Research Report on Safety Management Systems

May 2007

DOT/FAA/AR-TN07/6

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U.S. Department of Transportation
Federal Aviation Administration

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Technical Report Documentation Page

1. Report No. DOT/FAA/AR-TN07/6	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle RESEARCH REPORT ON SAFETY MANAGEMENT SYSTEMS		5. Report Date May 2007	
		6. Performing Organization Code	
7. Author(s) Lynn Jensen, Stefan Keller, and Frederick J. Leonelli		8. Performing Organization Report No.	
9. Performing Organization Name and Address FJ Leonelli Group, Inc. Aviation Systems Consultants Waxhaw, NC 28173		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. GS-35F-4071H	
12. Sponsoring Agency Name and Address U.S. Department of Transportation Federal Aviation Administration Air Traffic Organization Operations Planning Office of Aviation Research and Development Washington, DC 20591		13. Type of Report and Period Covered December 2003- December 2004 Technical Note	
		14. Sponsoring Agency Code AFS-400	

15. Supplementary Notes
The Federal Aviation Administration Airport and Aircraft Safety R&D Division COTR was Kathy Fazen.

16. Abstract

The purpose of this project was to conduct research to determine the degree to which safety management systems have been implemented in a variety of aviation safety oversight systems outside the United States; to determine the basis and characteristics of those systems; and to what degree similarities and differences exist among those systems, as well as the nature of those differences and similarities.

17. Key Words Civil aviation safety, International Air Transport Association, Oversight, Quality assurance, Safety management systems, Safety oversight, Transport Canada	18. Distribution Statement This document is available to the U.S. public through the National Technical Information Services (NTIS), Springfield, Virginia 22161		
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 49	22. Price

Form DOT F 1700.7 (8-72)   Reproduction of completed page authorized

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LIST OF ACRONYMS

AC	Advisory Circular
AOC	Air Operator Certificates
ASRB	Air Safety Review Board
CAA	Civil Aviation Authority
CARAC	Canadian Aviation Regulation Advisory Committee
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
CEO	Chief Executive Officer
CSB	Corporate Safety Board
ERP	Emergency Response Plan
FAA	Federal Aviation Administration
HSE	Health, safety, and environment
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IOSA	IATA Operational Safety Audit
ISMS	Integrated Safety Management System
ISARP	Standards and Recommended Practices contained in the IATA IOSA Program
JAA	Joint Aviation Authority
JAR-OPS	JAA Joint Aviation Requirements-Operations
MOS	Manual of Standards
NPA	Notice of Proposed Amendment
QAS	Quality Assurance System
SAG	Safety Action Group
SMS	Safety Management Systems
SRG	Safety Regulation Group
TC	Transport Canada
UK	United Kingdom

EXECUTIVE SUMMARY

The purpose of this project was to conduct research to determine the degree to which safety management systems (SMS) have been implemented in a variety of aviation safety oversight systems outside the United States; to determine the basis and characteristics of those systems; and to what degree similarities and differences exist among those systems, as well as the nature of those differences and similarities.

The information presented in this report includes a summary, and a certain degree of analysis, of the SMS implementation guidance published by Transport Canada (TC), the Civil Aviation Authority (CAA) of the United Kingdom (UK), the Civil Aviation Safety Authority (CASA) of Australia, and the Joint Aviation Authorities (JAA).

In addition, some information is included about the SMS guidance and training provided by the International Air Transport Association (IATA) to member and nonmember airlines.

The research conducted was primarily a search, capture, and review of a variety of documentation, including the following activities:

- Internet searches for available government, U.S. and foreign, official publications and proposed and implemented regulations for SMS approaches.

- Literature searches for academic and other authoritative writing on SMS principles and implementation strategies.

- Review of some nonaviation application of SMS to see if there is relevant application information useful to aviation systems.

The research also included discussions with (1) representatives of TC and Air Canada about the plans, nature, and experience of the TC SMS implementation thus far, (2) representatives of the CASA and QANTAS Airlines about the Australian SMS development and implementation experience, and (3) representatives of the UK CAA about SMS policy and plans.

None of the regulatory authorities considered in this effort have fully implemented SMS as a requirement for the regulated entities for which they have oversight responsibilities. The CASA (Australia) has the most mature developing process with regulations in effect and a required transition framework in place.

The IATA approaches the matter of adequate SMS being implemented by member airlines through the framework of the IATA Operational Safety Audit program and conformity with the safety-related IATA Standards and Recommended Practices. IATA produces no other guidance in the SMS area, except for a training course of a general nature.

The SMS should be documented and kept in a form that is readily accessible to all members of an organization. The method of accessibility used by an operator will depend on the size and

complexity of the operation. All members of the organization should have ready access to the SMS. It should present information, procedures, or instructions in a way that can be clearly understood and followed by all personnel.

For larger operators, this will involve more detailed material, process, and procedures, including those of the operator's operations and maintenance manuals. Additionally, an SMS integrated into a larger operation is likely to involve more formalized processes than a smaller operator.

PURPOSE.

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METHODOLOGY.

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Discussions were likewise held at IATA to gain a perspective on the IATA approach in supporting the implementation of SMS.   IOSA is a key element of the IATA approach.

CURRENT STANDARDS AND SMS PRINCIPLES—TRANSPORT CANADA

In December 1999, TC published a strategic planning document entitled "Flight 2005: A Civil Aviation Safety Framework for Canada."   A major section of that plan addressed safety management, entitled "Safety Management: Implementing Safety Management Systems in Aviation Organizations." The text of that section is as follows:

"The aim here is to improve safety through proactive management rather than reactive compliance with regulatory requirements. As aviation organizations generally possess an in-depth knowledge of the risks inherent to their operations, they are well placed to manage them and achieve positive shifts in their safety culture. Transport Canada's role is to provide these organizations with information on the safety management concept and to facilitate its implementation. Instituting this concept will require specialists in different areas of the Civil Aviation program to interact with one another as well as their safety partners in the aviation community through small, informal multidisciplinary work teams. For those teams to be effective, an atmosphere of trust and respect will be paramount as the members bring their different disciplines, specialties and perspectives to the table, as will ready access to information and reliable communications technology."

A related section, "Human and Organizational Factors," takes into account the human and organizational factors in safety management practices and contains the following text:

"While individual human factors contribute to the majority of aviation accidents and incidents, and have received considerable attention, there is a growing realization that organizational factors can also create unsafe conditions. Civil Aviation needs to focus its attention on developing valid and practical means of evaluating strategic and operational decisions, work processes, organizational culture, communications and system design. Only by acquiring a broad understanding of these factors, their inter-relationships and the ways in which they influence human performance can Transport Canada promote their consideration in safety management practices."

The section titled "Achieving Results" is divided into two subsections:

1. Key Results is shown as follows:

   – Continued Improvement on the High Level of Aviation Safety in Canada
   – A High Level of Public Confidence in our Civil Aviation Program

2. Safety Indicators and Targets contains the following descriptive text:

"The indicators are uncomplicated; linked back to major components of the program; sensitive to changes in forces affecting the program; and, easily compared with data generated by internationally-recognized organizations (e.g. ICAO) and the principal aviation authorities. They have been derived from data sources within the Transportation Safety Board and Transport Canada. Where data were unavailable, specifically exposure data for Business and General Aviation, steps are underway to derive them.

The safety targets have been determined based on weighing what is desirable with what is realistic. These measures, which will be evaluated and reported on annually, are important for setting broad priorities for the Civil Aviation program as well as for measuring the performance of the program in contributing to our safety goals."

In support of the SMS goals of the Flight 2005 plan, TC staffs have been working to develop the regulatory requirements and guidance material for implementing SMS in the air operator sector. The guidance development takes into account certain, as described by TC, key generic features of the SMS approach.

As TC recognized, there was no definitive meaning attached to the term safety management system and that every organization and industry has its own interpretation of what it is. From the TC Civil Aviation perspective, there are five features that characterize an SMS:

- A comprehensive systematic approach to the management of aviation safety within the aircraft operating company, including the interfaces between the company and its suppliers, subcontractors, and business partners

- A principal focus on the hazards of the business and their effects upon those activities critical to safety

- The full integration of safety considerations into the business, via the application of management controls to all aspects of the business processes critical to safety

- The use of active monitoring and audit processes to validate that the necessary controls identified through the hazard management process are in place and to ensure continuing active commitment to safety

- The use of quality assurance principles, including improvement and feedback mechanisms

In searching for ways to enable the aforementioned features, according to TC, an organization may choose to use a commercial off-the-shelf system. While this might be appropriate for some companies, the program should be tailored to meet the requirements of the individual organization rather than assuming that one size fits all. Attention should also be given to the linkages between the individual components; which should be linked in a systematic way rather than appearing to be stand-alone units.

The TC guidance frames the system structure into six basic components: a safety management plan; documentation; safety oversight, including reactive and proactive processes; training; quality assurance; and emergency response plan. The components are described in the following sections.

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SAFETY MANAGEMENT PLAN.

An operator's safety management plan should contain three principle requirements:

- A definition of the fundamental approach a company will adopt for managing safety within their organization. This includes a safety policy that clearly defines what the company's philosophical approach to safety and the performance goals it has established for itself.

- Clearly defined roles and responsibilities for all personnel involved in safety

- A description of the safety management system components

DOCUMENTATION.

Up-to-date documentation is essential if the company is to operate in a safe and efficient manner in accordance with current aviation safety regulations, standards, and exemptions. For this reason, an operator's SMS must address the four following documentary requirements:

- The identification of applicable aviation safety regulations

- Consolidated documentation describing the systems for each component of the safety management system

- The implementation of changes to company documentation required by changes to aviation safety regulations, standards, and exemptions

- The maintenance of current, applicable, and effective documentation

SAFETY OVERSIGHT.

Safety oversight is fundamental to the safety management process. A principal tenet of safety management policies, principles, and procedures requires an organization to critically review its existing operations, proposed operational changes, and additions or replacements for their safety significance. This is achieved through two principal means:

- Reactive—Occurrence and hazard reporting
- Proactive—Safety assessments

TRAINING.

For employees to comply with all safety requirements, they need the appropriate information, skills, and training. To effectively accomplish this, the company should document the training requirements for each area of work within the company. The type of training to be offered is already mandated via regulation for certain positions in the company. This includes initial,

recurrent, and updated training requirements and, where required, training specific to the operation of the SMS. Documentation that the required training has been completed is an integral part of the requirement.

QUALITY ASSURANCE.

A quality assurance system (QAS) defines and establishes an organization's quality policy and objectives. It also allows an organization to document and implement the procedures needed to attain these goals. A properly implemented QAS ensures that procedures are carried out consistently, that problems can be identified and resolved, and that the organization can continuously review and improve its procedures, products, and services. It is a mechanism for maintaining and improving the quality of products or services so that they consistently meet or exceed the organization's implied or stated needs and fulfill their quality objectives. In an SMS, these elements are applied to an understanding of the human and organizational issues that can impact safety. In the same way that a QAS measures quality and monitors compliance, the same methods are used to measure safety within the organization. In the SMS context, this means quality assurance of the SMS, which in effect includes the entire operation.

An effective QAS should encompass the following elements:

- Well designed and documented procedures for product and process control
- Inspection and testing methods
- Monitoring of equipment including calibration and measurement
- Internal and external audits
- Monitoring of corrective and preventive action(s)
- The use of appropriate statistical analysis, when required

Quality assurance is based on the principle of the continuous improvement cycle. In much the same way that SMS facilitates continuous improvements in safety, quality assurance ensures process control and regulatory compliance through constant verification and upgrading of the system. These objectives are achieved through the application of similar tools: internal and independent audits, strict document controls, and ongoing monitoring of corrective actions.

EMERGENCY RESPONSE PLAN.

An air operator emergency response plan is an integral part of the SMS. It must contain the following items:

- Air operator policy
- Air operator mobilization and agencies notification
- Passenger and crew welfare
- Casualty and next of kin coordination
- Accident investigation on behalf of the air operator
- Air operator team's response to the accident site
- Preservation of evidence

- Media relations
- Claims and insurance procedures
- Airplane wreckage removal
- Emergency response training

PLANS AND CURRENT STATUS OF SMS IMPLEMENTATION.

The process of formally implementing SMS by TC is founded on regulations. The regulatory process includes, in sequence, a Notice of Proposed Amendment (NPA) being drafted by staff and accepted by a technical committee of the Canadian Aviation Regulation Advisory Committee (CARAC), approval of the NPA by the Justice Ministry, and approval of the NPA by the Parliament after two public readings.

The TC vision has been that SMS will be implemented in all regulated civil aviation organizations by 2007. Of course, SMS implementation depends on the date regulations come into force, and full implementation will be phased in over 3 years.

Some parts of the Canadian Aviation Regulations have had SMS NPA accepted by the respective CARAC technical committee, while others have not. Some have completed the Ministry of Justice review. The various initial NPAs were written by a variety of staff members working independently. Many issues of language and focus harmonization among those NPAs existed and needed to be resolved. In addition, there has been an ongoing, and yet unresolved, policy debate among TC staff as to the best approach to implementing the performance-based regulation, i.e., how much detail should be prescribed and to what degree the safety management function should be centralized versus focused in the operating organizational entities. Implementation should be completed by 2008.

Following the regulations coming into force, there are four phases of implementation, providing for a progressive system development: Initial Certification (Phase 1), One-Year Follow-up (Phase 2), Two-Year Follow-up (Phase 3), and Three-Year Follow-up (Phase 4). The phases will contain the following requirements:

PHASE 1: INITIAL CERTIFICATION. Within 3 months of the publication of the SMS regulation, initial certification requires that applicants provide TC with

- the name of the accountable executive.

- the name of person responsible for implementation.

- a statement of commitment to the implementation of SMS (signed by the accountable executive).

- documentation of gap analysis between the organization's existing system and the SMS regulatory requirements.

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- the organization's implementation project plan, based on the requirements of the exemption and the certificate holder's internal gap analysis.

PHASE 2: ONE-YEAR FOLLOW-UP. At 1 year, certificate holders will demonstrate that their system includes the following components:

- Documented safety management plan

- Documented policies and procedures relating to the required SMS components

- Process for reactive occurrence reporting with the associated supportive elements such as a method of collecting, storing, and distributing data, and a risk management process

PHASE 3: TWO-YEAR FOLLOW-UP. Two years after initial certification, the certificate holder will demonstrate that, in addition to the components already demonstrated during Phase 2, they also have a process for the proactive identification of hazards and associated methods of collecting, storing, and distributing data, and a risk management process. The required components are:

- Documented safety management plan
- Documented policies and procedures
- Process for reactive occurrence reporting
- Process for proactive identification of hazards

PHASE 4: THREE-YEAR FOLLOW-UP. One year following Phase 3, certificate holders will demonstrate that, in addition to the components already demonstrated during Phases 2 and 3, they have also addressed:

- Training
- Quality assurance
- Emergency preparedness

All the components demonstrated will be assessed by TC at each phase using the SMS Assessment Protocol.

SAFETY MANAGEMENT SYSTEM ASSESSMENT PROTOCOL.

The SMS Assessment Protocol looks at the six components described and their defined associated elements. For each element, there are expectations. These expectations define what the TC oversight organization expects to see or what it expects an organization to do regarding each specific element.

It is important that the expectations be verified using a set of relevant, predetermined, and well-designed questions. Each element is then scored from 1 to 5 using criteria specific to it.

The criteria work are as follows:

- A score of 1 is considered to be not documented and not implemented.

- A score of 3 is considered as meeting the minimum acceptable standard of assessment. A score of 3 in all criteria would indicate meeting the minimum requirements of the regulations.

- A score above 3 is considered to exceed the minimum acceptable standard of assessment.

- To achieve a score of 5 an organization will have to meet the regulatory requirements as well as demonstrate industry best practices at a very high level.

The implementation plan identifies what components are required at each phase. As SMSs are progressive in their development, the expectation is to see continuous improvement in the system.

AIR CANADA APPROACH

Notwithstanding that a regulatory requirement is not yet in place, Air Canada is proceeding with the development of an Integrated Safety Management System (ISMS). With that development, the Air Canada fulfillment of operational safety responsibilities will transition from a non-SMS, flight safety office-based approach to an SMS integrating all elements of corporate safety and quality concerns, along with the Standards and Recommended Practices of the IATA IOSA program.

Full development of the ISMS depends on the approach defined in any requirements of the TC regulations still to come. Air Canada prefers to implement a system and organization that is more centralized because of the advantages of efficiency and availability of resources, standardization, reduced training costs, and the ability to more widely affect the corporate safety culture that a centralized approach provides.

In the event that the TC requirements ultimately are that the full administration of the SMS is dispersed among all operational entities, Air Canada is prepared to implement a safety office function that will be able to provide expertise and safety and quality support services, such as risk and data analysis, internal auditing, and reports management, to the operational divisions, perhaps through a signed service-level agreement.

One of the key elements of the Air Canada ISMS is the Corporate Safety Board (CSB). The CSB participants include the chief safety officer, airports, cargo, maintenance and technical services, in-flight, flight operations (including dispatch), security, and other corporate branches, depending on specific agenda items to be addressed. The CSB meets at least quarterly.

The CSB standing areas of responsibility include the following:

- Review and approve company policies and standards related to safety and environment

- Assess unresolved safety or quality issues and determine accountability for actions

- Review company safety and environment performance based on established performance criteria/indices/targets, regulatory, and company policies and standards

- Establish company safety and quality objectives both qualitatively (developmental) and quantitatively (targets) on an annual basis, and review quarterly

- Review and develop corporate positions on proposed changes to legislation and regulations that could affect the company's ability to effectively manage responsibilities and obligations related to safety and environment

- Review and approve scientific studies/evaluations/investigations of employee health, safety and environmental problems, or issues as required

In developing the ISMS, the following are the core elements being addressed:

- Safety policy
- Safety goals and objectives
- Safety communication
- Safety awareness
- Safety as a core value
- Employee involvement
- Hazard identification
- Incident or accident investigation
- Emergency response
- Safety information
- Safety reporting system
- Risk management
- Quality assurance
- Documentation
- Industry safety information exchange

CURRENT STANDARDS AND SMS PRINCIPLES—AUSTRALIA-CASA

The focus on system safety concerns in the Australian aviation environment began in the mid-1990s with a series of accidents involving commercial operators operating light aircraft (roughly equivalent to Title 14 Code of Federal Regulations Part 135 operators), including a high-profile accident involving a government official. A Parliamentary inquiry led to the conclusion that commercial operators of small and medium aircraft needed to implement a system safety

approach for their operations. Part of the conclusion of the inquiry was that airline operators of large aircraft had some systems in place and required no further government focus.

The CASA was directed to develop an education program to implement the recommendations of the inquiry. The education program was developed, which led to the further development of a guidebook about how to introduce system safety into the operations of the target companies. Further study of the subject revealed a widely varied understanding among the aviation community of what the actual level of safety was, either industrywide or with respect to any given operator, and the Australian Transportation Safety Board had little data available to clarify the question.

The next step was to develop a baseline of the level of system safety that existed in the industry, which concluded in 2002 as the first phase of introducing system safety in the Australian aviation community. By that time, the conclusion had been reached that all commercial aviation operators should be subject to the requirements of the developing system.

Following the baseline phase, the CASA set out on an introductory phase to develop a widespread, common understanding of system safety in general and SMSs in particular. That introductory phase was conducted over a year's time, which included the publication of articles and presentations from many seminars.

The Civil Aviation Safety Regulations (CASR) Part 119—Air Operator Certification—Air Transport is the fundamental regulation requiring the implementation of an SMS in air carrier operations. The Manual of Standards (MOS) Part 119—Air Operator Certification—Air Transport is a CASA policy manual addressing SMS, and it contains specifications and standards prescribed by CASA, of uniform application, determined to be necessary for the safety of air navigation. In addition, CASA has published an Advisory Circular (AC) 119-270(1), Safety Management Systems, as guidance for the implementation of SMS.

As described in the CASA literature, an SMS is an integrated set of work practices, beliefs, and procedures for monitoring and improving the safety and health of all aspects of an operation. It recognizes the potential for errors and establishes robust defenses to ensure that errors do not result in incidents or accidents.

According to CASA, a successful SMS involves goal setting, planning, allocation of resources and time, documentation, and the measuring of performance against goals. Safety must be actively managed from the top of the company, and safety management must be seen as an integral aspect of business management.

In the CASA view, regardless of the size of the operation, all successful SMS will include (but are not limited to) four key elements:

- Top level management committed to safety
- Systems are in place to ensure hazards are reported in a timely manner
- Action is taken to manage risks

- The effects of safety actions are evaluated

As identified by the CASA, the primary benefit of introducing an SMS is to improve on existing levels of aviation safety. Apart from this obvious primary benefit, an SMS should assist an operator in

- marketing the safety standards of the organization.
- guarding against the direct and indirect costs of incidents and accidents.
- improving organization, communication, morale, and productivity.
- meeting legal responsibilities to manage safety.

Furthermore, according to CASA, an SMS is as important to business survival as a financial management system, and the implementation of an SMS should lead to achievement of one of aviation's key business goals: enhanced safety performance and moving beyond mere compliance with regulatory requirements.

CASA also specifically addresses the issue of the application of SMS implementation for smaller operators. Under CASR Part 119, all air transport operators are required to introduce an SMS. Smaller operators may feel that the introduction of SMS is a difficult exercise; however, according to CASA, an effective SMS can be implemented into any operation regardless of size and complexity of the operation. The key to a simple and successful SMS is to make it meaningful and to customize it to the individual organization. A customized SMS is easier to maintain and modify if required. There are significant advantages for smaller operators wanting to implement an SMS, these are identified as follows:

- The cost and effort required to set up an SMS is lower in smaller operations, because they employ fewer people, and it is much easier to create open lines of communication, a key component in any SMS.

- The greatest single barrier to success for smaller operators is the belief that it is too difficult. However, in the long term, it can be more difficult and dangerous not to set up an SMS.

A key to the CASA approach is that there are many ways to integrate an SMS into an operation. There may be some elements of an SMS in place already. It should incorporate all of the operator's activities undertaken in the organization's certificates. In general, the SMS requirements are compatible with quality management systems.

In the CASA guidance, operators are encouraged to structure their documented processes to achieve a fully integrated management system. An SMS should be consistent with the Civil Aviation Act 1988, Civil Aviation Regulations 1988, and CASR 1998, and the MOS Part 119 relating to SMS. Further, and most importantly, the SMS must be consistent with the operator's safety aims and policy, risk management objectives, and the operator's operations and maintenance manuals.

In understanding and implementing an SMS, the CASA believes four points must be made at the outset, to indicate that implementation of an SMS involves evolution rather than revolution. These points are as follows:

- Companies establishing an SMS need to take a pragmatic approach, building where possible on existing procedures and practices (particularly quality management). SMS identifies and prioritizes the use of resources to manage risk, and it should lead to gains in efficiency.

- A full-fledged SMS is a formalized, companywide system. Established at the corporate level, the SMS is decomposed 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.

- For small operators, only straightforward systems are required. They are often quick and effective to implement, yet the balance between formal (documented) and informal systems must be found.

- Where safety-sensitive functions of the operator are outsourced (e.g., maintenance, ground, and handling), contractual agreements should stipulate that the supplier should prove that it has an auditable SMS.

The CASA approach points out that 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.

Unless starting from scratch, it is not necessary, in the CASA thinking, to adhere to any particular sequence of actions. Many operators will find that their existing processes and procedures can be linked into the framework of a formal SMS. An SMS is a customized and structured system used by the operator to manage the safety of operations and personnel in an active and integrated manner.

Regardless of how an organization incorporates a system for managing safety, the CASA guidance suggests the consideration of each of the ten key steps that research has found to be essential to the success of SMS. The ten basic steps to establishing an SMS are:

- Gain senior management commitment
- Set safety management policies and objectives
- Appoint a safety officer (for large organizations)
- Set up a safety committee (usually only for large or complex organizations)
- Establish a process to manage risks
- Set up a reporting system to record hazards, risks, and actions taken
- Train and educate staff

- Audit your operation and investigate incidents and accidents
- Set up a system to control documentation and data
- Evaluate how the system is working

Putting these elements in place is the first stage in building an SMS. However, they will only be effective if they are integrated into operation and organizational culture.

CIVIL AVIATION SAFETY AUTHORITY GUIDANCE.

The CASA has put together the following material, which is consistent with CASR Part 119 and the standards contained in the MOS Part 119 chapter on SMS to provide guidance to operators on implementing an SMS. The material is divided into the following major subtopics.

OPERATOR'S SAFETY AIMS AND POLICY. The safety aims should state an intended safety outcome and may comprise long-term objectives and short- to medium-term objectives. The safety aims should

- be specific, measurable, achievable, and realistic, and
- have a specified and timely time frame within which they are to be achieved.

The safety policy should include a statement, in writing, that the chief executive officer (CEO) is committed to

- achieving and maintaining the operator's safety objectives.

- giving emphasis to the importance of a positive safety culture in the operator's organization.

- providing for a commitment to the establishment and review of the operator's safety objectives:

  – be communicated throughout the organization,
  – regularly reviewed to ensure that it remains appropriate for the organization

INTERNAL COMMUNICATIONS AND CONSULTATION. An SMS should provide for

- communication within the organization and
- consultation with people in the organization about the SMS.

Internal communication and consultation procedures should be appropriate to the size and complexity of the operators operations. The advantage for smaller operators in this regard is that communication and consultation is relatively straightforward, since people usually know each other well and discussions can be conducted in an informal manner on a regular basis.

An operator should establish and maintain information management procedures to ensure that all personnel have access to the sources of relevant information to enable them to carry out tasks effectively. Information management procedures can range from, but is not limited to, the distribution of safety-related literature, magazines, periodicals, textbooks, posters, videos, CDs, DVDs, and web-based information, informal discussions that are more appropriate to a smaller organization.

An SMS should provide for regular, adequately planned and resourced briefings about the SMS for all personnel in the organization. Briefings should include the following:

- The basic principles of the SMS and the way in which the system will function in the organization

- The importance of complying with the operator's safety policy and with the requirements of procedures that form part of the operator's safety management system

- The roles and responsibilities of personnel in achieving compliance with safety policy and procedures

MANAGEMENT OF RISK AND CHANGE. When establishing procedures for preventive action, the operator should include requirements for

- identifying potential accidents, serious incidents, or reported problems and their causes.
- implementing preventive action needed.
- recording results of action taken.
- reviewing preventive action taken.

An SMS should establish and maintain procedures for the management of risk and change for the operator's organization involving:

- Risk identification
- Risk analysis and assessment
- Risk management and minimization
- Reporting procedures

Each of these aspects is expanded upon in the following:

a. Risk Identification

Risk identification should involve a systematic process where organizational risks are identified, managed, and introduced in a manner that does not compromise the safety of aircraft operations. Organizational risks are to be determined individually by identifying the types and extent of any

- changes to operations authorized by the air operator certificates (AOC) or to the operator's organization.

- new internal or external influences.

b. Risk Analysis and Assessment

Risk analysis should include a determination of the severity of the consequences of each identified risk and the likelihood of its occurrence. Once reported, there must be an agreed way to analyze mistakes and events to reveal the underlying systemic and individual issues. Risk assessment should

- involve determining the priority of an identified risk.

- include an assessment of the defenses that exist to protect against the risk and the adequacy of those defenses.

c. Risk Management and Minimization

Risk management should include the establishment of appropriate procedures to eliminate or minimize a risk. Risk minimization should include:

- Providing and implementing solutions
- The development of procedures
- Personnel training

d. Reporting Procedures

Procedures for the identification, reporting, analysis, and management of identified safety improvements should be documented and implemented as part of the risk management procedures. Depending on the size and complexity of the operator's organization and the nature of the potential risk, an appropriate way of reporting could include one or more of the following:

- To the safety manager directly
- Through a safety committee
- Through a confidential reporting or suggestion box scheme

Smaller operators could be expected to undertake reporting in a less formal manner, such as staff meetings, where issues are discussed in an open manner. Whatever the approach, the aim is to document and record the actions taken to minimize future risks in the organization. The operator should establish and maintain procedures for analyzing data from internal and external sources using, if necessary, appropriate statistical techniques.

SAFETY MANAGEMENT REPORTING. An SMS should establish safety-structured improvement reporting procedures so that

- each operation is regularly reviewed to identify safety improvements, and

- each employee in the operator's organization has a duty to report, in writing and in an appropriate way, a potential safety risk of which he or she is aware.

The SMS reporting should provide for the operator's safety manager to reply in writing to an employee who has made a report. This reply should provide the action (if any) taken in response to the report. However, this should not apply if the report was made anonymously or otherwise in confidence.

Any information from the report that is made available to CASA may be done anonymously. Besides accepting reports in writing, a smaller operator may elect to accept oral reports (anonymously or otherwise).

ERROR AND NONCOMPLIANCE MANAGEMENT. An SMS should include error and noncompliance management procedures designed to reduce the frequency of errors and instances of noncompliance by

- identifying and analyzing the reasons for those errors and instances of noncompliance.

- providing training in human factors as required by CASR Parts 121A, 121B, or 133, as appropriate.

Further, no blame is to be attributed to a person for an error or instance of noncompliance in the absence of proof of the person's negligence, recklessness, or malicious intent.

TRAINING. The operator should ensure that new personnel are trained in the operation of the SMS during their initial training program. Personnel training about the organization's SMS may range from very structured formalized training using sophisticated materials and training aids to the less formal and more basic training sessions.

The style and type of training will depend upon the size and complexity of the operation. The aim is to ensure that all personnel are made aware of the importance of, and to obtain a commitment to, SMS throughout the organization.

CHANGE MANAGEMENT. The operator should establish and maintain procedures to ensure that the development process in designing and introducing any new service is adequately planned. The operational and safety requirements (including regulatory requirements) for a new service should be defined and documented. The operator should ensure that

- the results of the development process for a new service are reviewed at appropriate stages, and

- the results of the review are recorded.

(For an operator, a new service includes the introduction of a new route or the addition of a new type of aircraft to an existing route.)

INTERNAL AUDIT. An internal audit should include at least the following processes:

- A defined scope of the audit
- Planning and preparation
- Gathering and recording evidence
- Analysis of the evidence

The operator should consider the following methods for inclusion in an internal audit:

- A review of existing procedures relating to the operation being audited
- Interviews or discussions with personnel
- The witnessing of the activities involved in the operation being audited
- The examination of an adequate sample of records

An internal audit may be undertaken by one or more internal auditors. They may be employed or appointed by an operator on a full- or part-time basis. An internal auditor should have the relevant operational and maintenance experience to carry out an internal audit of an operation that is being audited and should have the appropriate responsibility and authority to do the following:

- Carry out internal audits

- Initiate and recommend solutions to concerns and findings through the operator's safety manager

- Verify the implementation of solutions within specified time frames

- Report directly to the safety manager

In determining the frequency of an internal audit of an operation, the internal audit procedures should take into account

- the importance of the operation to be audited.

- the frequency of significant changes to the organization, management, operation, relevant technology, or regulatory requirements.

The internal audit procedures should provide for unscheduled audits to be carried out when trends that indicate potential problems are identified. If an internal audit shows that procedures

relating to the audited operation can be improved, the operator should take steps to improve those procedures.

ACCIDENT AND INCIDENT RECORDING, REPORTING, AND INVESTIGATION. The objectives of the reporting scheme are to

- enable an assessment of the safety implications of each accident, or incident to be made, taking into account any previous similar occurrence, so that any necessary action can be taken.

- ensure that information gained through the investigation of accidents and incidents is disseminated so that other operators and their personnel, and other interested organizations, may improve the safety aspects of their operations.

The procedures established for the reporting scheme should be accessible to all personnel.

REMEDIAL, INVESTIGATIVE, AND CORRECTIVE ACTION. The operator should develop procedures to deal with the following:

- Remedial action: action required to be taken, in response to an audit finding, to remedy the immediate situation so that operations are brought within safe parameters, to enable the operations to continue until such time as corrective action(s) can be initiated.

- Investigative action: action required to be taken to investigate the accident, incident, or safety risk and to determine the causal factors.

- Corrective action: action required to address the root cause to ensure that the accident, serious incident, incident, or safety risk does not recur again.

- Preventive action: the action, resulting from internal processes to analyze data (from internal and external sources), to eliminate the causes of potential problems.

The operator should establish and maintain monitoring procedures to review corrective action and ensure that it is effective.

DOCUMENT AND RECORD CONTROL. For smaller operators, document and record control may be a simple process that ensures the adequate storage of records. Document control procedures should

- include methods for identifying the current issue of any safety-related document so that the currency of the document set to which it belongs can be determined.

- ensure that changes to any safety-related document are clearly identified within the document and are communicated to all personnel to whom the document applies.

The records may be stored in any form, (including an electronic form) and should be

- adequately filed and labeled.
- stored in a way that prevents loss or deterioration.
- readily accessible to an authorized officer.

The procedures should specify

- the period for which the records are required to be kept, and
- the means of their disposal.

A safety-related document that is not authorized, or is obsolete, should be

- clearly marked as not authorized, or as obsolete, or
- removed from the workplace to prevent its use.

If a safety-related document is updated, an archive copy of any superseded document should be stored, for at least 3 years, to maintain a historical record of updates.

SAFETY MANAGEMENT SYSTEM IMPROVEMENT AND PREVENTIVE ACTION. An SMS should be reviewed at least annually, through a combination of an annual strategic review, and more frequent tactical reviews, of the performance of the SMS. A strategic review conducted annually should focus on the performance and continuing suitability of

- the SMS,
- the safety policy, and
- the safety objectives.

This should be conducted in response to statistics prepared by the operator's safety manager, or the CEO for smaller operators, on the performance of the SMS, and to reports to the CEO by other key personnel.

A tactical review, conducted more frequently than the strategic review, should focus on the following:

- Ongoing progress of accident, serious incident and incident investigations, and subsequent actions

- Corrective and preventive actions in progress

- Risk management procedures, including safety improvement reporting

- Results of emergency planning exercises and subsequent actions

Each review should

- be an integral part of the operator's management meeting schedule.

- follow appropriate meeting protocols, including the taking of minutes, a review of previous minutes and action items, and the recording and assigning of action items.

The operator's CEO, together with the operator's other key personnel, should

- review the emergency response procedures on a regular basis and particularly after the occurrence of an accident, incident, or emergency situation and

- periodically test the procedures where practicable.

For the smaller operator, the above guidance may appear overwhelming, given that this material is aimed more at larger organizations. However, similar principles can be applied to smaller organizations, suitably modified to suit the size and complexity of the operator. The aim is simply to review the processes, identify areas of concern, rectify those areas, and minimize causes of potential accidents or incidents.

PLANS AND CURRENT STATUS OF SMS IMPLEMENTATION.

The CASR Part 119 amendment requiring SMS implementation for air operators was final and in place in April 2004. The rule went into full effect 1 year later, in April 2005, and there is a 3-year transition period.

Operators will be given an individual transition date when they will be expected to be recertified to the new regulations; considering at present, transition dates are planned to occur between April 2005 and April 2008. By the effective date of CASR Part 119, operators will receive a certificate authorizing continuance under the old regulations until their individual transition date.

A year before their transition date, operators will be sent an information pack that will contain a Gap Analysis form. This will specify the differences between the old and new regulations and have provision for a statement of how the operator intends to comply with the individual regulations.

Operators will then be asked to modify their procedures to comply with the new regulations. The completed Gap Analysis form, containing descriptions of the new procedures and systems, should be sent to their nominated CASA case manager.

The CASA case manager will review the documents and work with the operator to develop an agreed upon plan with timelines, deliverables, and goals, etc., to move the operator from the old certificate to the new.

Once an assessment of the proposed changes indicates that they are able to comply with CASR Part 119 and other relevant parts, the operator will be given a new AOC. Operators will receive guidance and support from their case manager throughout the transition period.

AUSTRALIAN STANDARDS FOR THE INTEGRATION OF SAFETY AND QUALITY MANAGEMENT SYSTEMS

The CASA has concluded that quality management systems and SMSs have about 70 percent commonality. They both must be planned and managed, because neither quality nor safety happens by chance. Both depend on measurement and monitoring, and both involve every function, process, and person. Both strive for continuous improvement.

During a CASA-sponsored workshop held in 2001, James Reason stated that safety management differs from quality management by focusing more on human and organizational factors, because those factors dominate risks in many ways. Safety management recognizes that human and organizational errors cannot be eliminated. SMSs set up processes to improve communication about hazards and errors and provide the basis to take action to minimize risks.

An important resource in the development of the integrated safety and quality management approach is the document "Guidance on Integrating the Requirements of Quality, Environment, and Health and Safety Management Systems Standards," published by Standards Australia. The publication outlines the benefits to the integration of those management systems to be the following:

- Rationalization of resources (avoiding duplication or triplication of resources)

- Enhanced corporate image

- Improved organizational performance (through elimination or reduction of accidents and incidents)

- Improved customer satisfaction (through better quality, safety, and environmental performance); reduction of complexity (minimized management system documentation, simpler implementation, easier for employees to refer to single, integrated procedures)

At the same time, the guidance describes some cautions about impediments to the integration of a safety and an environmental management system with an existing quality system, such as the vested interests that may exist to retain separate, independent systems, as well as some of the limitations that may exist when attempting to integrate elements into an existing quality system.

Notwithstanding the issues and limitations that may tend to inhibit integration, the publication goes on to outline the steps to integration, beginning with identifying the gaps that exist between what currently is in place and the desired system, identifying interim control measures, and planning and implementing the integrated system. Detailed guidance for system integration continues throughout the document.

QANTAS AIRLINES APPROACH

The parent corporate entity, QANTAS Group, consists of six flying business segments (subsidiary airlines, in effect) and a number of nonflying operations, e.g., maintenance, airports and catering, cargo handling, etc. While all the QANTAS Group business segments are responsible for safety and quality management within the respective segment, QANTAS Group Safety has responsibility for an overall SMS and for providing safety and quality management services for all business segments.

QANTAS Group Safety was in the process of developing the ISMS, and the target time frame for implementation was during early 2005. The ISMS is an integrated health, safety, and environment management system. The stated goal is that the integrated system will support the business segments in providing a safe place of work and safe and environmentally responsible business outcomes. Where quality systems are in place, they will be incorporated and integrated into the total system as well.

The objectives of the ISMS are stated as follows:

- To achieve a world class standard of health, safety, and environment (HSE)

- To define a consistent set of HSE management requirements throughout QANTAS that will support the implementation of the ISMS

- To enable a consistent approach to HSE management in QANTAS

- To seek continuous improvement in HSE performance

- To provide a consistent framework against which HSE management system performance can be recorded

- To provide auditable criteria against which the HSE management systems across QANTAS can be assessed

The QANTAS Group HSE policies and the ISMS are applicable to all employees, sites, and activities throughout QANTAS. The ISMS is designed in a hierarchical structure, where documents and systems must meet and support the requirements of those of higher levels, i.e., business segment work instructions must support business segment procedures that must support group standards and business segment systems, which support QANTAS Group HSE policy, and in turn, support the QANTAS Group Safety and Group Environment Charter.

The following are the 12 elements of the ISMS:

- Building leadership and commitment
- Policy, planning, and objectives
- Risk management

- Design
- Process management
- Skills and competence
- Supply and procurement
- Documentation and record management
- Programs
- Incident management and emergency preparedness
- Monitoring, analysis, and evaluation
- Audit

As of this report, the criteria and performance requirements have been developed for about half of the elements.

One of the important elements still under development is the element of monitoring, analysis, and evaluation, and that function will be multifaceted. There will be scheduled audits of all business segments. A system of leading indicators is being developed to trigger concerns that must be addressed outside regular auditing. Flight Operations Quality Assurance data will supply some indicators while others will be identified at a later date. In addition, a more subjective approach of a balanced score card is used, which is a system of direct, personal contact between the CEO and the business segment executives in which a variety of business performance objectives, including safety, are reported directly to the CEO.

Another important part of the ISMS is the Risk Management Executive Committee, which involves the business segment executives and group safety professionals collaborating in a process of day-to-day business and safety risk vulnerability review and mitigation. Also participating in that process is the Audit Risk Liaison Officers, essentially a nonflying business segment version of a safety officer. Every business segment is required to perform a monthly risk review, and the results of that review are reported on a standard form, the Monthly Risk Management Questionnaire.

CURRENT STANDARDS AND SMS PRINCIPLES—UK CAA

The UK CAA Safety Regulation Group (SRG) has published guidance in support of the requirements of the JAA Joint Aviation Requirements—Operations (JAR–OPS) requirement, which states that "an operator shall establish an accident prevention and flight safety program, which may be integrated with the Quality System, including programs to achieve and maintain risk awareness by all persons involved in operations." The JAR-OPS statement is based on the ICAO recommended practice (Annex 6, Part 1) for operators to have such a program in place. ICAO Doc 9422 (Accident Prevention Manual) gives appropriate guidance material and describes an SMS. The SRG guidance is primarily in two publications: CAP 712, Safety Management Systems for Commercial Air Transport Operations (April 2002), and CAP 726, Guidance for Developing and Auditing a Formal Safety Management System (March 2003).

In the guidance, full account is taken for 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. The guidance material concerns the principles of managing aviation safety, but many of the principles described also apply to occupational health and safety management.

The SRG material describes the benefit of an SMS as follows:

> "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."

The SRG cites two definitions related to SMS appropriate to commercial air transport operations as follows:

- 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.

- An SMS 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.

As pointed out by the SRG, an SMS can be compared to a financial management system as a method of systematically managing a vital business function, wherein financial targets are set, budgets are prepared, and 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 finance management. The adoption of an effective SMS 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.

According to the SRG material, a similar argument applies to a comparison with quality management, which should interface with safety management as part of the organization's core management system.

As a fundamental requirement of safety management, the SRG takes the position that success in a company's safety performance will be greatly strengthened by the existence of a positive safety culture. Safety culture in an organization 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 culture, 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, recognizing the company's high priority to safety. To that end, a demonstrable board-level commitment to an effective formal SMS must exist. Equally, every level of management must be given safety accountability. The contribution of the staff at and below supervisor level must be emphasized.

According to the SRG, four points must be made to indicate that implementation of an SMS involves evolution rather than revolution:

- Companies establishing an SMS need to take a pragmatic approach, building where possible on existing procedures and practices (particularly quality management). SMS identifies and prioritizes 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 full-fledged SMS is a formalized, companywide system. Established at the corporate level, the SMS policy is disseminated to 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.

There are three essential prerequisites for a SMS:

- A comprehensive corporate approach to safety
- An effective organization for delivering safety
- Systems to achieve safety oversight

Each of those prerequisites is further described in the following sections.

COMPREHENSIVE CORPORATE APPROACH TO SAFETY. An effective SMS will provide a means of achieving enhanced safety performance that 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 organization's Board of Directors and CEO. The Board of Directors 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 organization

- Documented business policies, principles, and practices in which safety is inherent

- Commitment to a safety oversight process that is independent of line management

- Regularly reviewed safety improvement plans

- Formal safety review processes

AN EFFECTIVE ORGANIZATION FOR DELIVERING SAFETY. The second essential prerequisite is for an organization that delivers safe standards by way of the following:

- 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

SYSTEMS TO ACHIEVE SAFETY OVERSIGHT. The following elements are desirable:

- A system for analyzing flight recorder data for the purpose of monitoring flight operations and for detecting unreported safety events

- A companywide system for the capture of written safety event/issue reports

- A planned and comprehensive safety audit review system that 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 organizational 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.

With respect to SMS implementation, the SRG suggests that to ensure its success, it is considered to be beneficial to approach the implementation process 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 organization for delivering safety
- Stage 3—Systems to achieve safety oversight

The important elements in each stage are elaborated upon in the following material.

COMPREHENSIVE CORPORATE APPROACH TO SAFETY.

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 organizational 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.

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. The Safety Manager must have a direct reporting line, on safety matters, to the CEO (the person who directs and controls the organization 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 fulfillment of his or her safety management task. The appointed Safety Manager would be expected to:

- Hold or have held a relevant license
- Have relevant operational or maintenance experience
- Have undertaken safety management and accident investigator training
- Have the respect of the organization

The Safety Manager would also need to draw on appropriate expertise from other disciplines as required. The Safety Manager must have clear responsibilities, such as:

- 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 (SAG) meetings

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

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 organizational 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 (diagram)

- The responsibilities of the Safety Review Board, the SAG, 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

Independent Safety Oversight Process. An independent oversight program is much like a quality assurance program, but is focused on the safe performance of the process under review rather than simple compliance. It is necessary for the staff doing the safety oversight to have an understanding of the process under review, ideally be qualified to carry out the function, while 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.

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.

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)) 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., SAG) and other safety-related tasks. The first body should be at top management level, the second would lie in the line manager's area.

- The ASRB is the company's highest-level internal safety-related meeting and should be chaired by the CEO (or a nonexecutive 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 programs are addressed. The Board is established to ensure that the objectives and specified actions in the Safety Plan are achieved in a timely manner. Consideration may be given to any issues that are blocking progress. The allocation of resources, commitment for new initiatives, and the establishment of a clear safety policy are issues that may also be resolved.

- 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.

AN EFFECTIVE ORGANIZATION FOR DELIVERING SAFETY.

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.

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 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.

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.

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.

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 to routinely confirm that operations are in compliance with these standards. This is normally done by the establishment of a safety audit program. It is the responsibility of the line manager to confirm that working practices comply with the appropriate requirement.

HAZARD ANALYSIS AND RISK ASSESSMENT TOOLS. There has been frequent mention 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 defenses to be developed and contingency plans to be produced and implemented.

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 and incident records from both internal and external sources. Hazard identification should be initially undertaken to provide a comprehensive assessment of the risks that a company faces. Subsequently, hazard identification should be periodically reviewed. The process should also be repeated whenever there is a significant change to the organization, its staff, procedures, or equipment.

The SAG should ensure that the line has considered and assessed all hazards to the organization. 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 a typical risk assessment matrix, those undertaking the risk assessments can prioritize the risks identified and, therefore, aid the line management to prioritize resources to mitigate their effects. However, an operator may prefer to undertake a more analytical, quantitative, objective approach. The chosen method must be clearly recorded in the SMS documentation.

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, or procedure. Such a risk must be recognized and any change managed in cooperation with the affected work areas.

ARRANGEMENTS FOR STAFF TO COMMUNICATE SIGNIFICANT SAFETY CONCERNS. While top down communication is very important on matters of safety, so too is communicating upwards to their supervisors and managers from those actually doing the job. 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.

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 an ERP and maintain a robust means of coordinating it with the main accident coordination procedures. The plan should assign responsibilities to specific individuals, provide emergency procedures, control the notification of outside agencies, nominate channels and centers of communication, and 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 staffs are adequately trained in the procedures that will be employed in the event of an accident or serious incident. Plans should be rehearsed regularly, both to familiarize staff and to reveal any problems. There should also be routine testing of emergency systems; all testing, training, and rehearsals should be recorded with action taken if deficiencies are identified during practices.

SYSTEMS TO ACHIEVE SAFETY OVERSIGHT.

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 programs, as part of an integrated SMS, can be used to confirm adherence to standard operating procedures. These data can be used to measure the effectiveness of training, identify risks, and monitoring the effectiveness of any remedial action. Analysis of the data should give the operator confidence in all aspects of his or her operation and also assure the regulator of the airline's safety standards and procedures.

WRITTEN SAFETY EVENT AND ISSUE REPORTS. The intention is to enhance an organization's knowledge of potentially hazardous situations. The use of existing reporting systems is to be encouraged, for example, air safety reports, flight reports, and maintenance error management systems. A record must be kept of all reports and their status.

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 and 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 SAG, the audit or 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.

CONDUCTING INTERNAL SAFETY INCIDENT INVESTIGATIONS AND IMPLEMENTING REMEDIAL ACTIONS. Companies must ensure that their staffs 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.

EFFECTIVE USE OF SAFETY DATA FOR PERFORMANCE ANALYSIS. The company should be able to show the method of operation of any safety data capture programs and the results of factual investigations that arise as a result of data analysis. 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.

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.

PERIODIC REVIEW OF THE SMS. 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.

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.

PLANS AND CURRENT STATUS OF SMS IMPLEMENTATION.

While much of the SMS material produced has become a standard for developing SMS around the world, the UK CAA has not developed any particular requirements or standards for implementing SMS by UK-regulated entities. There is apparently some implementation of SMS by UK air carriers, but any measure of effectiveness of safety or quality management systems is left to the individual judgment of the CAA surveyors (inspectors).

Specifically, it has been told that implementation of SMS will not be accepted unless a fully functioning quality management system is in place. Implementation of safety and quality

management systems are encouraged in the context of meeting the provisions of JAR OPS 1, published by the JAA.

CURRENT STANDARDS AND SMS PRINCIPLES—INTERNATIONAL AIR TRANSPORT ASSOCIATION

According to the IATA Director of Safety, the position of IATA with respect to the implementation and adequacy of an airline's SMS is tied directly to the airline's degree of conforming to the safety-related Standards and Recommended Practices contained in the IATA IOSA Program (ISARPs). If the airline conforms to the ISARPs, as shown by the satisfactory completion of an IOSA program audit, it has an adequate SMS, according to IATA.

The following are the safety ISARPs that are, in effect, the IATA standards on SMS:

- ORG 3.1.1—The Operator shall appoint a manager who has appropriate qualifications, significant authority, and independence from operational and line management activities to be responsible for the flight safety program.

- ORG 3.1.2—The Operator shall have a flight safety management plan that describes the philosophy, structure, responsibilities, resources, and processes in place to prevent accidents and achieve safe operations.

- ORG 3.1.3—The Operator shall have a process for setting safety goals as a means of establishing an indication of flight safety performance.

- ORG 3.2.1—The Operator shall have a process to ensure the capture and analysis of information that can be used to identify operational hazards.

- ORG 3.2.2—The Operator shall have a process for the investigation of aircraft accidents and serious incidents. The process shall include procedures for an interface with relevant government regulatory and investigative agencies, as well as other entities, including original equipment manufacturers.

- ORG 3.2.3—The Operator shall have a process for identifying and investigating internal events, occurrences, and irregularities that might be precursors to an accident or serious incident.

- ORG 3.2.4—The Operator shall have a process to ensure the implementation of action by appropriate operational managers to correct and prevent nonconformities that affect flight operations.

- ORG 3.2.5—The Operator shall have a process to ensure regular and periodic management reviews of significant and relevant safety issues arising from the accident prevention and flight safety program.

- ORG 3.2.6—The Operator shall have a safety reporting system that permits feedback from personnel regarding hazards and safety-related concerns, and includes analysis and action by management as appropriate to identify and address safety deficiencies.

- ORG 3.2.7—The Operator shall have a process to ensure dissemination of flight safety information to appropriate operational and other personnel to promote continuing education and interest.

- ORG 3.3.1—The Operator should have a formal program for hazard analysis and risk assessment that has the flexibility to focus on aspects of unacceptable risk specific to flight safety.

- ORG 3.3.2—The Operator should have a program for analyzing recorded flight data for the purpose of identifying hazards, evaluating the operating environment, validating operating criteria, and establishing training effectiveness.

- ORG 3.3.3—The Operator should have a program for gathering safety data through systematic observations of flight crew performance during normal line operations.

- ORG 3.3.4—The Operator should have a system of confidential human factors reporting and feedback for flight and cabin crew.

Part of the data gathering for this report included attending, in an auditing capacity, the IATA training course, "Implementing Safety Management Systems." The intent was to determine to what extent the training course, presented by the Worldwide Airline Trade Association, provided effective guidance to participants in establishing and maintaining an SMS for an airline.

In fact, the training course was quite general in that it covered safety management principles and provided some good background to higher level management in those principles. However, it lacked specific details applicable to a detailed design, implementation, and maintenance framework for a practical SMS for an airline.

<p align="center">CURRENT STANDARDS AND SMS PRINCIPLES—JAA</p>

There are two brief references to the area of safety management in the JAR-OPS:

- The JAR-OPS 1.037 Accident Prevention and Flight Safety Program

  "(a)   An operator shall establish an accident prevention and flight safety program, which may be integrated with the Quality System, including:

     (1)   Programs to achieve and maintain risk awareness by all persons involved in operations; and

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    (2) Evaluation of relevant information relating to accidents and incidents and the promulgation of related information."

- JAR-OPS 1.175 General Rules for AOC

  "(a) An applicant for an AOC, or variation of an AOC, shall allow the Authority to examine all safety aspects of the proposed organization.

    (1) Satisfy the authority that he is able to conduct safe operations"

Additional reference is made to ICAO Doc 9422 (Accident Prevention Manual) and ICAO Doc 9376 (Preparation of an Operating Manual).

Discussion with JAA staff indicated JAA plans to issue further guidance by reference to the SMS material developed by the UK CAA.

SUMMARY

The components of effective SMS are consistent, which includes:

- Accountability
- Safety policy
- Documentation
- Hazard identification and analysis
- Hazard tracking
- Safety-risk profile
- Change management
- Audit and evaluation
- Safety measurement
- Training and promotion
- Emergency response planning

There may be more or fewer elements listed, and some may have different titles, but the elements from system-to-system are quite consistent.

A common theme is that the most effective system is one built by enhancing a system, or building on the elements of a system, already in place to address operational safety.

There is consistent emphasis on a strong relationship between an SMS and the overall quality management system of an organization. SMS may be an extension of the quality system, or it may be an integral part, but at least there must be a strong interface between SMS and a broader quality management system.

From a regulator standpoint, while there are several SMS in various states of completion, none that have been addressed are fully implemented as regulatory requirements.

For the highest degree of consistent and fair implementation and oversight, the implementation of SMS should be based on a regulatory requirement.

<div align="center" style="color:blue">REFERENCE MATERIAL REVIEWED</div>

The following is a list showing reference material that was collected and reviewed for information related to this project. The information is categorized by country/region in which the version reviewed was published.

- Australia

    AC 119-165 (0), Safety Management Training

    AC 119-270 (1), Safety Management System

    CASA New Rules Transition information (Website)

    Flight Safety Australia, "In Search of Resilience," by James Reason

    Flight Safety Australia, "Safety Culture: The Ultimate Goal," by Patrick Hudson Flight

    Safety Australia, "Safe and Sound," by Merran Williams

    Flight Safety Australia, "Safety Management: Making it Happen," by Merran Williams

    Flight Safety Australia, "Practical Safety Management," by Bruce Byron

    Guidance on Integrating the Requirements of Quality, Environment, and Health and Safety Management System Standards (Standards Australia)

    Managing Error and System Safety (Presentation by James Reason)

    Manual of Standards, Part 119—Air Operator Certification—Air Transport (CASA-Draft)

    NPRM 0201OS: CASR Part 119—Air Operator Certification—Air Transport (CASA)

    Practical Safety Management (Presentation by Bruce Byron)

    Safety Management and Safety Culture: The Long and Winding Road (Presentation by Patrick Hudson)

    Safety Management System—What's in it for You? (CASA)

    Safety Management System—Getting Started (CASA)

Your Safety Management System—Is it Working? (CASA)

The Surveillance Procedures Manual and the Management System Model (CASA)

- Canada

  Air Canada ISMS Presentation

  Introduction to Safety Management Systems (Transport Canada)

  Safety Management Systems: Transport Canada's Implementation Plan (Presentation by Don Sherritt)

  Safety Management Systems for Flight Operations and Aircraft Maintenance Organizations: A Guide to Implementation (Transport Canada)

  SMS Assessment Protocol—Expectations (Transport Canada – Draft)

  SMS Assessment Protocol—Criteria (Transport Canada – Draft)

  Numerous Notices of Proposed Amendment to Canadian Aviation Regulations

- Hong Kong

  Safety Management of the Hong Kong Aviation System, Journal of ATC, July-September 2002

  Effectiveness of Safety Management Strategies on Safety Performance in Hong Kong, Construction Management and Economics, 1998

  Modeling of Safety Management Systems, Safety Science Volume 26, No. 1 and 2 1977

- Joint Aviation Authorities- Europe

  JAR-OPS 1
  JAR-145

- Netherlands

  NLR-CR-2003-316 Aviation Safety Management in Switzerland

- New Zealand

  AC 120-01A, Internal Quality Assurance
  AC 12-2, Incident Investigation

Civil Aviation Rules, Part 119, Air Operator—Certification
Quality Index Form 001

- United Kingdom

    CAP 642, Airside Safety Management
    CAP 712, Safety Management Systems for Commercial Air Transportation
    CAP 716 Aviation Maintenance Human Factors (www.caa.co.uk).
    CAP 726, Guidance for Developing and Auditing a Formal Safety Management System
    BSI-OHSAS 18002, Occupational Health and Safety Management Systems

- United States

    Federal Aviation Administration Safety Management System Manual (FAA, 2003)

    Pilot and Flight Instructor Risk Management Handbook (FAA-AFS, 2004)

    Air Force Instruction 90-901, "Operational Risk Management"

    Numerous Internet articles, presentations from the proceedings of the Risk Analysis and Safety Performance Measurement in Aviation 6th International Workshop, and presentations from the proceedings of the GAIN 7th World Conference

    AC 00-46, Aviation Safety Reporting System

    AC 00-58, Voluntary Disclosure Reporting Program

    AC 120-59, Air Carrier Internal Evaluation Programs

    AC 120-66, Aviation Safety Action Programs

    AC 120-79, Continuing Analysis and Surveillance System