary hazard report rate (e.g. per 1 000 FH)	Consideration	Consideration
			Operator DGR incident report rate (e.g. per 1 000 FH)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate

Aerodrome Operator

High-consequence indicators (occurrence/outcome-based)			*Lower-consequence indicators (event/activity-based)*		
Safety Performance Indicator	*Alert level criteria*	*Target level criteria*	*Safety Performance Indicator*	*Alert level criteria*	*Target level criteria*
Aerodrome operator quarterly ground accident/serious incident rate — involving any aircraft (e.g. per 10 000 ground movements)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Aerodrome operator internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
Aerodrome operator quarterly runway excursion incident rate — involving any aircraft (e.g. per 10 000 departures)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Aerodrome operator quarterly runway foreign object/debris hazard report rate (e.g. per 10 000 ground movements)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
Aerodrome operator quarterly runway incursion incident rate — involving any aircraft (e.g. per 10 000 departures)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	Operator voluntary hazard report rate(per operational personnel per quarter)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
			Aerodrome operator quarterly aircraft ground foreign object	Average + 1/2/3 SD	__% (e.g. 5%) improvement between each

			damage incident report rate — involving damage to aircraft (e.g. per 10 000 ground movements)	(annual or 2 yearly reset)	annual mean rate

ATS Organisation

High-consequence indicators (occurrence/outcome-based)			*Lower-consequence indicators (event/activity-based)*		
Safety Performance Indicator	*Alert level criteria*	*Target level criteria*	*Safety Performance Indicator*	*Alert level criteria*	*Target level criteria*
ATS operator quarterly FIR serious incident rate — involving any aircraft (e.g. per 100 000 flight movements)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	ATS operator quarterly FIR TCAS RA incident rate — involving any aircraft (e.g. per 100 000 flight movements)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
ATS operator quarterly FIR TCAS RA incident rate — involving any aircraft (e.g. per 100.000 flight movements)	Assuming the historical annual average rate is 3, the possible alert rate could be 5.	Assuming the historical annual average rate is 3, the possible target rate could be 2.	ATS operator quarterly FIR level bust (LOS) incident rate — involving any aircraft (e.g. per 100 000 flight movements)	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate
			ATS operator internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration

DOA, POA or MRO Organisation

High-consequence indicators (occurrence/outcome-based)			*Lower-consequence indicators (event/activity-based)*		
Safety Performance Indicator	*Alert level criteria*	*Target level criteria*	*Safety Performance Indicator*	*Alert level criteria*	*Target level criteria*
MRO/POA quarterly rate of component technical warranty claims	Average + 1/2/3 SD (annual or 2 yearly reset)	__% (e.g. 5%) improvement between each annual mean rate	MRO/POA/DOA internal QMS/SMS annual audit LEI % or findings rate (findings per audit)	Consideration	Consideration
POA/DOA quarterly rate of operational products which are the subject of ADs)/ASBs (per product line)	Consideration	Consideration	MRO/POA/DOA quarterly final inspection/testing failure/rejection rate (due to internal quality issues)	Consideration	Consideration
MRO/POA quarterly rate of component mandatory/major defect reports raised (due to internal quality issues)	Consideration	Consideration	MRO/POA/DOA voluntary hazard report rate (per operational personnel per quarter)	Consideration	Consideration

5. Leading indicators - examples

The following are examples of SPIs that may be relevant to the organisation's systemic and operational issues.

SPI Examples: Systemic Issues

Area	Focus of Measurement	Safety Performance Indicator
Compliance	Internal audits/compliance monitoring: all non- compliances	▪ Total number per audit planning cycle / trend ▪ % of findings analyzed for their safety significance,
	Internal audits/ compliance monitoring: significant non-compliances	▪ Number of significant findings versus total number of findings ▪ Number of repeat findings within audit planning cycle
	Internal audits/ compliance monitoring: responsiveness to corrective action requests	▪ Average lead time for completing corrective actions per oversight planning cycle - trend
	External audits/ compliance monitoring: all non- compliances	▪ Total number per oversight planning cycle / trend ▪ % of findings analyzed for their safety significance,
	External audits: significant non-compliances	▪ Number of significant findings versus total number of findings
	External audits: responsiveness to corrective action requests	▪ Average lead time for completing corrective actions per oversight planning cycle - trend
	Consistency of results between internal and external audits/compliance monitoring	▪ Number of significant findings only revealed through external audits

Area	Focus of Measurement	Safety Performance Indicator
SMS effectiveness	Management commitment	▪ Number of management walk-arounds per month/quarter/year ▪ Number of management meetings dedicated to safety per month/quarter/year
	Turnover rate of key safety personnel	▪ length of term ▪ Number of cases where the reasons for departure of key personnel have been analysed
	Supervision	▪ Number of cases where supervisors provided positive feedback on safety-conscious behavior of your staff per month/quarter/year
	Reporting	▪ Number of reports received per month/quarter/year & trend ▪ % of reports for which feedback to reporter was provided within 10 working days ▪ % of reports followed by an independent safety review
	Hazard identification	▪ Number of accident/serious incident scenarios analysed to support Safety Risk Management (SRM) per month/quarter/year ▪ Number of new hazards identified through the internal reporting system per month/quarter/year & trend ▪ Findings from external audits concerning hazards that have not been perceived by personnel/ management previously ▪ Number of safety reports received from staff per month/quarter/year & trend

Area	Focus of Measurement	Safety Performance Indicator
	Risk controls	▪ Number of new risk controls validated per month/quarter/year ▪ % of overall budget allocated to new risk controls
	Management of change	▪ Number of organisational changes for which a formal safety risk assessment has been performed per month/quarter/year & trend ▪ Number of changes to Standard Operating Procedures (SOPs) for which a formal safety risk assessment has been performed per month/quarter/year & trend ▪ Number of technical changes (e.g., new equipment, new facilities, new hardware) for which a formal safety risk assessment has been performed ▪ Number of risk controls implemented for changes per month/quarter/year & trend ▪ % of changes (organisational/SOP/technical etc.) that have been subject to risk assessment
	Supervision of contractors	▪ % of contractors whose safety performance has been assessed ▪ Frequency for assessing safety performance of contractors ▪ % of contractors integrated with your company's safety reporting scheme ▪ % of contractors for which safety training has been provided ▪ % of contractors that have implemented training control procedures

Area	Focus of Measurement	Safety Performance Indicator
		▪ % of contractors that have a feedback system on safety issues in place with their customer ▪ Number of safety reports received from contractors per month/quarter/year & trend ▪ Number of safety actions initiated following assessment of safety performance or safety reports received per month/quarter/year & trend
	Emergency response planning (ERP)	▪ Number of emergency drills per year ▪ Frequency of reviewing the ERP ▪ Number of trainings on ERP per month/quarter/year ▪ % of staff trained on the ERP within a quarter/year ▪ Number of meetings with main partners and contractors to coordinate ERP per month/quarter/year
	Safety promotion	▪ Number of safety communications published ▪ Number of trainings performed ▪ Number of safety briefings performed.

SPI Examples: Operational Issues

Area	High Severity Outcome to be prevented	Safety Performance Indicator
Air operators	Mid-air collision	▪ Number of Traffic Collision Avoidance System (TCAS) resolution advisories per 1000 flight hours (FH)
	Runway excursion	▪ Number of unstabilised approaches per 1000 landings
	Ground collision	▪ Number of runway incursions per 1000 sectors
	Controlled flight into terrain	▪ Number of Ground Proximity Warning System (GPWS) and Enhanced Ground Proximity Warning System (EGPWS) warnings per 100 take-offs
	Accident/incident related to poor flight preparation	▪ Number of cases where flight preparation had to be done in less than the normally allocated time ▪ Number of short fuel events per 100 flights ▪ Number of fuel calculation errors per 100 flights
	Accident/incident related to fatigue	▪ Number of extensions to flight duty periods per month/quarter/year
	Accident/incident related to ground-handling	▪ Number of incidents with ground handlers per month/quarter/year ▪ Number of mass and balance errors per ground handler per month ▪ Number of dysfunctions per ground handler per month/quarter/year
	Accident/incident related to maintenance	▪ Pilot Reports per 100 take offs

Area	High Severity Outcome to be prevented	Safety Performance Indicator
		▪ Deferred items per month and aircraft ▪ In Flight Shut Down (IFSD) per 1000 FH ▪ In Flight Turn Backs (IFTB) and deviations per 100 take offs ▪ Number of ROSIs related to service difficulty ▪ Number of cancellations per 100 scheduled flights due to technical issues ▪ Rejected take offs per 100 take offs due to technical issues
Maintenance organisations	Accident/incidents related to maintenance planning/rostering	▪ % of work orders for which a detailed planning has been made ▪ Maintenance engineer fatigue / maintenance error: ▪ % of work orders with a difference > 10% between the expected lead time and the actual processing time ▪ % of work orders with a difference > 10% between the estimated work force and the actual needs
	Accident/incidents related to maintenance	▪ Number of maintenance errors ▪ Number of maintenance Exceedance ▪ % of work orders that required re-work ▪ Number of duplicate inspections that identified a maintenance error ▪ Number of investigations performed following components removed from service significantly before expected life limit was reached

Area	High Severity Outcome to be prevented	Safety Performance Indicator
Air Traffic management/ Air Navigation Services	Traffic collision	▪ Number of level busts/exposure ▪ Number of TCAS required action (RA) (with and without loss of separation) /exposure ▪ Number of minimum separation infringement/exposure ▪ Number of inappropriate separation (airspace in which separation minima is not applicable) /exposure ▪ Number of aircraft deviation from air traffic control (ATC) clearance/exposure ▪ Number of airspace infringements/exposures
	Traffic collision / controlled flight into terrain	▪ Number of aircraft deviations from air traffic management (ATM) procedures/exposure ▪ Number of inappropriate or absences of ATC assistance to aircraft in distress ▪ Number of near Controlled Flight Into Terrain (CFIT) IFSD /exposure
	Runway excursion	▪ Number of inappropriate ATC instruction (no instruction, wrong information, action communicated too late, etc.)
	Runway incursion	▪ % of runway incursions where no avoiding action was necessary ▪ % of runway incursion where avoiding action was necessary
Airports	Post-accident/incident fire	▪ Fire Extinguishing Services (ICAO Airport Fire Fighting Categories) decrease in value (# decrease- hours/ # airport annual operating hours)

Area	High Severity Outcome to be prevented	Safety Performance Indicator
		▪ Number of radio/phone failures per 100 operations ▪ number of fire rescue vehicles failures per 100 operations
	Runway incursion	▪ Number of runway incursions per 1000 operations ▪ Number of failures or defects regarding signage found during routine inspection ▪ Number of signage defects reported ▪ Average lead-time for repair/replacement of defective signage ▪ Number of runway lights failures or defects found during routine inspection ▪ Number of runway lights defects reported ▪ Average lead-time for repair/replacement of runway lights (per month/quarter/year & trends)
	Collision with vehicle on ground / ground-equipment	▪ notified platform safety rules violations per 1000 operations
	Ground collision with wildlife	▪ Number of ground collisions with wildlife ▪ Number of inspections of fences and other protective devices ▪ Number of with wildlife sighting reports (per month/quarter/year & trends)
	FOD (Foreign Object Damage)	▪ Number of FOD found during routine inspections ▪ Number of FOD found out of inspections and after report

Area	High Severity Outcome to be prevented	Safety Performance Indicator
	bird-strike In Flight Shut Down (IFSD)	▪ Number of IFSD per 10000 FH following bird-strike
Flight training organisations	Accident/incident related to poor training	▪ Number of trainees per instructor ▪ Number of changes in instructor per training ▪ Number of major changes to training program (per month/quarter/year & trends)

SPI Examples-Operational Issues (Helicopter Operators)

Area	Safety Objective	Safety Performance Indicator
Helicopter Operators	Reduction in the number incidents that cause damage and the amount of damage	▪ Number of FOD Incidents
		▪ Number of External Load Incidents
		▪ Number of incidents involving damage due to bird Strikes
		▪ Number Operations to an Uncertified Landing Area (on Temporary Approval)
		▪ Number of Incidents involving Crane Operations
	Overall reduction in the number of ''Precursor Incidents''	▪ Number of "near-miss" events (TCAS Events and Traffic Conflicts in Class G Airspace))
		▪ Number of (GPWS) incidents
		▪ Number of LOC Incidents in flight (Auto Pilot Disengage/Trip off/Loading Errors)

Area	Safety Objective	Safety Performance Indicator
		▪ Number of LOC Incidents on Ground (Ground Resonance, Blade Sailing, etc)
		▪ Number of Inadvertent Activations of Ancillary Equipment that affect Safe conduct of Flight Operations
		▪ Number of Critical Deviations in FDM
	Increase in the number of actions raised from safety meetings	▪ Ratio Between the Closed Actions against the Total Actions Raised through SMS
	Increased compliance with the Safety Incident Management Process	▪ Number of Reports Raised by Staff ▪ Number of Line Checks/Ramp Checks/ Conducted ▪ % of reports closed
	Reduce the number of Injuries to organisation personnel, guests and passengers	▪ Number of Injuries to Personnel or customers ▪ Number of ERP drills conducted

APPENDIX 7b: UNDERSTANDING SAFETY PERFORMANCE TARGET (SPT)

1. Setting SPTs

(a) Safety performance targets (SPTs) define short-term and medium-term safety performance management desired achievements. They act as "milestones" that provide confidence that the organisation is on track to achieving its safety objectives and provide a measurable way of verifying the effectiveness of safety performance management activities. SPT setting should take into consideration factors such as the prevailing level of safety risk, safety risk tolerability, as well as expectations regarding the safety of the particular aviation sector. The setting of SPTs should be determined after considering what is realistically achievable for the associated aviation sector and recent performance of the particular SPI, where historical trend data is available.

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

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

(2) Setting targets with SMART safety objectives: Safety objectives can be difficult to communicate and may seem challenging to achieve; by breaking them down into smaller concrete safety targets, the process of delivering them is easier to manage. In this way, targets form a crucial link between strategy and day-to-day operations. Organisations should identify the key areas that drive the safety performance and establish a way to measure them. Once an organisation has an idea what their current level of performance is by establishing the baseline safety performance, they can start setting SPTs to give everyone in the organisation a clear sense of what they should be aiming to achieve. The organisation may also use benchmarking to support setting performance targets. This involves using performance information from similar organisations that have already been measuring their performance to get a sense of how others in the community are doing.

(c) An example of the relationship between safety objectives, SPIs and SPTs is illustrated in the below Figure. In this example, the organisation recorded 100 runway excursions per million movements in 2018. It has been determined this is too many, and an objective to reduce the number of runway excursions by fifty per cent by 2022 has been set. Specific targeted actions and associated timelines have been defined to meet these targets. To monitor, measure and report their progress, the organisation has chosen "RWY excursions per million movements per year" as the SPI. The organisation is aware that progress will be more immediate and effective if specific targets are set which align with the safety objective. They have therefore set a safety target which equates to an average reduction of 12.5 per year over the reporting period (four years). As shown in the graphical representation, the progress is expected to be greater in the first years and less so in the later years. This is represented by the curved projection towards their objective. In the Figure:

(1) the SMART safety objective is "50 per cent reduction in RWY excursions rate by 2022";

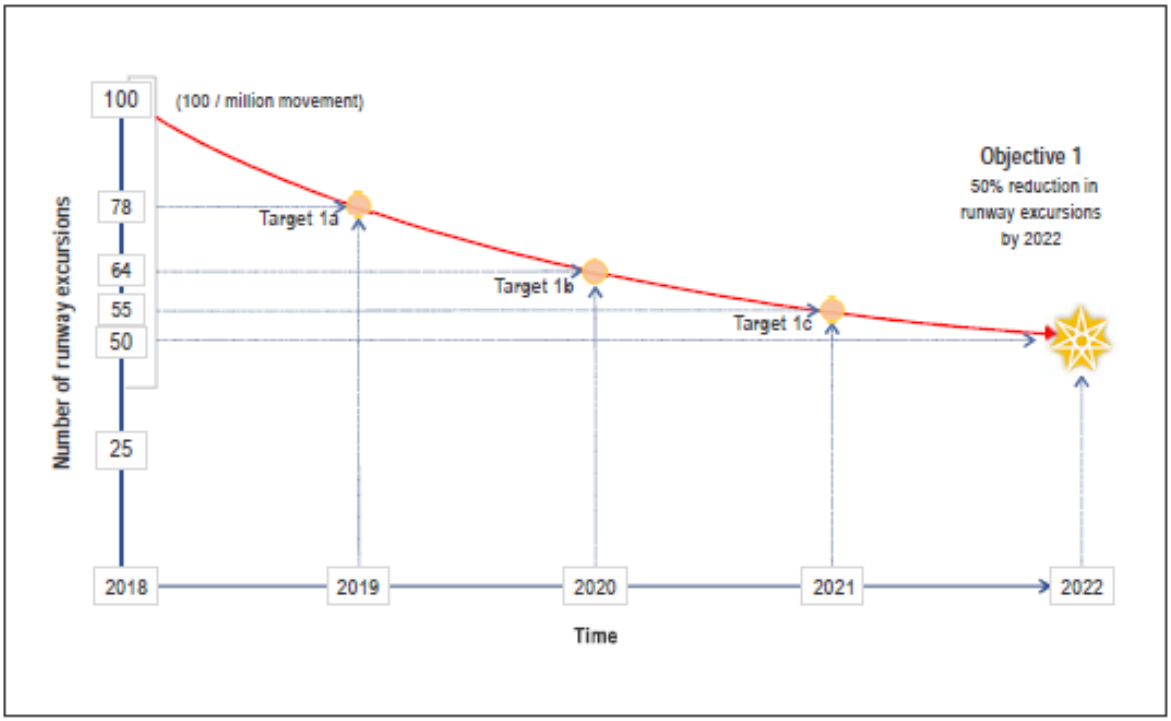
(2) the SPI selected is the "number runway excursions per million movements per year"; and

(3) the safety targets related to this objective represent milestones for reaching the SMART safety objective and equate to a ~12 per cent reduction each year until 2022:

(i) SPT 1a is "less than 78 runway excursions per million movement in 2019";

(ii) SPT 1b is "less than 64 runway excursions per million movement in 2020";

(iii) SPT 1c is "less than 55 runway excursions per million movement in 2021".



(d) For each SPI, specific action plan should be developed and implemented to:

(1) achieve the intended target or trend to ensure that they are likely to be effective in achieving the targets. Examples of action plans may be implementation of new policy/procedures, training additional to that required by regulations, workshops and seminars, self-audits, in addition to others.

(2) determine responsibilities for implementation of each action in the plan. While the SPI owner or the head of the relevant department would normally be ultimately responsible for the actual performance and actions for achievement of Safety Performance Target and any alert level breach, he may not be responsible for all of the actions.

(3) state approximate target dates for completion of the action in the plan where applicable.

2. Additional considerations for SPT selection

(a) Encouraging desired behaviour. SPTs can change behaviours and contribute to desired outcomes. This is especially relevant if achievement of the target is linked to organisational rewards, such as management remuneration. SPTs should foster positive organisational and individual behaviours that deliberately result in defensible decisions and safety performance improvement. It is equally important to consider the potential unintended behaviours when selecting SPIs and SPTs.

(b) Achieving SPTs. This is a particularly important consideration, and linked to the desired safety behaviours. Achieving the agreed SPTs is not always indicative of safety performance improvement. The organisation should distinguish between just meeting SPTs and actual, demonstrable organisational safety performance improvement. It is imperative that the organisation consider the context within which the target was achieved, rather than looking at an SPT in isolation. Recognition for overall improvement in safety performance, rather than an individual SPT achievement, will foster desirable organisational behaviours and encourage exchange of safety information that lies at the heart of both SRM and safety assurance. This could also enhance the relationship between the GCAA and the organisation and their willingness to share safety data and ideas.

3. Caveats on setting SPTS

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

(b) The following should also be considered in deciding appropriate SPTs:

(1) Drive undesirable behaviours; if managers or organisations are too focused on achievement of the numbers as an indicator of success they may not achieve the intended improvement in safety

performance, becoming too focused on achieving the target and perhaps losing sight of what the target was intended to achieve, rather than an improvement in organisational safety performance

(2) Operational targets; too much focus on achieving operational targets (such as: on time departures, reduction in overhead costs, etc.) without a balance of SPTs can lead to "achieving the operational targets" while not necessarily improving safety performance.

(3) Focus on quantity rather than quality; this can encourage personnel or departments to meet the target but in doing so deliver a poor product or service.

(4) Cap innovation; although not intended, once a target is met this can lead to a relaxation and that no further improvements are needed and complacency can set in.

(5) Organisational conflict; targets can create conflict between departments and organisations as they argue over who is responsible rather than focusing on trying to work together.

APPENDIX 7c: MONITORING SAFETY PERFORMANCE

1. Need for monitoring safety performance

(a) Once an organisation has identified the targets based on the SPIs they believe will deliver the planned outcome, they must ensure the stakeholders follow through by assigning clear responsibility for delivery.

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

2. Need for establishing the baseline safety performance

Understanding how the organisation plans to progress towards its safety objectives requires that they know where they are, in relation to safety. Once the organisation's safety performance structure (safety objectives, indicators, targets, triggers) has been established and is functioning, it is possible to learn their baseline safety performance through a period of monitoring. Baseline safety performance is the safety performance at the commencement of the safety performance measurement process, the datum point from which progress can be measured.

3. Refinement of SPIs and SPTs

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

(b) Safety performance management is an ongoing activity. Safety risks and/or availability of data change over time.

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

(1) events including structural damage to equipment;

(2) events indicating circumstances in which an accident nearly occurred;

(3) events in which operational personnel or members of the aviation community were fatally or seriously injured;

(4) events in which operational personnel became incapacitated or unable to perform their duties safely;

(5) rate of voluntary reports; and

(6) rate of mandatory occurrence reports.

Refer to Appendix 7a for more examples.

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

(e) The set of SPIs and SPTs selected by an organisation should be periodically reviewed to ensure their continued meaningfulness as indications of organisational safety performance. Periodic reviews will also help identify when specific indicators are no longer needed (e.g., if the intended positive changes have been achieved) and allow adjustment of SPIs so that they always focus on the most important issues in terms of safety. Some reasons to continue, discontinue or change SPIs and SPTs include:

(1) SPIs continually report the same value (such as zero per cent or 100 per cent); these SPIs are unlikely to provide meaningful input to senior management decision-making;

(2) SPIs that have similar behaviour and as such are considered a duplication;

(3) the SPT for an SPI implemented to measure the introduction of a programme or targeted improvement has been met;

(4) another safety concern becomes a higher priority to monitor and measure;

(5) any change in nature of risk, applicable regulations or the organisation or national safety priorities;

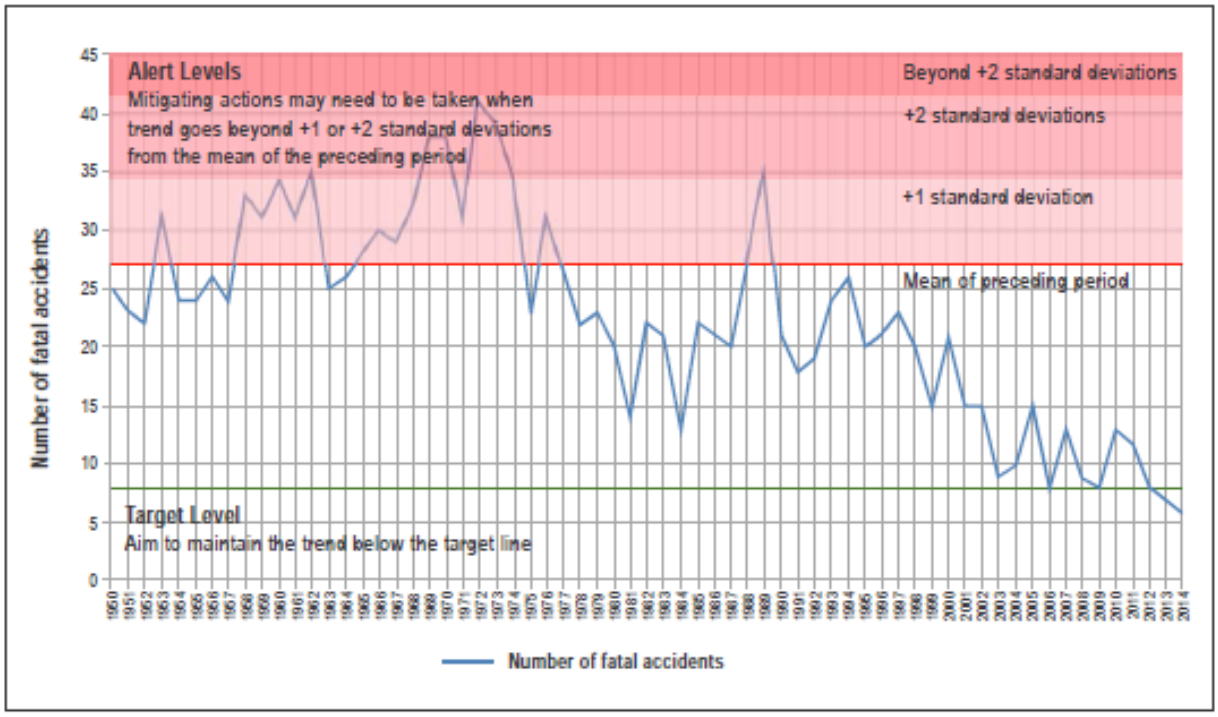
(6) to gain a better understanding of a particular safety concern by narrowing the specifics of an SPI (i.e. reduce the "noise" to clarify the "signal"); and

(7) safety policy or objectives have changed and as a consequence the SPIs require updating to remain relevant.

4. Safety triggers

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

(b) A trigger is an established level or criteria value that serves to trigger (start) an evaluation, decision, adjustment or remedial action related to the particular indicator. One method for setting out-of-limits trigger criteria for SPTs is the use of the population standard deviation (STDEVP) principle. This method derives the standard deviation (SD) value based on the preceding historical data points of a given safety indicator. The SD value plus the average (mean) value of the historical data set forms the basic trigger value for the next monitoring period. The SD principle (a basic statistical function) sets the trigger level criteria based on actual historical performance of the given indicator (data set), including its volatility (data point fluctuations). A more volatile historical data set will usually result in a higher (more generous) trigger level value for the next monitoring period. Triggers provide early warnings which enable decision makers to make informed safety decisions, and thus improve safety performance. An example of trigger levels based on standard deviations (SDs) is provided at Figure 4-5 below. In this example, data-driven decisions and safety mitigation actions may need to be taken when the trend goes beyond +1SD or +2SD from the mean of the preceding period. Often the trigger levels (in this case +1SD, +2SD or beyond +2SD) will align with decision management levels and urgency of action.



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

achievement and each trigger level not breached. Alternatively, numeric values (points) may be used to provide a quantitative measurement of the overall performance of the SPIs package.

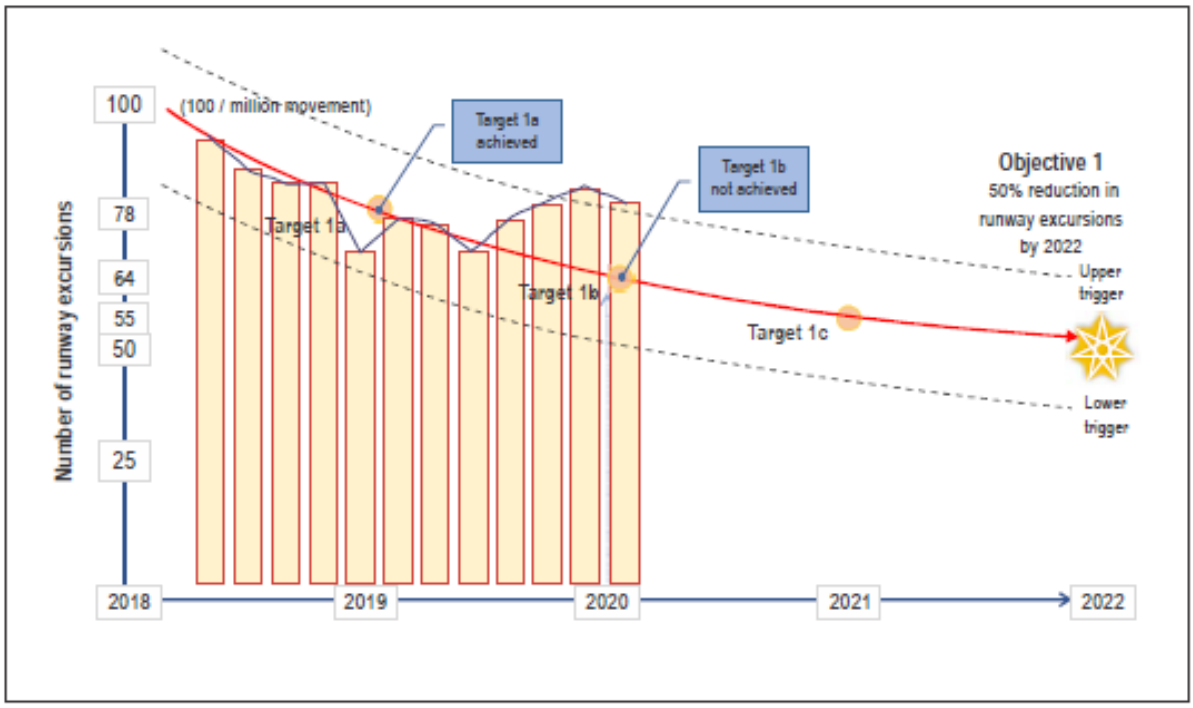
(d) It should be noted that trigger values serve to trigger (start) an evaluation, decision, adjustment or remedial action related to the particular indicator. An SPI being triggered is not necessarily catastrophic or an indication of failure. It is merely a sign that the activity has moved beyond the predetermined limit. The trigger aims to attract the attention of decision makers who are now in a position to take remedial action, or not, depending on the circumstances.

5. Caveat on safety triggers

(a) There are challenges in identifying reliable trigger levels. Triggers and their associated levels work best when there are ample safety data and safety data management capabilities. This can impose an additional workload on the organisation. The notion of trigger was designed and is best suited to SRM of purely technical systems (e.g. aircraft engine monitoring). In this case, large amounts of quantitative data support the identification of accurate triggers and trigger levels. The notion of triggers is arguably less relevant to SRM of socio-technical systems. Socio-technical systems are systems where people actively interact with the processes and technologies to achieve the system's service delivery or production objectives. Both SSP and SMS are socio-technical systems. The less reliable and meaningful triggers used in socio-technical systems are due to the limitations of reliable measures when humans are involved.

(b) A more flexible approach is therefore needed for the triggers to be meaningful. Annex 19 does not require that organisations define trigger levels for each SPI. However, there are benefits for organisations where their data for an SPI is very specific, there are enough data points and the data is sufficiently trustworthy.

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



6. Identifying actions required

(a) Arguably the most important outcome of establishing a safety performance management structure is the presentation of information to the organisation's decision makers so they can make decisions based on current, reliable safety data and safety information. The aim should always be to make decisions in accordance with the safety policy and towards the safety objectives.

(b) In relation to safety performance management, data-driven decision-making is about making effective, well-informed decisions based on the results of monitored and measured SPIs, or other reports and analysis of safety data and safety information. Using valid and relevant safety data combined with information that provides context supports the organisation in making decisions that align with its safety objectives and targets. Contextual information may also include other stakeholder priorities, known deficiencies in the data, and other complementary data to evaluate the pros, cons, opportunities, limitations and risks associated with the decision. Having the information readily available and easy to interpret helps to mitigate bias, influence and human error in the decision-making process.

(c) Data-driven decision-making also supports the evaluation of decisions made in the past to support any realignment with the safety objectives. More guidance about data-driven decision-making is provided in PART 2 SUBPART 2.

(d) Corrective actions in the event of alert level breaches or measures to control any abnormal/unacceptable trends should be implemented, after identification of the root cause for the alert level breach, development and implementation of an effective control measure/corrective action.

APPENDIX 8: SMS MANUAL CONTENT

Disclaimer: The content of SMS manual should be developed in a manner to show compliance with this CAR including its AMCs

1. SMS Manual document control

Describe how the manual(s) will be kept up to date and how the organisation will ensure that all personnel involved in safety-related duties have the most current version.

(a) Hard copy or controlled electronic media and distribution list.

(b) The correlation between the SMS manual and other existing manuals such as the maintenance control manual (MCM) or the operations manual.

(c) The process for periodic review of the manual and its related forms/documents to ensure their continuing suitability, adequacy and effectiveness.

(d) The manual's administration, approval and regulatory acceptance process.

(e) Cross-reference documents

(f) Quality manual, engineering manual, etc.

2. SMS regulatory requirements

Address current SMS regulations and guidance material for necessary reference and awareness by all concerned.

(a) Spell out the current SMS regulations/standards. Include the compliance timeframe and advisory material references as applicable.

(b) Where appropriate, elaborate on or explain the significance and implications of the regulations to the organisation.

(c) Establish a correlation with other safety-related requirements or standards where appropriate.

(d) Cross-reference documents

(e) SMS regulation/requirement references, SMS guidance document references, etc.

3. Scope and integration of the Safety Management System

Describe the scope and extent of the organisation's aviation-related operations and facilities within which the SMS will apply. Basically, the approval/certificate/authorisation's number must be added in the SMS manual.

The scope of the processes, equipment and operations deemed eligible for the organisation's hazard identification and risk management (HIRM) programme should also be addressed.

(a) Spell out the nature of the organisation's aviation business and its position or role within the industry as a whole.

(b) Identify the major areas, departments, workshops and facilities of the organisation within which the SMS will apply.

(c) Identify the major processes, operations and equipment which are deemed eligible for the organisation's HIRM programme, especially those which are pertinent to aviation safety. If the scope of the HIRM-eligible processes, operations and equipment is too detailed or extensive, it may be controlled under a supplementary document as appropriate.

(d) Where the SMS is expected to be operated or administered across a group of interlinked organisations or contractors, define and document such integration and associated accountabilities as applicable.

(e) Where there are other related control/management systems within the organisation, such as QMS, OSHE and SeMS, identify their relevant integration (where applicable) within the aviation SMS.

(f) Cross-reference documents

(g) Quality manual, engineering manual, etc

4. Safety policy (including disciplinary regime)

Describe the organisation's intentions, management principles and commitment to improving aviation safety in terms of the product or Organisation. A safety policy should be a short description similar to a mission statement.

(a) The safety policy should be appropriate to the size and complexity of the organisation.

(b) The safety policy states the organisation's intentions, management principles and commitment to continuous improvement in aviation safety.

(c) The safety policy is approved and signed by the Accountable Manager.

(d) The safety policy is promoted by the Accountable Manager and all other managers.

(e) The safety policy is reviewed periodically.

(f) Personnel at all levels are involved in the establishment and maintenance of the Safety Management System.

(g) The safety policy is communicated to all employees with the intent that they are made aware of their individual safety obligations.

(h) Cross-reference documents

(i) OSHE safety policy, etc.

5. Safety objectives

Describe the safety objectives of the organisation. The safety objectives should be a short statement that describes in broad terms what the organisation hopes to achieve.

Criteria

(a) The safety objectives have been established.

(b) The safety objectives are expressed as a top-level statement describing the organisation's commitment to achieving safety.

(c) There is a formal process to develop a coherent set of safety objectives.

(d) The safety objectives are publicized and distributed.

(e) Resources have been allocated for achieving the objectives.

(f) The safety objectives are linked to safety indicators to facilitate monitoring and measurement where appropriate.

(g) Cross-reference documents

(h) Safety Performance Indicators document, etc.

6. Safety accountabilities, responsibilities and authorities

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

(a) The Accountable Manager is responsible for ensuring that the Safety Management System is properly implemented and is performing to requirements in all areas of the organisation.

(b) An appropriate safety manager (office), safety committee or Safety Action Groups have been appointed as appropriate.

(c) Safety authorities, responsibilities and accountabilities of personnel at all levels of the organisation are defined and documented.

(d) All personnel understand their authorities, responsibilities and accountabilities with regard to all safety management processes, decisions and actions.

(e) An SMS organisational accountabilities diagram is available.

(f) Cross-reference documents

(g) Company exposition manual, SOP manual, administration manual, etc.

7. The voluntary and mandatory safety reporting systems and any other SDCPS

A reporting system should include both reactive (accident/incident reports, etc.) and proactive/ predictive (hazard reports). Describe the respective reporting systems. Factors to consider include: report format, confidentiality, addressees, investigation/evaluation procedures, corrective/ preventive actions and report dissemination.

Criteria

(a) The organisation has a procedure that provides for the capture of internal occurrences including accidents, incidents and other occurrences relevant to SMS.

(b) A distinction is to be made between mandatory reports (accidents, serious incidents, major defects, etc.), which are required to be notified to the GCAA, and other routine occurrence reports, which remain within the organisation.

(c) There is also a voluntary and confidential hazard/occurrence reporting system, incorporating appropriate identity/data protection as applicable.

(d) The respective reporting processes are simple, accessible and commensurate with the size of the organisation.

(e) High-consequence reports and associated recommendations are addressed to and reviewed by the appropriate level of management.

(f) Reports are collected in an appropriate database to facilitate the necessary analysis.

(g) Cross-reference documents

(h) GCAA Reporting of Safety Incidents (ROSI), Voluntary Reporting of Safety Incident (VORSY), internal hazard reporting system

8. Hazard identification and risk assessment process

Describe the hazard identification system and how such data are collated. Describe the process for the categorization of hazards/risks and their subsequent prioritization for a documented safety assessment. Describe how the safety assessment process is conducted and how preventive action plans are implemented.

(a) Identified hazards are evaluated, prioritized and processed for risk assessment as appropriate.

(b) There is a structured process for risk assessment involving the evaluation of severity, likelihood, tolerability and preventive controls.

(c) Hazard identification and risk assessment procedures focus on aviation safety as their fundamental context.

(d) The risk assessment process utilizes worksheets, forms or software appropriate to the complexity of the organisation and operations involved.

(e) Completed safety assessments are approved by the appropriate level of management.

(f) There is a process for evaluating the effectiveness of the corrective, preventive and recovery measures that have been developed.

(g) There is a process for periodic review of completed safety assessments and documenting their outcomes.

(h) Cross-reference documents

(i) Hazard/Risk register, safety assessments

9. Safety performance monitoring and measurement process

Describe the safety performance monitoring and measurement component of the SMS. This includes the organisation's SMS Safety Performance Indicators (SPIs).

(a) The formal process to develop and maintain a set of Safety Performance Indicators and their associated performance targets.

(b) Correlation established between the SPIs and the organisation's safety objectives where applicable and the process of regulatory acceptance of the SPIs where required.

(c) The process of monitoring the performance of these SPIs including remedial action procedure whenever unacceptable or abnormal trends are triggered.

(d) Any other supplementary SMS or safety performance monitoring and measurement criteria or process.

(e) Cross-reference documents

(f) SPI, SPT, Alert Level documents and charts

10. Safety-related investigations process and remedial actions

Describe how accidents/incidents/occurrences are investigated and processed within the organisation, including their correlation with the organisation's SMS hazard identification and risk management system.

(a) Procedures to ensure that reported accidents and incidents are investigated internally.

(b) Dissemination of completed investigation reports internally as well as to the CAA as applicable.

(c) A process for ensuring that corrective actions taken or recommended are carried out and for evaluating their outcomes/effectiveness.

(d) Procedure on disciplinary inquiry and actions associated with investigation report outcomes.

(e) Clearly defined conditions under which punitive disciplinary action would be considered (e.g. illegal activity, recklessness, gross negligence or wilful misconduct).

(f) A process to ensure that investigations include identification of active failures as well as contributing factors and hazards.

(g) Investigation procedure and format provides for findings on contributing factors or hazards to be processed for follow-up action by the organisation's hazard identification and risk management system where appropriate.

(h) Cross-reference documents

(i) Investigation reports, risk register

11. SMS documentation record management

Describe the method of storing all SMS-related records and documents.

(a) The organisation has an SMS records or archiving system that ensures the retention of all records generated in conjunction with the implementation and operation of the SMS.

(b) Records to be kept include hazard reports, risk assessment reports, Safety Action Group/safety meeting notes, Safety Performance Indicator charts, SMS audit reports and SMS training records.

(c) Records should be traceable for all elements of the SMS and be accessible for routine administration of the SMS as well as internal and external audits purposes.

(d) Cross-reference documents

(e) Archival system (electronic preferred)

12. Safety promotion strategy including safety training and education and communication strategy

Describe the type of SMS and other safety-related training that staff receive and the process for assuring the effectiveness of the training. Describe how such training procedures are documented.

Describe the safety communication processes/channels within the organisation.

(a) The training syllabus, eligibility and requirements are documented.

(b) There is a validation process that measures the effectiveness of training.

(c) The training includes initial, recurrent and update training, where applicable.

(d) The organisation's SMS training is part of the organisation's overall training programme.

(e) SMS awareness is incorporated into the employment or indoctrination programme.

(f) The safety communication processes/channels within the organisation.

(g) Cross-reference documents

(h) Training syllabus, individual training records

13. Continuous improvement and SMS audit

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

(a) The process for regular internal audit/review of the organisation's SMS to ensure its continuing suitability, adequacy and effectiveness.

(b) Describe any other programmes contributing to continuous improvement of the organisation's SMS and safety performance, e.g. MEDA, safety surveys, ISO systems.

(c) Cross-reference documents

(d) Internal audits, safety survey results

14. Management of change process

Describe the organisation's process for managing changes that may have an impact on safety risks and how such processes are integrated with the SMS.

(a) Procedures to ensure that substantial organisational or operational changes take into consideration any impact which they may have on existing safety risks.

(b) Procedures to ensure that appropriate safety assessment is performed prior to introduction of new equipment or processes which have safety risk implications.

(c) Procedures for review of existing safety assessments whenever there are changes to the associated process or equipment.

(d) Cross-reference documents

(e) Company SOP relating to management of change, etc.

15. ERP and its coordination

Describe the organisation's intentions regarding, and commitment to dealing with, emergency situations and their corresponding recovery controls. Outline the roles and responsibilities of key personnel. The Emergency Response Plan can be a separate document or it can be part of the SMS manual.

Criteria (as applicable to the organisation)

(a) The organisation has an emergency plan that outlines the roles and responsibilities in the event of a major incident, crisis or accident.

(b) There is a notification process that includes an emergency call list and an internal mobilization process.

(c) The organisation has arrangements with other agencies for aid and the provision of emergency services as applicable.

(d) The organisation has procedures for emergency mode operations where applicable.

(e) There is a procedure for overseeing the welfare of all affected individuals and for notifying next of kin.

(f) The organisation has established procedures for handling the media and insurance-related issues.

(g) There are defined accident investigation responsibilities within the organisation.

(h) The requirement for preservation of evidence, securing the affected area, and mandatory/ governmental reporting is clearly stated.

(i) There is emergency preparedness and response training for affected personnel.

(j) A disabled aircraft or equipment evacuation plan has been developed by the organisation in consultation with aircraft/equipment owners, aerodrome operators or other agencies as applicable.

(k) A procedure exists for recording activities during an emergency response.

(l) Cross-reference documents

(m) ERP manual, etc.

APPENDIX 9: SAFETY HAZARD REGISTER FORM

Operation / System			
Hazard No.			
Hazard Description			
Safety Events (Causes or Threats)			
Potential Outcomes (and Associated Consequence Magnitudes)			
Risk Controls (Barriers and Mitigations)			
No.	**Description**		**Responsible**
1			
2			
3			
4			
5			
Risk Assessment (Worst Foreseeable Scenario – i.e. Highest Risk)			
Hazard Frequency			
Outcome Likelihood			
Consequence Severity			
Risk			
Management Approval	Name:	Post:	Signature:
Relevant Previously Reported Incident Data			
Safety Performance Monitoring Requirements			
No.	**Description**		**Responsible**
1			
2			
3			

APPENDIX 10: ROOT CAUSE ANALYSIS (RCA)

(a) Introduction

(1) Principles of RCA are closely related to those of risk assessment, particularly in terms of the thoroughness of the analysis. Both processes consider not simply the person involved in an issue, but all aspects of the organisation and each individual in that organisation where that person works. This approach has the premise that human error is a consequence rather than a deliberate action and, as such, proactive measures and continuous reform of different aspects of the processes and organisation can address latent conditions in the system and increase the system's resistance to operational hazards. The term "latent conditions" refers to flawed procedures or organisational characteristics capable of creating hazards if the right conditions or actions occur.

(2) Therefore, RCA treats errors as defects in the system rather than in an individual. RCA looks beyond the symptom to find the organisational defect that permitted an error to occur. The more thorough the analysis, the greater the likelihood you will uncover why the system deficiency could occur, and how your organisation can respond definitively.

An effective RCA can be as simple as asking and answering a question (five times) about **why** something happened. A superficial analysis might have led to disciplinary action against one individual, which is indicative of a blame culture, and would, most likely, lead to a recurrence of the same error by a different individual.

(b) Considerations for the RCA process

(1) RCA should consider two major areas:

(i) Systems analysis plays an increasingly important role because of the increasing aviation complexity and variety of organisation activities, equipment and multicultural environment issues. Systems analysis emphasizes a harmonized approach to an enterprise, including specific written procedures and planning for all activities, clearly established authority and responsibilities, communications processes, and methods of measuring results, detecting system errors, and preventing recurrence. This harmonized approach recognizes the wide range of interrelated issues that are potentially associated with a problem in the system.

(ii) Human factors analysis begins with the field organisation itself where the occurrence happens (flight operations, ground operations, training, maintenance, ATS, etc. Each of those organisations

(A) Defines the environment where staff conducts their tasks.

(B) Defines the policies and procedures that staff must follow and respect.

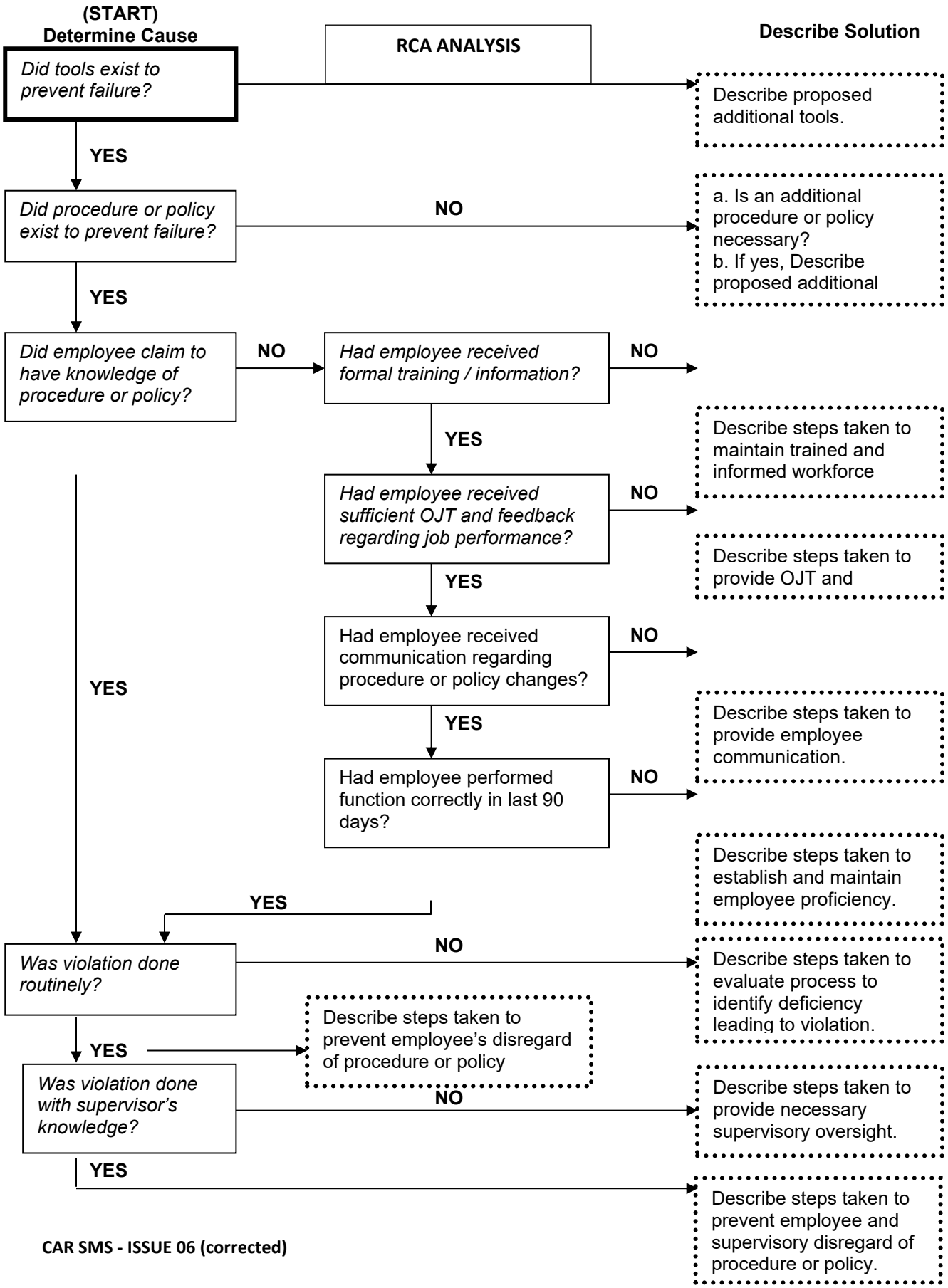
(C) Allocates the resources that staff needs to achieve the safety and production goals.

(c) Within the field organisation, human factors analysis looks at how their staffs communicate and perform in the work environment and then seeks to incorporate that knowledge into the design of equipment, processes, and organisations. This enhances safety and maximizes the human contribution, partly by designing systems to anticipate the inevitability of human error. The human factors discipline addresses a wider range of issues affecting how people interface with technology and the operational system; how people learn about new or changed equipment, technology, and documentation; and how people adapt to the general workplace environment.

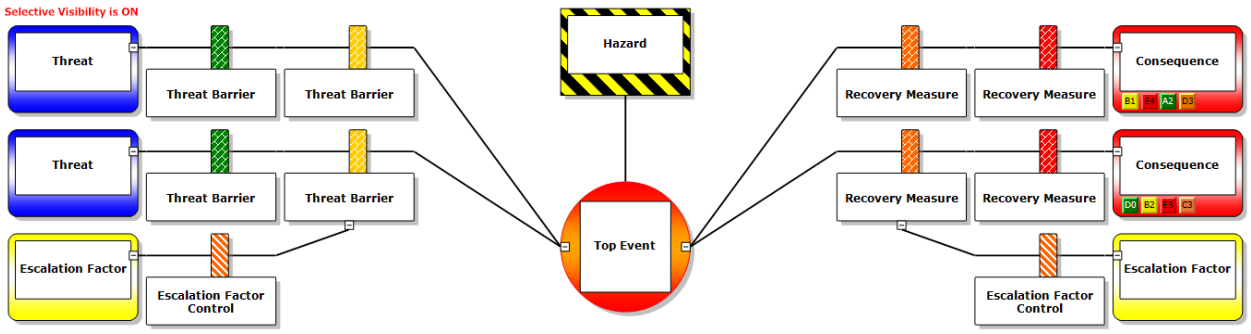
(d) Any organisation should be aware that knowledge gained from human factors can help to avoid operational staff errors, ensure that individuals' initial skill sets match task requirements, ensure that individuals maintain and improve their skills, and enhance the work environment.

GCAA expects that any RCA consider human factors as part of the investigation of individual events by any personnel designated to respond to safety related occurrences. Otherwise, data reviewed in a quality assurance process could be incomplete.

(e) A proper implementation of RCA, need a suitable and sustainable "Safety Culture" environment, which should discourage the temptation to quick fixes by blaming operational and looking for corrective actions on unrealistic and unachievable human performance.


(START)
Determine Cause
RCA ANALYSIS
Describe Solution
Did tools exist to prevent failure?
Describe proposed additional tools.
YES
Did procedure or policy exist to prevent failure?
NO
a. Is an additional procedure or policy necessary?
b. If yes, Describe proposed additional
YES
Did employee claim to have knowledge of procedure or policy?
NO
Had employee received formal training / information?
NO
YES
Describe steps taken to maintain trained and informed workforce
Had employee received sufficient OJT and feedback regarding job performance?
NO
Describe steps taken to provide OJT and
YES
Had employee received communication regarding procedure or policy changes?
NO
YES
Describe steps taken to provide employee communication.
Had employee performed function correctly in last 90 days?
NO
Describe steps taken to establish and maintain employee proficiency.
YES
Was violation done routinely?
NO
Describe steps taken to evaluate process to identify deficiency leading to violation.
YES
Describe steps taken to prevent employee's disregard of procedure or policy
Was violation done with supervisor's knowledge?
NO
Describe steps taken to provide necessary supervisory oversight.
YES
Describe steps taken to prevent employee and supervisory disregard of procedure or policy.

APPENDIX 11: EXAMPLE OF BOWTIE MODEL



Definitions related to the BowTie Model:

Threats A possible direct cause that will potentially release a hazard by producing a top event.

Consequences A potential event resulting from the release of a Hazard, which directly results in loss or damage.

Top Event A point in time which describes the release or loss of control over a Hazard (the undesired system state).

Hazard: The condition, object or activity with the potential of causing injuries to personnel, damage to equipment or structures, loss of material or reduction of ability to perform a prescribed function.

Escalation Factors: A condition that leads to increased risk by defeating or reducing the effectiveness of controls (a control decay mechanism).

Escalation Factor Control: A control that manages the conditions which reduce the effectiveness of other controls

Threat Barrier: Measures that are considered to reduce the likelihood of the top event to occur.

Recovery Measure: Measures that are considered to reduce the likelihood of the top event developing into a consequence as well as mitigating the severity of the consequence.

APPENDIX 12a: DATA-DRIVEN DECISION-MAKING TOOL

1. Data-driven decision-making tool

(a) Safety risk decision-making tools and processes can be used to improve the repeatability and justification of decisions taken by organisational safety decision makers.

(b) The primary purpose of safety analysis and safety reporting is to present a picture of the safety situation to decision makers which will empower them to make decisions based on the data presented. This is known as data-driven decision-making (also referred to as DDDM or D3M), a process-driven approach to decision-making.

(c) Many aviation occurrences have resulted, at least in part, from poor management decisions, which can result in wasted money, labour and resources. The goal of safety decision makers is, in the short term, to minimize poor outcomes and achieve effective results, and in the long term, to contribute to the achievement of the organisation's safety objectives.

(d) Good decision-making is not easy. Decisions are often made without being able to consider all the relevant factors. Decision makers are also subject to bias that, whether consciously or not, affects decisions made.

(e) The intent of D3M is not necessarily to make the "perfect" or ideal decision, but rather to make a good decision that achieves the short-term objective (about which the actual decision is being made) and works towards satisfying the longer-term objective (improved organisational safety performance).

(f) Good decisions meet the following criteria:

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

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

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

(4) Justifiable and defendable: the decision can be shown to be reasonable given the inputs to the decision and the process followed.

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

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

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

2. Advantages of data-driven decision-making

(a) D3M enables decision makers to focus on desired safety outcomes which align with the safety policy and objectives, and address various aspects related to change management, safety risk assessments, etc. D3M can assist with decisions related to:

(1) changes that can be expected in statutory and regulatory requirements, emerging technologies or resources which may affect the organisation;

(2) potential changes in the needs and expectations of the aviation community and interested parties;

(3) various priorities that need to be established and managed (e.g. strategic, operational, resources);

(4) new skills, competencies, tools and even change management processes that may be needed to implement new decision(s);

(5) risks that must be assessed, managed or minimized;

(6) existing services, products and processes that currently provide the most value for interested parties; and

(7) evolving demands for new services, products and processes.

(b) A structured approach such as D3M drives decision makers to decisions that are aligned with what the safety data is indicating. This requires trust in the safety performance management framework; if there is confidence in the SDCPS, there will be trust in any decisions derived from them.

3. Common challenges with data-driven decision-making

(a) Implementing processes for data collection and analysis takes time and money, as well as expertise and skills that may not be readily available to the organisation. The appropriate amount of time and resources vested into the decision-making process needs to be carefully considered.

(b) Factors to consider include the amount of money involved in the decision, the extent of the influence of the decision and the decision’s safety permanence. If the organisation does not understand what

is involved, then the D3M process may become a source of frustration for safety decision makers, causing them to undermine or abandon the process.

(c) Like SMS, D3M and safety performance management require a commitment to build and sustain the structures and skills necessary to maximize the opportunities presented by D3M.

(d) It is harder to build trust in data than it is to trust an expert's input and opinion. Adopting the D3M approach requires a shift in the culture and mindset of the organisation where decisions are based upon reliable SPIs and the results of other safety data analysis.

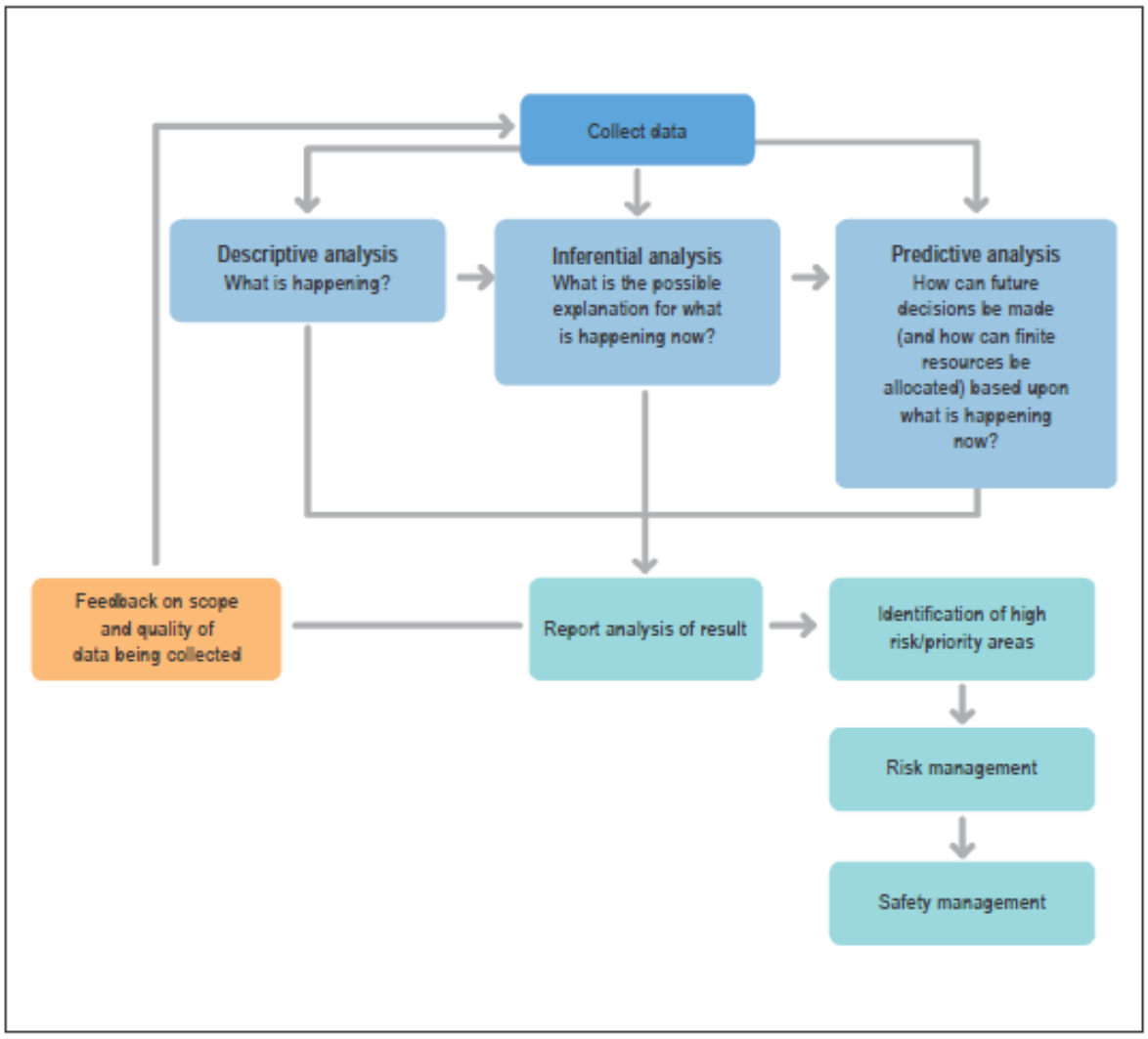
(e) The D3M process can be a critical tool that increases the value and effectiveness of the SMS. Effective safety management depends on making defendable and informed decisions. In turn, effective D3M relies on clearly defined safety data and information requirements, standards, collection methods, data management, analysis and sharing, all of which are components of a D3M process.

(f) In some cases, the decision-making process may become bogged down in an attempt to find the "best possible" solution, also known as "analysis paralysis". Strategies that can be used to avoid this include:

(1) setting a deadline;

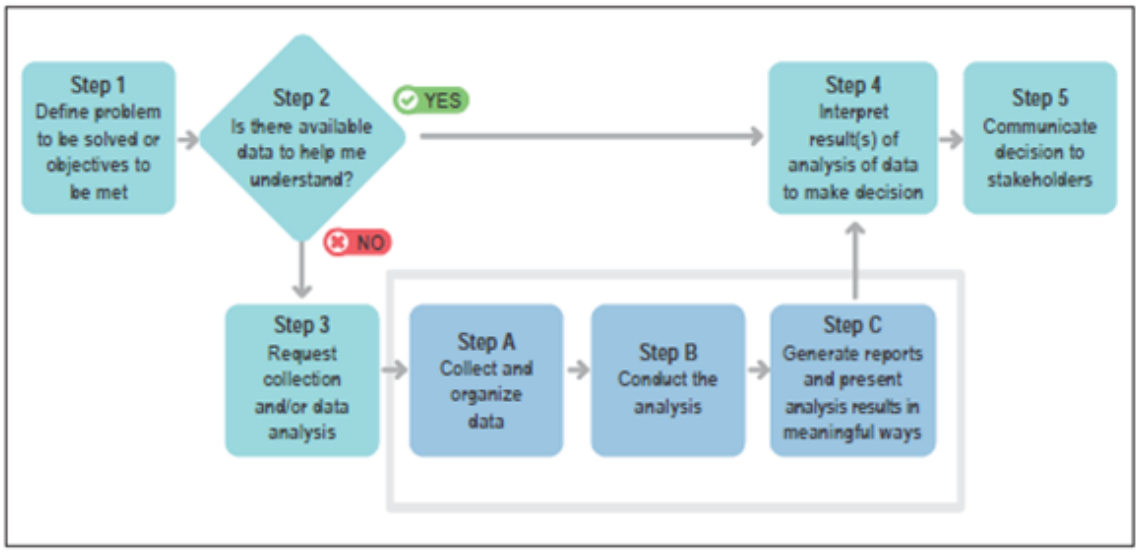
(2) having a well-defined scope and objective; and

(3) not aiming for a "perfect" decision or solution the first time, but rather coming up with a "suitable" and "practical" decision and improving further decisions.


Collect data
Descriptive analysis
What is happening?
Inferential analysis
What is the possible explanation for what is happening now?
Predictive analysis
How can future decisions be made (and how can finite resources be allocated) based upon what is happening now?
Feedback on scope and quality of data being collected
Report analysis of result
Identification of high risk/priority areas
Risk management
Safety management

APPENDIX 12b: DATA-DRIVEN DECISION-MAKING PROCESS

Following figure illustrates the D3M process.



1. STEP 1 — defining the problem or objective

(a) The first step in planning and establishing the D3M process is to define the problem that needs to be solved or the safety objective that must be achieved. What is the question that needs to be answered? What decision must the safety decision makers make? How will it align with the more strategic organisational objectives? In the process of defining the problem statement, decision makers should ask themselves the following questions:

(1) Does the collection and analysis of data support and relate to the organisation's safety objectives or safety targets?

(2) Is the required data available? Or can it be obtained in a reasonable manner?

(3) Is it practical and feasible to collect and analyse the data?

(4) Are the required resources (people, equipment, software, funds) available?

(b) In the safety management context, the main problem statements within the organisation are related to evaluating and selecting safety priorities – in alignment with the safety objectives – and establishing measures for safety risk mitigation.

2. STEP 2 — access to data to support the decision-making

(a) The next step is to identify what data is needed to answer the problem (taking into account the provisions on information protection). No data is any more valuable than other data. Focus should be on whether the available data is appropriate to help answer and resolve the problem.

(b) If the data required is available, proceed to step 4. If the right data is not available, the organisation will need to collect, store, analyse and present new safety data and safety information in meaningful ways.

3. STEP 3 — request data to support the decision-making

(a) If the data isn't already available, the organisation needs to find ways of collecting it. This may mean establishing another SPI and perhaps aligned SPTs.

(b) Establishing additional indicators can come at a cost. Once the cost is known, the organisation should estimate if the benefits outweigh those costs. The focus should primarily be on identifying, monitoring and measuring safety data that is needed to make effective data-driven safety decisions. If the costs outweigh the benefits, consider alternative data sources and/or indicators.

(c) In the planning phase of the D3M process, the organisation must define what it wants to achieve by establishing the SPTs and SPIs, and analysing the data. Why does the organisation need to address the identified problem? What is a reasonable target? And how and where will safety decision makers use the results of data collection and analysis? Having a clear understanding of why the organisation needs to collect, analyse, share and exchange safety data and information is fundamental for any SDCPS.

(d) The following elements combine to enable an organisation to identify trends, make informed decisions, evaluate the safety performance in relation to defined objectives, assess risks or fulfil its requirements:

(1) safety performance management - as the safety data and safety information governance framework;

(2) SDCPS - as the safety data collection and processing functionality; and

(3) D3M as a dependable decision-making process.

4. STEP 4 — interpret results of data analysis and make data-driven decision

(a) The data gathered must be presented to the decision makers at the right time and in meaningful ways. The appropriateness and size of the data sets, the sophistication of the analytics and the skills of the data analysts will only be effective if the data is presented when needed and in formats that make it easy for decision makers to comprehend. The insights gained from the data should inform decision-making, and ultimately, improve safety performance.

(b) There are many decision-making models available. Using an agreed and standardized approach will maximize consistency and effectiveness of the organisation's data-driven decisions, most include the following steps:

(1) assemble a team/group with the necessary skills and experience (e.g. safety action group (SAG));

(2) clearly define the safety problem or objective and the context;

(3) review the organisation's SPTs and safety objectives to ensure continued alignment;

(4) review and interpret the safety data to understand what it is indicating;

(5) consider and analyse the viable alternatives;

(6) consider the risk of feasible actions (or inactions);

(7) gain consensus among the decision-making group;

(8) commit to the data-driven decision and act on the decision (turning data into action); and

(9) monitor and evaluate the outcomes.

5. STEP 5 — communicate the decision

For the safety decision to be effective, it needs to be communicated to stakeholders, these include:

(a) staff required to enact the necessary actions;

(b) person who reported the situation (if required);

(c) all personnel, to ensure they are kept informed of safety improvements (safety promotion); and

(d) organisational knowledge managers to ensure the safety decision is incorporated into the learning of the organisation.