

**Civil Aviation Department**  
The Government of the  
Hong Kong Special Administrative Region



**CAD 712**

**SAFETY MANAGEMENT SYSTEMS (SMS)  
FOR AIR OPERATORS AND MAINTENANCE  
ORGANIZATIONS**

**A Guide to Implementation**

**Issue 1**  
**November 2007**

*(This document is re-issued in April 2013 with no change of content except the new CAD logo.)*

**CAD 712**

**SAFETY MANAGEMENT SYSTEMS (SMS)  
FOR AIR OPERATORS AND MAINTENANCE  
ORGANIZATIONS**

**A Guide to Implementation**

CIVIL AVIATION DEPARTMENT  
Hong Kong, China

CHAPTER 1	INTRODUCTION.....	1
1.1	The Benefits of an SMS .....	1
1.2	Purpose of this Guide .....	2
1.3	Definitions.....	2
CHAPTER 2	THE KEY COMPONENTS OF AN SMS .....	3
2.1	SMS Essential Cornerstones .....	3
2.2	SMS Key Components .....	3
2.2.1	Safety policy and objectives- .....	3
2.2.2	Safety risk management- .....	3
2.2.3	Safety assurance-.....	3
2.2.4	Safety promotion-.....	3
CHAPTER 3	SMS REQUIREMENTS .....	4
CHAPTER 4	SENIOR MANAGEMENT’S ACCOUNTABILITY FOR SAFETY .....	5
CHAPTER 5	SMS IMPLEMENTATION .....	6
5.1	Safety Policy .....	6
5.2	Safety Roles and Responsibilities .....	7
5.3	Safety Objectives, Performance Targets and Indicators .....	9
5.4	Hazard and Risk Management .....	11
5.5	Safety Training and Promotion .....	17
5.6	SMS Documentation and Records .....	18
5.7	Safety Assurance .....	19
5.8	Emergency Response Planning .....	20
CHAPTER 6	INTEGRATING SMS WITH EXISTING SYSTEMS .....	22
CHAPTER 7	GAP ANALYSIS AND PROJECT PLAN .....	23
CHAPTER 8	IMPLEMENTATION TIMESCALES .....	24
CHAPTER 9	CONCLUSION .....	25
CHAPTER 10	REFERENCES.....	26
APPENDIX A:	GUIDANCE FOR THE DEVELOPMENT OF AN SMS MANUAL.....	27

## CHAPTER 1 INTRODUCTION

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 organization. For this reason, safety management must start from senior management, and the effects on safety must be examined at all levels of the organization.

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.

An SMS 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 organization. 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.

It is an integrated system which includes the 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.

The above statements are based on the ICAO Standards and Recommended Practices (on safety management in Annex 6 Part 1) for air operators and maintenance organizations to have such an SMS in place. ICAO Doc 9859 (Safety Management Manual) gives appropriate guidance material and describes a basic SMS.

In this Guide, full account is taken of the need to maintain civil aviation operational safety risks as low as reasonably practicable. CAD policies are incorporated and provide commonality of approach with disciplines of flight operations and aircraft maintenance.

### 1.1 The Benefits of an SMS

To improve on existing levels of aviation safety in the light of the continuing growth of the industry, additional measures are needed. One such measure is to encourage individual operators to introduce their own SMS. Such a system is as important to business survival as a financial management system and the implementation of a SMS should lead to achievement of one of civil aviation's key business goals: enhanced safety performance aiming at best practice and moving beyond mere compliance with regulatory requirements.

## **1.2 Purpose of this Guide**

This Guide, focusing on air transport operations and maintenance activities, sets out to inform and aid the reader such that an effective SMS can be developed for managing safety appropriate to the size and scope of any particular organization. It applies to all Hong Kong Air Operator's Certificate (AOC) Holders and HKAR-145 Approved Maintenance Organizations (AMO) holding Certificates and Approvals granted by Civil Aviation Department, Hong Kong.

The guidance produced is also intended to provide general guidance and principles to implement an effective SMS.

## **1.3 Definitions**

ALARP	As low as reasonably practicable.
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.
Risk	Is the likelihood of injuries to personnel, damage to equipment or structures, loss of material, or reduction of ability to perform a prescribed function, measured in terms of severity and probability.
Risk Index	Combined value of risk probability and severity.
Risk Mitigation	Measures to eliminate the potential hazard or to reduce the risk probability or severity.
Risk Probability	The likelihood that an unsafe event or condition might occur.
Risk Severity	The possible consequences of an unsafe event or condition, taking as reference the worst foreseeable situation.
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.
SMS	A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.

## **CHAPTER 2      THE KEY COMPONENTS OF AN SMS**

### **2.1      SMS Essential Cornerstones**

There are three essential cornerstones for an SMS. These are:

- a comprehensive corporate approach to safety;
- an effective organization for delivering safety; and
- systems to achieve safety oversight.

### **2.2      SMS Key Components**

Each of the associated key components will now be considered in outline, the details being presented as follows:

#### **2.2.1      Safety policy and objectives**

- Management commitment and responsibility.
- Safety accountabilities of managers.
- Appointment of key safety personnel.
- SMS implementation plan.
- Coordination of emergency response planning.
- Documentation.

#### **2.2.2      Safety risk management**

- Hazard identification processes.
- Risk assessment and mitigation processes.

#### **2.2.3      Safety assurance**

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

#### **2.2.4      Safety promotion**

- Training and education.
- Safety communication.

## **CHAPTER 3     SMS REQUIREMENTS**

All Hong Kong AOC Holders and HKAR-145 AMO are recommended to initiate the implementation of an SMS immediately to meet the implementation date of 1 January 2009. Such a system should include:

- (a) A safety policy on which the system is based;
- (b) Setting of safety objectives, performance targets and indicators;
- (c) Clearly defined lines of safety accountability throughout the organization, including a direct accountability for safety on the part of the Accountable Manager;
- (d) Identification of hazards to aviation safety and the evaluation and management of their associated risks;
- (e) Safety training to ensure their competency to perform their duties;
- (f) Documentation of all SMS components, procedures and activities including their relevant integration;
- (g) Periodic reviews or audits of the SMS;
- (h) An emergency response plan.

Hong Kong AOC Holders and HKAR-145 AMO 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 organization's needs and customized to its operations. The establishment of the basic components of an SMS should start 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 programmes.

## **CHAPTER 4    SENIOR    MANAGEMENT'S    ACCOUNTABILITY    FOR SAFETY**

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. An SMS will not be effective if it receives attention only at the operational level.

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

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

## CHAPTER 5 SMS IMPLEMENTATION

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

### 5.1 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 safety in the organization 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 organization's safety management principles;
- Establishment of safety as a core value;
- Responsibility for the safety programme;
- Non-punitive reporting policy (Just Culture).

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

A safety policy statement could look like this:

*"To prevent accidents and reduce their potential for damage or injury, our organization will maintain an effective 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 injury to people and damage to aircraft or the environment. To that end, we will continuously examine our operation for 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 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 to prevent incidents and accidents.”*

## **5.2 Safety Roles and Responsibilities**

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

The safety roles and accountabilities between the organization’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 organization.

### **(i) Safety (SMS) Manager**

Although the Accountable Manager is ultimately responsible for the SMS, 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 organization. This is accomplished by appointing a safety (SMS) manager whose primary responsibility is to develop and maintain an effective SMS. The safety manager position, dependent on the size and structure of the organization 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 analysis 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 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 development and maintenance of the SMS itself, he or she should not be held accountable for the safety performance of the organization.

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 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.

**(ii) 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 SRB would depend on the size and structure of the organization.

The Accountable Manager should chair this Board with all relevant functional areas of the organization being represented.

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

- Making recommendations or decisions concerning safety policy and objectives;
- Defining safety performance indicators and set safety performance goals for the organization;
- 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 SRB should be documented in the SMS manual.

### **(iii) Safety Action Groups**

Safety Action Groups are accountable to and take strategic directions from the safety committee. Managers and supervisors from a given functional area would be members of the SAG for that area. The functional head of that area should chair the SAG. The role of the SAG would include:

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

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

## **5.3 Safety Objectives, Performance Targets and Indicators**

### **(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. These would cover relevant aspects of the organization'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.
- To perform hazard and risk analysis for all proposed new equipment acquisitions, facilities, operations and procedures.
- To provide relevant SMS education and training to all personnel.
- To provide a safe, healthy work environment for all personnel.
- To minimize accidents/incidents that are attributable to organizational factors.
- To prevent damage to aircraft and injury to people resulting from the operations.
- To improve the effectiveness of the SMS through a yearly safety audit that reviews all aspects of the SMS.

## **(ii) Safety Performance Targets**

Safety performance targets must be created in relation to each safety objective so that the organization remains aware of whether the relevant objectives are being met. These safety performance targets would be measured and monitored with the use of safety performance indicators. Examples of possible safety performance targets are as follows:

- To increase the number of hazard reports received by X % over the next Y year.
- To reduce direct/indirect cost due to incidents/accidents by X % over the next Y year.
- To formalise safety assessment compliance for all existing safety related equipment, facilities, operations and procedures by \_\_\_\_ (date).
- To reduce the number of operational technical incidents by X % over the next Y year.
- 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.

## **(iii) 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 organizations. The indicator(s) chosen should correspond to the relevant safety objectives. Examples of possible safety performance indicators would be as follows:

- Number of in flight incidents per 1000 flight hours/cycles.
- Number of warranty claims per 1000 man-hours.
- Number of findings per audit.
- Number of hazard reports received.

Safety performance monitoring is the process by which safety performance indicators and/or targets of the organization are reviewed in relation to safety policy and objectives. Such monitoring would normally be done at the safety committee and/or SAG level. Any significant abnormal trend or breach of safety benchmark level would warrant appropriate investigation into potential hazards or risks associated with such deviation.

## 5.4 Hazard and Risk Management

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.

**5.4.1 Hazard identification** is a process where organizational hazards are identified and managed so that safety is not compromised. Organizations may utilise a range of safety activities to identify hazards that may jeopardise part of its operations or may weaken its safety defences.

There is a natural tendency to describe hazards as an outcome. For example, “runway incursion” is an outcome, not a hazard. On the 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 means and terminology.
- Organizational factors, such as company policies for recruitment, training, remuneration and allocation of resources.
- Work environment factors, such as ambient noise and vibration, temperature, lighting and protective equipment and clothing.
- Defences, 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 organization'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 opened 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 performance indicator trends.
- When major operational changes are planned.
- Before a new project, equipment or facility is set up.
- During a period of significant organizational change.

In essence, the three steps of hazard management are:

- State the generic hazard (hazard statement), e.g. airport construction;
- Identify specific components of the hazard, e.g. construction equipment;
- Project specific risk(s) associated with each hazard, e.g. aircraft colliding with construction equipment.

**5.4.2 Risk Management** is the identification, analysis and mitigation of risks associated with the operations of an organization. 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 SMS. It is a data-driven approach to safety management resources allocation, i.e. priority is accorded to activities based on their risk index.

**5.4.3 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 frequent is the equipment or procedure under assessment used?
- Are there any organizational, management or regulatory implications that might generate larger threats to public safety?

Table 1 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"> <li>Likely to occur many times (has occurred frequently).</li> </ul>	5
Occasional	<ul style="list-style-type: none"> <li>Likely to occur some times (has occurred infrequently).</li> </ul>	4
Remote	<ul style="list-style-type: none"> <li>Unlikely, but possible to occur (has occurred rarely).</li> </ul>	3
Improbable	<ul style="list-style-type: none"> <li>Very unlikely to occur (not known to have occurred).</li> </ul>	2
Extremely improbable	<ul style="list-style-type: none"> <li>Almost inconceivable that the event will occur.</li> </ul>	1

Table 1: Typical Risk Probability Table

**5.4.4 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 government)?
- What is the damage to the organization's reputation?

Table 2 shows a sample risk severity table.

<b>Severity of occurrences</b>		
<b>Aviation definition</b>	<b>Meaning</b>	<b>Value</b>
Catastrophic	<ul style="list-style-type: none"> <li>• Equipment destroyed.</li> <li>• Multiple deaths.</li> </ul>	<b>A</b>
Hazardous	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Serious injury or death to a number of people.</li> <li>• Major equipment damage.</li> </ul>	<b>B</b>
Major	<ul style="list-style-type: none"> <li>• 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.</li> <li>• Serious incident.</li> <li>• Injury to persons.</li> </ul>	<b>C</b>
Minor	<ul style="list-style-type: none"> <li>• Nuisance.</li> <li>• Operating limitations.</li> <li>• Use of alternate procedures.</li> <li>• Minor incident.</li> </ul>	<b>D</b>
Negligible	<ul style="list-style-type: none"> <li>• Little consequences.</li> </ul>	<b>E</b>

Table 2: Sample Risk Severity Table

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).

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

Table 3: Risk Index Matrix

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

<b>Risk Index</b>	<b>Acceptability/Action Required</b>
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

**5.4.5 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, the 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 staff 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 daytime, visual conditions.

#### **5.4.6 Cost 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 and safety goals. Aviation workplaces (as with other industries) contain 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.

#### **5.4.7 Continuing Assessment**

The need for routine review of completed safety assessments should be considered as appropriate. Such review intervals may be scheduled on a case-by-case basis or as a standard interval, e.g. annually.

Aviation organizations 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/organizational changes, new equipment introduction or new procedures, etc.

A formal management of change process should identify changes within or from outside the organization 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.

### **5.5 Safety Training and Promotion**

Safety training and promotion 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 programmes, e.g. Quality Management System, Maintenance Error Management System, etc.

Following is an example of the scope of SMS training:

Operational personnel - (For personnel involved in safety assessments) SMS fundamentals, organization safety policy, organization 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 - Organizational 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.

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

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

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

## **5.6 SMS Documentation and Records**

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

- Scope of the SMS;
- Regulatory SMS requirements;
- The safety policy and objectives;
- Safety accountabilities;
- Key safety personnel;
- Documentation and records;
- Hazard identification and risk management processes;
- Management of change;
- Safety performance monitoring;
- Safety assurance and auditing;
- Safety training and promotion;
- Emergency response planning.

Appendix A provides guidance on the compilation of the SMS Manual. An SMS exposition should preferably be a manual by itself. For those organizations who wish to incorporate the SMS exposition within an existing organization exposition manual, cross reference of other manuals or expositions of the organization which contain relevant details of the SMS element or process must be available. In either case, the various SMS components and their relevant integration should be adequately and systematically documented.

Operating an SMS generates significant amounts 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 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 an organization have traditionally limited the scope of safety data distribution to within the department itself. Cross-functional safety data integration is one of the cornerstones of SMS achievement.

It is necessary that the organization 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 ongoing 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:

- Incident/Accident reports.
- Incident/Accident investigation reports.
- Safety audit reports.
- Periodic analyses of safety trends/indicators.
- Minutes of SRB or SAG meetings.
- Hazard and Risk Analysis Reports.

## **5.7 Safety Assurance**

Safety (SMS) audits are used to ensure that the structure of an SMS is sound. The protocol for conducting a safety audit (from planning to final corrective action closure) should be no different from any other system audit. The overall scope of a safety audit should include:

- Levels and accountability of staff for safety;
- Compliance with SMS hazard/risk evaluation procedure;
- Adequacy of staff training for their technical/SMS roles;
- Availability of safety performance targets and indicators;
- Effective SMS component integration.

A safety audit may be undertaken by a single individual or a team, depending on the scope of the audit. Experienced and trained individuals within the organization may perform safety audits or they may assist external auditors engaged for this purpose. The staff selected to conduct an audit should have practical experience in disciplines relevant to the area to be audited and a good knowledge of the relevant regulatory requirements and the organization's SMS. They should also have been trained in auditing procedures and techniques. As much as possible, the audit team members should be independent of the area being audited. Wherever practical, these functions should be undertaken by persons who are not responsible for, and have not been involved in, the design or performance of the tasks and functions being audited. In this way, the evaluation is neutral and independent from the operational aspects of the organization.

Audits should involve the use of appropriate checklists, which should address areas such as:

- Compliance to ICAO SMS recommendations/regulations;
- Organizational safety policy and standards;
- Structure of safety accountabilities;
- Documentation, including SMS manual and records;
- Hazard identification and risk management processes;
- Provisions for assuring SMS integration with contractors where applicable;
- Management of change.

Safety surveys may be employed as a complementary procedure to safety audits for examining particular elements, processes or a specific operation for any potential hazard/risk. Such targeted safety surveys may be initiated in view of informal feedback or voluntary/confidential reports involving issues as:

- Problem areas or bottlenecks in daily operations;
- Perceptions and opinions about personnel's actions 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.

## **5.8 Emergency Response Planning**

An emergency response plan (ERP) outlines in writing what should be done upon a major incident or accident. The purpose of an ERP is to ensure:

- Planned actions to minimize indirect or consequential damage upon the occurrence of a major incident or accident;
- Recovery actions as well as procedures for orderly transition from normal to emergency operations;
- Designation of emergency authority;

- Assignment of emergency responsibilities;
- Authorization by key personnel for actions contained in the plan;
- Coordination of efforts to cope with the emergency;
- Safe continuation of operations, or return to normal operations as soon as possible.

An ERP could cover the different aspects of emergency response, such as governing policies, notifications, initial response, additional assistance, crisis management centre (CMC), records, management of the accident site, news media, formal investigations, family assistance, post critical incident stress counselling, and post occurrence review.

## CHAPTER 6     INTEGRATING SMS WITH EXISTING SYSTEMS

SMS differs from quality management system in that it focuses on the safety, human and organizational aspects of an operation, i.e. “safety satisfaction”. Quality management primarily focuses on the product (service) of an operation, i.e. customer or “specification satisfaction”, while the hazard identification and risk mitigation components are much apparent in SMS. Safety management results in the design and implementation of organizational processes and procedures to identify hazards and control/mitigate risks in aviation operations. Quality management techniques provide a structured process for ensuring that organizational 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 system. An organization’s safety policy and objectives should be integrated with its quality policy. Conversely, the coverage of quality policy should be fundamentally based upon quality in support of safety. Safety objectives should receive primacy where conflicts are identified.

In civil aviation today, there are probably various control systems existing within an organization, such as:

- ISO 9000 system.
- Quality management system (QMS).
- Maintenance error management system (MEMS)
- Environment management system (EMS).
- Occupational health and safety management system (OHSMS).
- Security management system
- An International Standard for Business Aircraft Operations (IS-BAO)

There are different ways to integrate an SMS in the operation of an organization. Aviation organizations may consider integrating their management systems for safety, quality, maintenance error, security, occupational health and environmental protection where appropriate.

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.

## **CHAPTER 7      GAP ANALYSIS AND PROJECT PLAN**

It is apparent that organizations would need to conduct a gap analysis of their system(s) to determine which components and elements of an SMS are currently in place and which components or elements must be added or modified to meet the SMS as well as other regulatory requirements. The review involves comparing the SMS requirements found in Chapter 3 of this document against the existing systems in your organization.

A checklist may be used to account for each component of Chapter 3 (a) to (h) and their respective sub-elements. The checklist can provide for a “Yes” and “No” response in terms of the compliance of the existing system to the SMS requirements. 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 completed and fully documented, the items which have identified as missing or deficient will form the basis of the SMS project plan. Organizations may format their project plan to suit their individual needs.

## **CHAPTER 8      IMPLEMENTATION TIMESCALES**

ICAO Annex 6 requires the implementation of SMS by air operators and maintenance organizations by 1 January 2009.

To allow sufficient time to develop and implement their own SMS, all Hong Kong AOC Holders and HKAR-145 AMO are encouraged to initiate the implementation of their SMS from now until December 2008. During this period, CAD will continue to provide guidance where appropriate as well as assess each organization'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 Hong Kong AOC Holders and HKAR-145 AMO must have in place a functioning SMS in order to meet the requirements relevant to their CAD Certificates and Approvals.

In order to comply with ICAO requirement, the implementation timetable to be adhered to by operators and maintenance organizations is as follows:

- (1) By November 2006 – CAD to issue Flight Operations Notice and Airworthiness Notice to promulgate the requirements (action completed)
- (2) By November 2007 – CAD to issue SMS guidance materials to industry for implementation (action completed)
- (3) By February 2008 – air operators and maintenance organizations to present preliminary SMS (plan, manual, training, personnel, safety performance targets, safety performance indicators, etc) to CAD for acceptance
- (4) From March 2008 – CAD to liaise with air operators and maintenance organizations to evaluate their SMS implementation progress
- (5) By November 2008 – CAD to confirm final acceptance of SMS submitted by air operators and maintenance organizations

## **CHAPTER 9      CONCLUSION**

This Guide has sought to give the air operators and maintenance organizations an overview of the constituent parts of an SMS and practical advice as to one possible method of implementation. In setting out these steps it has been the intention to guide as opposed to prescribe. It is hoped that it will not prevent innovative methods of meeting these challenges being developed and implemented.

Safety management remains at the forefront of methods by which organizations can make aviation, already the safest form of travel, even safer. The prime difference in the approach adopted can be found in a move beyond the traditional reactionary systems to those which try to predict areas of exposure through assessment of any residual risk areas in airworthiness and operations and supplementing them with operational knowledge and professional judgement.

Above all, the information provided in this guide is intended to help to set up the system that suits the organization's needs. It is only by embracing the concept and implementing it at all levels that we will all collectively achieve the next step forward in safety enhancement as the aviation industry grows.

## **CHAPTER 10 REFERENCES**

### **REFERENCE MATERIALS:**

- (i) ICAO Annex 6 (Operation of Aircraft)
  - Part I Chapter 8.7.3 Safety Management
- (ii) ICAO Safety Management Manual (Doc 9859)
- (iii) UKCAA CAP 712 Safety Management Systems for Commercial Air Transport Operations

## **APPENDIX A: GUIDANCE FOR THE DEVELOPMENT OF AN SMS MANUAL**

---

This Appendix is designed to help organizations document the processes and procedures required for an SMS. It is intended to provide guidance for the development of an SMS 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 organization 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 specimen Manual 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 expositions of the organization which contain relevant details of the element or process as applicable.

## Manual Contents

1. Document Control
2. SMS Regulatory Requirements
3. Scope of the SMS
4. Safety Policy
5. Safety Objectives and Performance Targets
6. Roles and Responsibilities
7. Non-Punitive Reporting Policy
8. Safety Reporting
9. Hazard Identification and Risk Assessment
10. Safety Performance Indicators
11. Safety Investigations
12. Safety Management Training
13. Safety Auditing
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 SMS related documentation and manuals to ensure their continuing suitability, adequacy and effectiveness.

The manual is readily accessible by all personnel.

### Cross Reference Documents:

## **2. SMS Regulatory Requirements**

### Objective

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

### Criteria

Spell out current CAD 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 organization.

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

### Cross Reference Documents:

### **3. Scope of the SMS**

#### Objective

Describe scope and extent of the organization's aviation related operations and facilities within which the SMS will apply.

#### Criteria

Spell out nature of the organization'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 organization within which the SMS will apply.

Where the SMS is expected to be operated or administered across a group of interlinked organizations, such integration and associated accountabilities is to be clearly defined and documented.

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

#### Cross Reference Documents:

#### **4. Safety Policy**

##### Objective

Describe the organization's intentions, management principles, and commitment to improving 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 organization.

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

The safety policy is approved by the Chief Executive Officer.

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 SMS.

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 Chief Executive Officer.

##### Cross Reference Documents:

## 5. Safety Objectives and Performance Targets

### Objective

Describe the safety objectives and the safety performance targets of the organization. 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. Safety Performance targets are specific and measurable targets 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 organization's commitment to achieving safety.

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

Safety objectives and performance targets are publicized and distributed.

Resources have been allocated for achieving the objectives and targets.

### Cross Reference Documents:

## **6. Roles and Responsibilities**

### Objective

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

### Criteria

The Accountable Manager is responsible for ensuring that the SMS is properly implemented and performing to requirements in all areas of the organization.

Appropriate Safety Manager, SRB or SAG have been appointed as appropriate.

Safety authorities, responsibilities and accountabilities of personnel at all levels of the organization 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.

An SMS organizational 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 organization.

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

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

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 organization.

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

There is a process in place to monitor and analyze trends.

The organization 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 organization is willing to accept together with any mitigating factors.

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

The organization 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. Safety Performance Indicators**

### 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.

Periodic planned reviews of company safety performance indicators including an examination of the company's SMS 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. Describe any provision for proactive safety investigation of suspected hazards or abnormal trends.

### 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 organizational 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. Safety Management 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, as applicable.

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

SMS awareness is incorporated into employment or indoctrination program.

### Cross Reference Documents:

### **13. Safety Auditing**

#### Objective

Describe the process for reviewing the effectiveness of your SMS.

#### Criteria

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

Qualification of personnel involved in audits, audit frequency, audit programme, audit reports, corrective action procedures, etc, are defined.

#### Cross Reference Documents:

#### **14. SMS Data and Records Management**

##### Objective

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

##### Criteria

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

Records kept include hazards register, risk assessments reports, SAG/SRB meeting notes, safety performance monitoring charts, safety audit reports, staff training records, etc.

##### Cross Reference Documents:

## 15. Management of Change

### Objective

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

### Criteria

The organization has a standard procedure or policy to perform safety assessment 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 stakeholders within or outside the organization are involved in such assessments prior to implementing changes. All such assessments are documented and approved by management as applicable.

### Cross Reference Documents:

## 16. Emergency Response Plan

### Objective

Describe the organization'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

The organization has an emergency plan that outlines roles and responsibilities in the event of an accident.

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

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

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

There are defined accident investigation responsibilities within the organization.

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 organization in consultation with aircraft owners, aerodrome operators or other agencies as applicable.

A procedure exists for recording activities during an emergency response.

### Cross Reference Documents: