**THE HASHEMITE KINGDOM OF JORDAN
CIVIL AVIATION REGULATORY COMMISSION**
DIRECTORATE OF AIRPORTS SAFETY AND STANDARDS

OVERVIEW OF

SAFETY MANAGEMENT SYSTEM

- Information Paper -

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F O R E W O R D

Safety Management Systems for Airports Overview, explains what a safety management system (SMS) is and how a systems approach to safety management will serve both the safety and business aspects of airports.

The implementation of SMS represents a change in the safety culture of an organization. In this regard, airport operators and members of their governing boards will find this document particularly useful since the successful implementation of SMS is dependent on the commitment of the highest levels of management.

This overview provides a brief description of a safety management system (SMS) and is intended to be an easy-to-read, quick introduction to SMS for airport operators , and their stakeholders. It describes the advantages associated with instituting such a system and explains the four components or pillars (safety policy, safety risk management, safety assurance, and safety promotion) that are part of an SMS.
Overview also provides background information on the International Civil Aviation Organization's requirements for SMS at airports.

Although the concept of safety management systems has been around for several years, it is relatively new to airports. Many of the procedures and practices that the Jordanian airport operators have been using to comply with the current requirements of JCAR Part 139 will provide the basis for establishing an SMS.

Historically, aviation safety has been built upon the reactive analysis of past accidents and the introduction of technological corrective actions to prevent the recurrence of those events. With today's extremely high technology, it is increasingly difficult to make further improvements to the level of safety by using this approach. Therefore, a proactive approach to managing safety has been developed that concentrates on the control of processes rather than solely relying on inspection and remedial actions on end products.

This innovation in aviation system safety is called a Safety Management System (SMS), an expression indicating that safety efforts are most effective when established as a fully integrated part of the business operation.

It is now generally accepted that most aviation accidents result from human error. It would be easy to conclude that these errors indicate carelessness or incompetence on the job, but that would not be accurate. Investigations revealed that the human is only the last link in a chain that leads to an accident. These accidents will not be prevented by merely changing people; increased safety can only occur when the underlying contributing factors are addressed.

Enhancing overall safety in the most efficient manner requires the adoption of a systems approach to safety management. Every segment and level of an organization must become part of a safety culture that promotes and practices risk reduction.

Safety management is based on the premise that there will always be safety hazards and human errors. SMS establishes processes to improve communication about these risks and take action to mitigate them. This approach will subsequently improve an organization's overall level of safety.

SYSTEM SAFETY AND THE BENEFITS OF
SAFETY MANAGEMENT SYSTEMS

A Safety Management System (SMS) is a formal, top-down business-like approach to managing safety risk that is built on basic system safety principles. This section describes those principles, outlines the differences between SMS and traditional approaches to safety, and details the benefits to be gained from SMS implementation.

System safety is the application of engineering and management principles, criteria, and techniques to achieve an acceptable level of safety throughout all phases of a system.

Achieving this definition of system safety is the primary objective of SMS. A well-structured SMS provides a systematic, explicit, and comprehensive process for identification hazards and managing risks. This process includes goal setting, planning, documentation, and regular evaluation of performance to ensure that goals are being met.

SMS includes several key system safety principles as shown below:

☞ **Management commitment to safety**

Because the attitudes and actions of management can significantly influence the entire staff, it is therefore critical that these leaders commit to the success of an SMS implementation.

☞ **Proactive identification of hazards**

Early identification and reporting of hazards can save a significant amount of time and resources down the road.

☞ **Actions taken to manage risks**

A system must be in place to determine logical approaches to counteract known risks to safe operation.

☞ **Evaluation of safety actions**

An ongoing evaluation of the impacts of risk management actions is necessary to determine if further remedial activities are required.

Most of these principles exist in some form in current safety systems. SMS is not intended to be a new system; rather it builds upon an organization's existing safety processes. However, there are a number of ways in which SMS differs from the traditional approaches. One of the key differences is that SMS takes a proactive approach to safety management—it goes beyond prescriptive audits and checklist-based inspections to develop procedures and indicators that define safety risks.

SMS spreads responsibility for safe operations throughout all levels and segments of the organization. This increase in the number of people watching for safety issues makes it less likely that a hazard will go undetected and possibly lead to an accident. This is depicted in Figure 1.1, where each "slice" represents a different segment or layer of the organization defenses. In the diagram, a generic organization is represented by four segments—in an airport setting, this could include such groups as facilities, operations, safety, and management.

 Each SMS implementation will have its own customized set of layers that coordinate to create the safety culture of SMS. Each slice has holes that symbolize the potential for a safety hazard to go unnoticed, because the that symbolize the potential for a safety hazard to go unnoticed, because the layer does not deal with that type of hazard, or due to human error. However, when these layers are unified by SMS principles, it becomes less likely that a hazard makes it through all the levels without being identified and mitigated.
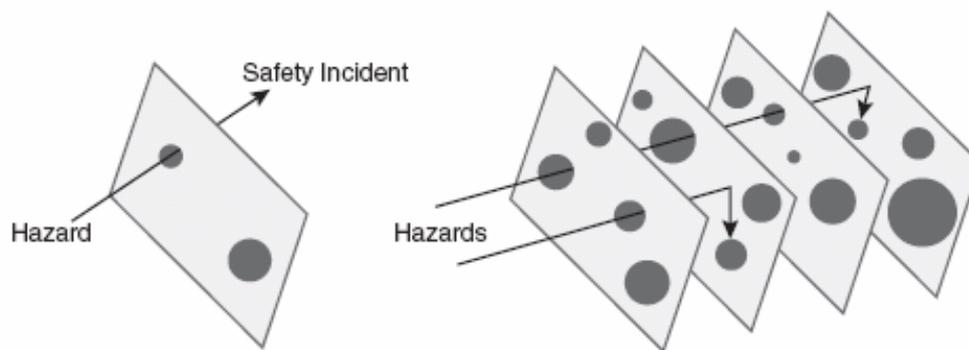

Figure 1: SMS Layers (Adapted from James Reason, Human Error Cambridge University Press)

SMS has much in common with Quality Management (or Quality Assurance) systems in that they both require planning, performance monitoring, communication, and the participation of all employees. Moreover, SMS recognizes that human and organizational errors can never be entirely eliminated and seeks to reduce them by developing a safety-oriented culture. This kind of environment focuses on managing hazardous conditions before they can become something more serious.

It is important to note that implementing SMS does *not* involve imposing an additional layer of oversight or regulations on the organization. Rather, it is an organizational shift that is seamlessly integrated into the routine day-to-day operations.

BENEFITS OF SMS

Clearly, the ultimate goal of SMS is to control risk up to an acceptable level, fewer accidents and injuries. Moreover, increasing a system's level of safety leads to reduced material losses and enhances productivity. This makes the case that safety is good for business.
Some further benefits include:

- Reduction of the direct and indirect costs of accidents
  - Fines, repair costs, damage claims, and increased insurance premiums are a few of the potential economic consequences of an airport mishap.

- Improved employee morale and productivity
  - Promoting communication between management and the rest of the organization prevents disenfranchisement and lifts morale.

- Establishing a marketable safety record
  - A record of consistently safe operations can be used to attract new business and investment.

- Logical prioritization of safety needs
  - SMS emphasizes risk mitigation actions that provide the biggest impact on both safety and the bottom line.

- Compliance with legal responsibilities for safety
  - Airport certification requirements mandate a number of safety processes and standards that can be included in an organization's SMS.

- More efficient maintenance scheduling and resource utilization
  - Effective hazard reporting in SMS allows proactive scheduling of maintenance tasks when resources are available; increasing the likelihood that maintenance is performed on time and more efficiently.

- Avoiding incident investigation costs and operational disruptions
  - Improved communication and risk mitigation will prevent many accidents from ever occurring.

- Continuous improvement of operational processes
    - SMS allows for lessons learned to be incorporated into the system and lead to superior operations.

Finally, ICAO have announced or proposed requirements or plans to implement safety management systems for air traffic services, airline oversight, and airports. This demonstrates their confidence in the safety management capabilities of SMS

THE COMPONENTS OF SMS

Every SMS implementation is based on four primary components, or pillars, as shown in Figure 2. This section describes how each one contributes to improving safety and briefly details the activities that make up each pillar.

SAFETY MANAGEMENT SYSTEM

SAFETY POLICY
- Policy Statement
- Organizational Structure
- Procedures

SAFETY RISK MANAGEMENT
- Hazard Identification
- Risk Assessment
- Risk Mitigation and Tracking

SAFETY ASSURANCE
- Internal Audits
- External Audits
- Corrective Action

SAFETY PROMOTION
- Culture
- Training
- Communication

Figure 2: The Pillars of SMS

1. SAFETY POLICY

SMS will only be effective when a Safety Policy is developed and communicated to the organization. A policy statement should be issued to clearly reflect top management's commitment to safety. The Safety Policy also must indicate how safety management principles will be integrated into the organizational structure and define the procedures necessary for a successful SMS implementation.
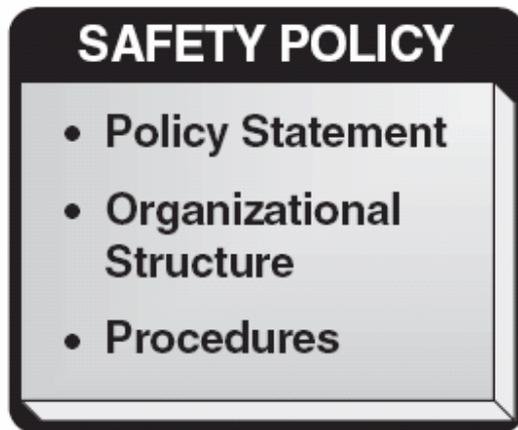
1.1 POLICY STATEMENT

The Safety Policy is a written document from senior management that is communicated to all employees. Other affiliated entities with a stake in organizational safety should also be informed. In an airport environment these might include airlines and other operators, local police, and concourse vendors. The Safety Policy should include the following:

- Commitment to implementation of the SMS.

- Assurance that executives are monitoring safety performance just as keenly as financial performance.

- Encouragement for all employees to report potential safety issues without fear of reprisal.

- Establishment of clear standards for acceptable behavior related to safety.

- Commitment to providing the necessary resources.

1.2 ORGANIZATIONAL STRUCTURE

The Safety Policy also includes the organizational structure that will be relied upon to achieve and maintain the stated safety objectives.

The organizational structure should be appropriate to the size, complexity, and operating environment of the organization. Large organizations may be best served by a formal SMS that utilizes a cross-functional Safety Committee, while smaller organizations may adequately perform the same functions with a more informal approach.

Regardless of the size of the organization, a Safety Manager should be designated as the focal point for implementation and maintenance of the SMS. While it is preferable for the Safety Manager to have no additional roles, this may not be possible in smaller organizations. In that case, the Safety Manager's other responsibilities should not present a conflict of interest with safety management. The Safety Manager should be high enough in the organization to be able to communicate directly with top management.

1.3 PROCEDURES

Safety procedures will lay out the process by which the organization identifies and remedies safety risks. They are subject to revision as circumstances change or more effective procedures are developed. It is critical that any changes be clearly communicated to all affected staff, and that the procedures are easily accessible to all for reference or continuing education purposes.

2. SAFETY PROMOTION

Safety Promotion is necessary to ensure that the entire organization fully understands and trusts the SMS policies, procedures, and structure. This pillar is achieved by establishing a culture of safety, training employees in safety principles, and allowing open communication of safety issues.

2.1 CULTURE

The main goal of safety promotion is to create a "safety culture" that allows the SMS to succeed. Having a safety culture means that all employees are responsible for safety. Such a culture is led by top management example, especially in the manner with which they deal with day-to-day activities. Employees must fully trust that they will have management support for decisions made in the interest of safety, while also recognizing that intentional breaches of safety will not be tolerated. The result is a non- punitive environment that encourages the identification, reporting, and correction of safety issues.

2.2 TRAINING

In order to fulfill their responsibilities in an SMS-based organization, each employee must be trained in, or at least be aware of, safety principles. All personnel must understand the organization's safety philosophy, policies, procedures, and practices. They must also know their roles and responsibilities within the safety management framework. The depth of the training should be appropriate to each individual's position and vary from general safety familiarization to expert-level training for safety specialists. Recurrent training may also be necessary to keep personnel up to date on any changes to SMS procedures.

2.3 COMMUNICATION

Individual safety training is supplemented by an ongoing two-way communication process that helps ensure that employees benefit from safety lessons learned, see the results of their actions, and continue to improve their understanding of the organization's SMS. When new procedures are introduced, the associated underlying safety analysis should also be communicated to the appropriate employees. In addition to written communications, it is important for employees to witness evidence of the commitment of top management to safety.

3. SAFETY RISK MANAGEMENT

Aviation is an activity that faces numerous risks on a daily basis. It is impossible to completely eliminate all risks; however, risk can be reduced to an acceptable level through Safety Risk Management (SRM) techniques.
These consist of hazard identification, risk assessment, and risk mitigation and tracking

3.1 HAZARD IDENTIFICATION

The first step in Safety Risk Management is to identify hazards that the organization faces in its operational environment. A description of the system or operation that is going to be changed or implemented must be developed as part of this step in order to be able to identify what could go wrong. A hazard is any existing or potential condition that can lead to an accident or incident. In an SMS, all identified hazards are documented and analyzed to determine what action is required to eliminate or reduce the safety risk associated with the hazard.

> ☞ **Identifying hazards is a key step to managing safety risk.** Safety researcher James Reason has estimated that for each major accident there are as many as 360 incidents that might have identified an underlying problem in time to prevent the accident had they been properly reported and investigated.

3.2 RISK ASSESSMENT

Each identified hazard undergoes a risk assessment to determine its potential consequences. The assessment considers both the severity of the consequences and the probability of such an event occurring. Risk assessment matrices like the ones shown below will be used in this analysis. The assessment may show that certain hazards have an acceptable level of risk, while others require mitigation.

(Matrix A) Risk probability

Probability of occurrences		
Qualitative definition	**Meaning**	**Value**
Frequent	Likely to occur many times (Has occurred frequently)	**5**
Occasional	Likely to occur some times (Has occurred infrequently)	**4**
Remote	Unlikely, but possible to occur (Has occurred rarely)	**3**
Improbable	Very unlikely to occur (Not known has occurred)	**2**
Extremely improbable	Almost inconceivable that the event will occur	**1**

(Matrix B) Risk severity

Severity of occurrences		
Aviation definition	**Meaning**	**Value**
Catastrophic	• Equipment destroyed • Multiple deaths	**A**
Hazardous	• A large reduction in safety margins, physical distress or a workload such that the operators cannot be relied upon to perform their tasks accurately or completely • Serious injury or death to a number of people • Major equipment damage	**B**
Major	• A significant reduction in safety margins, a reduction in the ability of the operators to cope with adverse operating conditions as a result of increase in workload, or as a result of conditions impairing their efficiency • Serious incident • Injury to persons	**C**
Minor	• Nuisance • Operating limitations • Use of emergency procedures • Minor incident	**D**
Negligible	• Little consequences	**E**

(Matrix C) Level of risk

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

**(Matrix D)
Level of risk tolerability**

| Assessment risk index	Suggested criteria
5A,5B,5C,4A,4B,4C,3A	Unacceptable under the existing circumstances
5D,5E,4D,3B,3C,2A,2B	Risk control/mitigation requires management decision
4E,3D,2C,1A,1B	Acceptable after Review of the operation
3E,2D,2E,1C,1D,1E	Acceptable

3.3 RISK MITIGATION AND TRACKING

Mitigating actions should be fully analyzed to ensure that they address the root cause of the hazard It may be beneficial to explore a range of mitigating strategies before choosing the preferred option, basing the decision upon factors such as timeliness, cost, organizational capabilities, and overall effectiveness. It is essential that management provide adequate resources to address the identified safety concerns.

A system must be in place to determine logical approaches to counteract any risks to safe operation. This can be accomplished by reducing or eliminating a hazard's likelihood of occurrence. Alternatively, a risk might be managed by reducing the severity of its effects. Occasionally, both may be possible.

Finally, the mitigations that have been put in place must be monitored and tracked in order to ensure that the control strategies are working correctly.

4. SAFETY ASSURANCE

Safety Assurance functions provides confidence that the organization is meeting or exceeding its safety objectives. The functions—internal audits, external audits, and corrective action—provide feedback on the performance of the organization, as well as the effectiveness of implemented risk mitigation strategies.
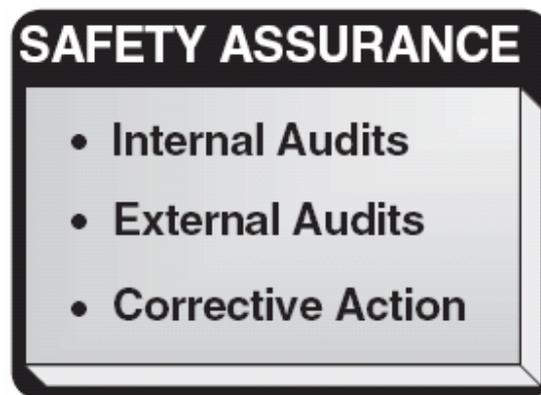
4.1 INTERNAL AUDITS

Internal audits are performed by each department within the organization to ensure that they are following the proper procedures and are achieving their safety objectives. These audits should be performed on a regular basis and may include surveys of employees and formal or informal inspections performed within a department. Both short- and long-term effectiveness of safety actions should be evaluated.

4.2 EXTERNAL AUDITS

External audits are conducted as part of the independent safety oversight of the organization. Audits can be scheduled or unscheduled and they provide a means for ensuring compliance with SMS standards, policies, and processes. For example, in a regulatory environment, the regulatory agency may conduct external audits.

4.3 CORRECTIVE ACTION

If an audit finds that prescribed procedures are not being followed, then corrective action should be taken by that department within the framework of Safety Assurance. Corrective action may also be taken to ensure that identified safety hazards are resolved.