



SAFETY MANAGEMENT SYSTEMS (AOC HOLDERS & SAR-145 AMOs)

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- 1. GENERAL.** Advisory Circulars (ACs) are issued by the Civil Aviation Authority of Singapore (CAAS) and contain information about standards, practices and recommendations acceptable to the Authority. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.
- 2. PURPOSE.** This AC is issued to provide general guidance and principles to implement a Safety Management System (SMS).
- 3. APPLICABILITY.** This AC applies to all Singapore Air Operator Certificate (AOC) Holders and SAR-145 Approved Maintenance Organisations (except SAR-145, Subpart D organisations).
- 4. CANCELLATION.** This AC supersedes AC 1-3(0) dated 20 December 2006.
- 5. EFFECTIVE DATE.** Original issue was effective on 20 December 2006. This Amendment (1) is effective on 01 June 2008.
- 6. REFERENCES.** ICAO Annex 6, ICAO Safety Management Manual (Doc 9859)

7. INTRODUCTION.

Safety has always been the overriding consideration in the conduct of all aviation activities. Safety is the state in which the risk of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and risk management.

Due to the nature of the aviation industry, the total elimination of accidents or serious incidents is unachievable. No human endeavour or human-made system can be free from risk and error, and failures will be expected to occur in spite of the most accomplished prevention efforts. The system must, however, seek to understand and control such risks and errors.

Traditional approaches to accident prevention have focused primarily on outcomes (probable cause) and unsafe acts by operational personnel. Safety improvement measures introduced usually address the identified safety concern exclusively. The 'what', 'who', 'when' and 'how' were often identified but not the 'why'. As such, the organisational, human factor and environmental contexts in which errors were made were often neglected, and measures adopted therefore often addressed only symptoms.

In the 1950s, accident prevention concentrated primarily on technical factors. Recognition that human performance issues (human factor) played a part gained momentum in the 1970s. In the 1990s, safety thinking has evolved to the point of widespread acknowledgement that organisational factors play a significant role in the performance of human beings and therefore is an important issue in risk and error management. The study of accident causation today focuses on organisational processes, latent conditions, workplace conditions, human factors, adequacy of defenses as well as active failures.

Today, aviation safety management systems seek to enhance the organisational approach to managing a safe and successful aviation operation. It focuses on a systematic and proactive discipline of performing hazard identification and risk assessment on an organisation's aviation safety related operations and processes.

This AC is intended to address SMS implementation with respect to an approved organisation's service, product or processes which have an impact on aviation safety.

8. SAFETY MANAGEMENT SYSTEM (SMS)

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

A Safety Management System (SMS) is a systematic, explicit and proactive process for managing safety that integrates operations and technical systems with financial and human resource management to achieve safe operations with as low as reasonably practicable risk.

It is *systematic* in that safety management activities are carried out in accordance with a pre-determined plan, and applied in a consistent manner throughout the organisation. It is *proactive* by taking an approach that emphasizes prevention, through hazards identification and risk control and mitigation measures, before events that affect safety occur. It is also *explicit*, in that all safety management activities are documented, visible and performed as an essential component of management activities. People, procedures, practices and technology needed to monitor and improve the safety of the aviation transportation system.

Safety management may be also described as the systematic application of specific technical and managerial skills to identify and control hazards and related risks. By identifying, assessing and eliminating or controlling safety-related hazards and risks, acceptable levels of safety will be achieved.

9. BENEFITS OF SMS

The primary reason for the introduction of SMS is to improve existing levels of aviation safety, i.e. reduction in aviation accidents and incidents, through a systematic process of hazard and risk management. An effective safety management system may also enable organisations to reap the following additional benefits:

- Minimise direct and indirect costs resulting from accidents and incidents
- Gain safety recognition from customers and traveling public
- Create a positive, reliable and generative organisational culture
- Reduction in insurance rate
- Exceed regulatory requirements with simultaneous bottom line and productivity gains
- Proof of due diligence in event of legal or regulatory safety enquiries
- Improved working environment resulting in better productivity and morale
- Synergy in the safety related processes and functions within the organisation

10. SMS IMPLEMENTATION SCHEDULE AND MANDATORY DEADLINE

Annex 6 to the Convention on International Civil Aviation requires States to mandate the implementation of safety management systems by air operators and maintenance organisations by January 2009.

To allow sufficient time for AOC Holders and SAR-145 AMOs to develop and implement their own SMS, CAAS has adopted a two-phased SMS implementation plan. All AOC Holders and SAR-145 AMOs are encouraged to initiate the implementation of their Safety Management System from 20 December 2006 until December 2008. During this period, CAAS will continue to provide guidance where appropriate as well as assess each organisation's level of SMS implementation. However, deficiencies will not be recorded as findings.

SMS will be mandated on 1 January 2009, and by then all AOC Holders and SAR-145 AMOs must have in place a functioning SMS in order to meet the requirements relevant to their CAAS approval.

There is no global harmonized standard for SMS regulations; however, guidance material is available from ICAO and all basic SMS regulations have several common key features. The SMS regulations which will be adopted by CAAS from January 2009 will encapsulate these features. The regulations will require the establishment of the basic components of a safety management system, starting with a safety policy and senior management commitment. To be effective, these components must be integrated into a coherent management system and not exist as independent safety programs.

11. SMS REGULATORY REQUIREMENTS

With effect from 20 December 2006, all Singapore AOC Holders and SAR-145 AMOs (except SAR-145, Subpart D organisations) are recommended to initiate the implementation of a safety management system. Such a system should include, as a minimum, the following elements:

- (a) a safety policy on which the system is based;
- (b) clearly defined lines of safety accountability for all members of senior management, including a direct accountability for safety on the part of the Accountable Manager;
- (c) setting of safety objectives and goals;
- (d) documentation of all SMS components, procedures and activities including their relevant integration;
- (e) an emergency response plan;
- (f) hazard identification and risk management process;
- (g) audit and continuous improvement of the SMS;
- (h) safety performance monitoring and an acceptable level of safety;
- (i) management of change;
- (j) personnel SMS training, communication and promotion.

AOC Holders and SAR-145 AMOs are free to build their SMS to the complexity of their operations. Organisations have a wide range of procedural options for compliance, and are encouraged to identify the best method of compliance to meet their individual circumstances. The key to a successful SMS is to develop and grow the SMS based on the organisation's needs and customized to its operations.

SMS implementation will be incorporated as a mandatory requirement for all Singapore AOC Holders and SAR-145 AMOs (except SAR-145, Subpart D organisations) by 1 January 2009.

12. SENIOR MANAGEMENT'S ACCOUNTABILITY FOR AVIATION SAFETY

The senior management of the organisation led by the Chief Executive Officer is ultimately responsible for the entire organisation's attitude towards safety. Its organisation safety culture will depend on the senior management's level of commitment toward safe operations.

Regardless of the size, complexity, or type of operation, the success of the SMS depends on the extent to which senior management devotes the necessary time, resources and attention to safety as a core management issue. A safety management system will not be effective if it receives attention only at the operational level. CAAS therefore considers it the responsibility of the Chief Executive Officer¹, as the Accountable Manager, to effectively implement the organisation's safety management system.

The Accountable Manager, having full authority over human resources and financial issues, must ensure that the necessary resources are allocated to the management of safety. He or she has direct responsibility for the conduct of the organisation's affairs and final responsibility for all safety issues.

Senior management's commitment to safety is first demonstrated to the organisation's staff through its stated safety policies, objectives and goals. The Accountable Manager, supported by the organisation's senior management team, must therefore be responsible for:

- Developing the organisation's safety policy
- Establishing safety objectives, goals and performance indicators
- Communicating, with visible endorsement, the safety policy, objectives and goals to all staff
- Providing the necessary human and financial resources

13. IMPLEMENTING A SAFETY MANAGEMENT SYSTEM

To establish an SMS, the organisation would need to build up its key SMS components. Following are guidance on what those components would be like. Organisations may scope these components to suit their operations:

SAFETY POLICY AND OBJECTIVES

(a) Safety Policy

The written safety policy is a concrete expression of the management's philosophy and commitment to safety. It should clearly encapsulate the senior management's commitment to improving aviation safety as their top priority. It should be a straightforward statement that includes the following points:

- Senior management commitment and intentions with regard to safety
- The organisation's safety management principles
- Establishment of safety as a core value
- Responsibility for the safety programme
- Non-Punitive Reporting policy (Just culture)

¹ In very large companies, it may be the case that the Chief Executive Officer may not be directly involved in the aviation business unit of the company. In such cases, the most senior person responsible for the aviation business unit, who has corporate authority for ensuring that all work can be financed and carried out to the required safety standards, may be accepted as the Accountable Manager. This is in line with the requirements for an Accountable Manager under the SAR-145 and AOCR.

This safety policy should bear visible endorsement by the Accountable Manager and all members of the organisation's senior management team, and communicated to all levels within the organisation.

A safety policy statement could look like this:

To prevent aviation accidents and incidents our organisation will maintain an active safety management system. I support the open sharing of information on all safety issues and encourage all employees to report significant errors, safety hazards or concerns. I pledge that no staff member will be asked to compromise our safety standards to "get the job done".

Safety is a corporate value of this company, and we believe in providing our employees and customers with a safe environment. All employees must comply with this policy.

Our overall safety objective is the proactive management of identifiable hazards and their associated risks with the intent to eliminate their potential for affecting aviation safety, and for injury to people and damage to equipment or the environment. To that end, we will continuously examine our operation for these hazards and find ways to minimize them. We will encourage hazards and incident reporting, train staff on safety management, document our findings and mitigation actions and strive for continuous improvement.

Ultimate responsibility for aviation safety in the company rests with me as the Chief Executive Officer/Accountable Manager. Responsibility for making our operations safer for everyone lies with each one of us – from managers to front-line employees. Each manager is responsible for implementing the safety management system in his or her area of responsibility, and will be held accountable to ensure that all reasonable steps are taken.

In preparing a safety policy, senior management should consult widely with key staff members in charge of safety-critical areas. Consultation ensures that the document is relevant to staff and encourages buy-in to the safety policy.

(b) Safety Roles and Accountabilities

The successful management of safety is a cooperative responsibility that requires the participation of all management and operational personnel of the organisation.

The safety roles and accountabilities between the organisation's key safety personnel (or department) and all other functional departments should be established and clearly defined. They should be documented and communicated to all levels of the organisation.

(i) Accountable Manager

The Accountable Manager should have ultimate responsibility for the implementation and maintenance of the SMS. He or she should have full control of human/ financial resources and have final authority over operations under the certificate of approval. He or she should have final responsibility for all aviation safety issues.

(ii) Safety (SMS) Manager

Although the Accountable Manager is ultimately responsible for the safety management system, it is necessary to appoint a focal point to act as the driving force for the implementation as well as maintenance of SMS activities across the entire organisation. This is accomplished by appointing a safety (SMS) manager whose primary responsibility is to facilitate and administer the organisation's SMS. The SMS manager position, dependent on the size and structure of the organisation may not necessarily be a dedicated position. He may have other non conflicting management responsibilities.

The safety manager should be directly accountable to the Accountable Manager.

Other responsibilities of the safety manager or department would include:

- Managing the SMS implementation plan
- Facilitating hazard identification and risk assessment activities
- Monitoring the effectiveness of mitigation actions
- Providing periodic reports on safety performance
- Maintaining the SMS documentation
- Planning and organizing staff safety training
- Providing independent advice on safety matters to the senior management

It must be emphasized that the safety manager is not the sole person responsible for aviation safety. Specific safety activities and the functional or operational safety performance and outcomes are the responsibility of the relevant operational or functional managers, and senior management must not hold the safety manager accountable for line managers' responsibilities. The safety manager should monitor all cross functional or departmental SMS activities to ensure their relevant integration. While the safety manager may be held accountable for the satisfactory administration and facilitation of the safety management system itself, he or she should not be held accountable for the safety performance of the organisation.

In order to avoid possible conflict of interest, the safety manager should not have conflicting responsibility for any of the operational areas. In principle, integration of aviation safety, occupational safety, quality, environmental control and security is possible. The safety manager should be at a sufficiently high level in the management hierarchy to ensure that he or she can have direct communication with other members of the senior management team.

(iii) Safety Review Board (Safety Committee)

A high level Safety Review Board (SRB) or safety committee would normally be necessary for functional or senior management involvement on safety policy, overall system implementation and safety performance review purposes. Level of participation in the safety committee would depend on the size and structure of the organisation.

The Accountable Manager should chair (see note* below) this committee with all relevant functional areas of the organisation being represented.

A safety committee would typically consist of the Accountable Manager, the safety manager and other members of the senior management team. The objective of the safety committee is to provide a forum to discuss safety issues and the overall health and direction of the SMS. The role of the safety committee would include:

- Making recommendations or decisions concerning safety policy and objectives
- Defining safety performance indicators and set safety performance goals for the organisation
- Reviewing safety performance and outcomes
- Providing strategic directions to departmental Safety Action Groups (SAG) where applicable
- Directing and monitoring the initial SMS implementation process.

Terms of reference for the safety committee should be documented in the SMS manual.

*Note: Should the Accountable Manager choose to assign this task to an appropriate senior person, it should be clearly stated and substantiated in the SMS manual that he is performing the task on behalf of the Accountable Manager whose accountability for safety [paragraph13(b)(i)] is not compromised and that he remains accountable for all decisions of the SRB.

(iv) Safety Action Group(s)

Large organisations that have relatively complex operations could set up Safety Action Groups accountable to the Safety Committee. Managers and supervisors from a given functional area would be members of the SAG for that area and would take strategic

directions from the Safety Committee. The functional head of that area should chair the SAG. The role of the SAG(s) would include:

- Overseeing operational safety within the functional area.
- Managing the area's hazard identification and risk assessment activities.
- Implementing mitigation or corrective actions to improve aviation safety relevant to the area.
- Assessing the impact of aviation safety on operational changes and activating hazard and risk assessment process as appropriate.
- Maintenance and review of relevant performance indicators
- Managing safety training and promotion activities within the area.

Departmental SAGs may wish to appoint "SMS Coordinators" to facilitate the department's SMS activities.

(c) Safety Objectives and Goals

(i) Safety Objectives

In conjunction with an overall safety principles statement incorporated in the Safety Policy, there should be a set of underlying tangible safety objectives. Safety Objectives are programs you set in place to help the organization achieve its Safety Goals. These would cover relevant aspects of the organisation's safety vision, senior management commitments, realistic safety milestones and desired outcomes. They should be unambiguous and reviewed on a regular basis. Examples of such safety objectives are listed below:

- To identify and eliminate hazardous conditions within our aviation related processes and operations
- To perform hazard and risk assessment for all proposed new equipment acquisitions, facilities, operations and procedures
- To promulgate an on going systematic hazard and risk assessment plan.
- To provide relevant SMS training/ education to all personnel.
- To provide a safe, healthy work environment for all personnel
- To minimize accidents/incidents that is attributable to organisational factors
- To prevent damage and injury to property and people resulting from our operations
- To improve the effectiveness of the safety management system through a yearly safety audit that reviews all aspects of the SMS

(ii) Safety Goals

Safety goals are quantifiable and have time components. They should be achievable and realistic. These safety goals would be measured and monitored with the use of safety performance indicators. Examples of possible safety goals are as follows:

- To increase the number of hazard reports received by X % over the next Y year²
- To reduce days lost to injury or illness by X % over the next Y year
- To reduce direct/indirect cost due to incidents/accidents by X % over the next Y year
- To complete initial safety assessment for all existing safety related equipment, facilities, operations and procedures according to the following schedule__ (schedule details)
- To reduce annual insurance claims due to incidents/accidents by X % over the next Y year
- To reduce number of operational technical incidents by X % over the next Y year.
- Zero safety-related defect in 5 years
- X safety-related defects per 10000 man-hour
- To reduce the number of customer warranty claims by X % over the next Y year.
- To reduce the number of findings per external audit by X % over the next Y year

² In a developing SMS with a new reporting system, you would expect to see an increase in the number of reports over the short term. This shows that the company culture encourages this feedback. In the long term, as the SMS matures, you would expect to see a decrease in number of hazard reports.

(d) SMS Documentation and Records

A SMS Manual (or exposition) is the key instrument for communicating the organisation's SMS approach and methodology to the whole organisation. It will document all aspects of the SMS, including the safety policy, objectives, accountabilities and procedures. A typical SMS Manual would include the following contents:

- Document Control
- SMS Regulatory Requirements
- Scope of the Safety Management System
- Safety Policy
- Safety Objectives and Goals
- Roles and Responsibilities
- Non-Punitive Reporting Policy
- Safety Reporting
- Hazard Identification and Risk Assessment
- Performance Indicators and Acceptable Level of Safety (ALS)
- Safety Investigations
- SMS/ Safety Training
- SMS Audit and Safety Review
- SMS Data and Records Management
- Management of Change
- Emergency Response Plan

Appendix 4 provides further guidance on the compilation of the SMS Manual. An SMS exposition should preferably be a manual by itself. For small organisations, it is possible for the SMS exposition to be incorporated within an existing organisation's exposition manual. In either case, the various SMS components and their relevant integration should be adequately and systematically documented. Where the SMS manual is a stand alone document, appropriate reference should be made to it in the relevant Organisation Exposition Manual. An organisation's SMS exposition/ manual shall be subject to CAAS approval.

In a large organisation, operating a SMS generates significant amount of data, documents and reports. Proper management and record keeping of such data is crucial for sustaining an effective SMS. Effective safety analysis is totally dependent upon the availability and competent use of the safety information management system. To facilitate easy retrieval and consolidation of safety data/information, it is necessary to ensure that there is relevant integration between the various sources of such data or reports. This is important where different departments within the organisation have traditionally limited the scope of safety data distribution to within the department itself. Cross functional safety data integration becomes important in this case.

It is necessary that the organisation maintain a systematic record of all measures taken to fulfill the objectives and activities of the SMS. Such records would be required as evidence of on going SMS processes including hazard identification, risks mitigation and safety performance monitoring. These records should be appropriately centralised and maintained in sufficient detail to ensure traceability of all safety related decisions. Examples of such records include:

- Hazards Register
- Incident/Accident reports
- Incident/Accident investigation reports
- Safety/SMS audit reports
- Periodic analyses of safety trends/indicators
- Minutes of safety committee or safety action group meetings
- Hazard and Risk Analysis Reports, etc.

(e) Emergency Response Plan

An Emergency Response Plan (ERP) outlines in writing what should be done by an AOC/AMO organisation upon a major safety-related incident or accident resulting in emergency or crisis situation. For AMOs, it should include (where applicable) the discovery of a critical defect or maintenance error that affects the safe operation of aircraft.

An ERP should include (where applicable):

- Planned actions to minimize indirect or consequential damage upon the occurrence of a crisis or emergency situation.
- Provision for preservation of aviation product/ services/ equipment to avoid subsequent safety/ quality/ continuity problems, where applicable.
- Recovery actions as well as procedures for orderly transition from normal to emergency operations
- Designation of emergency authority
- Assignment of emergency roles and responsibilities
- Authorization of key personnel for actions contained in the plan
- Coordination procedures with contractors or operators where applicable
- Criteria for safe continuation of operations, or return to normal operations

For an AOC holder, a comprehensive ERP would include other aspects of aircraft accident response such as, crisis management centre, management of an accident site, news media, coordination with state investigations, family assistance, post critical incident stress counseling, etc. It should also include arrangements for emergencies at line stations.

SAFETY RISK MANAGEMENT

(f) Hazard Identification and Risk Management Process

(i) Hazard Identification

Risks cannot be totally eliminated and the implementation of risk management processes is critical to an effective safety management programme. Hazard identification is part of the risk management process.

Hazard identification is a process where organisational hazards are identified and managed so that safety is not compromised. Organisations may utilise a range of safety activities to identify hazards that may jeopardise part of its operations or may weaken its safety defenses.

There is a natural (and erroneous) tendency to describe hazards as an outcome. For example, "runway incursion" is an outcome, not a hazard. On other hand, "unclear aerodrome signage" is a hazard, not an outcome. Mistaking hazards as outcomes disguise their nature and interfere with proper identification of actual outcomes or risks associated with those hazards. A correctly named hazard will enable the tracking of its source or origin on the one hand and the identification of its potential outcome(s) or risk(s) on the other. Following are some examples of hazards –

- Flight Operations : Unfamiliar phraseology, inclement weather, birds in take-off path, heavy traffic, unfamiliar airports, high terrain around airport, etc.
- Aircraft Maintenance : Fuel vapour from open wing tanks, discrepant test equipment, ambiguous work instructions, improper shift handover procedure, etc.

The scope for hazards in aviation is wide, and may be related to:

- Design factors, such as equipment and task design
- Procedures and operating practices, such as documentation and checklists
- Communications, such as language proficiency and terminology

- Organisational factors, such as company policies for recruitment, training, remuneration and allocation of resources
- Work environment factors, such as ambient noise and vibration, temperature, lighting, protective equipment and clothing
- Defenses, such as detection and warning systems, and the extent to which the equipment is resilient against errors and failures
- Human factors, such as medical conditions, circadian rhythms and physical limitations
- Regulatory factors, such as the applicability of regulations and the certification of equipment, personnel and procedures.

Hazards may be identified from the organisation's reactive, proactive and predictive processes. This should include the company's voluntary reporting system, audits and surveys, accident/incident reports as well as industry incident/accident reports.

The hazard identification and reporting process should be open to any employee. It may be done through formal as well as informal processes. It may be performed at any time as well as under specific conditions. Specific conditions would include:

- When there is an unexplained increase in safety-related events or infractions
- When there are abnormal audit or safety indicator trends
- When major operational changes are planned
- Before a new project, major equipment or facility is set up
- During a period of significant organisational change

In essence, the three steps of hazard identification and risks projection are:

- State the generic hazard (hazard statement), e.g. an operating aircraft engine
- Identify specific components of the hazard, e.g. engine intake suction
- Project specific risk(s) associated with each hazard, e.g. foreign object ingestion

Appendix 1 shows a sample Hazard Management flowchart.

(ii) Risk Management

Risk management is the identification, analysis and mitigation of risks associated with the operations of an organisation. It aims at a balanced allocation of resources to address all risks and ensure that viable risk control and mitigation actions are in place.

Risk management is a key component of safety management systems. It is a data-driven approach to safety management resources allocation i.e. priority is accorded to activities based on their risk index. Appendix 2 shows a typical risk management process flowchart.

Risk Probability

Risk Probability is the likelihood that a situation of danger might occur. Certain questions may be used to guide the assessment of probability, such as:

- Is there a history of occurrences like the one being assessed, or is the occurrence an isolated event?
- What other equipment, or similar types of components might have similar defects?
- What number of operating or maintenance personnel must follow the procedure(s) in question?
- How frequently is the equipment or procedure under assessment used?
- Are there organisational, management or regulatory implications that might generate larger threats to public safety?

Table 1 below shows a sample risk probability table. It is sometimes useful to attach logical meanings to the qualitative definition, as illustrated in Table 1.

Probability of occurrence		
Qualitative definition	Meaning (example)	Value
Frequent	<ul style="list-style-type: none"> Likely to occur many times (has occurred frequently) 	5
Occasional	<ul style="list-style-type: none"> Likely to occur some times (has occurred infrequently) 	4
Remote	<ul style="list-style-type: none"> Unlikely, but possible to occur (has occurred rarely) 	3
Improbable	<ul style="list-style-type: none"> Very unlikely to occur (not known to have occurred) 	2
Extremely improbable	<ul style="list-style-type: none"> Almost inconceivable that the event will occur 	1

Table 1: Typical Risk Probability Table

Risk Severity

Risk severity measures the possible consequences of a situation of danger, taking as reference the worst foreseeable situation. Severity may be defined in terms of property, health, finance, liability, people, environment, image, or public confidence. Certain questions may be used to guide the assessment of severity, such as:

- How many lives are at risk (e.g. employees, passengers, bystanders, general public)?
- What is the environmental impact (e.g. spillage of fuel or other hazardous products, physical disruption of natural habitats)?
- What is the severity of property, financial damage (e.g. direct asset loss; damage to aviation infrastructure, third party damage, financial impact and economic impact for the State)?
- What is the damage to the organisation's reputation?

Table 2 below shows a sample risk severity table.

Severity of occurrences		
Aviation definition	Meaning	Value
Catastrophic	<ul style="list-style-type: none"> Equipment destroyed Multiple deaths 	A
Hazardous	<ul style="list-style-type: none"> A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely. Serious injury or death to a number of people. Major equipment damage 	B

Severity of occurrences		
Aviation definition	Meaning	Value
Major	<ul style="list-style-type: none"> A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency. Serious incident. Injury to persons. 	C
Minor	<ul style="list-style-type: none"> Nuisance. Operating limitations. Use of alternate procedures. Minor incident. 	D
Negligible	<ul style="list-style-type: none"> Little consequences 	E

Table 2: Sample Risk Severity Table

Risk Index

Once the risk Probability and risk Severity values are determined, they will (together) constitute the “Risk Index” for that occurrence. The complete “Risk Index” matrix is shown in Table 3. The acceptability (action required) for each risk index is reflected in the Risk Acceptability table (Table 4).

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

Table 3: Risk Index Matrix

Note: Although the Risk Index matrix shown above is a “5 X 5” model, organisations may use other models as appropriate to their own operations.

Risk Index	Acceptability/Action Required
5A, 5B, 5C, 4A, 4B, 3A	STOP: Unacceptable under the existing circumstances. Do not permit any operation until sufficient control measures have been implemented to reduce risk to an acceptable level.
5D, 5E, 4C, 3B, 3C, 2A, 2B	Management attention and approval of risk control/mitigation actions required.
4D, 4E, 3D, 2C, 1A, 1B	Acceptable after review of the operation
3E, 2D, 2E, 1C, 1D, 1E	Acceptable

Table 4: Risk Acceptability Table

Risk Mitigation

Risk mitigation is the process of implementing actions or defences to eliminate or reduce the probability or severity of risks associated with hazards. The basic defences employed in the aviation industry are technology, training and procedures (or regulations).

When analysing defences during a mitigation process, following questions may be useful:

- Do defences to protect against such risk (s) exist?
- Do defences function as intended?
- Are the defences practical for use under actual working conditions?
- Are the staffs involved aware of the risks and the defences in place?
- Are additional risk mitigation measures required?

Three basic strategies in risk mitigation are as follows:

- *Avoidance* – The operation or activity is cancelled because risks exceed the benefits of continuing the operation or activity. Example: *Operations into an aerodrome surrounded by complex geography and without the necessary aids are cancelled.*
- *Reduction* – The frequency of the operation or activity is reduced, or action is taken to reduce the magnitude of the consequences of the accepted risks. Example: *Operations into an aerodrome surrounded by complex geography and without the necessary aids are continued based upon the availability of specific aids and application of specific procedures.*
- *Segregation of exposure* – Action is taken to isolate the effects of risks OR ensure there is build-in redundancy to protect against it i.e reducing the severity of risk. Example: *Operations into an aerodrome surrounded by complex geography are limited to day-time, visual conditions.*

Appendix 3 shows a sample flowchart of the risk mitigation process and a sample risk mitigation worksheet.

(iii) Costs Considerations

During the process of evaluating mitigation actions or additional defences, it is necessary to strike a balance between production and safety goals. Efficient and safe operations or provision of service require a constant balance between production goals and safety goals. Airline operation contains hazardous conditions or risks which may not be cost-effective to eliminate totally. Hence, operations may have to continue so long as safety risks associated with such hazards have been mitigated to a level that is as low as reasonably practicable. (The acronym ALARP is used to describe a safety risk which has been reduced to a level that is "as low as reasonably practicable"). In determining what is reasonably practicable, consideration is given to both the technical feasibility and the cost of further reducing the safety risk. This may involve a cost/benefit study where necessary.

While the cost of risk mitigation is an important factor in safety management, it must be weighed out against the cost of undesirable outcomes due to lack of mitigation. Direct costs of incidents/accidents (which can be determined) can be reduced by insurance coverage. However, purchasing insurance only transfers the monetary aspect of a risk. It is the indirect uninsured costs which may be underestimated in such considerations. An understanding of these uninsured costs (or indirect costs) is fundamental to understanding the economics of safety. Usually they amount to more than the direct costs. These indirect costs include loss of business, damage to reputation, loss of use of equipment, loss of staff productivity, legal actions and claims, fines and citations, insurance deductibles, etc.

In addition to having an effective SMS, all organizations have to comply with all the minimum requirements of the AOCR and SAR 145.

(iv) Continuing Assessment

The procedure for routine review of completed safety assessments should be established as appropriate. The interval for such scheduled review may be on a case by case basis or as a standard interval, for example annually. Such scheduled review may take into consideration previously unidentified hazard/ risks based on operational or industry incident/ accident investigation findings. Likewise, any modification or change subsequent to the initial safety assessment done should be evaluated for any possible effect on the existing safety assessment.

(v) Hazard Identification and Risk Assessment (HIRA) Program

As part of an organisation's SMS implementation plan, there should be a program for systematic hazard identification and risk analysis (HIRA) of its operations and processes which are pertinent to aviation safety. The systematic and progressive performance (and maintenance) of such a program should constitute the primary long term safety objective of an organisation's SMS. Such a program should include a short to medium term target of completing an initial (baseline) HIRA for all eligible operations and processes (as determined by the organisation). Depending on the size and complexity of the organisation, such an initial (baseline) evaluation and safety assessment program may take from several months to a few years to be fully completed. A historical review on aviation safety related incidents/ accidents associated with these operations and processes should be assessed with higher level of priority.

Organisations with newly acquired equipment or processes may take into consideration OEM (Original Equipment Manufacturer) system design risk analysis data or recommendations during its initial safety assessment. The organization should also review the interface between such equipment/ processes and its own operational environment and internal procedures where applicable. Where there are subsequent (or historical) local modifications or incidents/ accidents attributable to such operations or processes, a review of its initial (baseline) safety assessment (with respect to the affected area or system) should be accounted for as appropriate.

(vi) HIRA Eligible Operations/ Processes

During an organisation's initial HIRA program, there will be an apparent need to identify what are the HIRA eligible operations/ processes for the organisation. In principle, all operations/ processes with the potential to harbor or generate hazards/ risks to aviation safety should be eligible for HIRA accountability. However, it is prudent that priority be given to the identification of those operations/ processes that are deemed by the organisation to be crucial or pertinent to aviation safety. In due course, the HIRA eligibility identification process may then be expanded to cover other lower priority operations/ processes. For this purpose, organisations may begin by compiling an inventory (or register) of HIRA eligible operations/ processes. These may be categorised to facilitate HIRA performance prioritization. Following are some examples of what organisations may consider as candidates for their initial/ priority HIRA performance:

Flight Operations

- Operational routes with unusual or special hazard/ risk such as ULR, ETOPs, polar, RVSM, RNP, volcanic regions, inefficient ATC, etc.
- Line stations (aerodromes) with unusual or special hazard/ risk such as difficult terrain, high traffic density, typhoon prone areas, inefficient apron control, inadequate markings or guidance systems, extreme weather conditions, etc
- Other AOC operations/ processes deemed by the organisation as essential for priority HIRA accountability.

Maintenance Organisations

- Aircraft Maintenance – high risk or complex aircraft maintenance operations/ processes such as aircraft marshalling, aircraft towing, engine ground run, engine change, functional checks involving hydraulic/ pneumatic/ electrical power, fuel tank entry work, etc

- Workshop Maintenance – crucial operations/ processes on aircraft/ engine parts such as NDT, metal machining, metal put-on, heat treatment, etc
- Other operations/ processes deemed by the organisation as essential for priority HIRA accountability.

SAFETY ASSURANCE

(g) Audit and Continuous Improvement of the SMS

(i) Internal SMS Audit

Internal safety (SMS) audits are used to ensure that the structure of an SMS is sound. It is also a formal process to ensure continuous improvement and effectiveness of the SMS. The protocol for conducting a SMS audit (from planning to final corrective action closure) should be no different from any other system audit. Audits should involve the use of appropriate checklists. The overall scope of an SMS audit should include:

- Regulatory SMS requirements
- Structure of safety accountabilities
- Organisational safety policies and standards
- Documentation, including SMS manual and SMS records
- Compliance with SMS hazard/ risk evaluation procedures
- Adequacy of staff training for their SMS roles
- Performance indicators and Acceptable Level of Safety
- Compliance with safety assessment plan or schedule
- Effective SMS integration with other control systems
- SMS integration with contractors where applicable
- Continuing assessments and management of change
- Review completed safety assessments for any that may be obviously sub-standard or inadequate

(ii) Safety Reviews

Over and above SMS audits, safety reviews or surveys may be employed as a proactive procedure for examining particular elements, processes or a specific operation for any safety concerns or sub-standard performance. Such targeted safety surveys may be initiated as a follow up to informal feedback or voluntary/confidential reports to identify issues that may contribute to generation of hazard/risks or their escalation factors, such as:

- Problem areas or bottlenecks in daily operations
- Perceptions and opinions about personnel's competency with possible safety implications
- Poor Teamwork and cooperation between employee groups or departments (especially involving safety/operational/technical functions)
- Areas of dissent or perceived confusion (especially involving safety/operational/technical functions)
- Unsafe working procedures or conditions
- Prolonged working hours or long-term manpower shortfall, etc

(h) Safety Performance and Acceptable Level of Safety (ALS)

(i) Safety Performance Indicators

Safety performance indicators are generally data based expressions of the frequency of occurrence of some events, incidents or reports. There is no single safety performance indicator that is appropriate to all organisations. The indicator(s) chosen should correspond to the relevant safety goals. Examples of possible safety indicators would be as follows:

- Number of in flight incidents per 1000 flight hours/cycles
- Number of warranty claims per 1000 man-hours

- Component infant mortality rate
- Final test rejects rate
- Number of findings per audit (or other measurable audit performance criteria)
- Number of hazard reports received, etc

(ii) Safety Performance Monitoring

Safety performance monitoring is the process by which safety indicators and/or goals of the organisation are reviewed in relation to safety policies and objectives. Such monitoring would normally be done at the safety committee and where applicable safety action group level. Any significant abnormal trend or breach of Acceptable Level of Safety (ALS) indicators would warrant appropriate investigation into potential hazards or risks associated with such deviation.

(iii) Acceptable Level of Safety (ALS)

Acceptable Level of Safety (ALS) is the expression of an organisation's minimum acceptable safety performance level (s). They are the minimum safety performance that an organisation should achieve while conducting their core business functions. Each organisation may have a slightly different ALS which will be commensurate with the complexity of the organisation's operational context. Those safety performance indicators which are meant to constitute an organisation's ALS monitoring framework shall be identified accordingly in the SMS manual. Their associated minimum safety or alert level (s) shall be subject to CAAS acceptance.

(i) Management of Change

Aviation organisations experience constant change due to expansion and introduction of new equipment or procedures. Changes can introduce new hazards or risks which can impact the appropriateness or effectiveness of previous risk mitigation. External changes would include change of regulatory requirements, security status/level or re-arrangement of air traffic control/provisions, etc. Internal changes can involve management/organisational changes, major new equipment introduction or new procedures, etc.

A formal management of change process should identify changes within or from outside the organisation which may affect established processes and services from a safety viewpoint. Prior to implementing such changes, the new arrangements should be assessed using the SMS hazard and risk analysis protocol or in relation to previously completed risk mitigation as applicable.

SMS TRAINING AND COMMUNICATION

(j) SMS Training, Communication and Promotion

(i) SMS Training

Safety training and education is an essential foundation for the development and maintenance of a safety culture.

The safety manager should, in conjunction with the personnel department or functional heads, review the job descriptions of all staff, and identify those positions that have safety responsibilities. These should include operational personnel, managers/supervisors, senior managers and the Accountable Manager. This is to ensure that relevant personnel are trained and competent to perform their SMS duties. The level/mode of training should be appropriate to the individual's involvement in the SMS. SMS training may possibly be integrated with related training programs eg HFEM, QMS etc.

Following is an example of the scope of SMS training:

- | | |
|-------------|--|
| SMS manager | - Should attend a formal comprehensive SMS training course |
|-------------|--|

Operational personnel	- (For personnel involved in safety assessments) SMS fundamentals, organisation safety policy, organisation SMS overview, hazard identification and risk management
Line managers & supervisors	- SMS process, management commitment and responsibilities, hazard identification and risk management, continuing safety assessment
Senior managers	- Organisational safety standards and national regulations, management commitment and responsibilities, safety assurance, management of change
Accountable manager	- Awareness of SMS roles and responsibilities, safety policy, SMS requirements, safety assurance

(ii) SMS Communication and Promotion

There is a need to communicate and promote the organisation's SMS processes and activities to the organisation's population. The purpose of such communication includes:

- Ensuring that all staff members are aware of the SMS
- Conveying safety lessons/information
- Explaining why SMS related activities are introduced or changed
- Conveying SMS activities updates
- Dissemination of completed safety assessments to concerned personnel.
- Educating personnel on procedure for hazards reporting
- Promotion of the company's safety objectives, goals and culture

The medium for such communication/promotion may include notices or statements on safety policy/objectives, news letters, bulletins, safety seminars/workshops, orientation program, etc.

14. SMS Integration

In civil aviation today, there are various safety or quality related control systems existing within an organisation, such as:

- ISO 9000, etc systems.
- Quality management system (QMS).
- Human Factor and Error Management System (HFEM)
- Environment management system (EMS).
- Occupational health and safety management system (OHSMS).
- Security management system

There are different ways to integrate a safety management system in the operation of an organization. Aviation organizations may consider integrating their management system for quality, safety, HFEM, security, occupational health and environmental protection where appropriate. Possible areas of integration would include having a:

- Common safety committee
- HIRA team with personnel from the various disciplines
- Consolidated hazards/ HIRA register
- Integrated SMS/ HF training
- Coordinated communication and promotion efforts

The benefits of such integration would include:

- Reducing resource duplication and therefore costs.
- Easy integration and processing of cross functional safety related data.
- Reducing potentially conflicting objectives and relationships.

- Recognition of Safety as the over arching and ultimate objective of all controlling systems

Apart from internal integration of an organisation's SMS components with related control systems, such integration should be coordinated with other organisations or contractors whereby such interface with their relevant SMS or control system is necessary during the provision of services.

15. Gap Analysis and Implementation Plan

It is apparent that organisations would need to conduct a gap analysis of their system(s) to determine which components and elements of a safety management system are currently in place and which components or elements must be added or modified to meet SMS as well as regulatory requirements. The review may include comparison of the SMS elements found in this AC against the existing systems in your organisation.

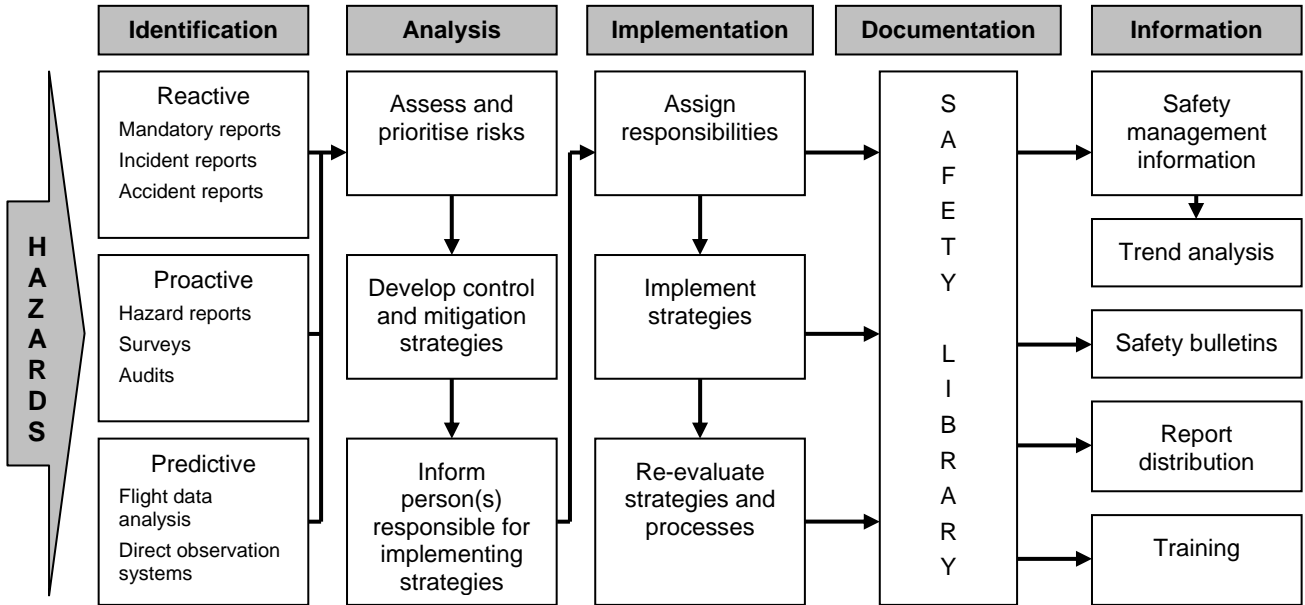
A checklist may be used to account for each of this AC and their respective sub- elements. Remarks for partial compliance or deviations should be made as well as actions required in order to meet the criteria. There should be a column for annotating existing company documentation where the requirement is addressed.

Once the gap analysis is complete and fully documented, the items you have identified as missing or deficient will form the basis of your SMS project plan. The first target of the plan should be compilation of the organisation's SMS manual.

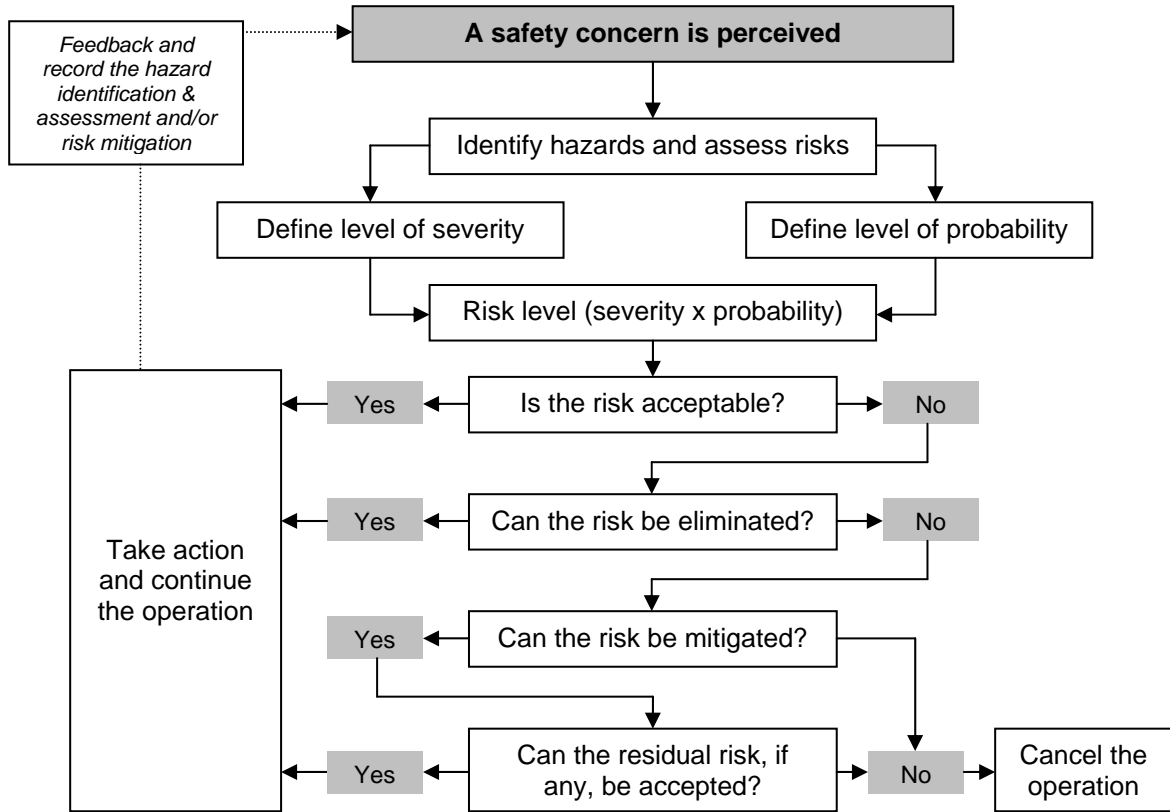
16. Definitions

ALARP	- As low as reasonably practicable
ALS	- Acceptable Level of Safety (ALS) expresses the safety performance indicator benchmark or alert level(s) of an organisation. They are the minimum safety performance deemed acceptable to an organisation while conducting their core business functions. They are subject to acceptance by CAAS.
Hazard	- Is a 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.
HIRA	- Hazard Identification and Risk Assessment.
Mitigation	- Measures to eliminate the potential hazard or to reduce the risk probability or severity.
Probability	- Likelihood that a situation of danger might occur.
Risk Index	- Combined value of risk probability and severity.
Risk	- Is the chance of a loss or injury, measured in terms of severity and probability. The chance that an event can happen and the consequences when it does.
Safety Assessment	- The process or action of performing hazard identification and risk analysis.
Severity	- The possible consequences of a situation of danger, taking as reference the worst foreseeable situation.
SMS	- A systematic, explicit and proactive process for managing safety that integrates operations and technical systems with financial and human resource management to achieve safe operations with as low as reasonably practicable risk.

APPENDIX 1: SAMPLE HAZARD MANAGEMENT FLOWCHART

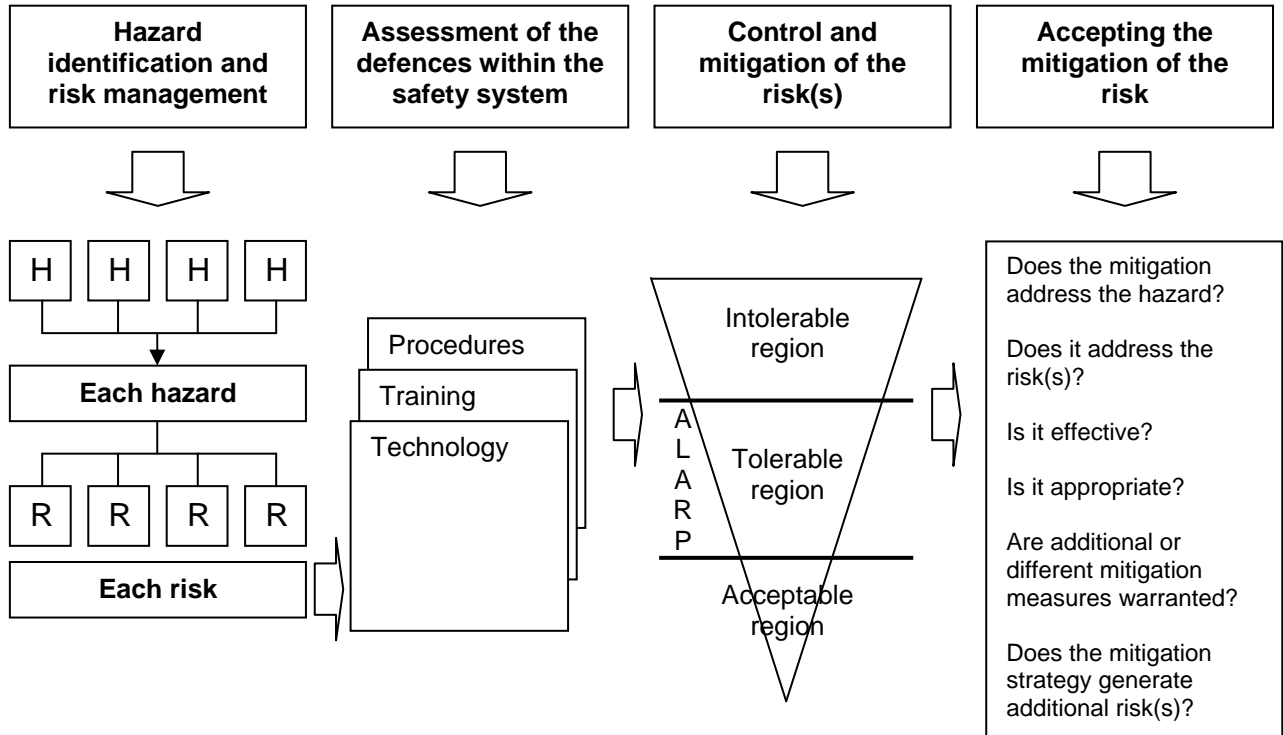


APPENDIX 2: SAMPLE RISK MANAGEMENT PROCESS FLOWCHART



APPENDIX 3: EXAMPLE OF A RISK MITIGATION PROCESS

Sample flowchart of the risk mitigation process



Sample risk mitigation worksheet

Item	Type of operation or activity	Identified hazard	Projected Risk(s)	Current mitigation actions	Current Risk Index	Additional mitigation actions (if required)	Resultant Risk Index
1	Introduction of new equipment "XYZ"	Hazard No 1 -	Risk No 1-1		3A		1B
			Risk No 1-2		2B		2D
		Hazard No 2	Risk No 2-1		4C		4D
		Hazard No 3	Risk No 3-1		3B		2C

APPENDIX 4: GUIDANCE FOR THE DEVELOPMENT OF A SAFETY MANAGEMENT SYSTEM MANUAL

This appendix is designed to help organisations document the processes and procedures required for a Safety Management System. It is intended to provide guidance for the development of a Safety Management System Manual, which can be a separate stand-alone document or it could be incorporated into an existing manual, as required. This suggested format is one way in which an organisation can meet the documentation requirements of SMS.

Use the SMS manual template to describe the processes for your company SMS. Remember that small operations will have very basic and simple processes compared to a larger company. For example, the reporting system for a company with three employees may well be verbal in many cases. The important thing to remember when developing processes that rely on verbal communication is to keep a record of any hazards discussed and decisions made.

The guide is formatted in the following manner:

- Section headings with numbering
- Objective
- Criteria
- Cross Reference Documents

Below each numbered section heading is a description of the “Objective” for that section, followed by its “Criteria” and “Cross Reference Documents”.

The “Objective” is what the manual writer is expected to achieve.

The “Criteria” defines the scope of what must be considered when writing the section.

The “Cross Reference Document” is for you to annotate references of other manuals or SOPs of the organisation which contain relevant details of the element or process as applicable.

Manual Contents

- | | |
|-----|---|
| 1. | Document Control |
| 2. | SMS Regulatory Requirements |
| 3. | Scope and Integration of the Safety Management System |
| 4. | Safety Policy |
| 5. | Safety Objectives and Goals |
| 6. | Roles and Responsibilities |
| 7. | Non-Punitive Reporting Policy |
| 8. | Safety Reporting |
| 9. | Hazard Identification and Risk Assessment |
| 10. | Performance Indicators and Acceptable Level of Safety (ALS) |
| 11. | Safety Investigations |
| 12. | SMS/ Safety Training |
| 13. | SMS Audit and Safety Review |
| 14. | SMS Data and Records Management |
| 15. | Management of Change |
| 16. | Emergency Response Plan |

1. Document Control

Objective

Describe how you intend to keep the manual up to date and ensure that all personnel have the most current version.

Criteria

Hard copy or controlled electronic media are used for manual distribution.

The initial correlation of this manual with other approved documentation, such as Company Exposition Manual, Maintenance Control Manual, Flight Operations Manual, as applicable.

There is a process for periodic review of other safety management system related documentation and manuals to ensure their continuing suitability, adequacy and effectiveness.

The manual is readily accessible by personnel.

Note: This SMS manual/ exposition is subject to CAAS approval

Cross Reference Documents:

2. SMS Regulatory Requirements

Objective

Elaborate on current CAAS SMS regulations for necessary reference and awareness by all personnel.

Criteria

Spell out current CAAS SMS regulations/standards. Include compliance timeframe and advisory material references as applicable.

Where, appropriate, to elaborate or explain the significance and implications of those regulations to the organisation.

Where, relevant, correlation to other safety related requirements or standards may be highlighted.

Cross Reference Documents:

3. Scope and Integration of the Safety Management System

Objective

Describe scope and extent of the organisation's aviation related operations and facilities within which the SMS will apply. The scope of HIRA eligible processes, equipment and operations should also be addressed.

Criteria

Spell out nature of the organisation's aviation business and its position or role within the industry as a whole.

Identify equipment, facilities, work scope, capabilities and other relevant aspects of the organisation within which the SMS will apply.

Identify the scope of all relevant processes, operations and equipment which are deemed to be eligible for the organisation's HIRA evaluation program. If the scope of HIRA eligible process, operations and

equipment is too detailed or extensive, it may be controlled under a supplementary document as appropriate.

Where the SMS is expected to be operated or administered across a group of interlinked organisations or contractors, such integration and associated accountabilities should be defined and documented as applicable.

Where there are other related control/ management systems within the organisation such as ISO9000, HFEM, OHSAS, QMS etc, their relevant integration (where applicable) within the SMS should be identified.

Cross Reference Documents:

4. Safety Policy

Objective

Describe the organisation's intentions, management principles, and commitment to improving aviation safety in the company. A safety policy should be a short description similar to a mission statement.

Criteria

The safety policy should be appropriate to the size and complexity of the organisation.

The safety policy states the organisation's intentions, management principles and commitment to continuous improvement in the aviation safety level.

The safety policy is approved by the Accountable Manager.

The safety policy is promoted by the Accountable Manager.

The safety policy is reviewed periodically.

Personnel at all levels are involved in the establishment and maintenance of the safety management system.

The safety policy is communicated to all employees with the intent that they are made aware of their individual safety obligations.

The safety policy should be signed by the Accountable Manager.

Cross Reference Documents:

5. Safety Objectives and Goals

Objective

Describe the safety objectives and the safety performance goals of the organisation. The safety objectives would be a short statement that describes in broad terms what you hope to achieve. In some cases this statement may be incorporated into the Safety Policy Statement in section 4 above. Performance goals are specific and measurable goals that allow you to measure the degree of success of your SMS.

Criteria

Safety objectives have been established

Safety objectives are expressed as a top-level statement describing the organisation's commitment to achieving safety.

There is a formal process to develop a coherent set of safety goals or benchmark/alert levels necessary to monitor safety performance.

Safety objectives and goals are publicized and distributed.

Resources have been allocated for achieving the objectives and goals.

Cross Reference Documents:

6. Roles and Responsibilities

Objective

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

Criteria

The Accountable Manager is responsible for ensuring that the safety management system is properly implemented and performing to requirements in all areas of the organisation.

Appropriate Safety Manager (office), Safety Committee or Safety Action Groups have been appointed as appropriate.

Safety authorities, responsibilities and accountabilities of personnel at all levels of the organisation are defined and documented.

Safety authorities, responsibilities and accountabilities are promulgated to all personnel in key documentation and communication media.

All personnel understand their authorities, responsibilities and accountabilities in regards to all safety management processes, decision and actions.

A SMS organisational accountabilities diagram is available.

Cross Reference Documents:

7. Non-Punitive Reporting Policy (Just Culture)

Objective

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

Criteria

There is a policy in place that encourages employees to report errors, safety deficiencies, hazards or occurrences.

Conditions under which punitive disciplinary action would be considered (e.g. illegal activity, recklessness, gross negligence or willful misconduct) are clearly defined.

The policy is widely understood within the organisation.

Cross Reference Documents:

8. Safety Reporting

Objective

A reporting system can be designed to handle both accident/incident reports (reactive) and Hazard reports (Proactive). Describe how your reporting system is designed and how it works. Factors to consider include: report format, confidentiality, data collection and analysis and subsequent dissemination of information on corrective actions, preventive measures and recovery controls.

Criteria

The organisation has a process or system that provides for the capture of internal information including incidents, accidents, hazards and other data relevant to SMS

The reporting process is simple, accessible and commensurate with the size of the organisation

Reports are reviewed at the appropriate level of management

There is a feedback process to notify contributors that their reports have been received and to share the results of the analysis

The report form(s) is (are) simple, standardized and accessible across the organisation

There is a process to ensure that information is received from all areas of the organisation within the scope of the SMS.

There is a process in place to monitor and analyze trends

The organisation has a process for the systematic investigation and analysis of operational conditions or activities that have been identified as potential hazards

Cross Reference Documents:

9. Hazard Identification and Risk Assessment

Objective

Describe how reported hazards or related issues are collated. Describe your process for any categorization of hazards/risks and their subsequent prioritization for a documented safety assessment. Describe how your safety assessment process is conducted and how preventive action plans are implemented.

Criteria

There is a structured process for the assessment of risk associated with identified hazards, expressed in terms of consequence (severity) and likelihood (probability of occurrence) or any equivalent matrix

There is a criterion for evaluating risk and the tolerable level of risk the organisation is willing to accept together with any mitigating factors.

The organisation has risk control strategies that include corrective, preventive and recovery action plans

The organisation has a process for evaluating and updating the effectiveness of the corrective, preventive and recovery measures that have been developed.

Corrective, preventive and recovery actions, including timelines, are documented

Cross Reference Documents:

10. Performance Indicators and Acceptable Level of Safety (ALS)

Objective

Describe how you plan to review the effectiveness of your SMS. This includes the safety performance of the company by reviewing the safety performance indicators.

Criteria

There is a formal process to develop and maintain a set of safety performance indicators for trend and target monitoring.

Safety benchmark or alert levels which are intended to constitute the organisation's Acceptable Level of Safety (ALS) shall be identified accordingly. These established levels shall be identified in this section of the manual and shall be subject to CAAS acceptance.

Periodic planned reviews of company safety performance indicators including an examination of the company's Safety Management System to ensure its continuing suitability, adequacy and effectiveness.

Cross Reference Documents:

11. Safety Investigations

Objective

Describe how accidents/incidents are investigated. Explain how the contributing factors to an accident/incident are determined and how corrective action is recommended to prevent reoccurrence. Describe how such corrective/preventive actions are reviewed for updating any existing safety assessment or the need to initiate a safety assessment for newly uncovered hazards/risks.

Criteria

Measures exist that ensure reported occurrences and incidents are investigated where applicable.

There is a process to ensure that such investigations include identification of active failures as well as contributing organisational factors.

Investigation procedure and format includes the integration of safety related findings with the SMS. This ensures that appropriate SMS follow up actions on related as well as unrelated hazard or risks uncovered during the course of investigations are addressed.

Cross Reference Documents:

12. SMS/ Safety Training

Objective

Describe the type of SMS and other safety related training that staff receives and the process for assuring the effectiveness of the training. Describe how such training procedures are documented.

Criteria

Training requirements are documented.

There is a validation process that measures the effectiveness of training.

The training includes initial, recurrent and update training, where applicable.

The organisation's SMS training is part of the organisation's overall training program.

SMS awareness is incorporated into employment or indoctrination program

Cross Reference Documents:

13. SMS Audit and Safety Review

Objective

Describe the process for reviewing the effectiveness of your SMS.

Criteria

There are planned regular audit/reviews of company safety performance including an examination of the company's Safety Management System to ensure its continuing suitability, adequacy and effectiveness.

Details of personnel involved in audits. Qualification. Frequency. Audit program. Audit reports. Corrective action procedures etc

Describe any other supplementary safety review or survey programs of the company.

Cross Reference Documents:

14. SMS Data and Records Management

Objective

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

Criteria

The organisation has a records system that ensures the generation and retention of all records necessary to document and support the SMS.

Records kept include hazard reports, risk assessments reports, SAG/SRB meeting notes, safety performance monitoring charts, SMS audit reports, SMS training records, etc

Cross Reference Documents:

15. Management of Change

Objective

Describe how you manage organisational internal/external/process changes that may have an impact on safety. How such processes are integrated with your SMS.

Criteria

The organisation has a standard procedure or policy to perform or review safety assessments for all substantial internal or external changes which may have safety implications.

There is procedure for performing safety assessment prior to introduction of new equipment or processes which may have safety implications before they are commissioned.

All concerned stake holders within or without the organisation are involved in such reviews. All such reviews are documented and approved by management as applicable.

Cross Reference Documents:

16 Emergency Response Plan

Objective

Describe the organisation's intentions 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 developed as a separate document or it can be placed in this manual.

Criteria (Some may be applicable only to an AOC)

The organisation has an emergency plan that outlines roles and responsibilities in the event of a major incident, crisis or accident

There is a notification process that includes an emergency call list and an internal mobilization process

The organisation has arrangements with other agencies for aid and the provision of emergency services as applicable.

The organisation has procedures for emergency mode operations where applicable.

There is a procedure for overseeing the welfare of all affected individuals and for notifying next of kin.

The organisation has established procedures for handling media and insurance related issues.

There are defined accident investigation responsibilities within the organisation.

The requirement for preservation of evidence, securing affected area and mandatory/governmental reporting is clearly stated.

There is emergency preparedness and response training for affected personnel

A disabled aircraft or equipment evacuation plan is developed by the organisation in consultation with aircraft/ equipment owners, aerodrome operators or other agencies as applicable.

A procedure exists for recording activities during an emergency response.

Cross Reference Documents:

APPENDIX 5: FREQUENTLY ASKED QUESTIONS

Section A: SMS and Quality Systems

- Q1. How does a safety management system differ from traditional control methods?
- Q2. What is the relationship between SMS and QMS?
- Q3. Is SMS a prescriptive regulation?
- Q4. If most of the elements of a SMS already exist in most companies, why is CAAS requiring that companies implement this new system?
- Q5. To what level must an organisation document its safety management system processes?
- Q6. How is occupational or workplace safety related to aviation SMS?

Section B: Implementation

- Q1. What is CAAS' plan for Implementation of SMS?
- Q2. What are the main challenges in implementing a safety management system, and how long will it take to implement?
- Q3. Will foreign AMOs be expected to implement SMS?
- Q4. Will new AOC/ AMO applicants be required to have a documented SMS?

Section C: Safety Assessments and Audits

- Q1. How do we determine the scope (extent) of HIRA eligible processes/ operations within an organisation?
- Q2. How will the effectiveness of an individual organisation's SMS be assessed?
- Q3. How will SMS affect the size and nature of CAAS audits?
- Q4. With the introduction of SMS, who is responsible for performing safety assessments?
- Q5. How will CAAS deal with safety assessments, which could be subjective and may vary from organisation to organisation?

Section D: Benefits

- Q1. Will SMS be affordable to industry organisations who may be struggling economically, particularly for the small operators?
- Q2. With the introduction of SMS, is CAAS expecting the industry to assume greater responsibility in monitoring and correcting problems?

Section E: Safety Culture

- Q1. What is meant by a reporting or generative culture?
- Q2. Why would an organisation disclose its internal hazards reports or safety assessments with auditors or other organisations?
- Q3. How does a company include service providers (eg ground handling agents) in their SMS? Is it mandatory for a company to include contractors and service providers in their SMS?

Section F: General

- Q1. What are CAAS' expectations with regard to integration of SMS documentation (SMS manual) with existing approved Operational or Exposition Manuals?
- Q2. What support will CAAS provide to assist organisations in implementing a safety management system?
- Q3. Is having an ERP relevant for an MRO organisation, especially for those servicing small or simple aviation components. Is an OSHE ERP adequate?
- Q4. Does the SMS manual require CAAS approval?

Note: Reference in [] refers to relevant paragraph in the Advisory Circular.

Section A: SMS and Quality Systems

Q1. How does a safety management system differ from traditional control methods?

[Paragraph 7 of the AC]

SMS is a natural progression from traditional techniques, based on modern understanding of the nature of organisational accidents and how they occur. SMS has much in common with modern quality assurance practices, but places even more emphasis on proactive hazard identification and risk assessment. It includes areas of the organisation that may not be directly involved with day to day flight or maintenance operations, but nevertheless have the potential to affect aviation safety.

One notable difference is that while traditional safety and quality systems were managed at the certificate or divisional level - for example, having separate quality systems for flight operations and engineering, SMS looks at the enterprise as a whole. While the majority of SMS activity will continue to be directed toward particular specialist functions, the system is also concerned with how all relevant functions are integrated.

To a large extent, the effectiveness of SMS relies on the corporate culture. The aim of SMS is to achieve a culture wherein each individual contributes to and is responsible for safety, and where the reporting of safety concerns is actively encouraged.

Q2. What is the relationship between SMS and QMS?

[Paragraph 7 & 14 of the AC]

Safety Management Systems differs from Quality Management Systems in that it focuses on the safety, human and organisational aspects of an operation i.e. "safety satisfaction". Quality management focuses on the product (service) of an operation i.e. customer or "specification satisfaction". Safety management results in the design and implementation of organisational processes and procedures to identify hazards and control/mitigate risks in aviation operations. Quality management techniques provide a structured process for ensuring that organisational processes and procedures achieve their intended product (service) specifications or customer expectations.

SMS is partly built upon the same procedural principles and objectives as quality management systems. An organisation's safety policy and objectives should be integrated with its quality policies. Conversely, the coverage of quality policies should be fundamentally based upon quality in support of safety. Safety objectives should receive primacy where conflicts are identified. QMS is the main supporting structure for a SMS.

Q3. Is SMS a prescriptive regulation?

[Paragraph 11 of the AC]

No. SMS is inherently performance based. The only prescriptive aspect is essentially the basic regulatory elements themselves. Organisations have a wide range of options for compliance, and are encouraged to identify the best means of compliance to meet their individual circumstances. In fact, the system should not be static, but should be continually evolving in response to changing needs.

Q4. If most of the elements of a SMS already exist in most companies, why is CAAS requiring that companies implement this new system?

[Paragraph 7 & 8 of the AC]

While the basic elements may be in place, a Safety Management System (SMS) is a systematic, explicit and comprehensive process for the management of safety risks, which integrates operations and technical systems with financial and human resource management, for all activities related to an enterprise. The process aims to improve the safety of an enterprise as a whole, by identifying and correcting any potential problems/hazards that could contribute to a reduction of safety margins.

Currently, certain (or most) elements may exist in an approved organisation. However, these may not be systematically or adequately integrated. Existing Quality assurance processes, functional procedures and accountability structures will need to be integrated with the SMS hazards

reporting/identification culture together with its crucial risk assessment process. Today's systems are predominantly reactive in nature. What is needed is to move to more proactive processes.

Q5. To what level must an organisation document its safety management system processes?

[Paragraph 13 (d) & Appendix 4]

An organisation must document its safety management system processes to the same level as other procedures described in the relevant company manuals (e.g., the Operations Manual and Maintenance Control Manual). To this end, much of the detailed processes relating to each basic SMS element may remain in separate/existing supporting documents or manuals where appropriate. However, as in the case of other procedures, each element must be addressed or accounted for in the relevant sections of the main SMS document (or SMS manual) to exercise effective control and integration. Refer Appendix 4 for guidance on SMS documentation.

Q6. How is occupational or workplace safety related to aviation SMS? *[Paragraph 14]*

Aviation SMS is not intended to address or oversight occupational/ workplace safety under the WSHA. Our SMS AC addresses primarily SMS in relation to aviation safety (air transportation system and its relevant service providers). Paragraph 7 (Introduction) of the AC emphasises the scope of hazards and risk management to "aviation safety-related operations and processes".

Nevertheless, the outcomes of aviation safety may sometimes be related to occupational or workplace safety. As such, the organisation should ensure that any relevant aspects of occupational/ workplace safety (as with any other management systems) are integrated into the aviation SMS where appropriate. Refer AC paragraph 14 on "*Integrating SMS with Existing Systems*".

Section B: Implementation

Q1. What is CAAS' plan for Implementation of SMS?

[Paragraph 10 of the AC]

CAAS will adopt a two phased approach for AOC/MRO SMS implementation. The first phase is from 20 Dec 2006 to 31 Dec 2008, whereby all AOC Holders and Approved Maintenance Organisations are encouraged to initiate or implement SMS in accordance with the guidelines of this AC. The second phase is from 1 January 2009 onwards, where SMS implementation will become a requirement. This requirement will be incorporated in AOCR and SAR-145 nearer the 1 January 2009 date line.

Q2. What are the main challenges in implementing a safety management system, and how can we assure its effectiveness?

[Paragraphs 13 of the AC]

While the procedural and organisational changes involved in introducing a SMS are relatively straightforward, the scope of full compliance will vary depending on the size of the organisation. Implementing the system and procedures merely lays the foundation. While this may satisfy the basic intent of SMS regulation, the main challenge lies in bringing about the necessary changes in company safety culture as well as the on going discipline of making safety assessments an integral and fundamental part of our business. Thus it may take up to several years for an organisation's SMS to be fully matured.

A primary short to medium term challenge of SMS is the pursuit of a systematic and progressive baseline safety assessment (HIRA) accountability program for all relevant processes within the organisation. Thereafter, the long term challenge will be to maintain and update all existing safety assessments with inputs from on going organisational, operational and industry developments.

The difficulties encountered in accomplishing the necessary cultural change will vary greatly from one organisation to another. Some organisations already have a healthy culture well established, while others will have some way to go. As a general rule, once the basic SMS organisation and procedures are in place, there should be indications of positive safety improvement within the next full external audit cycle.

Additionally, as an enterprise-wide system, provisions must be made for the SMS processes to be subjected to internal, but independent, audits. Externally, SMS consultants are available in the industry. Apart from ICAO Doc 9859, there is also good SMS guidance material from various NAA websites. CAAS will also be available for consultation or guidance especially during the recommendation phase.

Q3. Will foreign AMOs be expected to implement SMS?

Foreign AMOs whose Certificate of Approval includes compliance with ANO/ SAR-145 would be expected to implement a SMS. The scope of their SMS framework should be in line with SAR-145, ICAO or equivalent local CAA SMS framework.

Q4. Will new AOC/ AMO applicants be required to have a documented SMS?

Yes. AOCR and SAR-145 SMS requirements will not make any distinction between existing certificate holders or new applicants.

Section C: Safety Assessments and Audits

Q1. How do we determine the scope of HIRA (Hazard Identification & Risk Analysis) eligible processes/ operations within an organisation? [Paragraph 13(f) (v) & (vi)]

Different organisation types (ie AOC, A rating, B rating, C rating etc) would have different scope of HIRA eligible processes. The scope of an organisation's processes/ operations that would be deemed as eligible (or applicable) for HIRA evaluation should be addressed by the organisation as one of her immediate safety objective. All equipment, processes or operations which have the potential to harbor or generate hazards or risks should be accounted for safety assessment purpose. Organisations with newly acquired equipment or processes with documented evidence of compliance with OEM system design risk analysis standards (eg MIL-STD-882D) may wish to recognize such equipment or processes as having undergone an acceptable baseline risk assessment protocol. Such HIRA eligible processes/ operations should be reflected in the SMS manual. (Refer App 4, paragraph 3 - Scope of the SMS)

Q2. How will the effectiveness of an individual organisation's SMS be assessed?

[Paragraph 13 (g) (i) of the AC]

There is a requirement for an internal SMS audit/ review process for the organisation to assure the effectiveness of its SMS. The acceptability of an organisation's SMS by CAAS will be determined through an SMS assessment protocol. The protocol comprises a set of objective questions for determining whether an organisation has a functional SMS in place. A minimum performance level (%) must be achieved for the SMS to be deemed acceptable. The minimum performance criteria (as well as scope of checklist) may be escalated in phases to match the industry's SMS maturity process.

Q3. How will SMS affect the size and nature of future CAAS audits?

Upon the achievement of industry wide SMS implementation, it is possible that CAAS may evaluate how best to integrate or calibrate an organisation's regulatory compliance audit with her SMS audit performance. In the long term, it is apparent that the trend is towards more performance based audit criteria as well as the concept of organisational risk profiling rather than a 'one size fits all' audit protocol.

Q4. With the introduction of SMS, who is responsible (within an organisation) for performing safety (risk) assessments?

[Paragraph 13 (f) of the AC]

Other than preliminary identification of hazards and threats relating to specific or specialist work environments, risk assessment may be performed by duly trained staff from any part of the

organisation. Large and multi-disciplinary organisations may have a specialist analysis unit devoted to this activity. Facilitation by consultants is possible. Normally, the analysis can be done by personnel from the functional department directly affected. Formalization of mitigation actions (preventive and recovery controls) however, should be under the authority of the applicable functional head. For example in the case of an AMO workshop, that will be the person responsible for Workshop operations, and in the case of Flight Operations, it may be the Director of Flight Operations. The functional head should be responsible for the assessment performed. All safety assessments would normally be signed by a project officer (or team leader) and approved by the departmental head or higher level management as appropriate.

Q5. How will CAAS deal with safety (risk) assessments, which could be subjective and may vary from organisation to organisation?

[Paragraph 13 (f) of the AC]

Safety assessments should be the result of sound information collection, logical analysis and thoughtful decision-making. A safety assessment that is seriously flawed or unsubstantiated may have to be rejected.

Safety assessments are inherently subjective, and that is not necessarily a bad thing. The variations may turn out to be reasonable and acceptable. So long as hazards identified and preventive controls promulgated are reasonable and valid (at the time of assessment), they should be deemed acceptable. It should be noted that safety assessments are meant to be a dynamic document which will be subject to subsequent routine or management of change updates.

In any case, the outside limits are established by regulatory compliance. A decision to permit obvious non-compliance with an existing regulation would be unacceptable, unless specific approval of such a particular assessment has been obtained from the relevant regulatory authority. Short of actual non-compliance, even a decision to do nothing in a case where it might have been more prudent to have a preventive measure in place, is better than not to have evaluated the situation at all. At least, if the issue has been analyzed and documented, the company has established due diligence and awareness on the issue or situation. Consistent failure to take reasonable action in response to identified real safety problems will be legitimate ground for a finding that the SMS is ineffective.

Section D: Benefits

Q1. Will SMS be affordable to industry organisations who may be struggling economically, particularly for the small operators?

[Paragraph 9 of the AC]

Apart from some initial training costs, SMS should not be particularly expensive to implement. The regulations will recognize that SMS must be tailored to the individual operation, so the changes required by a small organisation should be relatively moderate and well within their financial capabilities.

The financial benefits of a safer organisation are self-evident. Less incidents/accidents, time lost due to work related injuries, etc. More immediately, SMS has the potential to identify inefficient and uneconomical processes (besides hazardous ones), resulting in improvements in productivity, reduction in waste, etc. Rather than being an additional expense, a properly implemented SMS should result in a net improvement to a company's bottom line and organisational culture.

Q2. With the introduction of SMS, is CAAS expecting the industry to assume greater responsibility in monitoring and correcting problems?

The industry has always rightly assumed responsibility in frontline problem solving, whether in routine operational issues or systemic problems. Intervention by CAAS is generally limited to issues with potential for broader fleet, industry or regulatory impact.

With the industry at its current size and complexity, the most effective use of resources is to prioritise safety management policies and objectives and ensure that they are effectively achieved. SMS facilitates this approach by allowing organisations as well as CAAS to focus more at the systems level.

When an organisation's safety and quality systems is duly enhanced through such emphasis, it will provide the organisation the best opportunity to consolidate resources for proactive problem management rather than reacting to random or piecemeal problems or audit findings or costly incidents/accidents

Section E: Safety Culture

Q1. What is meant by a reporting or generative culture?

Effective safety management requires a free exchange of safety information within an organisation and between the organisation and its safety partners. This applies both to actual incidents and accidents occurring within the organisation, and to any hazards, accident precursors and systemic vulnerabilities that may be identified. Therefore, the organisation must not only have a reporting system in place, but must also foster a culture that actively encourages its use by staff at all levels and in all departments.

A generative culture will not only avoid disincentives, such as "blaming the messenger" or penalizing individuals who make honest errors, but will also provide staff with positive confirmation that all reports are taken seriously and subjected to an appropriate safety assessment. This is not to imply that there should be a "blame free" environment. Rather, the idea is to achieve a "fair" or "just" environment that distinguishes between errors and willful acts, acceptable and unacceptable risks.

Q2. Why would an organisation disclose its internal hazards reports or safety assessments with auditors or other organisations?

One of the concepts of SMS is a free and uninhibited reporting culture that encourages information to be collected and not used against the reporter or organisation in cases of unpremeditated and inadvertent violations. An auditor's inspection of an organisation's internal hazard reports or safety assessment records should not be for the purpose of exposing hidden or unreported non-compliances and taking enforcement actions thereof. Rather, such inspection or review is to confirm that the organisation's hazard identification and safety assessment processes are valid and effective.

Inter-organisation sharing of hazard reports and safety assessments is also evidence of a matured organisational safety culture. Such a scenario will ensure that safety lessons learnt by one organisation will benefit other similar organisations and hence enhance the overall safety experience of the industry.

A large number of hazard reports is not necessarily an indicator of a problem, but may well be an indicator of a healthy safety culture. Registered hazards need not be addressed all at the same time. They may be prioritized from that requiring immediate risk mitigation action to those with no action required.

Q3. How does a company include service providers (eg ground handling agents) in their SMS? Is it mandatory for a company to include contractors and service providers in their SMS?

[Para 14, App 4-8]

While it may not be mandatory for a company to include all contractors and service providers in their SMS, their SMS has to factor in the risks associated with having persons other than employees accessing either aircraft or associated facilities. Even outsiders who have no contact with the airside at all can affect the overall safety picture. If a service provider does have a SMS, it should be possible to formally link their respective reporting systems. Such integration should be appropriately documented. For those service providers who are not required to have a SMS, it would be beneficial if contractors and their relevant employees could be offered entry level training that could enable/facilitate their input to the approved company's SMS or reporting system. This training could stimulate activity on the contractor's part to upgrade their own management system.

Section F: General

Q1. What are CAAS' expectations with regard to integration of SMS documentation (SMS manual) with existing approved Operational or Exposition Manuals?

[Paragraph 13(d) & Appendix 4 of the AC]

For substantial organisations, the SMS manual should be an overarching separate document from other existing manuals. There should be a reference to this overarching SMS manual in the appropriate Operations, Maintenance Control or Exposition Manual. The reference may indicate that the organisation's documentation of SMS elements is located in the SMS manual.

Detailed documentation or procedures associated with an SMS element and which are currently located in another manual may be appropriately cross referenced in the SMS manual.

For small organisations, it is possible for the SMS exposition to be incorporated within an existing organisation exposition manual. In either case, the various SMS components and their relevant integration should be adequately and systematically documented.

CAAS expects adequate document control to avoid any potential divergences on policy or procedures, omissions or conflicts that could result from having multiple manuals.

Q2. What support will CAAS provide to assist organisations in implementing a safety management system?

A fundamental principle of SMS success is that the organisations build the SMS themselves. With SMS, CAAS will guide organisations in finding their own effective SMS levels. This is being done through SMS educational forums, guidance materials, SMS facilitation workshops, voluntary self assessment exercises and on-site trial assessments by CAAS.

Q3. Is having an ERP relevant for an MRO organisation, especially for those servicing small or simple aviation components. Is an OSHE ERP adequate?

It is recognised that an organisation's ERP is normally initiated from OSHE requirements. For purpose of aviation SMS ERP, a MRO should evaluate the nature of its services or products, and decide if it needs to include a plan for urgent response/ recovery actions in a worst case scenario with respect to safety or quality issue of its product or services. This may include the mass recall of parts, obtaining concession for continued service etc. So long as the scope of the ERP is appropriate to the nature/ complexity of your organization, it should be acceptable.

Q4. Does the SMS manual require CAAS approval?

Yes. The SMS manual will be approved during the CAAS SMS assessment process. It may be a standalone manual or a dedicated section of the MOE/ FOM. Subsequent amendments shall be processed in the same manner as with MOE/ FOM.