Safety Regulation Group

Civil Aviation Authority

CAP 712

Safety Management Systems for Commercial Air Transport Operations

A Guide to Implementation prepared by the Air Transport Operations - Safety Management Group

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2 April 2002

ISBN 0 86039 857 9

First edition May 2001
Second edition 2 April 2002

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Printed copies and amendment services are available from: Documedia Solutions Ltd., 37 Windsor Street, Cheltenham, Glos., GL52 2DG.

List of Effective Pages

Chapter	Page	Date	Chapter	Page	Date	Chapter	Page	Date
	iii	2 April 2002						
	iv	2 April 2002						
	v	2 April 2002						
Chapter 1	1	2 April 2002						
Chapter 1	2	2 April 2002						
Chapter 1	3	2 April 2002						
Chapter 2	1	2 April 2002						
Chapter 2	2	2 April 2002						
Chapter 3	1	2 April 2002						
Chapter 3	2	2 April 2002						
Chapter 3	3	2 April 2002						
Chapter 3	4	2 April 2002						
Chapter 3	5	2 April 2002						
Chapter 3	6	2 April 2002						
Chapter 3	7	2 April 2002						
Chapter 4	1	2 April 2002						
Bibliography	1	2 April 2002						
Bibliography	2	2 April 2002						
Appendix A	1	2 April 2002						
Appendix A	2	2 April 2002						
Appendix B	1	2 April 2002						
Appendix C	1	2 April 2002						
Appendix D	1	2 April 2002						
Appendix E	1	2 April 2002						
Appendix F	1	2 April 2002						
Appendix F	2	2 April 2002						
Appendix G	1	2 April 2002						
Appendix G	2	2 April 2002						
Appendix G	3	2 April 2002						
Appendix G	4	2 April 2002						
Appendix G	5	2 April 2002						
Appendix G	6	2 April 2002						
Appendix G	7	2 April 2002						
Appendix G	8	2 April 2002						
Appendix G	9	2 April 2002						
Appendix G	10	2 April 2002						
Appendix G	11	2 April 2002						
Appendix G	12	2 April 2002						

Contents

Amendment Record

Amendment Number	Amendment Date	Incorporated by	Incorporated on
Edition 2	2 April 2002		

Chapter 1 Introduction

JAR–OPS states that 'an operator shall establish an accident prevention and flight safety programme, which may be integrated with the Quality System, including programmes to achieve and maintain risk awareness by all persons involved in operations'. This statement is based on the ICAO recommended practice (Annex 6 Pt 1) for operators to have such a programme in place. ICAO Doc 9422 (Accident Prevention Manual) gives appropriate guidance material and describes a Safety Management System.

In early 1999, following industry consultation, the UK Civil Aviation Authority's Safety Regulation Group (SRG) published an introductory document regarding Safety Management Systems (see Bibliography). The discussion that followed publication of the SRG document demonstrated the need for additional material to assist both the newcomer and the more experienced with the practicalities of Safety Management System (SMS) implementation.

In this Guide, full account is taken of the need to maintain civil aviation operational safety risks as low as reasonably practicable. SRG policies are incorporated and provide commonality of approach with disciplines other than operations and maintenance. This document concerns the principles of managing aviation safety but many of the principles to be described also apply to occupational health and safety management.

1 The Benefits of a Safety Management System

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 Safety Management System. Such a system is as important to business survival as a financial management system and the implementation of a Safety Management System 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.

2 Purpose of this Guide

Recognising the need to work together, SRG and the operating and maintenance sectors of the UK civil aviation industry have taken the initiative. The Air Transport Operations – Safety Management Group (ATO-SMG), a joint UK Industry/Civil Aviation Authority working group was formed. The Group's task was to develop guidance material for commercial air transport operators and maintenance organisations which will assist them to develop effective and comprehensive systems for managing safety. This document is the product of that work.

This Guide, focusing on commercial 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 organisation. The Guide will answer three questions:

- What is a SMS?
- What is it expected to achieve? and
- How do we go about implementing and maintaining such a system?

By relating the guidance to existing systems in their companies, organisations will be able to formulate a view on the likely financial costs of implementation of SMS principles. Given the benefits, any incremental costs make sound business – as well as safety – sense.

This Guide builds on earlier work on the management of safety by offering practical guidance material for air transport operators to assist with the development of effective systems for managing safety. The guidance produced is also intended to cover the development of measures necessary to ensure that any safety-related interfaces between air operators, maintenance organisations and their respective suppliers and sub-contractors are managed in accordance with sound safety management principles.

3 What is a Safety Management System?

We begin with two definitions appropriate to commercial air transport operations:

'Safety Management' is defined as the systematic management of the risks associated with flight operations, related ground operations and aircraft engineering or maintenance activities to achieve high levels of safety performance.

A 'Safety Management System' is an explicit element of the corporate management responsibility which sets out a company's safety policy and defines how it intends to manage safety as an integral part of its overall business.

A Safety Management System can be compared with a financial management system as a method of systematically managing a vital business function. It is instructive to look briefly at this aspect.

The features of a financial management system are well recognised. Financial targets are set, budgets are prepared, levels of authority are established and so on. The formalities associated with a financial management system include 'checks and balances'. The whole system includes a monitoring element so that corrections can be made if performance falls short of set targets.

The outputs from a financial management system are usually felt across the company. Risks are still taken but the finance procedures should ensure that there are no 'business surprises'. If there are, it can be disastrous for a small company. For the larger company, unwelcome media attention usually follows an unexpected loss.

An aircraft accident is also 'an unexpected loss' and not one that any company in the civil aviation industry wishes to suffer. It should be apparent that the management of safety must attract at least the same focus as that of finance. The adoption of an effective Safety Management System will provide this.

A developed SMS provides a transparent, recorded system to manage safety and deserves at least the same degree of care that would be applied to a financial management system.

A similar argument applies to a comparison with Quality Management, which should interface with Safety Management as part of the organisation's core management system.

4 The Fundamental Requirement of Safety Management

Success in a company's safety performance will be greatly strengthened by the existence of a positive safety culture. Safety culture in an organisation can be described as the way in which it conducts its business and particularly in the way it manages safety. It emanates from the communicated principles of top management and results in all staff exhibiting a safety ethos which transcends departmental boundaries. It can be measured by informal or formal staff surveys, or by observations conducted in safety-related work areas. Safety must be actively managed from the very top of a company. Safety management must be seen as an integral strategic aspect of business management, recognising the high priority attached by the company to safety. To that end, a demonstrable Board-level commitment to an effective formal Safety Management System must exist. Equally, every level of management must be given a safety accountability. The contribution of the staff at and below supervisor level must be emphasised.

5 Understanding and Implementing a Safety Management System

Four points must be made at the outset, to indicate that implementation of a SMS involves evolution rather than revolution.

- Companies establishing a SMS need to take a pragmatic approach, building where possible on existing procedures and practices (particularly Quality Management). SMS identifies and prioritises the use of resources to manage risk and it should lead to gains in efficiency.
- Adoption of 'best practice' standards must be the goal.
- A fully-fledged SMS is a formalised, company-wide system. Established at the corporate level, the SMS then devolves out into the individual departments of the company. Flight Operations, Engineering and Maintenance, Ground Operations and all other departments whose activities contribute to the operator's safety performance will have their own processes and procedures under the umbrella of the corporate SMS.
- Where safety sensitive functions of the operator are outsourced (e.g. maintenance, ground handling), contractual agreements should identify the need for equivalent, auditable SMS in the supplier.

Many existing procedures and practices are reactive, i.e. they are put in place following a safety event. SMS is both proactive and reactive, giving a means to anticipate and prevent or reduce the effect of risks. This is the essential benefit of Safety working in partnership with Quality Management.

Successful development of SMS in a company follows an initial approach to the task; preparation for and implementation of SMS and, finally, the assurance of continued success of the system.

Unless 'starting from scratch', it is not necessary to adhere to any particular sequence of actions. Many – perhaps all – operators will find that their existing processes and procedures can be linked into the framework of a formal SMS.

The rest of this Guide is given over to an explanation of the SMS philosophy followed by practical advice on the establishment of a SMS. Chapter 2 explains the key elements of a SMS. Chapter 3 details the implementation of those elements.

Chapter 2 The Key Elements of a Safety Management System

1 SMS Essential Prerequisites

There are three essential prerequisites for a Safety Management System. These are:

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

Each will now be considered in outline, the details being presented in Chapter 3 to this document.

1.1 A Comprehensive Corporate Approach to Safety

An effective SMS will provide a means of achieving enhanced safety performance which meets or exceeds basic compliance with the regulatory requirements associated with safety and quality. Enhanced safety performance is founded upon a proactive safety culture inherent in all the company's safety-related activities. It is achieved by effective, devolved executive management in association with a means of independent safety oversight, both of which are the ultimate responsibility of the organisation's Board and Chief Executive Officer (CEO). The Board and CEO are then able to demonstrate how safety is managed in the company to the owners; workforce; shareholders; safety regulatory authorities and customers.

A corporate approach to safety must be able to meet the following criteria:

- published safety accountabilities of managers and key staff
- requirements for a safety manager
- the ability to demonstrate that it generates a positive safety culture throughout the organisation
- documented business policies, principles and practices in which safety is inherent
- commitment to a safety oversight process which is independent of line management
- regularly reviewed safety improvement plans
- formal safety review processes.

1.2 An Effective Organisation for Delivering Safety

The second essential prerequisite is for an organisation that delivers safe standards by way of:

- effective arrangements for selection, recruitment, development and training of staff
- safety awareness training for management and staff
- defined standards for, and auditing of, asset purchases and contracted services
- controls for the early detection of – and action on – deterioration in the performance of safety-significant equipment or systems or services
- controls for monitoring and recording the overall safety standards of the company

- the application of appropriate hazard identification, risk assessment and effective management of resources to control those risks
- change management
- arrangements enabling staff to communicate significant safety concerns to the appropriate level of management for resolution and feedback of actions taken
- emergency response planning and simulated exercises to test its effectiveness
- assessment of commercial policies with regard to impact on safety.

1.3 Systems to Achieve Safety Oversight

The following elements are desirable:

- a system for analysing flight recorder data for the purpose of monitoring flight operations and for detecting unreported safety events
- a company-wide system for the capture of written safety event/issue reports
- a planned and comprehensive safety audit review system which has the flexibility to focus on specific safety concerns as they arise
- a published system for the conduct of internal safety investigations, the implementation of remedial actions and the communication of such information
- systems for effective use of safety data for performance analysis and for monitoring organisational change as part of the risk management process
- arrangements for ongoing safety promotion based on the measured internal safety performance and assimilation of experience of other operations
- periodic review of the continued effectiveness of the safety management system by an internal, independent body
- line manager's monitoring of work in progress in all safety critical activities to confirm compliance with all regulatory requirements, company standards and local procedures.

Chapter 3, which follows, discusses the three essential prerequisites for implementing Safety Management in detail.

Chapter 3 Implementation

1 Introduction

Chapters 1 and 2 give essential information regarding the background and elements of a SMS but the key to success is in the implementation. To ensure its success, it is considered to be beneficial to approach this in three stages which should, if properly implemented, provide a closed-loop system of sustaining the cultural and procedural change necessary:

Stage 1 – A comprehensive approach to safety

Stage 2 – An effective organisation for delivering safety

Stage 3 – Systems to achieve safety oversight

2 A Comprehensive Corporate Approach to Safety

2.1 Published Safety Accountabilities

Successful handling of safety matters is a line responsibility, requiring the active participation of all levels of management and supervision. This should be reflected in the structure of the company and in published safety accountabilities. The company should define, document, and communicate – with the aid of organisational diagrams where appropriate – responsibilities, accountabilities, and authorities. The company should stress to all employees their individual and collective responsibilities and accountabilities for safety performance. Top-level accountabilities may not be delegated, but should be cascaded throughout the company so that all aspects of aviation safety are covered without gaps.

2.2 Safety Manager

In most small and medium sized companies it is expected that the Flight Safety and Quality tasks will have many common points and there can be no objection to the combination of the roles in one staff member. This 'safety manager' must have a direct reporting line, on safety matters, to the CEO (the person who directs and controls the organisation at the highest level – accountable manager). It is important that this person has the respect of the staff from the shop floor up to the senior management, yet is able to be objective in the fulfilment of his/her Safety Management task. The appointed Safety Manager would be expected to:

- hold or have held a relevant licence
- have relevant operational or maintenance experience
- have undertaken Safety Management and accident investigator training
- have the respect of the organisation.

He would also need to draw on appropriate expertise from other disciplines as required.

The safety manager must have clear responsibilities e.g.:

- management of the Safety Improvement Plan
- the facilitation of hazard management and risk assessment
- advice to managers on safety matters

- the Emergency Response plan
- investigation of incidents and accidents
- dissemination of appropriate safety information
- staff training in safety and quality management
- control of safety and quality documentation
- facilitation of Safety Review Board and Safety Action Group meetings.

2.3 Positive Safety Culture

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

2.4 Documentation of Business Policies and Practices

The safety policies of a company define the senior management's intentions in safety matters. These policies document the fundamental approach to be taken by staff and contractors towards safety. The policies should be based on a clear and genuine Board-level commitment that, for the company, the management of aviation safety is paramount. To this is added a commitment to best practice and compliance with aviation regulations. The achievement of the policies can be implemented through suitable organisational arrangements and management systems. These provide the focus for all staff to enact their management's policies. The administrative arrangements that are in place for Quality Management should be used to provide the audit and follow-up process required by Safety Management.

As a minimum the following should be published:

- the safety policy statement by the CEO
- the structure of the SMS (organogram)
- the responsibilities of the Safety Review Board (see paragraph 2.7 below), the Safety Action Group and the Safety Manager
- the safety accountability of each position having a safety responsibility
- the company's system for hazard identification and risk assessment
- the safety data capture system and its confidentiality
- the remedial action process
- the policy on records to be maintained.

2.5 Independent Safety Oversight Process

An independent oversight programme is much like a Quality Assurance programme, but is focused on the safe performance of the process under review rather than simple compliance. It is necessary for the staff doing the safety oversight to have an

understanding of the process under review, indeed ideally be qualified to carry out the function, whilst being fully independent of it during the audit. An example of this is a line or route check carried out from the third seat in the cockpit, as opposed to such a check carried out by the checking captain who is part of the operating crew.

The controls that have been identified to manage the process safely should be checked for their use and effectiveness. Shortfalls against the expected standard must be formally reported through the remedial action process, for line management's consideration or action.

2.6 Regularly Reviewed Safety Plans

A Safety Improvement Plan describes how a company will achieve its corporate safety objectives and targets and how it will meet any new or revised safety requirements, regulatory or otherwise. Significant items in the Safety Plan will normally be included in the corporate business plan. A Safety Plan, which may consist of more than one document, details the actions to be taken, by whom and in what time-scale.

2.7 Formal Safety Review Processes

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

- The ASRB is the company's highest-level internal safety-related meeting and should be chaired by the CEO (or a non-executive director with the CEO in attendance) and include the safety manager. Safety performance and achievements are periodically reviewed and the results of safety and quality audits and monitoring programmes are addressed. The Board is established to ensure that the objectives and specified actions in the Safety Plan are achieved in a timely manner. Consideration may be given to any issues that are blocking progress. The allocation of resources, commitment for new initiatives and the establishment of a clear safety policy are issues that may also be resolved. Example Terms of Reference for the ASRB are shown at **Appendix E**.
- The SAGs comprise a representative selection of the line management and supervisory staff of all sections of the company (not only operations and maintenance, but also other disciplines, such as financial and commercial). In a large company there may be more than one SAG. These groups should meet periodically to support the line with the assessment of risks faced by the company and to suggest methods of mitigation. They should also support the systematic review of safety-related standards and procedures used in the company. The working of the group should be facilitated, but not directed, by the Safety Manager. This group should be used to provide experienced advice on the major aviation safety issues. Example Terms of Reference for the SAG are shown at **Appendix F**.

3 An Effective Organisation for Delivering Safety

3.1 Arrangements for Selection, Recruitment, Development and Training

The objectives of selection, recruitment, development and training are to improve safety, quality and efficiency by placing employees in jobs to which they are suited and qualified. Although obvious, this is so fundamental at all levels within a company

that it is worthy of emphasis. Responsibilities for safety can only be determined according to the level of competence and training of the staff member concerned. The appropriate experience and training requirements for safety-related posts must be defined, monitored and recorded. All induction and **ab initio** training, including that of contract staff, should explain the company's safety culture and describe the SMS operated.

3.2 Safety Awareness Training for Management and Staff

A company should have processes to monitor, maintain and, where required, improve upon the competence of its managers and staff especially in relation to aviation safety. Competency and subsequent refresher training may be provided through formal courses and/or through structured development in the workplace. Appropriate training records should be maintained. All of the foregoing is further enhanced by day-to-day safety awareness demonstrated by senior management.

3.3 Defined Standards and Auditing of Asset Purchases and Contracted Services

Contracted services or products can have a dramatic effect on the company and therefore standards need to be clearly defined at the outset. Purchasing policies must include controls to ensure the maintenance of safety standards. The purchasing control system should include the requirement that all new products, equipment, materials and services are reviewed to ensure that safety requirements are met.

An item of particular importance to any company is the procurement of services from contractors. Contractor selection procedures should include a review of the contractor's safety management arrangements and consideration of the contractor's previous safety record. These factors should be given equal weight with other considerations such as quality and prompt completion. The contractor should be made aware of the requirements of the company's Safety Management System and their responsibilities within it. One such requirement will be a routine audit of the services provided, this being carried out by the company or its representatives. Before the commencement of work and throughout the contract, close liaison should be maintained to ensure that safety standards are observed.

3.4 Monitoring Performance of Safety Significant Equipment, Systems or Services

Planning for safety includes making physical resources available when needed. Clearly, such resources must function correctly. The provision and maintenance of properly engineered facilities and equipment is therefore an integral part of a Safety Management System.

3.5 Recording and Monitoring Safety Standards

A company's safety standards are the baseline against which all safety critical activities should be measured. Once established, it is necessary routinely to confirm that operations are in compliance with these standards. This is normally done by the establishment of a safety audit programme. It is the responsibility of the line manager to confirm that working practices comply with the appropriate requirement.

3.6 Hazard Analysis and Risk Assessment Tools

3.6.1 Mention has frequently been made in this Guide of the importance of a proactive – as well as reactive – approach to the management of safety. Hazard identification and risk management are proactive methods in that they are the systematic examination of potentially hazardous activities to establish safe, effective procedures and practices. Analysis of hazardous activities will identify areas of relatively higher risk that require monitoring. This enables defences to be developed and contingency plans to be produced and implemented.

3.6.2 Hazard Analysis

The effective identification of hazards can be achieved by brainstorming, using an appropriate selection of management and staff; staff surveys and a review of pertinent accidents/incident records from both internal and external sources. Hazard identification should be initially undertaken to provide a comprehensive assessment of the risks that face a company. Subsequently, hazard identification should be periodically reviewed. The process should also be repeated whenever there is a significant change to the organisation, its staff, procedures or equipment. Example Hazard Logs are at **Appendix A**. It should be noted that the Log identifies the manager in whose area the risk lies. The line manager has the responsibility for setting in place measures to remove, or mitigate the risks of, the identified hazard. The Safety Action Group will monitor the completion of this task.

3.6.3 Risk Assessment Tools

The Safety Action Group should ensure that the line has considered and assessed all hazards to the organisation. Risk assessment is assumed to be primarily a subjective, qualitative method of evaluation of the likelihood and severity of damage inherent in the identified hazard. Using the matrix in Appendix B, those undertaking the risk assessments can prioritise the risks identified and therefore aid the line management to prioritise resources to mitigate their effects. However, an operator may prefer to undertake a more analytical, quantitative, objective approach, which is beyond the scope of this paper. The chosen method must be clearly recorded in the SMS documentation.

Hazard analysis and risk assessment processes may appear complex at first sight: but experience has shown that familiarity is soon gained. These processes also produce benefits for many other areas of the Safety Management System and increase efficiency. Simple examples of these processes are at **Appendices A – D.**

NOTE: A **hazard** is an event that has the potential to result in damage or injury. The degree of **risk** is based on the likelihood that damage or harm will result from the hazard and the severity of the consequences. It is the responsibility of the line managers to carry out risk assessments. It would be the function of the Safety Action Group to review them.

3.7 Change Management

Effective change management is another important aspect of safety management. There is a risk of confusion whenever change is introduced to an existing system; operational requirement; maintenance process, and/or procedure. Such a risk must be recognised and any change managed in co-operation with the affected work areas.

3.8 Arrangements for Staff to Communicate Significant Safety Concerns

Whilst 'top down' communication is very important on matters of safety, so too is communication upwards, from those actually doing the job, to their supervisors and managers. Documented arrangements must be in place within the company to ensure that staff can communicate significant safety concerns to the appropriate level of management for resolution. It is essential that all staff safety suggestions are responded to and that reasons for adoption or rejection of safety concerns are given. Any resultant changes in procedures should be discussed with the staff affected. Records should be kept of the resolution of safety concerns.

3.9 Emergency Response Planning

An Emergency Response Plan (ERP) is established to facilitate management of a hazardous event and mitigate the impact to the normal operation. All of the

company's operational locations must develop ERPs and maintain a robust means of co-ordinating these with the main accident co-ordination procedures. The plan should assign responsibilities to specific individuals; provide emergency procedures; control the notification of outside agencies; nominate channels and centres of communication; provide for 'in-house' emergency response and effective liaison with accident investigators and outside emergency services. In addition, methods for communicating with the public in the event of a major incident should be covered in the plan.

Once the plans have been formulated, it is important to ensure that staff are adequately trained in the procedures that will be employed in the event of an accident or serious incident. Plans should be rehearsed regularly, both to familiarise staff and to reveal any problems. There should also be routine testing of emergency systems and all testing, training and rehearsals should be recorded with action taken if deficiencies are identified during practices.

4 Systems to Achieve Safety Oversight

4.1 Arrangements for the Analysis of Flight Data

The intelligent analysis of operations, engineering and maintenance safety data through media such as Engineering or Operational Flight Data Monitoring (OFDM) programmes, as part of an integrated SMS, can be used to confirm adherence to standard operating procedures (SOPs). These data can be used to measure the effectiveness of training, identify risks and monitor the effectiveness of any remedial action. Analysis of the data should give the operator confidence in all aspects of his operation and also assure the Regulator of the airline's safety standards and procedures.

4.2 Written Safety Event/Issue Reports

The intention is to enhance an organisation's knowledge of potentially hazardous situations. The use of existing reporting systems is to be encouraged, for example Air Safety Reports (ASRs); flight reports and maintenance error management systems. The internal system must encompass the MOR scheme requirements and build upon them. The established flight operation reporting system should be extended to other safety critical areas of the company. A record must be kept of all reports and their status.

4.3 Conducting a Safety Audit Review

The Quality Management System required by JAR-145 and JAR-OPS specifies an audit plan. The specified plan includes an audit of flight safety and maintenance/ airworthiness activities. By simply extending the focus of the audit plan to encompass the safety issues identified through the risk analysis or by the company's Safety Action Group, the audit/correction function of SMS will be achieved: flexibility in the audit plan will ensure that newly discovered safety concerns can be investigated at an early stage. Conversely, rigid adherence to an audit timetable will not enable safety concerns to be dealt with in a timely manner, nor will it ensure that the audit effort is focused on the areas of the operation that are most at risk.

4.4 Conducting Internal Safety Incident Investigations and Implementing Remedial Actions

Companies must ensure that their staff are aware of the internal safety-related investigation procedure. The subject and findings of the investigation should be disseminated to all staff affected. The findings should result in positive actions to

prevent recurrence of the event and not seek to apportion blame (see paragraph 2.2 above).

4.5 Effective use of Safety Data for Performance Analysis

The company should be able to show the method of operation of any safety data capture programmes and the results of factual investigations which arise therefrom. The response of executive management should ensure the effective use of safety data monitoring to address company safety issues and provide advice accordingly. Performance analysis should also monitor the adequacy of safety processes, ensuring that new or modified processes are introduced where a shortfall is identified.

4.6 Arrangements for ongoing Safety Promotion

The company should have clearly defined arrangements to ensure that the work achieved by the Safety Manager and Committees (ASRB, SAG or other), as well as line management, is transmitted to all those involved in the relevant activities. The lessons learned must be communicated effectively.

4.7 Periodic Review of the Safety Management System

The effectiveness of the SMS in addressing safety-related findings and in the achievement of continuous safety improvement must be monitored. This should be achieved by periodic management review overseen by the ASRB.

4.8 Line Manager's Monitoring

The practices used by flight crews, maintenance staff and all others involved in safety sensitive areas of aviation are key to the achievement of safety. Compliance with procedures is often assumed but not invariably achieved. Whether through line or route checks, or compliance monitoring in line with JAR-145.65, it is essential that managers and supervisors know how each safety critical task is actually achieved. The line manager's monitoring is therefore a crucial element of safety management.

Chapter 4 Conclusion

This Guide has sought to give you the operator and/or maintenance organisation an overview of the constituent parts of a Safety Management System 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. The structure of the document is such that it can be developed as experience grows and new tools become available and recipients are actively encouraged to feed these back to members of the ATO-SMG so that we can all learn from experience.

Safety Management remains at the forefront of methods by which organisations 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, please use the information provided in this guide to help you to set up the system that suits your organisation. It is only by embracing the concept and implementing it as your own at all levels in your organisation that we will all collectively achieve the next step forward in safety enhancement as our industry grows.

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Making the Safety Case – Shell Aircraft Ltd

The 'Three Prerequisites' approach to safety management described in this document is based on the concept first developed by Mike Overall.

'Safety Management – From Theory into Practice: Making it Happen' – paper presented by Mike Overall to the International Air Safety Seminar, Capetown, November 1998.

'Managing Safety Management' – presentation by Mike Overall to the UK Flight Safety Committee Seminar, October 2000.

The Air Transport Operations – Safety Management Group

The names and affiliations of the members of the Air Transport Operations – Safety Management Group (ATO-SMG) are listed below. ATO-SMG was formed in early 2000 during which year the Group held a number of meetings. Through their representatives on ATO-SMG, members of the UK Flight Safety Committee, the UK Safety Management System Combined Action Group and the CAA's Safety Regulation Group were kept appraised of progress. Final drafts of the Guide were extensively critiqued by people in those organisations.

UK Flight Safety Committee:

Ed Pooley, Head of Safety, British Regional Air Lines Group plc and **Mel Grievson**, General Manager Flight Safety and Quality, British Midland. At the end of 2000, **Martin Pitt**, Flight Safety Officer, Air 2000 took over as the second UKFSC representative, Mel Grievson continuing as an independent co-opted member.

The United Kingdom Flight Safety Commitee (UKFSC) was founded in 1957 and is a membership organisation dedicated to the furtherance of air safety in its widest sense. Members are drawn from civil and military air transport operators, the air traffic service community, aircraft maintenance organisations, airport operators, aircraft and aircraft systems manufacturers, employee associations, insurance agencies and Safety Regulators supported by a number of co-opted expert advisers and a full time Secretariat.

UK Safety Management System Combined Action Group:

Cliff Edwards, Quality and Safety Development Manager, Shell Aircraft and
Simon Witts, Technical Director, British Regional Air Lines Group plc.

The UK Safety Management System Combined Action Group is a voluntary grouping of UK Engineering and Maintenance related interested parties with a mutual interest in promoting the adoption of Safety Management Systems in the UK Air Transport Industry.

CAA – Safety Regulation Group:

Jim Done, Head of Aircraft Maintenance Standards Department and
David Orringe, Quality Manager, Flight Operations Department.

ATO-SMG Chairman: Peter Hunt, Head of Operating Standards Division, SRG.

Appendix A Hazard Identification and Risk Assessment Log

Hazard Identification and Risk Assessment Log – First Example

Risk Ref:	Generic Risk	Risk Description	Current Measures to Reduce Risk	Risk Rating[1]			Further Actions to Reduce Risk	Responsibility
				L	S	No.		
M-5	Human Error	Non-compliance with a company maintenance procedure.	1. Minimum Competency requirements 2. Effective Safety Culture in company (maintenance department) 3. Effective Task Planning 4. Availability of procedures 5. Procedure reviews and simplification into task cards 6. QA requirements for certifying staff 7. Recurrent Training 8. Human Factors Training	5	4	20	1. Introduce Compliance Monitoring 2. Effective supervision including work compliance assessment 3. Competency assessments 4. Maintenance Policy to reinforce need for compliance	Quality Assurance Line Manager Maintenance Manager Maintenance Manager

1. Risk rating (see Appendix B): L=Likelihood S=Severity No.=Factor (LxS)

The specimen Hazard Log above is used to provide a record of identified hazards and the actions taken by nominated individuals to address the risks. The record should be retained permanently in order to provide evidence of Safety Management and to provide a reference for future risk assessments.

Having identified and ranked the hazards, any existing defences against them should be identified. These defences must then be assessed for adequacy. If these are found to be less than adequate, then additional actions will have to be prescribed. All actions must be addressed by a specified individual (usually the line manager responsible) and a target date for completion must be given. The Hazard Log entry is not to be cleared until this action is completed.

Hazard Identification and Risk Assessment Log – Second Example

IDENTIFIED HAZARD: Aircraft departs with loading out of trim limits for safe flight **HAZARD CLASSIFIED AS:** Company Wide/Specific Location

ASSESSMENT ACCEPTED BY DEPARTMENT DIRECTOR(S): ..... **ASSESSMENT NOTED BY SAFETY REVIEW BOARD**.....

RISK	CONTROLLING PROCESS (P=Primary/S=Secondary)	RESPONSIBLE MANAGER(S) SIGN OFF/DATE
1. Certified loadsheet may show incorrect hold loading.	1A(P) A system of hold loading is in place which employs the use of Standard Loading Instruction form (LIF) for use by load controllers to specify loading requirements to loading team supervisors and which requires sign off on completion and is returned to the load controller prior to their presentation of the loadsheet to the aircraft commander. 1B(P) Hold loading procedures include a positive check by the loading team supervisor signed on the LIF that, at commencement of loading, the holds were empty or contained only a stated transit or other load recorded on the LIF. 1C(P) Reliable procedures exist which guarantee that only baggage labelled for a flight will be loaded on the allocated aircraft.	
2. Certified loadsheet may show incorrect pax loading.	2A(P) Applicable DCS system is set up correctly. 2B(P) Manual loadsheet reversion procedure is fully specified with particular reference to the issue of passenger boarding cards. 2C(S) A loadsheet copy is provided to Cabin Crew to allow a gross pax seating error check to be made. 2D(S) Guidance to Cabin Crew on how to make a gross pax seating error check is given in their written procedures.	
3. Loadsheets may show incorrect data entry/completion when presented.	3A(P) Suitable flight crew procedures are documented with a distinction drawn between DCS and manual loadsheet checking requirements.	

Appendix B Risk Analysis

SEVERITY		
4	**Catastrophic**	• Loss of the aircraft • Multiple fatalities
3	**Hazardous**	• Large reduction in safety margins • Physical distress or a high workload such that a flight crew cannot be relied upon to perform their tasks accurately or completely • Serious or fatal injury to a relatively small number of occupants
2	**Major**	• Significant reduction in safety margins • Reduction in the ability of flight crew to cope with adverse operating condition impairing their efficiency
1	**Minor**	• Nuisance • Operating limitations or emergency procedures

Appendix C Likelihood

LIKELIHOOD			
4	**Probable**	1 to 10^{-5} per flight hour (see note)	May occur once or several times during operational life
3	**Remote**	10^{-5} to10^{-7} per flight hour	Unlikely to occur during total operational life of each system but may occur several times when considering several systems of the same type
2	**Extremely Remote**	10^{-7} to 10^{-9} per flight hour	Unlikely to occur when considering systems of the same type, but nevertheless, has to be considered as being possible
1	**Extremely Improbable**	$< 10^{-9}$ per flight hour	Should virtually never occur in the whole fleet life

NOTE: The use of mathematical probabilities is not essential. They are included here to give an indication of order of magnitude when making qualitative estimates.

Appendix D Risk Tolerability Matrix

Severity and Likelihood

SEVERITY

Catastrophic	4	4 Review	8 Unacceptable	12 Unacceptable	16 Unacceptable
Hazardous	3	3 Acceptable	6 Review	9 Unacceptable	12 Unacceptable
Major	2	2 Acceptable	4 Review	6 Review	8 Unacceptable
Minor	1	1 Acceptable	2 Acceptable	3 Acceptable	4 Review
		Extremely Improbable ***1***	***Extremely Remote*** ***2***	***Remote*** ***3***	***Probable*** ***4***

LIKELIHOOD OF OCCURRENCE

NOTE: The numbers used in the table are the product of the severity/likelihood assessments. The matrix is used to prioritise actions to mitigate risk.

THIS TABLE ILLUSTRATES ONE POSSIBLE CLASSIFICATION SCHEME.
THE ACTUAL SCHEME USED MUST BE STATED IN THE DOCUMENTATION.

Appendix E Example Terms of Reference for the Air Safety Review Board

Introduction. In either an airline or Maintenance Organisation, a top-level Air Safety Review Board (ASRB) is normally established.

Accountability. The ASRB is chaired by the CEO and is a sub-committee of the main Board.

Membership. In an airline, ASRB membership comprises the CEO, directors of Flight Operations, Ground Operations and Aircraft Maintenance/Engineering (heads of the 'functional areas'). In a Maintenance Organisation, ASRB membership would comprise the CEO and the heads of the key areas e.g. workshops, quality department. The organisation's Safety Manager will normally attend ASRB as Secretary.

Terms of References As a minimum the ASRB is responsible for:

- monitoring the organisation's operational safety performance against the Operational Safety Programme
- monitoring that any necessary corrective action is being taken in a timely manner
- monitoring the effectiveness of the organisation's safety management processes which give effect to the declared corporate priority of business management for operational safety
- monitoring the effectiveness of the corporate oversight processes which independently validate the organisation's safety performance
- ensuring that appropriate resources are allocated to meet agreed actions which enhance safety performance beyond that required by regulatory compliance alone
- monitoring the effectiveness of safety oversight of sub-contracted operations carried out on behalf of the organisation
- giving strategic direction to the organisation's Safety Action Groups.

Appendix F Example Terms of Reference for the Safety Action Group

Introduction. In an airline, Safety Action Groups (SAGs) are normally established in Flight Operations, Ground Operations and Aircraft Maintenance/Engineering (the 'functional areas'). In a Maintenance Organisation, SAGs would be established in the key areas e.g. workshops, quality department etc.

Accountability. SAGs are responsible to the corporate Air Safety Review Board, the membership of which includes the relevant functional directors. Each SAG is chaired by the appropriate functional director and is responsible for that function's contribution to development and maintenance of the organisation's Flight Safety Programme.

Membership. SAG membership will normally be drawn from managers, supervisors and staff from within the appropriate functional area. The organisation's Safety Manager will normally attend each SAG primarily to function as an independent facilitator/observer.

Terms of Reference. As a minimum each SAG is responsible for the following:

- to oversee operational safety within the functional area
- to ensure that any necessary corrective action is taken in a timely manner
- to report to and accept strategic direction from the corporate Safety Review Board.

This will be done by:

- ensuring that hazard identifications and risk assessments are carried out as appropriate with such involvement of staff as may be necessary to build up safety awareness
- ensuring that satisfactory arrangements exist for safety data capture and actioning employee feedback
- ensuring that suitable safety performance indicators are developed and regularly reviewed for the functional area
- ensuring that the mandatory Quality Audit Programme is so operated as to maximise its direct contribution to safety performance and that full assistance is afforded to the corporate safety department in the event of a requirement to carry out a safety audit or review of any aspect of the functional area
- convening of such meetings or briefings as may be necessary to ensure that effective opportunities are available for all employees to participate fully in management for safety
- ensuring that shortfalls in human performance which are found to have contributed to safety events are dealt with in such a manner that no avoidable indirect detriment is caused to the contribution which the workforce must make to the required culture of safety as a priority
- ensuring that adequate investigation of safety events/issues takes place and that safety reviews are then conducted and any actions arising tracked to completion
- ensuring that appropriate safety, emergency and technical training of personnel is carried out to meet or exceed minimum regulatory requirements

- reviewing incident, accident and safety information received from other operators, manufacturers and Airworthiness Authorities, and the dissemination of appropriate information to staff
- ensuring that aircraft operational safety actions interface adequately with workplace occupational safety so that the latter are compatible.

Appendix G Guidance for Auditing a Formal Safety Management System

1 SMS Policy Statements

Board level approved safety policy statements which are likely to cover:

1.1 **A statement of intent about maintaining or improving current safety performance.**

	Areas for Consideration	Current Practice
1	Is there a formal safety policy statement?	
2	Does the safety policy statement explicitly address aviation safety?	
3	Does the safety policy define the intent to maintain or improve the current safety performance?	
4	Is the safety policy statement endorsed by the Board?	
5	Is the safety policy statement signed by the current head of the organisation?	
6	Is the safety policy statement reviewed and revised at suitable intervals?	
7	Is the safety policy publicised within the organisation in such a way that all those staff with a responsibility for aircraft safety are aware of the policy?	
8	Does the safety policy statement indicate that safety will be managed proactively?	

1.2 **A statement of intent to minimise the risks of an accident occurring – probably with the 'as far as is reasonably practicable' caveat.**

	Areas for Consideration	Current Practice
1	Is the safety policy to minimise aviation risks to as far as is reasonably practicable?	
2	Are required levels of safety defined?	
3	Does the SMS specifically address the control of potential aviation safety risks?	
4	How is 'reasonably practicable' defined if the term is used?	
5	How are the required levels of safety shown to cover all potentially hazardous aviation activities?	
6	How often are the required levels of safety reviewed to check they are still appropriate?	

1.3 **A statement of intent to implement an effective formal safety management system.**

	Areas for Consideration	Current Practice
1	Does the safety policy statement state that safety will be managed through the application of a formal safety management system?	
2	Does the Board or most senior level of management endorse the implementation of a formal SMS?	
3	Is there an overview of the SMS that explains its structure and approach?	
4	Is the overview of the SMS readily available to staff?	
5	How is the SMS supported by the management?	

1.4 A statement about individual and management responsibility for safety performance.

	Areas for Consideration	Current Practice
1	Does the safety policy statement state that each individual has a responsibility for the safety of their own actions?	
2	Does the safety policy statement state that managers are accountable for the safety performance of the activities for which they have responsibility?	
3	Does the safety policy statement state who is ultimately accountable for safety in the organisation?	
4	Is the person ultimately accountable for safety in the organisation, the senior executive officer in the organisation?	
5	Is there a logical flow, within the organisation, of accountabilities and responsibilities for safety?	
6	Is there a nominated post responsible for safety assurance in the organisation?	
7	Does the person responsible for safety assurance report directly to the Board?	
8	Insofar as is practical, given the size of the organisation, is there a managerial and reporting separation between staff performing safety assurance roles and those staff with operational responsibilities?	

1.5 A statement about the priority ascribed to flight safety relative to commercial, operational, environmental and working practice pressures.

	Areas for Consideration	Current Practice
1	Does the safety policy define the priority that safety is to be given in the organisation?	
2	Is there an explanation of what the safety priority statement means in practice?	
3	What measures are taken to assess the priority level set for aviation safety?	

1.6 A statement about compliance with safety standards and regulatory requirements.

	Areas for Consideration	Current Practice
1	Does the safety policy explicitly state that the organisation will comply with all appropriate external safety standards and requirements?	
2	Who is responsible for identifying relevant external safety standards and requirements?	
3	How, and by whom, are internal safety standards, procedures and work instructions prepared?	
4	How are the relevant external and internal safety standards and requirements indicated to the staff performing the work?	
5	How often are the lists of appropriate safety standards and requirements reviewed to ensure they remain current, relevant and complete?	
6	How are non-compliances to internal safety standards identified and dealt with?	
7	How are non-compliances to external safety standards identified and dealt with?	
8	Where, and by whom, are copies of all appropriate safety standards and requirements kept?	

1.7 A statement about ensuring sub-contractors meet company safety standards and requirements.

	Areas for Consideration	Current Practice
1	Does the safety policy state that external suppliers must satisfy the organisation's relevant safety management standards and safety requirements?	
2	How are the safety requirements for external suppliers determined and by whom?	
3	How, and by whom, are safety requirements communicated to external suppliers?	
4	How, and by whom, is it decided whether a potential external supplier has an acceptable SMS in place before being awarded a contract or order?	

	Areas for Consideration	Current Practice
5	Are safety requirements on suppliers contractually binding?	
6	What procedures are in place to check that external suppliers comply with the safety requirements put on them?	
7	How is the competence of external supplier/contractor staff checked?	

2 Typical Safety Management Principles

Safety management principles define the components or scope of a Safety Management System.

2.1 Published safety accountabilities (where applicable) of managers and key staff/ appointments.

	Areas for Consideration	Current Practice
1	Are safety accountabilities promulgated for all applicable Board members, managers and key staff?	
2	Are safety accountabilities promulgated for key appointments (e.g. shift managers, specialists etc)?	
3	Are safety accountabilities reviewed after a significant organisation change has taken place?	
4	Are there any obvious gaps in the allocation of accountabilities?	
5	Are there any overlaps or duplication of accountabilities that could cause confusion?	
6	If the organisation is a part, subsidiary or division of a parent organisation, is safety accountability and reporting linked into the parent organisation?	

2.2 Arrangements to conduct internal safety incident investigations and implement remedial action.

	Areas for Consideration	Current Practice
1	Is the process for recording and investigating safety significant occurrences explicitly defined?	
2	Is the range/scope of safety significant occurrences which must be recorded explained/defined?	
3	Does the investigation of safety significant occurrences include the identification of any safety management failures?	
4	How, and by whom, are safety significant occurrences reported?	
5	How, and by whom, are the reports of safety significant occurrences to be investigated and recorded?	

	Areas for Consideration	Current Practice
6	Who decides if corrective action is necessary?	
7	How are corrective actions monitored to ensure that they are implemented and that they solve the identified deficiency?	

2.3 **Arrangements for recording and monitoring the overall safety standards of the organisation (usually a record of significant safety incidents), if applicable.**

	Areas for Consideration	Current Practice
1	What procedures exist for recording and monitoring safety significant incidents?	
2	Who sets the requirements for recording safety significant incidents?	
3	Where, and by whom, are the records of compliance with safety standards kept?	
4	Is there a process for monitoring and assessing the records of safety significant incidents?	
5	How long should records be kept?	
6	Is the format for safety significant records defined?	
7	Are the safety records reviewed at appropriate intervals to confirm that they are still relevant?	
8	How are the safety records used to support the overall unit Safety Assurance Document (e.g. Safety Case or Aerodrome Manual)?	

2.4 Arrangements to report (internally and externally) the results of investigations and dissemination of the lessons learnt.

	Areas for Consideration	Current Practice
1	Is the process for disseminating 'lessons learnt' from hazardous occurrences explicitly defined?	
2	How, and by whom, are relevant 'lessons learnt' identified from internal hazardous occurrences?	
3	How, and by whom, are relevant 'lessons learnt' identified from external hazardous occurrences?	
4	How, and by whom, is it decided what information needs to be disseminated?	
5	How, and by whom, is the information disseminated?	
6	How, and by whom, is the effectiveness of the dissemination monitored?	
7	How is it confirmed that 'lessons learnt' are incorporated appropriately into the safety culture and the organisation's long-term memory?	

2.5 Arrangements to carry out regular safety audits, reviews or surveys within the organisation and for ensuring that agreed actions are implemented.

	Areas for Consideration	Current Practice
1	Is there a detailed requirement for safety audits, reviews or surveys?	
2	Who plans and schedules safety audits, reviews or surveys?	
3	Is the appropriate maximum interval between safety audits, reviews or surveys defined?	
4	Who determines the scope of a safety audit, review or survey?	
5	How, and by whom, are audits, reviews or surveys of external suppliers initiated and performed?	
6	How are the findings of audits, reviews or surveys recorded?	
7	Who determines the need for corrective actions arising from the results of safety audits, reviews or surveys?	

	Areas for Consideration	Current Practice
8	Who determines the timescales for the corrective actions?	
9	How are the results of safety audits, reviews or surveys made known to appropriate staff and senior management?	

2.6 Arrangements for ensuring staff are adequately trained and competent for the job they are required to do.

	Areas for Consideration	Current Practice
1	Is the management of competency for safety significant roles and/or responsibilities explicitly addressed?	
2	Does the management of competency extend beyond the necessary licensing of individuals?	
3	How, and by whom, are the competency requirements determined for safety significant roles and/or responsibilities?	
4	Where are the competency requirements for safety significant roles and/or responsibilities recorded?	
5	Is there any training in the concept of proactive safety management?	
6	Is the effectiveness of the proactive safety management training monitored and, where necessary, reinforced?	
7	How, and by whom, is it decided if a member of staff meets the competency requirements for safety significant roles and/or responsibilities?	
8	How, and by whom, is the evidence kept that staff are competent for safety significant roles and/or responsibilities?	
9	Where, and by whom, is the appropriate period for which competency records must be retained defined?	
10	How often, and by whom, are staff competencies reviewed to ensure that the staff remain competent for safety significant roles and/or responsibilities?	
11	How is the competence of external supplier/contractor staff checked?	

	Areas for Consideration	Current Practice
12	What process is followed if it is determined that a member of staff is not fully competent for the safety significant role assigned?	
13	Does the competency management process address the improvement of currently competent staff (e.g. to ensure that staff are more than minimally competent and/or to prepare for future roles)?	

2.7 Supervision arrangements for early detection of deviations from intended practices or procedures that degrade safety.

	Areas for Consideration	Current Practice
1	How do the arrangements enable detection of deviations?	
2	Are those procedures and practices recorded?	
3	Is supervision proportionate to the safety criticality of the practice or procedure?	
4	Are practices and procedures that affect safety routinely monitored through audit?	
5	Can it be determined from the monitoring of safety significant incidents that these may be a result of deviation from intended practices or procedures?	
6	Is there a method for determining if a deviation from intended practices or procedures has a safety impact in other areas?	

2.8 Arrangements for monitoring any deterioration in performance of safety significant equipment or systems, if applicable.

	Areas for Consideration	Current Practice
1	Is there a method of determining if safety significant equipment meets the requirements?	
2	Who determines if the maintenance levels are appropriate?	
3	Are there formal records of performance of the safety significant equipment or systems?	

	Areas for Consideration	Current Practice
4	Does the monitoring of the records of safety significant incidents highlight where equipment or systems fail?	
5	Does the monitoring of the records of safety significant incidents highlight where any deterioration in equipment or systems has had an impact on that incident?	
6	Is there a method for determining if the deterioration in one area of safety significant equipment or systems has a safety impact on another area?	

2.9 Arrangements enabling staff to communicate significant safety concerns to the appropriate level of management for resolution.

	Areas for Consideration	Current Practice
1	Does a safety improvement process exist, in addition to the implementation of corrective action following safety significant occurrences or safety audits?	
2	What processes are in place enabling staff to raise safety concerns with senior management?	
3	How do senior management actively participate in the safety improvement programme?	
4	How, and by whom, are staff encouraged to offer safety improvement suggestions?	
5	How, and to whom, are staff to present their safety improvement suggestions?	
6	How, and by whom, are safety improvement suggestions investigated and, where appropriate, agreed?	
7	How, and by whom, are decisions/progress on their safety improvement suggestions fed back to the proposer?	

2.10 Arrangements to identify and address potential risks arising from changes in operations, systems, procedures and staff associated with safety significant functions or activities.

	Areas for Consideration	Current Practice
1	How, and by whom, are all proposed changes, (including additions, replacements and removals) to operations, procedures or equipment to be assessed to determine their safety significance with respect to aviation safety?	
2	How is the person (or group) accountable for safety assurance made aware of those operations or changes that have safety significance?	
3	How, and by whom, are safety assessments performed on all those aspects determined to have safety significance with respect to aviation?	
4	Does the safety assessment evaluate the severity of the consequences of the hazard, its probability of occurrence and its tolerability against safety criteria?	
5	Who decides if a hazard is tolerable or if further risk reduction is required?	
6	How, and by whom is any necessary risk reduction managed?	
7	How is the person ultimately accountable for safety made aware of any perceived intolerable risks arising from change?	