SAFETY MANAGEMENT SYSTEM (SMS)

FRAMEWORK

For:

Safety Management System (SMS) Pilot Project Participants and Voluntary Implementation of SMS Programs

Federal Aviation Administration

Flight Standards Service - SMS Program Office

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AVIATION SERVICE PROVIDER SAFETY MANAGEMENT SYSTEM (SMS) FRAMEWORK

INTRODUCTION AND BACKGROUND

A key objective of the Office of the Associate Administrator for Aviation Safety (AVS) and the Flight Standards Service (AFS) is to produce expectations, guidance, and tools that allow many types of aviation organizations to develop and implement Safety Management Systems (SMSs) throughout their organizations. Since many organizations must interact with more than one regulator, AVS and AFS want to minimize the need for more than one management system.

AFS originally developed and published a set of SMS process requirements in Appendix 1 to Advisory Circular (AC) 120-92. That early SMS framework was considered essential for an aviation organization to develop and implement an effective, comprehensive SMS. As AVS and AFS work closely with U.S. aviation organizations, foreign authorities and businesses that have FAA-issued certificates, and other authorizations, AFS has revised and reorganized this SMS Framework to address four important needs:

1. To provide industry aviation organizations with one standard set of concepts, documents, and tools for the voluntary (i.e., the absence of a SMS rule) development and implementation of Safety Management Systems (SMSs);
2. To make SMS implementation standards agree with AVS Policy in FAA Order VS 8000.367, Appendix B;
3. To make Flight Standards (AFS) documents and tools align with the structure and format of the International Civil Aviation Organization *(*ICAO) SMS framework; and
4. To make new documents and tools that are internally mapped in a manner that is easier to use than the first generation of tools.

AFS has restructured this SMS Framework to align with FAA Order VS 8000.367 and the ICAO Framework:

1. The expectations in this document are not different from the original, except for minor changes in the titles and text, which were needed to align with the requirements in FAA Order VS 8000.367.
2. The expectations have been restructured to align with the ICAO Framework. For this reason, some text has been moved from where it was originally found.

To make this document clearer, we have defined *components*, *elements*, and *processes* in terms of *functional expectations*, or how and organization would need to use them in order to contribute to a robust SMS. We further define these *functional expectations* in terms of *performance objectives* – what the process needs to *do* – and *design expectations* – what to develop – to better align with current System Safety and Air Transportation Oversight System (ATOS) models.

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1. PURPOSE. This Framework provides guidance for SMS development by aviation service providers. It contains a uniform set of expectations that align with the structure and format of the International Civil Aviation Organization *(*ICAO) Framework; and AVS policy in FAA Order VS 8000.367, Aviation Safety (AVS) Safety Management System Requirements, appendix B.

2. APPLICABILITY.

a. Developing an SMS. This SMS Framework applies to both certificated and non-certificated aviation service providers (and organizations) that desire to develop and implement a SMS. **This Framework is not mandatory and does not constitute a regulation.** Development and implementation of a SMS is voluntary. While the Federal Aviation Administration (FAA) encourages each aviation service provider to develop and implement a SMS, these systems are not substitutes for compliance with Federal regulations and all other certificate requirements, where applicable. However, for aviation service providers that voluntarily implement a SMS, the FAA views the objectives and expectations in this Framework to be the minimum for a comprehensive and robust SMS.

Note: Within the context of this document, the term "*aviation service provider*" refers to any organization providing aviation services. The term includes certificated and non-certificated aviation organizations, aviation service providers, air carriers, airlines, maintenance repair organizations, air taxi operators, single pilot operators, corporate flight departments, repair stations, pilot schools, approved training organizations that are exposed to safety risks during the provision of their services, and organizations responsible for type design and/or the manufacture of aircraft. The term *aviation service provider is* interchangeable with the term o*rganization* and *service provider* within this document.

b. This SMS Framework is a functional expectations document. This document stresses *what* the organization must do to implement a robust SMS rather than *how* it will be accomplished. At the same time, the SMS Framework needs to be applicable to a wide variety of types and sizes of service providers. Therefore, by design, it is scalable and allows service providers to integrate safety management practices into their unique business models.

3. RELATED READING MATERIAL. The following references may be of value to users of this SMS FRAMEWORK, as they develop their SMS:

a. Annex 6 to the Convention on International Civil Aviation, *Operation of Aircraft.*

b. International Civil Aviation Organization (ICAO) Document 9859, *ICAO Safety Management Manual* (SMM, Second Edition).

c. FAA Order 8000.369, *Safety Management System Guidance.*

d. FAA Order VS 8000.367, *Aviation Safety (AVS) Safety Management System Requirements.*

e. AC 120-59A, *Air Carrier Internal Evaluation Programs (IEP).*

f. AC 120-66B, *Aviation Safety Action Programs (ASAP).*

g. AC 120-79, *Developing and Implementing a Continuing Analysis and Surveillance System (CASS).*

h. AC 120-82, *Flight Operational Quality Assurance (FOQA).*

4. BACKGROUND. The modern aviation system is characterized by increasingly diverse and complex networks of business/governmental organizations as well as increasingly advanced aircraft and equipment. The rapidly changing aviation operational environment requires these organizations to adapt continuously to maintain their viability and relevance.

a. SMS and System Safety. Systems are integrated networks of people and other resources performing activities that accomplish some mission or goal in a prescribed environment. Management of the system's activities involves planning, organizing, directing, and controlling these assets toward the organization's goals. Several important characteristics of systems and their underlying process are known as process attributes or safety attributes[1] when they are applied to safety related operational and support processes. These process attributes must have safety requirements built in to their design if they are to result in improved safety outcomes. The attributes include:

(1) *Responsibility* and *Authority* for accomplishment of required activities,

(2) *Procedures* to provide clear instructions for the members of the organization to follow,

(3) *Controls* which provide organizational and supervisory controls on the activities involved in processes to ensure they produce the correct outputs,

(4) *Process Measures* of both the processes and their products, and

(5) *Interfaces* are a critical aspect of system management; recognizing the important interrelationships between processes and activities within the organization as well as with contractors, vendors, customers, and other organizations with which the organization does business.

b. Safety Culture: The Human Aspect of Organizations. "An organization's culture consists of its values, beliefs, legends, rituals, mission goals, performance measures, and sense of responsibility to its employees, customers, and the community.[2]" The principles or attributes discussed above, that make up the SMS functions, will not achieve their goals unless the people that comprise the organization function together in a manner that promotes safe operations.

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[1] The six system characteristics, *responsibility, authority, procedures, controls, process measures*, and *interfaces*, are called safety attributes in the Federal Aviation Administration's Air Transportation Oversight System (ATOS).

[2] Manuele, Fred A. On the Practice of Safety. John Wiley & Sons, 2003, Hoboken, NJ.

The organizational aspect relating to safety is called the *safety culture*. The safety culture consists of psychological (how people think and feel), behavioral (how people and groups act and perform), and organizational or systematic (the programs, procedures, and organization of the enterprise) elements. The organizational/systematic elements are the things that are most under management control, the other two elements being outcomes of those efforts and other influences. For this reason, this SMS Framework includes requirements for policies that will provide the structure for the SMS and requirements for organizational functions. These functions include an effective employee safety reporting system and clear lines of communication both up and down the organizational chain regarding safety matters.

5. THE SMS FRAMEWORK: INTRODUCTION.

a. The Need for Safety Management Systems.

(1) FAA Standardization. The FAA Associate Administrator for Aviation Safety is keenly interested in developing an integrated functional SMS in which business and governmental roles and relationships are well defined, expectations include sound systems engineering and system safety principles, and both regulators and regulated industries participate in a unified safety effort. This SMS Framework provides the functional requirements to that end (development of aviation service provider's SMS).

(2) ICAO SMS Requirements and the FAA. The International Civil Aviation Organization, in a recent set of documents, manuals, and amendments[3] for key annexes to the ICAO Conventions, has revamped its standards and recommended practices to reflect a systems approach to safety management. This coincides with the FAA's move toward a systems approach for oversight over the past several years. Because of the many diverse relationships between organizations and the above stated global nature of the aviation system, it is critical that the functions of a SMS be standardized to the point that there is a common recognition of the meaning of SMS among all concerned, both domestically and internationally. Amendment 33 to ICAO Annex 6, excerpt below, introduced a 12 element SMS Framework. The FAA SMS Framework aligns with the ICAO SMS Framework; however the FAA Framework provides additional details to facilitate a service provider's implementation of a SMS.

ICAO Annex 6, Appendix 7, Framework for Safety Management Systems

1. Safety policy and objectives
   - 1.1 – Management commitment and responsibility
   - 1.2 – Safety accountabilities
   - 1.3 – Appointment of key safety personnel
   - 1.4 – Coordination of emergency response planning
   - 1.5 – SMS documentation
2. Safety risk management

[3] International Civil Aviation Organization (ICAO) Document 9734, Safety Oversight Manual; ICAO Document 9859, Safety Management Manual, 2nd Edition, 2009; and ICAO Annex 6, part 1 International Commercial Air Transport – Aeroplanes with Amendment 33.

2.1 – Hazard identification
2.2 – Safety risk assessment and mitigation
3. Safety assurance
3.1 – Safety performance monitoring and measurement
3.2 – The management of change
3.3 – Continuous improvement of the SMS
4. Safety promotion
4.1 – Training and education
4.2 – Safety communication

(3) Functional Expectations. The FAA SMS Framework is designed to provide definitive functional requirements that are compatible with auditing by the organization's own personnel, regulators, or other third-party consultants. For this reason, the SMS Framework is described in a requirements-oriented tone. These requirements are expressed as objectives and expectations that are necessary for a functional, comprehensive and robust SMS. To the maximum extent possible, each indexed statement defines a single expectation so that system auditors can easily use the Framework.

b. Process Approach. As stated above, the FAA SMS Framework is written as a functional expectations document. It stresses *what* the organization must do rather than *how* it will be accomplished. This is important to the FAA and service providers alike. The FAA feels that each of the SMS processes detailed in the SMS Framework is essential for a comprehensive SMS. At the same time, the SMS Framework needs to be applicable to a wide variety of types and sizes of service providers. This was a reason for using a similar scope, scale, and language to the International Organization for Standardization (ISO) standards, which also are designed for broad application. Therefore, design of the SMS Framework is scalable and allows service providers to integrate safety management practices into their unique business models. **Service providers are not expected to configure their systems in the format of the SMS Framework or to duplicate existing programs that accomplish the same function.** The SMS Framework attempts to strike a balance between flexibility of implementation and standardization of essential safety management processes.

c. Scalability. The SMS functions do not need to be extensive or complex to be effective. Smaller organizations may use a paper log to document safety issues and a paper system or simple spreadsheet or word processor files to track them to resolution.

Internal Evaluation and Management Reviews may consist of periodic conferences between business owners or top management and other employees to review information and track progress toward resolution. This can be done whether the organization operates under 14 CFR part 91, 121, 133, 135, public use, etc. A larger organization may need more sophisticated resources such as web-based data systems and trained safety personnel to manage the nuts and bolts and a more formal committee system to accomplish the same functions. While sophisticated process development tools and methods are available, simple brainstorming sessions with managers, supervisors, and other employees are often the most effective. In smaller organizations, the President, CEO or owner may elect to conduct internal audits and internal evaluation functions themselves, in conjunction with the management review function.

Likewise, in very small organizations the owner/operator may elect to conduct internal audits, continuous monitoring, document reviews, safety risk analysis/assessment and training review either personally or in conjunction with co-owners, managers, supervisors or employees.

6. FOUR COMPONENTS (PILLARS) OF SAFETY MANAGEMENT. The SMS Framework is organized around four basic building blocks of safety management. These four components or *pillars* are essential for a safety-oriented management system. They come directly from the SMS principles discussed earlier.

a. Policy. All management systems must define policies, procedures, and organizational structures to accomplish their goals. Component 1.0 in the SMS Framework outlines expectations for these elements, which in turn provide the foundations for SMS functional elements.

b. Safety Risk Management (SRM). A formal system of hazard identification and SRM (Component 2.0) is essential in controlling risk to acceptable levels. The SRM function of the SMS is based upon the system safety process model and is used in the System Safety Training Course, Air Transportation Oversight System (ATOS) Course, and SMS Course that are taught at the FAA Academy.

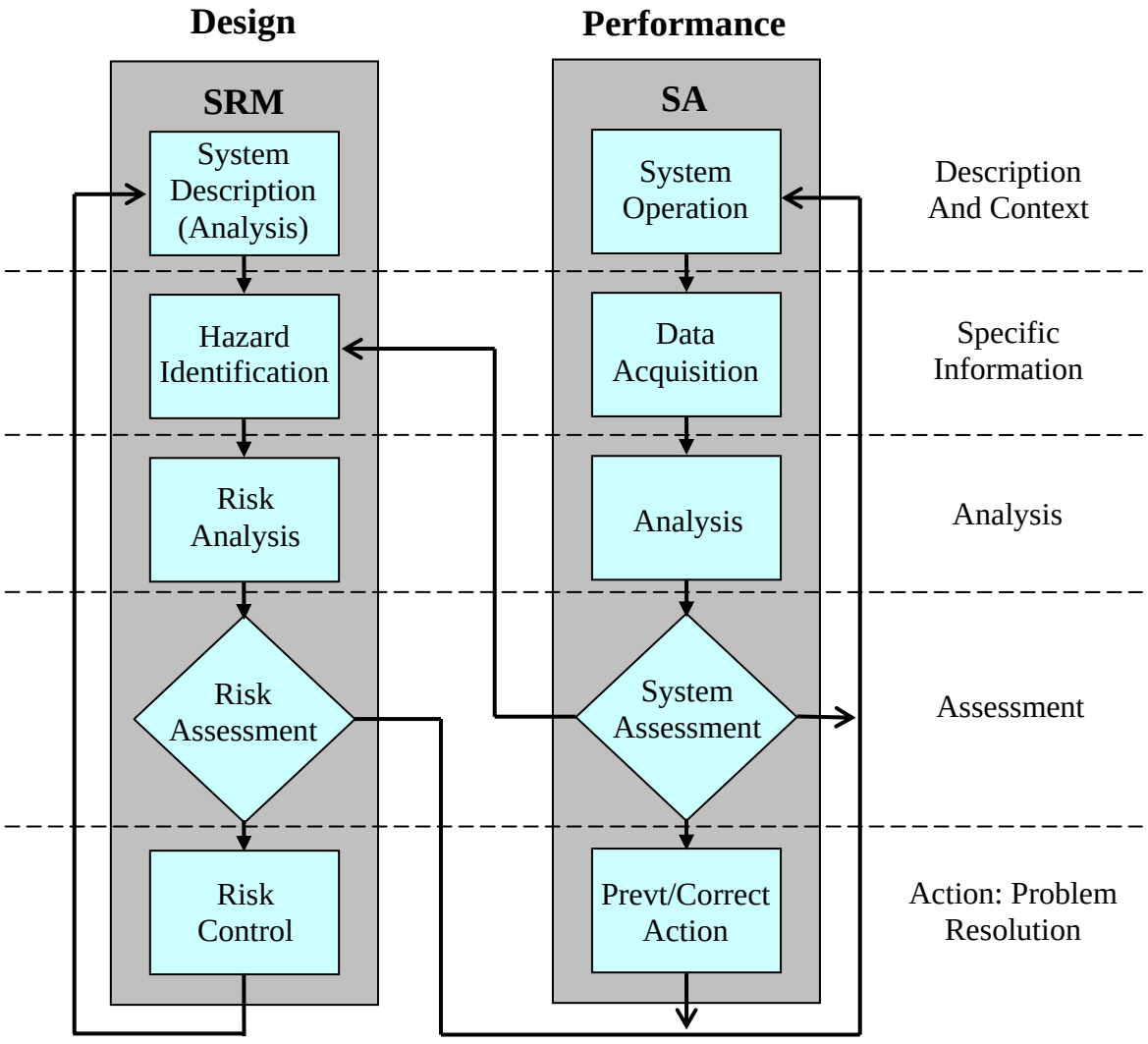
c. Safety Assurance (SA). Once SRM controls (sometimes termed *mitigations*) are identified and employed, the service provider must ensure the controls continue to be effective in a changing environment. The SA function (Component 3.0) provides for this, using system safety and quality management concepts and processes.

d. Safety Promotion. Finally, the service provider must promote safety as a core value with practices that support a sound safety culture. Component 4,0 provides guidance for setting up these functions.

Integration of SRM and SA. Figure 1, shows how the SRM and SA functions relate to one another. The SRM function (design) provides for initial identification of hazards and assessment of risk. Organizational risk controls are developed and, once determined to be capable of bringing the risk to an acceptable level, are employed operationally. The SA function (performance) takes over at this point to ensure that the risk controls are practiced and they continue to achieve their intended objectives. The SA function also provides for assessment of the need for new controls because of changes in the operational environment.

FIGURE 1

SAFETY RISK MANAGEMENT (SRM) AND SAFETY ASSURANCE (SA) PROCESSES



7. THE SMS FRAMEWORK.

a. General Organization of the SMS Framework. The SMS Framework aligns with the structure and format of ICAO Annex 6 to the Convention on International Civil Aviation, *Operation of Aircraft* and the ICAO Framework contained in Document 9859, Chapter 8; incorporates the requirements of FAA Order VS 8000.367 and follows the principles of a Quality Management System (QMS) in accordance with ISO Standards. The first part of the SMS functional expectations follows the general organization of ISO 9001-2008 and ISO 14001. The first three sections describe scope and applicability, references, and definitions. The fourth section addresses each of the four components of SMS, as described below. Each component is

further defined in terms of elements and processes, each containing respective performance objectives and design expectations:

(1) *Performance Objectives* are the desired outcomes of the particular element or process under evaluation.

(2) *Design Expectations* are the characteristics of the element or process that, if properly implemented, should provide the outcomes identified in the performance objectives.

b. POLICY: Setting the Foundation (Appendix 1, Component 1.0).

(1) Importance of Top Management Involvement. (Appendix 1, Component 1.0, Element 1.1 & 1.2) The SMS Framework specifies that top management has the primary responsibility for safety management. Managers must plan, organize, direct, and control employees' activities and allocate resources to make safety controls effective. A key factor in both quality and safety management is top management's personal and material involvement in quality and safety activities. The SMS Framework also states that top management must clearly delineate safety responsibilities throughout the organization. While it is true that top management must take overall responsibility for safe operations, it is also true that all members of the organization must know their responsibilities and be both empowered and involved with respect to safety.

(2) Roles, Responsibilities, and Relationships: The Three Rs of Safety Management. There is a relationship between the *productive* processes of the aviation service provider as well as the joint *protective* processes of the regulator (FAA oversight) and the aviation service provider's SMS (SMS Safety Assurance). On the *production* side, the aviation service provider has a role to provide a useful service or product. On the *protection* side (aviation service provider's SMS), they have a role to provide a ***safe*** service or product. The FAA's oversight role is to assure that the aviation service provider lives up to it's statutory safety responsibilities. One of the principal roles of the oversight system is to establish risk controls in the form of regulations, standards, and policies. It follows that regulatory compliance that accomplishes the regulations' safety objectives, is also part of the aviation service provider's role in safety management. It is the objective of the SMS concept to combine system safety based oversight systems and aviation service provider's SMSs into a cooperative, professional relationship, within the context of the above roles.

(3) Procedures and Controls. (Appendix 1, Component 1.0) Two key attributes of systems are procedures and controls. Policies are translated into procedures in order for them to be applied. Organizational controls must be in place to ensure that critical steps are accomplished as designed. Organizations must develop, document, and maintain procedures to carry out their safety policies and objectives. Moreover, supervisory controls must be used to monitor the accomplishment of the procedures and ensure that employees understand their safety roles.

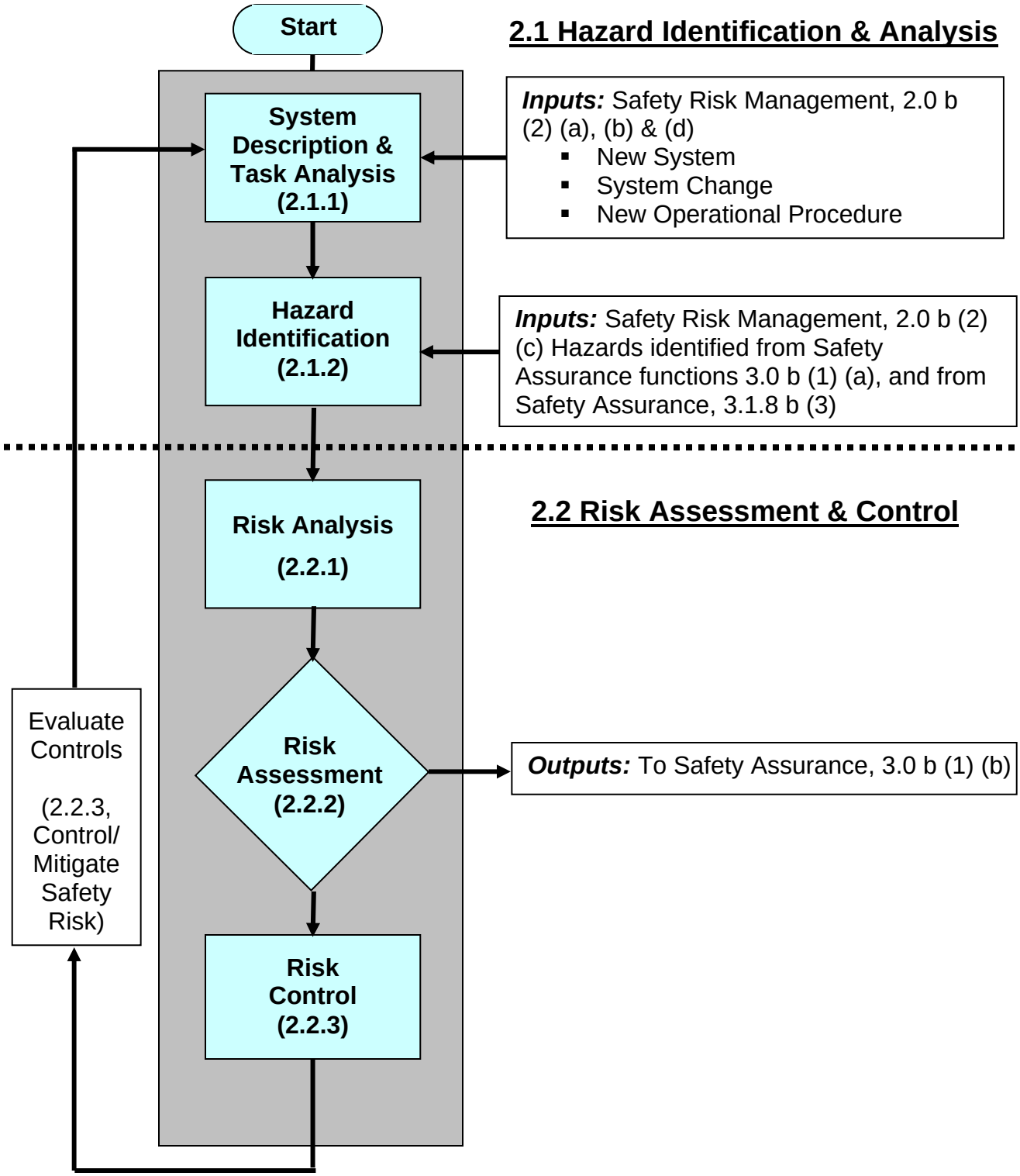
(4) Safety and Quality: Striking a Balance. (Appendix 1, Component 1.0) As discussed above, the SMS Framework uses quality management principles, but it is the expectation that aviation service providers will manage their operation based on an objective assessment of safety risk, rather than customer satisfaction with products or other conventional commercial goals.

Management of process quality, with emphasis on characteristics of those processes that affect safety, is an important aspect of safety management. The SMS Framework specifies that the aviation service provider should prescribe both safety and quality policies. The coverage of quality policies is limited in scope to quality in support of safety, although aviation service providers are encouraged to integrate their management systems as much as feasible. Safety objectives should be predominant where conflicts are identified.

c. SAFETY RISK MANAGEMENT (SRM). Setting Expectations for Safety Management (Appendix 1, Component 2.0). Employ the SRM process to examine the operational functions of the organization and their operational environment to identify hazards and to analyze associated risk. The intent of the SRM process is to focus on the areas of greatest risk from a safety perspective, taking into account complexity, operational scope, etc.

Note: The SRM flow diagram (Figure 2, on the following page) includes the SMS Framework element/process numbers and other notes to help the reader visualize the SMS Framework in terms of a process flow (with interfaces, i.e., inputs and outputs), and understand the component/element/process expectations.

FIGURE 2. SAFETY RISK MANAGEMENT (SRM) PROCESS FLOW



(1) System Description and Task Analysis. (Appendix 1, Process 2.1.1) SRM begins with system design. This is true whether the system in question is a physical system, such as an aircraft, or an organizational system such as an air operator, maintenance, or training establishment. These systems consist of the organizational structures, processes, and procedures, as well as the people, equipment, and facilities used to accomplish the organization's mission.

The system or task descriptions should completely explain the interactions among the organization (facilities, hardware, software, people, etc.) and environment that make up the system in sufficient detail to identify hazards and perform risk analyses. No particular format is required for system documentation. System documentation would normally include the aviation service provider's manual system,[4] checklists, organizational charts, and personnel position descriptions. A suggested functional breakdown of operational and support processes for air aviation service providers includes:

(a) Flight operations;

(b) Dispatch/Flight following;

(c) Maintenance and inspection;

(d) Cabin safety;

(e) Ground handling and servicing

(f) Cargo handling; and

(g) Training.

Note: Long and excessively detailed system or task descriptions are not necessary, provided they are sufficiently detailed to perform hazard and risk analyses.

(2) Hazard Identification. (Appendix 1, Process 2.1.2) Hazards in the system and its operating environment must be identified, documented, and controlled. It also requires that the analysis process used to define hazards consider all components of the system, based on the system description detailed above. The key question to ask during analysis of the system and its operation is *what if?* As with system and task descriptions, judgment is required to determine the adequate level of detail. While identification of every conceivable hazard would be unlikely, aviation service providers are expected to exercise due diligence in identifying significant and reasonably foreseeable hazards related to their operations.

(3) Risk Analysis and Assessment. (Appendix 1, Process 2.2.1 & 2.2.2) The risk analysis and risk assessment components of the SMS Framework use a conventional breakdown of risk by its two components: likelihood of occurrence of an injurious mishap and severity of the mishap related to an identified hazard, should it occur. A common tool for risk decision-

[4] While Safety Management Systems (SMS) manuals are not required, aviation service providers and agencies may find them to be a practical means of documenting their policies and procedures.

making and acceptance is a risk matrix similar to those in the U.S. Military Standard (MIL STD 882) and the ICAO Safety Management Manual[5] (SMM). Appendix 3 shows a model of the SMM and discussion of safety risk matrices. Aviation service providers should develop a matrix that best represents their operational environment. A separate matrix with different risk acceptance criteria may also be developed for long-term versus short-term operations.

(4) Controlling Risk. (Appendix 1, Process 2.2.3) After hazards and risk are fully understood though the preceding steps, risk controls must be designed and implemented. These may be additional or changed procedures, new supervisory controls, addition of organizational hardware, or software aids, changes to training, additional, or modified equipment, changes to staffing arrangements, or any of a number of other system changes.

(a) Residual and Substitute Risk. (Appendix 1, Process 2.2.3) Residual risk is the risk remaining after mitigation has been completed. Often this is a multi-step process, continuing until risk has been mitigated down to an acceptable level necessary to put the system/process into operation (or continue operation). It is seldom possible to entirely eliminate risk, even when highly effective controls are used. After these controls are designed but before the system is placed back in operation, an assessment must be made of whether the controls are likely to be effective and/or if they introduce new hazards to the system. The latter condition, introduction of new hazards, is referred to as substitute risk, a situation where the cure is worse than the disease. The loop seen in Figure 2 that returns back to the top of the diagram depicts the use of the preceding systems analysis, hazard identification, risk analysis, and risk assessment processes to determine if the modified system is acceptable.

(b) System Operation. (Appendix 1, Process 2.2.3) When the controls are acceptable, the system is placed into operation. The next process, Safety Assurance, uses auditing, analysis, and review systems that are familiar from similar quality management systems. These processes are used to monitor the risk controls to ensure they continue to be implemented as designed and continue to be effective in a changing operational environment.

d. SAFETY ASSURANCE (SA): Managing the Expectations (Appendix 1, Component 3.0). Black's Law Dictionary, a popular legal reference, defines *assurance* as *something that gives confidence*. Therefore, SA might be defined as activities designed to gain confidence that risk controls established during SRM (Appendix 1, Component 2.0) continue to be effective.

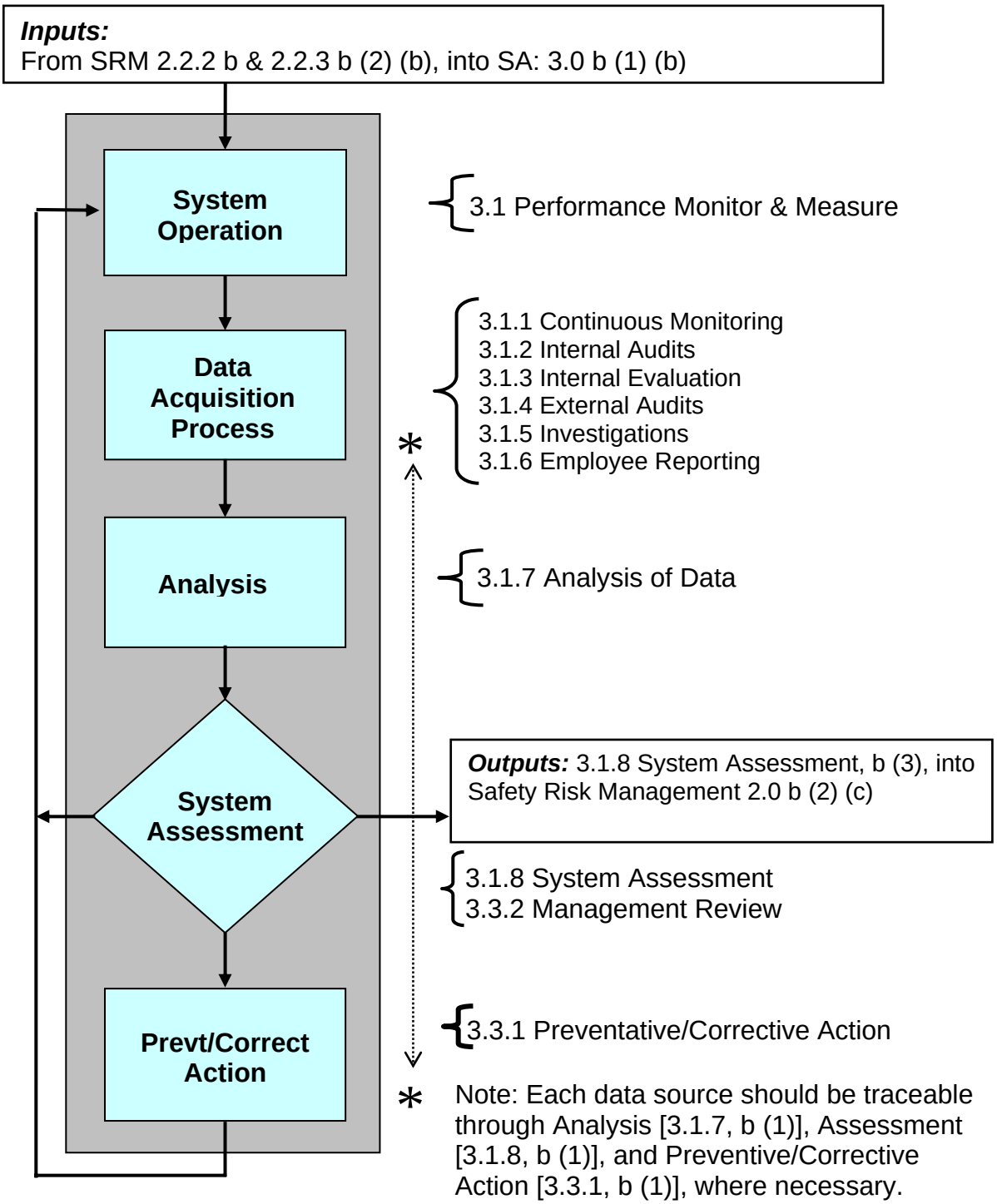
The SA function applies the activities of safety assurance and internal evaluation to ensure that risk controls, once designed, continue to conform to their expectations and that they continue to be effective in maintaining risk within acceptable levels. These assurance and evaluation functions also provide a basis for continuous improvement.

Note: The SA Process Flow diagram (Figure 3, below) includes the SMS Framework element/process numbers and other notes to help the reader visualize the SMS

[5] The ICAO Safety Management Manual)SMM) is Document 9859 and is available at: http://www.icao.int/anb/safetymanagement/Documents.html

Framework in terms of a process flow (with interfaces, i.e., inputs and outputs), and understand the component/element/process expectations.

FIGURE 3. SAFETY ASSURANCE (SA) PROCESS FLOW



(1) System Operation - Performance Monitoring and Measurement.
Accomplishment of satisfactory risk controls through the SRM process allows a process or

system to be put into, or continue in operation. The SA process starts with a System Description which adds structure and helps map organizational responsibilities, functions and interfaces.

Safety Assurance processes concentrate on proving, through collection and analysis of objective evidence (i.e., documents, records, etc.), that process or system expectations continue to be met.

In a SMS, the system's requirements are based on assessment of risk in the organization's operation or in the products that it produces, as discussed above. Safety assurance techniques, including internal auditing and evaluation, are used to determine if risk controls designed into the service provider's processes are being practiced and are performing as designed. If an aviation already has a comprehensive IEP, it should be reviewed to ensure that it conforms to the SMS SA expectations.[6]

(2) Data Acquisition Process – Getting the Facts.

(a) Continuous Monitoring. (Appendix 1, Process 3.1.1) Information for SA comes from a variety of sources, including continuous process monitoring of day-to-day activities and inputs from employees through employee reporting systems. While each of these types of information sources exists to some degree in every organization, the SMS Framework formalizes requirements for each.

Line managers are the technical experts in any organization and thus the most knowledgeable about the specific processes involved. Line managers of the operational departments should exercise their responsibility for monitoring these processes and periodically assessing the status of routine operations and risk controls. Specifications for these and other related SA processes are left at a functional level, allowing individual organizations to tailor them to the scope and scale appropriate for their size and type of organization.

(b) Internal Audits by Operating Departments. (Appendix 1, Process 3.1.2) Top management has the ultimate responsibility and authority for the SMS, however line managers of operational departments have the daily responsibility for quality control and for ensuring that the processes in their areas of responsibility function as designed. Thus, the primary responsibility for safety management rests with those who own the technical processes. It is here where hazards are most directly encountered, where deficiencies in processes contribute to risk, and where direct supervisory control and resource allocation can mitigate the risk to acceptable levels. Line managers exercise their responsibility though an internal auditing and evaluation program.

The SMS Framework specifies a responsibility for internal auditing of the aviation service provider's productive processes. As with other requirements, the SMS Framework's auditing requirements are left at a functional level, allowing for a broad range of complexity, commensurate with the complexity of the organization.

[6] The Safety Assurance (SA) functions in the SMS Framework contained in Appendix 1 were derived almost directly from ISO 9001-2008, the international quality management standard and the Internal Evaluation Program (IEP) development guidance in advisory circular (AC) 120-59.

(c) Internal Evaluation. (Appendix 1, Process 3.1.3) This function involves evaluation of the technical processes of the aviation service provider as well as the SMS-specific functions. Evaluations conducted for the purpose of this requirement must be conducted by persons or organizations that are functionally independent of the technical process being evaluated. A safety specialist, quality assurance department or another sub-organization as directed by top management may accomplish the audit. The internal evaluation function also requires auditing and evaluation of the safety management functions, policymaking, SRM, SA, and safety promotion. These evaluations provide the management officials with objective evidence with which to evaluate the SMS itself.

Note: The provisions of the SMS Framework are not intended to duplicate the functions of a Continuing Analysis and Surveillance System (CASS) (required for aviation service providers under 14 CFR part 121 or part 135) or Internal Evaluation Programs (IEP). In fact, the FAA encourages an integrated approach where these programs are all part of a comprehensive SMS.

(d) External Audits. (Appendix 1, Process 3.1.4) External audits of the SMS may be conducted by the regulator (FAA), code-share partners, customer organizations, or other third parties selected by the aviation service provider. These audits not only provide a strong interface with the oversight system (Safety Assurance System or SAS) but also a secondary assurance system.

Organizations may elect to have third-party audits of their SMS from organizations such as the IATA or other consultant organizations. It is not the intent of a SMS to require the arrangement or purchase of external audits, especially by small aviation service providers. However, if external audits are conducted of the organization, the data collected should be used by the organization in their data acquisition process.

(e) Investigations. (Appendix 1, Process 3.1.5) Investigation of safety occurrences should have the objective of identifying systemic safety deficiencies rather than assigning blame. It is not as important to identify “who did it” as it is to learn “why it happened”. System resilience can be much more effectively reinforced by removing systemic deficiencies than by removing individuals, who may only be caught in the human activity of making mistakes.

(f) Employee Reporting System. (Appendix 1, Process 3.1.6) The SMS Framework specifies that the aviation service provider must provide for a means of employee communication that allows for timely submission of reports on safety deficiencies without fear of reprisal The main objective of an employee safety reporting and feedback system is to establish and maintain an environment in which employees can report hazards, issues and concerns, as well as occurrences, incidents, etc., and propose safety solutions and improvements.

Employees must be encouraged to use the employee reporting system without fear of reprisal. Data from the safety reporting and feedback system should be monitored to identify emerging hazards. Additionally, data collected in the safety reporting and feedback system should be included in all SMS analyses functions. Many certificated operators already have invested in Aviation Safety Action Programs (ASAP). ASAP is a collaborative, reporting, analyses and problem solving effort among the FAA, operators, and employee unions. As mentioned earlier, this program is an example of a voluntary program that could be integrated into the SMS

(providing it encompasses the entire organization), having a strong potential to contribute to SA and Safety Promotion.

(2) Analysis and Assessment. (Appendix 1, Processes 3.1.7 & 3.1.8) Audits and other information-gathering activities are useful to management only if the information is provided in a meaningful form and conclusions are drawn to form a bottom line assessment. Recall that a primary purpose of the SA process is to assess the continued effectiveness of risk controls put into place by the SRM process. Where significant deviations to existing controls are discovered, the SMS Framework requires a structured, documented process for preventive and corrective action to place the controls back on track.

(3) Management of Change. (Appendix 1, Element 3.2) A change management process should identify changes within the organization which may affect established processes, procedures, products and services. Prior to implementing changes, a change management process should describe the arrangements to ensure safety performance. The result of this process is the reduction in the safety risks resulting from changes in the provision of products or services by the organization. Change management should consider the criticality of the system and activities, the stability of the system and operational environment and past performance of the system.

(4) Continuous Improvement. (Appendix 1, Element 3.3) The organization must continuously improve the effectiveness of the SMS and of safety risk controls through the use of the safety and quality policies, objectives, audit and evaluation results, analysis of data, preventive/corrective actions, and management reviews. As part of the SA function, the analysis and assessment functions must alert the organization to significant changes in the operating environment, possibly indicating a need for system change to maintain effective risk controls. When this occurs, the results of the assessment start the SRM process, as depicted in Figure 3.

One of Dr. James Reason's organizational safety culture principles is that of a *learning culture*.[7] The information in reports, audits, investigations, and other data sources is not useful if the organization does not learn from it. The SMS Framework requires an analysis process, a preventive/corrective action process, and a path to the SRM process for the development of new safety controls, as environments change and new hazards are identified. It further requires that the organization provide training and information about risk controls and lessons learned.

(a) Preventive/Corrective Action and Follow-up. (Appendix 1, Process 3.3.1, formerly Process 3.1.9) The SA process should include procedures that ensure that preventive/corrective actions are developed, documented and tracked in response to findings of audits and evaluations, and to verify their timely and effective implementation.

Organizational responsibility for the development and implementation of preventive/corrective actions should reside with the operational departments cited in audit and evaluation findings. If new hazards are discovered, the SRM process should be employed to determine if new risk controls should be developed.

[7] Reason. Managing the Risks of Organizational Accidents.

(b) Management Review. (Appendix 1, Process 3.3.2, formerly Process 3.1.10) Top management should conduct regular reviews of the SMS, including outputs of safety risk management, safety assurance, and lessons learned. Management reviews should include assessing the performance and effectiveness of an organization's operational processes and the need for improvements.

e. SAFETY PROMOTION: Promoting a Positive Safety Culture (Appendix 1, Component 4.0). An organizational safety effort cannot succeed by mandate only or strict implementation of policy. As in the case of attitudes where individual people are concerned, organizational cultures set the tone that predisposes the organization's behavior. An organization's culture consists of the values, beliefs, mission, goals, and sense of responsibility held by the organization's members. The culture fills in the blank spaces in the organization's policies, procedures, and processes and provides a sense of purpose to safety efforts.

(1) Safety Cultures. (Appendix 1, Component 4.0) Cultures consist of psychological (how people think and feel), behavioral (how people and groups act and perform) and organizational or systematic (the programs, procedures, and organization of the enterprise) elements. Dr. James Reason, among other current organizational system safety theorists, stresses the need for a *reporting culture* as an important aspect of safety culture. The organization must do what it can to cultivate the willingness of its members to contribute to the organization's knowledge base. Dr. Reason further stresses the need for a *just culture*, where employees have the confidence that, while they will be held accountable for their actions, the organization will treat them fairly.[8]

(2) Competencies and Training. (Appendix 1, Processes 4.1.1 & 4.1.2) There are process expectations in the Safety Promotion Component (4.0) of the SMS Framework to ensure employees, throughout the organization, are trained and competent on their safety-related job functions. Additionally, it is important for all employees to know how to report safety concerns and know that it is their responsibility to do so.

(3) Communication and Awareness: (Appendix 1, Element 4.2) Top Management should communicate the outputs of its SMS to its employees, and should provide its oversight organization access to SMS outputs in accordance with established agreements and disclosure programs. The processes specified in the Safety Policy, SRM, SA, and Safety Promotion components of the SMS provide the structure for the organization's processes. However, the organization must also put in place processes that allow for open communication among employees and the organization's management. The aviation service provider must make every effort to communicate its goals and objectives, as well as the current status of the organization's activities and significant events. Likewise, the organization must supply a means of upward communication in an environment of collaboration, trust, and respect.

8. CONTACT. For additional information or suggestions, please contact the Flight Standards Service, SMS Program Office, AFS-920, at (703) 661-0516.

[8] Reason. Managing the Risks of Organizational Accidents.

APPENDIX 1

AVIATION SERVICE PROVIDER SAFETY MANAGEMENT SYSTEM (SMS) FRAMEWORK: FUNCTIONAL EXPECTATIONS

1. PURPOSE OF THIS APPENDIX. To provide standardization and a uniform set of expectations (basic functional expectations) for SMS development by aviation service providers.

2. SCOPE AND APPLICABILITY.

a. This SMS Framework describes the expectations for an aviation service provider's (for example, certificated and non-certificated aviation organizations, aviation service providers, air carriers, airlines, maintenance repair organizations, air taxi operators, corporate flight departments, repair stations, and pilot schools) SMS in the air transportation system.

(1) This SMS Framework is not mandatory and does not constitute a regulation. Development and implementation of an SMS is voluntary. While the Federal Aviation Administration (FAA) encourages each aviation service provider to develop and implement an SMS, these systems are not substitutes for compliance with Federal regulations and all other certificate requirements, where applicable. However, for aviation service providers that elect to voluntarily implement an SMS, the FAA views the objectives and expectations in this SMS Framework to be the minimum for a comprehensive and robust SMS.

(2) This SMS Framework is intended to address aviation safety related operational and support processes and activities that are related to aviation safety, not occupational safety, environmental protection, or customer service quality.

(3) The expectations of this SMS Framework apply to SMSs developed and used by organizations that provide products and/or services in the air transportation system.

(4) Operators and service providers are responsible for the safety of services or products contracted to or purchased from other organizations.

b. While this document establishes the minimum acceptable expectations; oversight entities and service providers may establish more stringent requirements.

3. REFERENCES. This advisory circular (AC) is in accordance with the following documents:

a. Annex 6 to the Convention on International Civil Aviation, *Part 1 International Commercial Air Transport – Aeroplanes* with Amendment 33.

b. International Civil Aviation Organization (ICAO) Document 9859, ICAO *Safety Management Manual* (SMM, 2nd Edition, 2009).

c. Federal Aviation Administration (FAA) Order 8000.369, *Safety Management System Guidance, 9/30/2008.*

d. FAA Order VS 8000.367, Aviation Safety (AVS) *Safety Management System Requirements, 5/14/2008.*

4. DEFINITIONS.

a. Accident. An occurrence associated with the operation of an aircraft that takes place between the time any person boards the aircraft with the intention of flight and all such persons have disembarked, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage (49 CFR 830.2, Definitions).

b. Analysis. The conversion of data into information, to identify measures that predict safety related problems to allow risk-management decision making, by the identification of trends, deficiencies and root causes. This involves the processes of identifying a question or issue to be addressed, modeling the issue, investigating model results, interpreting the results, and possibly making a recommendation. Analysis typically involves using scientific or mathematical methods for evaluation.

c. Assessment. The process of measuring or judging the value or level of something.

d. Attributes. System Attributes, are inherent characteristics of a system and apply to an effective SMS. While the six system attributes were first applied with Air Transportation Oversight System (ATOS) fielding, there are conceptual differences when applied to SMS, as discussed below:

(1) Responsibility. Who is accountable for management and overall quality of the process (planning, organizing, directing, controlling) and its ultimate accomplishment.

(2) Authority. Who can direct, control, or change the process, as well as who can make key decisions such as risk acceptance. This attribute also includes the concept of empowerment.

(3) Procedures. International Organization for Standardization (ISO)-9000-2005 defines "procedure" as "a specified way to carry out an activity or a process" – procedures translate the *what* in goals and objectives into *how* in practical activities (things people do). Procedures are simply documented activities to accomplish processes, e.g., a way to perform a process. The organization should specify their own procedures for accomplishing processes in the context of their unique operational environment, organizational structure, and management objectives.

(4) Controls. Controls are elements of the system, including hardware, software, special procedures, or procedural steps, and supervisory practices designed to keep processes on track to achieve their intended results. Organizational process controls are typically defined in terms of special procedures, supervisory and management practices, and processes. Many controls are inherent features of the SMS Framework. Practices such as continuous monitoring, internal audits, internal evaluations, and management reviews (all parts of the Safety Assurance (SA) component) are identified as controls within the design expectations. Additionally, other practices such as documentation, process reviews, and data tracking are identified as controls within specific elements and processes.

(5) Process Measures. Ways to provide feedback to responsible parties that required actions are taking place and required objectives are being achieved. A basic principle of SA is that fundamental processes be measured so that management decisions can be data-driven. The general expectations for the Policy Component 1.0, specify that SMS outputs be measured and analyzed. These measurements and analyses are accomplished in SA Component 3.0. Outputs of each process should, therefore, be identified during Component 3.0 activities and should be the subjects of continuous monitoring, internal audits, and internal evaluation.

(6) Interfaces. This aspect includes examining such things as lines of authority between departments, lines of communication between employees, consistency of procedures, and clearly delineating lines of responsibility between organizations, work units, and employees. Interfaces are the *inputs* and *outputs* of a process.

e. Audit. Scheduled, formal reviews and verifications that evaluate whether an organization has complied with policy, standards, and/or contract requirements. An audit starts with the management and operations of the organization and then moves to the organization's activities and products/services.

(1) Internal Audit. An audit conducted by, or on behalf of, the organization being audited, e.g., the flight training department audits the flight training department.

(2) External Audit. An audit conducted by an entity outside of the organization being audited, e.g., the flight operations department audits the flight training department.

f. Aviation Service Provider. Refer to definition for *organization* below. *Aviation service provider* is interchangeable with the terms *service provider* and *organization* within this document.

g. Aviation System. The functional operation or production system used by an organization to produce an aviation product or service (see *System* and *Function* below).

h. Complete. Nothing has been omitted and what is stated is essential and appropriate to the level of detail.

i. Competency. An observable, measurable set [pattern] of skills, knowledge, abilities, behaviors, and other characteristics that an individual needs to perform work roles of occupational functions successfully. Competencies are typically required at different levels of proficiency depending on the work roles or occupational function. Competencies can help ensure that individual and team performances align with the organization’s mission and strategic direction.

j. Conformity. Fulfilling or complying with a requirement (refer to ISO 9000-2005); this includes but is not limited to complying with Federal Aviation Regulations. It also includes complying with company requirements, requirements of aviation service provider developed risk controls, or aviation service provider policies and procedures.

k. Continuous Monitoring. Uninterrupted (constant) watchfulness (checks, audits, etc) over a system.

l. Corrective Action. Action to eliminate (remove) or mitigate (lessen) the cause or reduce the effects of a detected nonconformity or other undesirable (unwanted) situation.

m. Correct. Accurate without ambiguity or error in its attributes.

n. Documentation. Information or meaningful data and its supporting medium (e.g., paper, electronic, etc.). In this context, *documentation* is different from *records* because *documentation* is the written description of policies, processes, procedures, objectives, requirements, authorities, responsibilities, or work instructions; where as *records* are the evidence of results achieved or activities performed.

o. Evaluation. An independent review of organization policies, procedures, and systems (refer to AC 120-59, current edition). If accomplished by the organization itself, the evaluation should be done by a person or organization in the organization other than the one performing the function being evaluated. The evaluation process builds on the concepts of auditing and inspection. An evaluation is an anticipatory process designed to identify and correct potential problems before they happen. An evaluation is synonymous with the term *systems audit*.

p. Function. A *function* consists of specific or discreet actions required by a system to achieve an objective (e.g. an operation that a system must perform in order to accomplish its mission, such as a maintenance action required to restore a system to operation). Such actions may be accomplished through the use of equipment, personnel, facilities, firmware, software or a combination thereof. In a broader sense, the term *function* refers to *what* is expected to be incorporated into each system rather than *how* the system accomplishes its objective. This makes for a more performance-based system and allows for a broad range of techniques to be used to accomplish the performance objectives. This, in turn, maximizes scalability while preserving standardization of results across the aviation organization communities.

q. Hazard. Any existing or potential condition that can lead to injury, illness, or death; damage to or loss of a system, equipment, or property; or damage to the environment. A hazard is a condition that might cause (is a prerequisite to) an accident or incident.

r. Incident. An occurrence other than an accident, associated with the operation of an aircraft, which affects or could affect the safety of operations (49 CFR 830.2, Definitions).

s. Lessons Learned. Knowledge or understanding gained by experience, which may be positive, such as a successful test or mission, or negative, such as a mishap or failure. Lessons learned should be developed from information obtained from inside and outside of the organization and/or industry.

t. Likelihood. The estimated probability or frequency, in quantitative or qualitative terms, of an occurrence related to the hazard.

u. Line Management. The management structure that operates (controls, supervises, etc) the operational activities and processes of the aviation system.

v. Nonconformity. Non-fulfillment of a requirement (refer to ISO 9000-2005). This could include but is not limited to, noncompliance with federal regulations, organization requirements,

requirements of aviation service provider-developed risk controls or aviation service provider-specified policies and procedures.

w. Objective. The desired state or performance target of a process. Usually it is the final state of a process and contains the results and outputs used to obtain the desired state or performance target.

x. Operational Life Cycle. Period of time from implementation of a product/service until it is no longer in use.

y. Organization. Within the context of this document, the term *organization* refers to any organization providing aviation services. The term includes certificated and non-certificated aviation organizations, aviation service providers, air carriers, airlines, maintenance repair organizations, air taxi operators, corporate flight departments, repair stations, pilot schools, approved training organizations that are exposed to safety risks during the provision of their services and organizations responsible for type design and/or manufacture of aircraft. (Also see *service provider* below). The term o*rganization* is interchangeable with the term *aviation service provider* and *service provider* within this document.

z. Outputs. The product or end result of an SMS process, which is able to be recorded, monitored, measured, and analyzed. Outputs are the minimum expectation for the product of each process area and the input for the next process area in succession. Each of the outputs of a process should have a method of measurement specified by the organization. Measures need not be quantitative where this is not practical; however, some method of providing objective evidence of the attainment of the expected output is necessary. A table of expected SMS process outputs is in Appendix 4.

aa. Oversight. A function performed by a regulator (such as the FAA) that ensures that an aviation organization complies with and uses safety-related standards, requirements, regulations, and associated procedures. Safety oversight also works to assure that the acceptable level of safety risk is not exceeded in the air transportation system.

bb. Preventive Action. Preemptive action to eliminate or mitigate the potential cause or reduce the future effects of an identified or anticipated nonconformity or other undesirable situation.

cc. Procedure. Specified ways to carry out operational activities that translate the *what* (objectives) into *how* (practical activities).

dd. Process. A set of interrelated or interacting activities that transform inputs into outputs.

ee. Process Measures. Refer to definition for process measures under the *attributes* definition, above, i.e., a means of providing feedback to responsible parties that required actions are taking place and required objectives are being achieved.

ff. Product/Service. Anything that is offered or can be purchased that might satisfy a want or need in the air transportation system.

gg. Records. Evidence of results achieved or activities performed (also see *documentation* above).

hh. Residual Safety Risk. The safety risk that exists after mitigation has been accomplished or all controls have been implemented or exhausted and verified. Only verified controls can be used for assessing residual safety risk.

ii. Risk. The composite of predicted severity (how bad) and likelihood (how probable) of the potential effect of a hazard in its worst credible (reasonable or believable) system state. The terms *risk* and *safety risk* are interchangeable for the purposes of this document.

jj. Risk Control. Steps taken to eliminate (remove) hazards or to mitigate (lessen) their effects by reducing the severity and/or likelihood of risk associated with those hazards.

kk. Safety Assurance (SA). A formal management process within the SMS that systematically provides confidence that an organization's products/services meet or exceed safety requirements. Safety Assurance expectations are provided in this SMS Framework, Component 3.0.

ll. Safety Culture. The product of individual and group values, attitudes, competencies, and patterns of behavior that determine the commitment to, and the style and proficiency of, the organization's management of safety. Organizations with a positive safety culture are characterized by communications founded on mutual trust, by shared perceptions of the importance of safety and by confidence in the efficacy of preventive measures.

mm. SMS. The formal, top-down business-like approach to managing safety risk. It includes systematic procedures, practices, and policies for the management of safety (as described in this document it includes Safety Policy, Safety Risk Management, Safety Assurance, and Safety Promotion).

nn. Safety Objective.[9] A goal or desirable outcome related to safety. Generally based on the organization's safety policy, and specified for relevant functions and levels in the organization. Safety objectives are typically measurable.

oo. Safety Planning.[10] Part of safety management focused on setting safety objectives and specifying needed operational processes and related resources to fulfill these objectives.

pp. Safety Risk. The composite of predicted severity (how bad) and likelihood (how probable) of the potential effect of a hazard in its worst credible (reasonable or believable) system state. The terms *safety risk* and *risk* are interchangeable for the purposes of this document.

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[9] Adapted from definition 3.2.5 in ISO 9000-2005 for *quality objectives.*

[10] Adapted from definition 3.2.9 in ISO 9000-2005 for *quality planning.*

qq. Safety Risk Control. A characteristic of a system that reduces or mitigates (lessens) the potential undesirable effects of a hazard. Controls may include process design, equipment modification, work procedures, training or protective devices. Safety risk controls must be written in requirements language, measurable, and monitored to ensure effectiveness.

rr. Safety Risk Management (SRM). A formal process within the SMS that describes the system, identifies the hazards, assesses the risk, analyzes the risk, and controls the risk. The SRM process is embedded in the processes used to provide the product/service; it is not a separate/distinct process. SRM expectations are provided in the SMS Framework, Component 2.0.

ss. Safety Promotion. A combination of safety culture, training, and data sharing activities that support the implementation and operation of an SMS in an organization. Safety Promotion expectations are provided in this SMS Framework, Component 4.0.

tt. Separate Aviation Maintenance Organizations. Are independent maintenance organizations such as, but not limited to, certificated repair stations, non-certificated repair facilities, and separate maintenance organizations. This does not include an air operator's maintenance organization and is not intended to duplicate Component 1.0 b, (1) (a) (3) of an air operator's organization.

uu. Service Provider. (Refer to definition for *Organization* above). The term s*ervice provider* is interchangeable with the terms *aviation service provider* and *organization* within this document.

vv. Severity. The degree of loss or harm resulting from a hazard.

ww. Substitute Risk. A risk unintentionally created as a consequence of safety risk control(s).

xx. System. An integrated set of constituent elements that are combined in an operational or support environment to accomplish a defined objective. These elements include people, hardware, software, firmware, information, procedures, facilities, services, and other support facets.

yy. System Attributes. Refer to definition for *attributes*, above.

zz. Top Management. The person or group of people who direct and control an organization, reference ISO 9000-2005 definition 3.2.7 – "person or group of people who directs and controls an organization at the highest level." Top management translates the policy into goals, objectives and strategies, and projects a shared-vision of the future. Top management makes decisions that affect everyone in the organization, and is held entirely responsible for the success or failure of the enterprise. In many large organizations, this can be the Chief Executive Officer, Chairman/Chairwoman, President or the Board of Directors; in smaller organizations, this might be the owner of the organization.

5. FUNCTIONAL EXPECTATIONS: SMS FRAMEWORK

5.1 SMS FRAMEWORK STRUCTURE. The SMS Framework is broken down into components, elements, and processes. The components and elements are based on the ICAO Framework. Elements in the SRM, Safety Assurance, and Safety Promotion components are further broken down into processes.

5.2 SMS FRAMEWORK EXPECTATIONS. This section describes expected characteristics of a robust SMS. They are considered *functional* expectations because they describe the *what*, not the *how* of each process. For example, the *what* of a de-icing process is to prevent any aircraft from taking off with ice adhering to any critical control surface. The *how* of the de-icing process would include de-icing equipment procedures, flight crew de-icing procedures, hold-over table activities, etc., and may be different between individual organizations. Organizations are expected to meet SMS Framework expectations by developing processes to fit their unique business and management models.

5.3 SMS FRAMEWORK ELEMENTS AND PROCESSES. SMS Framework elements and processes are further defined in terms of performance objectives and design expectations:

a. Performance Objectives are the desired outcomes of the particular element or process under evaluation.

b. Design Expectations are the characteristics of the element or process that, if properly implemented, should provide the outcomes identified in the performance objectives.

COMPONENT 1.0 SAFETY POLICY AND OBJECTIVES.

a. Performance Objectives. The organization will develop and implement an integrated, comprehensive SMS for its entire organization and will incorporate a procedure to identify and maintain compliance with current safety-related legal, regulatory, and statutory requirements.

b. General Design Expectations.

(1) Safety management will be included in the complete scope and life cycle of the organization's systems including:

(a) For air operators:

1. Flight operations,

2. Operational control (dispatch/flight following),

3. Maintenance and inspection,

4. Cabin safety,

5. Ground handling and servicing,

6. Cargo handling, and

7. Training.

(b) For separate aviation maintenance organizations:

1. Parts/materials,

2. Resource management (tools and equipment, personnel, and facilities),

3. Technical data,

4. Maintenance and inspection,

5. Quality control,

6. Records management,

7. Contract maintenance, and

8. Training.

(2) SMS processes will be:

(a) Documented,

(b) Monitored,

(c) Measured, and

(d) Analyzed.

(3) SMS outputs will be:

(a) Recorded,

(b) Monitored,

(c) Measured, and

(d) Analyzed.

(4) It is expected that:

(a) The organization will promote the growth of a positive safety culture (described under Component 4.0, b);

(b) If the organization has a quality policy, top management will ensure that the quality policy is consistent with the SMS;

(c) The SMS will include a means to comply with FAA policy, legal, regulatory and statutory requirements applicable to the SMS;

(d) The organization will establish and maintain a procedure to identify current FAA policy, legal, regulatory and statutory requirements applicable to the SMS;

(e) The organization will establish and maintain procedures with measurable criteria to accomplish the objectives of the safety policy[11];

(f) The organization will establish and maintain supervisory and operational controls to ensure procedures are followed for safety-related operations and activities; and

(g) The organization will establish and maintain a safety management plan to describe how it will achieve its safety objectives.

ELEMENT 1.1 SAFETY POLICY.

a. Performance Objective: Top management will define the organization's safety policy and convey its expectations and objectives to its employees.

b. Design Expectations:

(1) Top management will define and sign the organization's safety policy.

(2) The safety policy will:

(a) Include a commitment to implement and maintain the SMS;

(b) Include a commitment to continuously improve the level of safety;

(c) Include a commitment to the management of safety risk;

(d) Include a commitment to comply with applicable regulatory requirements;

(e) Include a commitment to encourage employees to report safety issues without reprisal (as per Process 3.1.6);

(f) Establish clear standards for acceptable operational behavior for all employees;

(g) Provide management guidance for setting safety objectives;

[11] Measures are not expected for each procedural step. However, measures and criteria should be of sufficient depth and level of detail to ascertain and track accomplishment of objectives. Criteria and measures can be expressed in either quantitative or qualitative terms.

(h) Provide management guidance for reviewing safety objectives;

(i) Be documented;

(j) Be communicated with visible management endorsement to all employees and responsible parties;

(k) Be reviewed periodically to ensure it remains relevant and appropriate to the organization; and

(l) Identify responsibility and accountability of management and employees with respect to safety performance.

ELEMENT 1.2 MANAGEMENT COMMITMENT AND SAFETY ACCOUNTABILITIES.

a. Performance Objective: The organization will define, document, and communicate the safety roles, responsibilities, and authorities throughout its organization.

b. Design Expectations:

(1) Top management will have the ultimate responsibility for the SMS.

(2) Top management will provide resources essential to implement and maintain the SMS.

(3) Aviation safety-related positions, responsibilities, and authorities will be

(a) Defined,

(b) Documented, and

(c) Communicated throughout the organization.

(4) The organization will define levels of management that can make safety risk acceptance decisions as described in Component 2.0, b (4)(c).

ELEMENT 1.3 KEY SAFETY PERSONNEL.

a. Performance Objective: The organization will appoint a management representative to manage, monitor, and coordinate the SMS processes.

b. Design Expectations:

(1) Top management will appoint a member of management who, irrespective of other responsibilities, will have responsibilities and authority that includes:

(a) Ensuring that processes needed for the SMS are established, implemented, and maintained;

(b) Report to top management on the performance of the SMS and the need for improvement; and

(c) Ensure the promotion of awareness of safety expectations throughout the organization.

ELEMENT 1.4 EMERGENCY PREPAREDNESS AND RESPONSE.

a. Performance Objective: The organization will develop and implement procedures that it will follow in the event of an accident, incident or operational emergency to mitigate the effects of these events.

b. Design Expectations: The organization will establish procedures to:

(1) Identify hazards that have potential for accidents, incidents or operational emergencies;

(2) Coordinate and plan the organization's response to accidents, incidents or operational emergencies; and

(3) Execute periodic exercises of the organization's response.

ELEMENT 1.5 SMS DOCUMENTATION AND RECORDS.

a. Performance Objectives: The organization will have documented safety policies, objectives, procedures, a document/record management process and a safety management plan that meet organizational safety expectations and objectives.

b. Design Expectations:

(1) The organization will establish and maintain information, in paper or electronic form, to describe:

(a) Safety policies;

(b) Safety objectives;

(c) SMS expectations;

(d) Safety procedures and processes;

(e) Accountabilities, responsibilities and authorities for safety-related procedures and processes;

(f) Interactions/interfaces between the safety-related procedures and processes; and

(g) SMS outputs.

(2) The organization will maintain their safety management plan in accordance with the objectives and expectations contained within this element.

(3) Documentation Management.

(a) Documentation will be:

1. Legible,

2. Dated (with dates of revisions),

3. Readily identifiable,

4. Maintained in an orderly manner, and

5. Retained for a specified period of time as determined by the organization.

(b) The organization will establish and maintain procedures for controlling all documents required by this SMS Framework to ensure that:

1. They can be located; and

2. They are periodically:

(a) Reviewed,

(b) Revised as needed, and

(c) Approved for adequacy by authorized personnel.

(c) The current versions of relevant documents are available at all locations where essential SMS operations are performed; and

(d) Obsolete documents are promptly removed from all points of use or otherwise assured against unintended use.

(4) Records Management.

(a) The organization will establish and maintain procedures to:

1. Identify,

2. Maintain, and

3. Dispose of their SMS records.

(b) SMS records will be:

1. Legible,

2. Identifiable, and

3. Traceable to the activity involved.

(c) SMS records will be maintained in such a way that they are

1. Readily retrievable and;

2. Protected against:

(a) Damage,

(b) Deterioration, or

(c) Loss.

(d) Records retention times will be documented.

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COMPONENT 2.0 SAFETY RISK MANAGEMENT (SRM).

a. Performance Objective: The organization will develop processes to understand the critical characteristics of its systems and operational environment and apply this knowledge to identify hazards, analyze and assess risk and design risk controls.

b. General Design Expectations:

(1) SRM will, at a minimum, include the following processes:

(a) System description and task analysis,

(b) Hazard identification,

(c) Safety risk analysis,

(d) Safety risk assessment, and

(e) Safety risk control and mitigation.

(2) The SRM process will be applied to:

(a) Initial designs of systems, organizations, and/or products;

(b) The development of operational procedures;

(c) Hazards that are identified in the Safety Assurance functions (described in Component 3.0, b); and

(d) Planned changes to operational processes.

(3) The organization will establish feedback loops between assurance functions described in Component 3.0, to evaluate the effectiveness of safety risk controls.

(4) The organization will define a risk acceptance process that:

(a) Defines acceptable and unacceptable levels of safety risk.

(b) Describes:

1. Severity levels, and

2. Likelihood levels.

(c) Defines specific levels of management that can make safety risk acceptance decisions prescribed in accordance with Element 1.2 b (3).

(d) Defines acceptable risk for hazards that will exist in the short-term while safety risk control/mitigation plans are developed and implemented.

ELEMENT 2.1 HAZARD IDENTIFICATION AND ANALYSIS.

PROCESS 2.1.1 SYSTEM DESCRIPTION AND TASK ANALYSIS.

a. Performance Objective: The organization will analyze its systems, operations, and operational environment to gain an understanding of critical design and performance factors, processes, and activities to identify hazards.

b. Design Expectations:

(1) System descriptions and task analysis will be developed to the level of detail necessary to:

(a) Identify hazards,

(b) Develop operational procedures, and

(c) Develop and implement risk controls.

PROCESS 2.1.2 IDENTIFY HAZARDS.

a. Performance Objective: The organization will identify and document the hazards in its operations that are likely to cause death, serious physical harm, or damage to equipment or property in sufficient detail to determine associated level of risk and risk acceptability.

b. Design Expectations:

(1) Hazards will be:

(a) Identified for the entire scope of the system, as defined in the system description[12]; and

(b) Documented.

(2) Hazard information will be:

(a) Tracked, and

(b) Managed throughout the entire SRM process.

ELEMENT 2.2 RISK ASSESSMENT AND CONTROL.

PROCESS 2.2.1 ANALYZE SAFETY RISK.

a. Performance Objective: The organization will determine and analyze the severity and likelihood of potential events associated with identified hazards, and will identify risk factors associated with unacceptable levels of severity or likelihood.

[12] While it is recognized that identification of every conceivable hazard is impractical, organizations are expected to exercise due diligence in identifying and controlling significant and reasonably foreseeable hazards related to their operations.

b. Design Expectations:

(1) The safety risk analysis process will include:

(a) Existing safety risk controls,

(b) Triggering mechanisms, and

(c) Safety risk of reasonably likely outcomes from the existence of a hazard, to include estimation of the[13]:

1. Likelihood, and

2. Severity.

PROCESS 2.2.2 ASSESS SAFETY RISK.

a. Performance Objective: The organization will assess risk associated with each identified hazard and define risk acceptance procedures and levels of management that can make safety risk acceptance decisions.

b. Design Expectations: Each hazard will be assessed for its safety risk acceptability using the safety risk acceptance process described in Component 2.0 b. (4).

PROCESS 2.2.3 CONTROL/MITIGATE SAFETY RISK

a. Performance Objective: The organization will design and implement a risk control for each identified hazard for which there is an unacceptable risk, to reduce risk to acceptable levels. The potential for residual risk and substitute risk will be analyzed before implementing risk controls.

b. Design Expectations:

(1) Safety control/mitigation plans will be defined for each hazard with unacceptable risk.

(2) Safety risk controls will be:

(a) Clearly described,

(b) Evaluated to ensure that the expectations have been met,

(c) Ready to be used in their intended operational environment, and documented.

(3) Substitute risk will be evaluated when creating safety risk controls/mitigations.

[13] Risk likelihood and severity may be expressed in quantitative or qualitative terms.

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COMPONENT 3.0 SAFETY ASSURANCE.

a. Performance Objective: The organization will monitor, measure, and evaluate the performance of their systems to identify new hazards, measure the effectiveness of risk controls, (to include preventative and corrective actions) and ensure compliance with regulatory requirements.

b. General Design Expectations:

(1) The organization will monitor their systems and operations to:

(a) Identify new hazards,

(b) Measure the effectiveness of safety risk controls,

(c) Ensure compliance with regulatory requirements applicable to the SMS, and

(d) Ensure the Safety Assurance function is based upon a comprehensive system description as described in Process 2.1.1.

(2) The organization will collect the data necessary to demonstrate the effectiveness of its:

(a) Operational processes, and

(b) The SMS.

ELEMENT 3.1 SAFETY PERFORMANCE MONITORING AND MEASUREMENT.

PROCESS 3.1.1 CONTINUOUS MONITORING.

a. Performance Objective: The organization will continuously monitor operational data, including products and services received from contractors, to identify hazards, measure the effectiveness of safety risk controls, and assess system performance.

b. Design Expectations:

(1) The organization will monitor operational data (e.g., duty logs, crew reports, work cards, process sheets, and reports from the employee safety feedback system specified in Process 3.1.6) to:

(a) Determine conformity to safety risk controls (described in Process 2.2.3);

(b) Measure the effectiveness of safety risk controls (described in Process 2.2.3);

(c) Assess SMS system performance; and

(d) Identify hazards.

(2) The organization will monitor products and services received from subcontractors.

PROCESS 3.1.2 INTERNAL AUDITS BY OPERATIONAL DEPARTMENTS.

a. Performance Objective: The organization will perform regularly scheduled internal audits of its operational processes, including those performed by contractors, to verify safety performance and evaluate the effectiveness of safety risk controls.

b. Design Expectations:

(1) Line management of operational departments will conduct regular internal audits of safety-related functions of the organization's operational processes (production system). (Note: The internal audit is a primary means of output measurement under Component 1.0, b, (3) (c) and (4) (e)).

(2) Line management will ensure that regular audits are conducted to:

(a) Determine conformity with safety risk controls, and

(b) Assess performance of safety risk controls.

(3) Planning of the audits program will take into account:

(a) Safety criticality of the processes to be audited, and

(b) Results of previous audits.

(4) The organization will define:

(a) Audits, including:

1. Criteria,

2. Scope,

3. Frequency,

4. Method;

(b) How the auditors will be selected; and

(c) Requirement that auditors will not audit their own work.

(5) The organization will document audit procedures, to include:

(a) Responsibilities; and

(b) Expectations for:

1. Planning audits,

2. Conducting audits,

3. Reporting results,

4. Maintaining records, and

5. Auditing contractors and vendors.

PROCESS 3.1.3 INTERNAL EVALUATION.

a. Performance Objective: The organization will conduct internal evaluations of the SMS and operational processes at planned intervals, to determine that the SMS conforms to its objectives and expectations.

b. Design Expectations:

(1) The organization will conduct internal evaluations of the operational processes and the SMS at planned intervals to determine that the SMS conforms to objectives and expectations (Note: SMS output measurement is a primary control under Component 1.0, b, (3) (c) and (4) (e)).

(2) Planning of the evaluation program will take into account:

(a) Safety criticality of the processes being evaluated, and

(b) Results of previous evaluations.

(3) The organization will define:

(a) Evaluations, including:

1. Criteria,

2. Scope,

3. Frequency, and

4. Methods;

(b) The processes used to select the evaluators; and

(c) Documented procedures, which include:

1. The responsibilities and

2. Requirements for:

(a) Planning evaluations,

(b) Conducting evaluations,

(c) Reporting results,

(d) Maintaining records, and

(e) Evaluating contractors and vendors.

(4) The program will include an evaluation of the programs described in Component 1.0, b (1).

(5) The person or organization performing evaluations of operational processes must be independent of the process being evaluated.

PROCESS 3.1.4 EXTERNAL AUDITING OF THE SMS.

a. Performance Objective: The organization will include the results of assessments performed by oversight (FAA) and other organizations (IOSA, IS-BAO, etc) in its analysis of data.

b. Design Expectations: The organization will include the results of oversight organization assessments, and other external audit results, in the analyses conducted as described in Process 3.1.7.

PROCESS 3.1.5 INVESTIGATION.

a. Performance Objective: The organization will establish procedures to collect data and investigate incidents, accidents, and instances of potential regulatory non-compliance to identify potential new hazards or risk control failures.

b. Design Expectations:

(1) The organization will collect data on:

(a) Incidents,

(b) Accidents, and

(c) Potential regulatory non-compliance.

(2) The organization will establish procedures to:

(a) Investigate accidents,

(b) Investigate incidents, and

(c) Investigate instances of potential regulatory non-compliance.

PROCESS 3.1.6 EMPLOYEE REPORTING AND FEEDBACK SYSTEM.

a. Performance Objective: The organization will establish and maintain a confidential employee safety reporting and feedback system. Data obtained from this system will be monitored to identify emerging hazards and to assess performance of risk controls in the operational systems.

b. Design Expectations:

(1) The organization will establish and maintain a confidential employee safety reporting and feedback system as in Component 4.0 b (1) (e).

(2) Employees will be encouraged to use the safety reporting and feedback system without fear of reprisal and to submit solutions/safety improvements where possible.

(3) Data from the safety reporting and feedback system will be monitored to identify emerging hazards.

(4) Data collected in the safety reporting and feedback system will be included in analyses described in Process 3.1.7.

PROCESS 3.1.7 ANALYSIS OF DATA.

a. Performance Objective: The organization will analyze the data acquired in Processes 3.1.1 through 3.1.6 to assess the performance and effectiveness of risk controls in the organization's operational processes and the SMS, and to identify root causes of nonconformance's and potential new hazards.

b. Design Expectations:

(1) The organization will analyze the data acquired in Processes 3.1.1 through 3.1.6 to demonstrate performance and effectiveness of:

(a) Risk controls in the organization's operational processes, and

(b) The SMS.

(2) Through data analysis, the organization will identify root causes of nonconformance and potential new hazards and evaluate where improvements can be made to the organizations:

(a) Operational processes, and

(b) The SMS.

PROCESS 3.1.8 SYSTEM ASSESSMENT.

a. Performance Objective: The organization will perform an assessment of the safety performance and effectiveness of risk controls, conformance to SMS expectations as stated herein, and the objectives of the safety policy.

b. Design Expectations:

(1) The organization will assess the performance and effectiveness of:

(a) Safety-related functions of operational processes against their objectives and expectations, and

(b) The SMS against its objectives and expectations.

(2) System assessments will document results that indicate a finding of:

(a) Conformity with existing safety risk control(s)/SMS expectations(s) (including regulatory requirements applicable to the SMS);

(b) Nonconformity with existing safety risk control(s)/SMS expectations(s) (including regulatory requirements applicable to the SMS); and

(c) New hazard(s) found.

(3) The SRM process will be utilized if the assessment indicates:

(a) The identification of new or potential hazards, or

(b) The need for system changes.

(4) The organization will maintain records of assessments in accordance with the expectations of Element 1.5 b (3) and (4).

ELEMENT 3.2 MANAGEMENT OF CHANGE.

a. Performance Objective: The organization's management will identify and determine acceptable safety risk for changes within the organization that may affect established processes and services by new system design, changes to existing system designs, new operations/procedures, or modified operations/procedures.

b. Design Expectations:

(1) The following will not be implemented until SRM (Component 2.0) is accomplished:

(a) New system designs,

(b) Changes to existing system designs,

(c) New operations/procedures, and

(d) Modified operations/procedures.

ELEMENT 3.3 CONTINUOUS IMPROVEMENT.

a. Performance Objective: The organization will promote continuous improvement of its SMS through recurring application of SRM (Component 2.0), SA (Component 3.0), and by using safety lessons learned and communicating them to all personnel.

b. Design Expectations:

(1) The organization will continuously improve SMS and safety risk control effectiveness through the use of the safety and quality policies, objectives, audit and evaluation results, analysis of data, preventive/corrective actions, and management reviews.

(2) The organization will develop safety lessons learned.

(a) Lessons learned information will be used to promote continuous improvement of safety; and

(b) The organization will communicate information on safety lessons learned throughout the organization.

PROCESS 3.3.1 PREVENTIVE/CORRECTIVE ACTION.

a. Performance Objective: The organization will take preventive and corrective action to eliminate the causes, or potential causes of nonconformance identified during analysis, to prevent recurrence.

b. Design Expectations:

(1) The organization will develop:

(a) Preventive actions for identified potential nonconformities with risk controls, and

(b) Corrective actions for identified nonconformities with risk controls.

(2) Safety lessons learned will be considered in the development of:

(a) Preventive actions, and

(b) Corrective actions.

(3) The organization will take necessary preventive/corrective action based on the findings of investigations.

(4) The organization will prioritize and implement preventative/corrective action(s) in a timely manner.

(5) Records will be kept and maintained of the disposition and status of preventive/corrective actions.

PROCESS 3.3.2 MANAGEMENT REVIEW.

a. Performance Objective: Top management will conduct regular reviews of the SMS to assess the performance and effectiveness of the organization's operational processes and the need for improvements.

b. Design Expectations:

(1) Top management will conduct regular reviews of the SMS, including:

(a) The outputs of SRM (Component 2.0),

(b) The outputs of SA (Component 3.0), and

(c) Lessons learned (Element 3.3 b (2).

(2) Management reviews will include assessing the performance and effectiveness of an organization's process designs, the implications of such, and the need for improvements of:

(a) Operational processes, and

(b) The SMS.

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COMPONENT 4.0 SAFETY PROMOTION.

a. Performance Objective: Top Management will promote the growth of a positive safety culture and communicate it throughout the organization.

b. General Design Expectations:

(1) Top management will promote the growth of a positive safety culture by:

(a) Publication of top management's stated commitment to safety to all employees;

(b) Visibly demonstrating their commitment to the SMS;

(c) Communicating the safety responsibilities for the organization's personnel;

(d) Clearly and regularly communicating safety policy, goals, objectives, standards, and performance to all organizational employees;

(e) Creating an effective employee reporting and feedback system that provides confidentiality;

(f) Using a safety information system that provides an accessible, efficient means to retrieve safety information; and

(g) Making essential resources available to implement and maintain the SMS.

ELEMENT 4.1 COMPETENCIES AND TRAINING.

PROCESS 4.1.1 PERSONNEL EXPECTATIONS (COMPETENCE).

a. Performance Objective: The organization will document competency requirements for those positions identified in Elements 1.2 b (3) and 1.3 and ensure those requirements are met.

b. Design Expectations:

(1) The organization will determine and document competency requirements for those positions identified in Elements 1.2 b (3) and 1.3.

(2) The organization will ensure that those individuals in the positions identified in Elements 1.2 b (3) and 1.3, meet the Process 4.1.1 b (1) competency requirements.

PROCESS 4.1.2 TRAINING.

a. Performance Objective: The organization will develop, document, deliver, and regularly evaluate training necessary to meet competency requirements of Process 4.1.1 b (1).

b. Design Expectations:

(1) Training needed to meet competency requirements of Process 4.1.1 b (1) will be developed for those individuals in the positions identified in Elements 1.2 b (3) and 1.3.

(2) Training development will consider scope, content, and frequency of training required to maintain competency for those individuals in the positions identified in Elements 1.2 b (3) and 1.3.

(3) Employees will receive training commensurate with their:

(a) Position level within the organization, and

(b) Impact on the safety of the organization's products or services.

(4) To ensure training currency, training will be periodically:

(a) Reviewed and

(b) Updated.

ELEMENT 4.2 COMMUNICATION AND AWARENESS.

a. Performance Objective: Top Management will communicate the outputs of its SMS to its employees, and will provide its oversight organization access to SMS outputs in accordance with established agreements and disclosure programs.

b. Design Expectations:

(1) The organization will communicate safety critical outputs of the SMS, rationale behind controls, preventative or corrective actions and insure awareness of SMS objectives to its employees.

(2) The organization will provide its oversight organization access to the outputs of the SMS.

(3) The organization's SMS will be able to inter-operate with other organization's SMSs to cooperatively manage issues of mutual concern.

APPENDIX 2

COMPARISON OF SAFETY MANAGEMENT SYSTEM (SMS) FRAMEWORK WITH OTHER STANDARDS

1. PURPOSE OF THIS APPENDIX. The table below is provided to assist those organizations developing and implementing an SMS. It provides a reference between existing standards and this SMS Framework. It includes references to the following:

a. Quality Management Systems via International Standards Organization International Organization for Standardization (ISO) 9001:2000 and the Aerospace Basic Quality System Standard (AS 9100) requirements;

b. Environmental Management Systems via ISO 14001 requirements; and

c. Occupational Safety and Health Management Systems via OHSAS 18001. OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems, which was created through a concerted effort from a number of the world's leading national standards bodies, certification bodies, and specialist consultancies.

d. Federal Aviation Administration (FAA) advisory circular (AC) 120-92, Appendix 1, clause numbers (old SMS Standard).

Note: The following table is intended to assist the organization SMS developers in building on existing management systems to develop the SMS and/or integrating its SMS with these existing management systems.

Table 1. SMS FRAMEWORK COMPARED WITH OTHER STANDARDS.

Content (Standards)	SMS Framework	AC 120-92 (2006, App 1)	ISO 9001: 2000/AS 9100	ISO 14001	OHSAS 18001
Purpose and Applicability	1	1	1	1	1
References (Normative)	2	2	2	2	2
Definitions	3	3	3	3	3
Functional Expectations	4	4	4	4	4
General requirements (and Responsibility/ Authority (ISO 9000))	1.0	4.1	4.1, 5.5	4.1	4.1
Policy (safety, environmental,	1.0 b (4)(b), 1.1	4.0	5.1, 5.3, 8.5	4.2	4.2

Content (Standards)	SMS Framework	AC 120-92 (2006, App 1)	ISO 9001: 2000/AS 9100	ISO 14001	OHSAS 18001
quality)					
Planning	1.0 b (4)(g)	4.4	5.4	4.3	4.3
Requirements (hazard/risk, environmental aspects, customer requirements)	2.0, 3.2	5.0, 5.7	5.2, 7.2.1, 7.2.2	4.3.1	4.3.1
Legal and other requirements, customer focus (ISO 9000)	1.0 b (4) (c), (d)	4.6	5.2, 7.2.1	4.3.2	4.3.2
Objectives and targets	1.1, 2.1.1	4.2, 5.1	5.4.1	4.3.3	4.3.3
Programs, action planning to meet targets, continuous improvement	1.0 b (4) (g), 2.2.3	4.4	5.4.2, 8.5.1	4.3.4	4.3.4
Management responsibility and organizational structure	1.2	4.5	5, 6 (Resource mgmt.)	4.4.1	4.4.1
Training	4.1.1, 4.1.2	7.3, 7.4	6.2.2	4.4.2	4.4.2
Communications	3.1.6, 3.3, 4.2	6.3.6, 6.8, 7.2	5.5.3, 7.2.3	4.4.3	4.4.3
Documentation and quality manual (ISO 9000)	1.5	4.9	4.2	4.4.4	4.4.4
Document and data control	1.5	4.9	4.2.3	4.4.5	4.4.5
Operational control and product realization	1.0 b (4) (e), (f)	4.1, 4.7	7	4.4.6	4.4.6
Emergency preparedness and response, control of nonconforming product (ISO	1.4	4.8	8.3	4.4.7	4.4.7

Content (Standards)	SMS Framework	AC 120-92 (2006, App 1)	ISO 9001: 2000/AS 9100	ISO 14001	OHSAS 18001
9000)					
Performance measurement and monitoring	1.0, 3.1.1, 3.1.7, 3.1.8	6.3.1, 6.4, 6.5	8	4.5	4.5
Content (Standards)	**SMS Framework**	**AC 120-92 (2006, App 1)**	**ISO 9001: 2000/AS 9100**	**ISO 14001**	**OHSAS 18001**
Accidents, incidents, nonconformity, corrective and preventive action	3.1.5, 3.1.8, 3.3.1	6.3.5, 6.5, 6.6	8.3, 8.5.2, 8.5.3	4.5.2	4.5.2
Auditing	3.1.3 - 3.1.5	6.3.2, 6.3.3, 6.3.4	8.2.2	4.5.4	4.5.4
Management review	3.3.2	6.7	5.6	4.6	4.6
Continuous Improvement	3.3	6.8	8.5.1	4.3.4	4.3.4

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APPENDIX 3

SAMPLE RISK ASSESSMENT TOOLS

1. PURPOSE OF THIS APPENDIX. The table below is provided to assist those organizations developing and implementing a Safety Management System (SMS). It provides examples of potential criteria for the severity of consequences and likelihood of occurrence that may be used by an aviation service provider.

2. SEVERITY AND LIKELIHOOD CRITERIA. The definitions and final construction of the matrix is left to the aviation service provider's organization to design. The definitions of each level of severity and likelihood will be defined in terms that are realistic for the operational environment. This ensures each organization's decision tools are relevant to their operations and operational environment, recognizing the extensive diversity in this area. An example of severity and likelihood definitions is shown in Table 1 on the following page. Each aviation service provider's specific definitions for severity and likelihood may be qualitative, but quantitative measures are preferable, where possible.

TABLE 1. SAMPLE SEVERITY AND LIKELIHOOD CRITERIA

Severity of Consequences			Likelihood of Occurrence		
Severity Level	Definition	Value	Likelihood Level	Definition	Value
Catastrophic	Equipment destroyed, multiple deaths	5	Frequent	Likely to occur many times	5
Hazardous	Large reduction in safety margins, physical distress or a workload such that aviation service providers cannot be relied upon to perform their tasks accurately or completely. Serious injury or death. Major equipment damage.	4	Occasional	Likely to occur sometimes	4
Major	Significant reduction in safety margins, reduction in the ability of aviation service providers to cope with adverse operating conditions as a result of an increase in workload, or as result of conditions impairing their efficiency. Serious incident. Injury to persons.	3	Remote	Unlikely, but possible to occur	3
Minor	Nuisance. Operating limitations. Use of emergency procedures. Minor incident.	2	Improbable	Very unlikely to occur	2
Negligible	Little consequence	1	Extremely Improbable	Almost inconceivable that the event will occur	1

a. Risk Acceptance. In the development of its risk assessment criteria, aviation service providers are expected to develop risk acceptance procedures, including acceptance criteria and designation of authority and responsibility for risk management decision making.

The acceptability of risk can be evaluated using a risk matrix such as the two examples illustrated in Figure 1. The example matrices show three areas of acceptability.

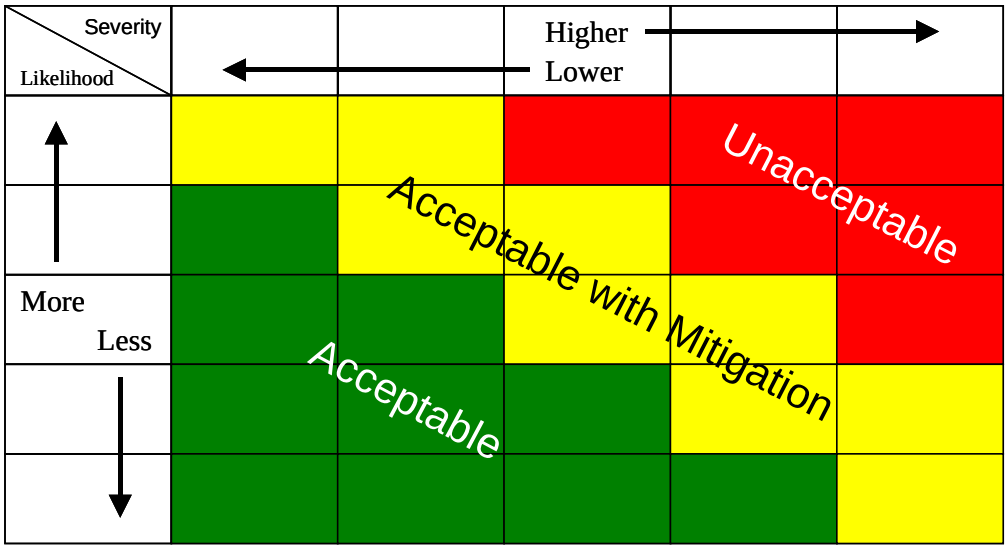
Risk matrices may be color coded; unacceptable (red), acceptable (green), and acceptable with mitigation (yellow).

(1) Unacceptable (Red). Where combinations of severity and likelihood cause risk to fall into the red area, the risk would be assessed as unacceptable and further work would be required to design an intervention to eliminate that associated hazard or to control the factors that lead to higher risk likelihood or severity.

(2) Acceptable (Green). Where the assessed risk falls into the green area, it may be accepted without further action. The objective in risk management should always be to reduce risk to as low as practicable regardless of whether or not the assessment shows that it can be accepted as is. This is a fundamental principle of continuous improvement.

(3) Acceptable with Mitigation (Yellow). Where the risk assessment falls into the yellow area, the risk may be accepted under defined conditions of mitigation. An example of this situation would be an assessment of the impact of a non-operational aircraft component for inclusion on a minimum equipment list (MEL). Defining an Operational (O) or Maintenance (M) procedure in the MEL would constitute a mitigating action that could make an otherwise unacceptable risk acceptable, as long as the defined procedure was implemented. These situations may also require continued special emphasis in the Safety Assurance function.

FIGURE 1. SAFETY RISK MATRIX EXAMPLES



Example 1

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

Example 2

Note: (The direction of *higher/lower* and *more/less* scales on a matrix is at the discretion of the organization)

b. Other Risk Assessment Tools for Flight and Operational Risk Management. Other tools can also be used for flight or operational risk assessment such as the Controlled Flight into Terrain (CFIT), Approach and Landing Accident Reduction (ALAR), operational control, and ground operations risk assessment tools available from the Flight Safety Foundation (http://www.flightsafety.org/technical_initiatives.html).

c. Causal Analysis. Risk analyses should concentrate not only on assigning levels of severity and likelihood but on determining why these particular levels were selected. This is referred to as *root cause analysis*, and is the first step in developing effective controls to reduce risk to lower levels.

Several structured software systems are available to perform root cause analysis. However, in many cases, simple brainstorming sessions among the company's pilots, mechanics, or dispatchers other experienced subject matter experts is the most effective and affordable method of finding ways to reduce risk. This also has the advantage of involving employees who will ultimately be required to implement the controls developed.

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APPENDIX 4

TABLE OF EXPECTED SAFETY MANAGEMENT SYSTEM (SMS) OUTPUTS

1. PURPOSE OF THIS APPENDIX. To a large extent, controls are built into the design of the SMS Framework. A general expectation of the Policy Component is that SMS outputs will be "recorded, monitored, measured, and analyzed" (Component 1.0, b (3)). The Internal Evaluation Process (3.1.3, b (1)), of the Safety Assurance Component 3.0 calls for evaluations "at planned intervals" of SMS conformance to objectives and expectations.

2. MEASUREMENTS. Each of the outputs should also have a method of measurement specified by the organization in accordance with Component 1.0, b (2) "SMS processes will be…measured…" Measures need not be quantitative where this is not practical. All that should be expected is some method of providing objective evidence of the attainment of the expectation.

Note: There is a relationship between controls and process measures. That is, the internal evaluation process is the method of controlling the processes, through the associated data collection, analysis, assessment, and preventive/corrective action processes. The individual outputs are the content of the measures.

3. MANAGEMENT REVIEWS. Finally, management reviews are the means of making sure that the appropriate levels of responsibility and authority are brought into the process and that management can be accountable in a proactive way, rather than an after-the-fact attribution.

Note: Table 1 below is a complete set of outputs, as a minimum expectation, for the content of internal evaluations of each process area.

TABLE 1. TABLE OF EXPECTED SMS OUTPUTS

Process	Reference	Output Expectation
Component 1.0 - Safety Policy and Objectives		
This table does not apply to the first component		
Component 2.0 - Safety Risk Management		
2.1.1 System/Task Analysis	2.1.1b(1)	System descriptions for following situations:
	2.0b(2)(a)	• Initial designs of systems, organizational procedures, and products
	2.0b(2)(b)	• Development of operational procedures
	2.0b(2)(d)	• Planned Changes
2.1.2 Identify Hazards	2.1.2b(1)b)	Hazards documented
	2.1.2b(2)(a)	Hazards tracked
2.2.1 Analyze Safety Risk	2.2.1b(1)(c)	Assignment of severity and likelihood for each hazard (as documented in 2.1.2)
2.2.2 Assess Safety Risk	2.2.2b(1)	Assessment of risk acceptability for each hazard (as documented in 2.1.2)
2.2.3 Control/Mitigate Safety Risk	2.2.3b(1)	Risk control/mitigation plans for each hazard with an unacceptable risk (as assessed in 2.2.2)
Component 3.0 - Safety Assurance		
3.1.1 Continuous	3.1.1	Objective evidence of monitoring activities in

Process	Reference	Output Expectation
Monitoring		accordance with company policy
3.1.2 Internal Audit by Operational Departments	3.1.2b(5)(b)(1)	Plans
	3.1.2b(5)(b)(3) & (4)	Reports/records
3.1.3 Internal Evaluation	3.1.3b(3)(d)(2)(a)	Plans
	3.1.3b(3)(d)(2)(c) & (d)	Reports/records
3.1.4 External Auditing of the SMS	3.1.4	Objective evidence of external audit findings (e.g., International Air Transport Association Operational Safety Audit (IOSA), International Business Aviation Council (IS-BAO), Air Charter Safety Foundation (ACSF), and Federal Aviation Administration (FAA))
3.1.5 Investigations	3.1.5b(1)	Data collected (e.g. records, reports) for investigations of:
	3.1.5b(1)(a)	• Incidents
	3.1.5b(1)(b)	• Accidents
	3.1.5b(1)(c)	• Potential regulatory violations (e.g., Voluntary Disclosure Reporting Program (VDRP) records)
3.1.6 Employee Reporting and Feedback System (ERS)	3.1.6b(1)	Evidence of system (e.g. report file, log, database)
	3.1.6b3)	Evidence of monitoring of ERS data for hazards
	3.1.6b(4)	Evidence of analysis of ERS data
3.1.7 Analysis of Data	3.1.7b 3.1.7b(1)	Objective evidence of analysis processes for each data type
3.1.8 System Assessment	3.1.8b(4)	Records of system assessments
3.3.1 Preventive/Corrective Action	3.3.1b(1)	Corrective action plans
	3.3.1b(5)	Records of disposition and status of corrective actions
3.3.2 Management Review	3.3.2b(1)	Objective evidence of management reviews (e.g., minutes, log)
Component 4.0 - Safety Promotion		
4.1.1 Personnel Expectations (Competence)	4.1.1b(1)	Documented competency requirements in accordance with 1.2 b(3) & 1.3b(1)
4.1.2 Training	4.1.2b(1)	Plans/requirements
	4.1.2b(3)	Records
	4.1.2b(4)	Reviews