Safety Management Systems for Aviation Distributors

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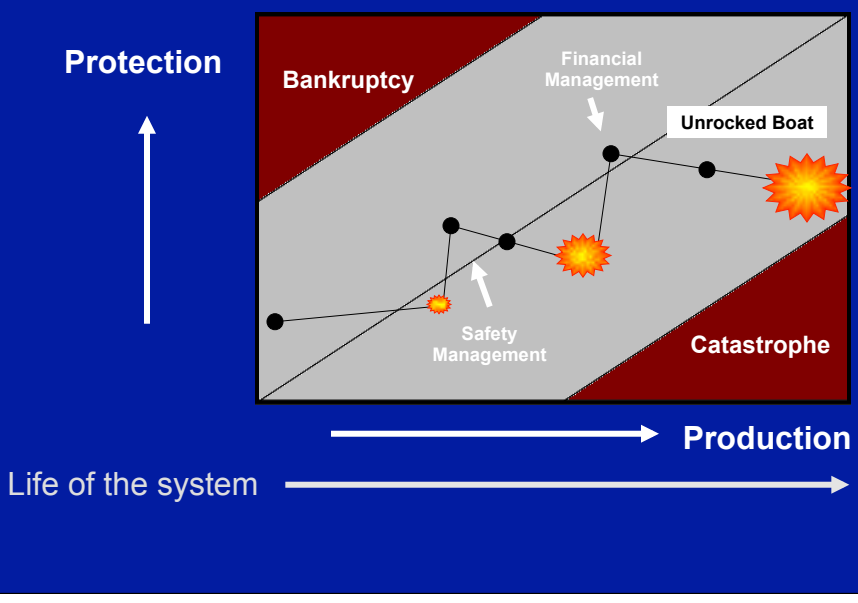
Block 1.0 The Business Case

- Aviation organization management requires managing many business processes.
- Safety management is a core business function just as financial management, HR management, etc.

This can be a management challenge!

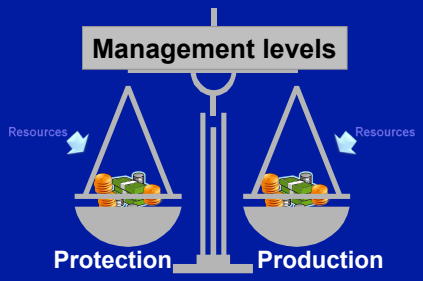
Safety Space



Safety Management System

Infuses safety into all parts of the system

- People
- Tools
- Procedures
- Materials
- Equipment
- Software



To maintain the balance of production and protection

Airline Accident and Incident Costs!

Direct costs

- Loss of aircraft
- Injuries to or death of flight crewmembers, passengers
- Insurance deductibles
- Costs not covered by insurance

Indirect costs

- Loss of use of equipment
- Loss of staff
  - Involved in accident issues
  - Lower productivity
- Investigation & clean-up
- Legal claims
- Fines
- Misplaced/stranded passengers
- Negative media exposure

Airline Income costs

Event	Direct	Indirect
Catering truck hits airplane	$17,000	$230,000
Jetway hits airplane	$50,000	$600,000
Landing event	$1,900,000	$4,800,000

Source: USAir/America West Airlines FY2006 Statistics

Distributor Income costs ???

Event	Direct	Indirect
FOD issues	$???	$???
Improper preservation (Inventory damage)	$???	$???
Shipping non-conforming part	$???	$???
Suspect / Counterfeit parts escapes	$???	$???
Improper disassembly of aircraft/engines	$???	$???

Traditional approach – Preventing accidents

- Focus on outcomes (causes)
- Unsafe acts by operational personnel
- Attach blame/punish for failures to "perform safely"
- Address identified safety concerns, exclusively

Identifies:

WHAT? **WHO?** **WHEN?**

But not always discloses:

WHY? **HOW?**

Safety Management Strategies

Reactive (Past)	Proactive (Present)	Predictive (Future)
Responds to events that have already happened, such as incidents and accidents	*Actively seeks the identification of hazardous conditions through the analysis of the organization's processes*	*Analyzes system processes and environment to identify potential future problems*

Block 0.2 Defining Safety

ICAO Definition of Safety

" …the state in which the possibility of harm to persons or of property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of hazard identification and safety risk management.

ICAO Doc 9859, Chapter 2.1.1

FAA Definition of Safety

"Safety or Safe. Freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment."

FAA System Safety Handbook, Chapter 1: Introduction December 30, 2000

SMS: Purpose and Methods

- Safety management systems provide a systematic way to control risk and to provide assurance that those risk controls are effective.
- The SMS gives the certificate holder a formal means of meeting statutory safety requirements (title 49) and the FAA a means of evaluating management capability

System Safety

- "The application of special technical and managerial skills in a systematic, forward looking manner to identify and control hazards throughout the life cycle of a project, program, or activity" (Roland & Moriarty, 1990)
- Traditional approach concentrates on technical
- SMS ***adds*** emphasis on management elements

ICAO Annex 19 – Safety Management

- Air traffic is projected to double in the next 15 years;
- Safety risks must proactively address significant capacity expansion;
- Must be managed through strategic regulatory and infrastructure developments.
- Consolidates existing SM provisions contained in other ICAO Annexes,

ICAO: "SMS"

Definition:

– A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.

FAA's SMS

"Aviation product/service providers over which FAA has safety oversight responsibility. Entities that provide products and services include airports, manufacturers, operators, maintenance organizations, training organizations, air traffic service providers, and others. Entities may be organizations or individuals.

•Ref :*FAA Order 8000.369B*

SMS applicability (cont.)

Who is an *aviation distributor*?

- air carriers,
- airlines,
- repair stations,
- maintenance repair organizations,
- air taxi operators,
- single pilot operators,
- corporate flight departments,
- pilot schools,
- approved training organizations
- organizations responsible for type design &/or manufactures (PAHs).

So, how does SMS relate to other Management Systems?

Same principles but different objectives

QMS Objective: Customer Satisfaction

EMS Objective: Environmental Safety

SMS Objective: Aviation Safety

SMS Misconceptions

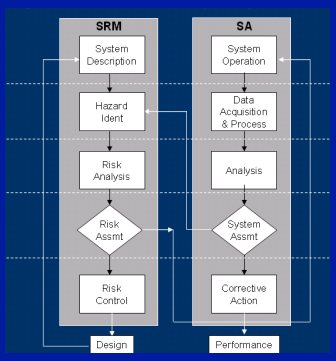
- There is an underlying misunderstanding between a QMS and a SMS.
- You can have a quality product or service, as defined by the ISO/AQMS standards, and *still* not have a safe product or service.
- Many people falsely assume this to mean processes designed to produce *a quality product*, (repeatedly doing the same thing, without variation) equates to the same thing as repeatedly producing a *safe product or service*.

•https://www.faa.gov/about/initiatives/sms/explained/quality_and_safety_management/
•Steven C. McNeely, Manager, Safety Management Systems, Jet Solutions, L.L.C, published by "Flight Safety Information February 12, 2010 No.034"

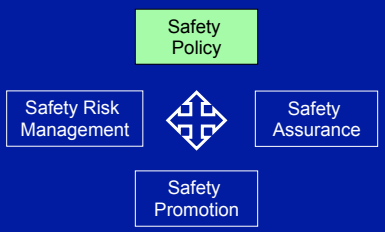
Block 0.3 The Pillars of SMS:

Provides a systematic way to:

1. Identify hazards and control risks.
2. Provide assurance that risk controls are effective.



1. Policy Component



Ref: FAA Flight Standards Service

SMS Safety Policy

- All management systems must define policies, procedures, and organizational structures to accomplish their goals.
- Policy establishes the structure of the SMS.
- Establishes management commitment and objectives – *what* the management wants
- Sets up framework of organizational structures, accountabilities, plans, procedures, and controls to meet objectives

Management Functions

Managers must be *actively* and *personally* involved in:

- Planning: Setting clear goals, guidelines, standards, and timelines for safety
- Organizing: Providing clear lines of management and supervisory responsibility, control and communication
- Directing: Allocation of resources needed for accomplishment of safety goals
- Controlling: Personal involvement in assurance of safety goals and objectives

Management Responsibility

- Managers should manage safety in the same way that they manage other areas of the business
- Safety management involves
  - judgment,
  - assessing priorities, and
  - making decisions
- Top management is required to provide resources

Top Management Involvement

Top management stimulates a healthy safety environment

- Visible, personal involvement of top management;
- Setting safety goals and objectives as policy;
- Allocation of resources to meet safety goals;
- Clear communication

AC 120-92, App. 1

Objectives of the Safety Policy

Top Management will:

- Implement an integrated, comprehensive SMS for entire organization
- Define a safety policy and set safety objectives
- Define roles, responsibilities, and authorities throughout the organization
- Appoint a member of management to implement and maintain the SMS

Safety Policy Requirements:

- There must be a commitment to:
  - Implement the SMS
  - Continually improve safety
  - Manage safety risk
  - Comply with statutory & regulatory requirements
- Establish clear standards of acceptable behavior:
  - Documented
  - Communicated
  - Periodically reviewed

A Bridge from Safety Policy to SRM and SA

Data → Analysis → Assessment

Facts (Data): Are reported (e.g. conditions; data)

- what exists or is happening now

Inferences (Analysis): Interpretations of facts (e.g. Hazards; Risk Analysis)

- What's likely to happen in the future, based on what's happening now
- Conclusions based on facts

Judgments (Assessments): Apply values onto inferences (e.g. Risk Assessment)

Airline Example:

- Facts (conditions):
  - Duty day is 14 hours
  - Flight schedule is 8 hours
  - Flights have 10 legs, 10 IFR approaches
  - Flights are legal (within regs.)
- Inference (hazard):
  - Crew fatigue will probably result
- Inference (risk analysis):
  - Likelihood that crew errors will increase
- Judgment (risk Assessment):
  - Unacceptable risk

Tier-2 OEM Example:

- Facts (Conditions):
  - Workweek is 5 days/wk
  - Workday production schedule is 8 hours; 1-shift
  - Customer demand for OEM to match increased aircraft/ engine roll-out schedule
- Inference (Hazard):
  - Increased demand on supply-chain will probably increase
  - Disruption of production schedule will probably result
- Inference (Risk analysis):
  - Need for alternate suppliers or materials could result
  - Likelihood product/service demand could exceed production capacity
  - Likelihood mfg. worker fatigue will increase
  - Likelihood operation errors could occur
- Judgment (Risk Assessment):
  - Unacceptable risk

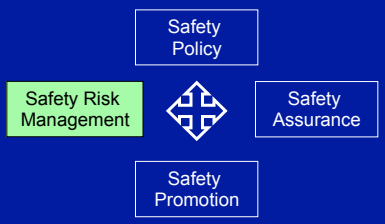
Repair Station Example:

- Facts (Conditions):
  - Workweek is 5 days/wk
  - Workday schedule is 8 hours; 2-shifts
  - Industry demand for CFM56 OHC reduced turn-times
- Inference (Hazard):
  - Work-shift turn-over will probably be needed
  - Work-shift fatigue will probably result
- Inference (Risk analysis):
  - Likelihood technician fatigue will increase
  - Likelihood operational errors will occur
- Judgment (Risk Assessment):
  - Unacceptable risk

Distributor Example:

- **Facts (Conditions):**
  - Workweek is 5 days/wk
  - Workday schedule is 8 hours; 1-shift
  - Industry demand for aftermarket CFM56 parts has increased
- **Inference (Hazard):**
  - Increased demand on industry aftermarket sources will probably increase
  - Inference (Risk analysis):
  - Likelihood for sourcing from unvetted sources could result.
  - Likelihood industry demand could exceed aftermarket supply
  - Likelihood SUPs or counterfeit parts could find their way into the supply-chain could occur
- **Judgment (Risk Assessment):**
  - Unacceptable risk

Block 2.0
Safety Risk Management



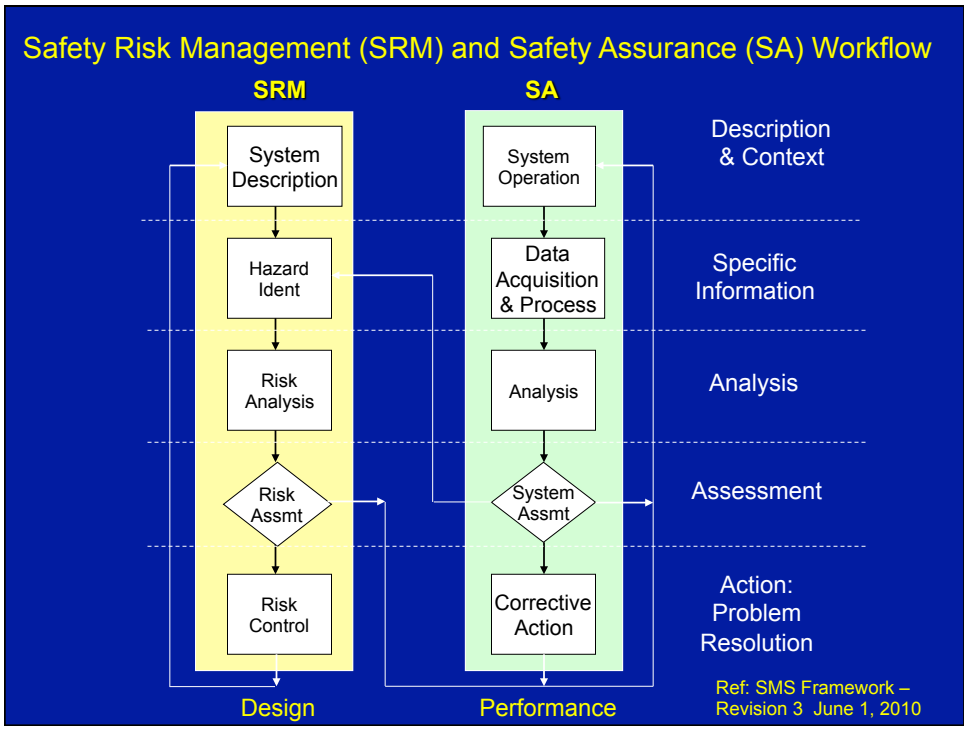
Source: FAA SMS Program Office Manager, *Don Arendt, Ph.D.*

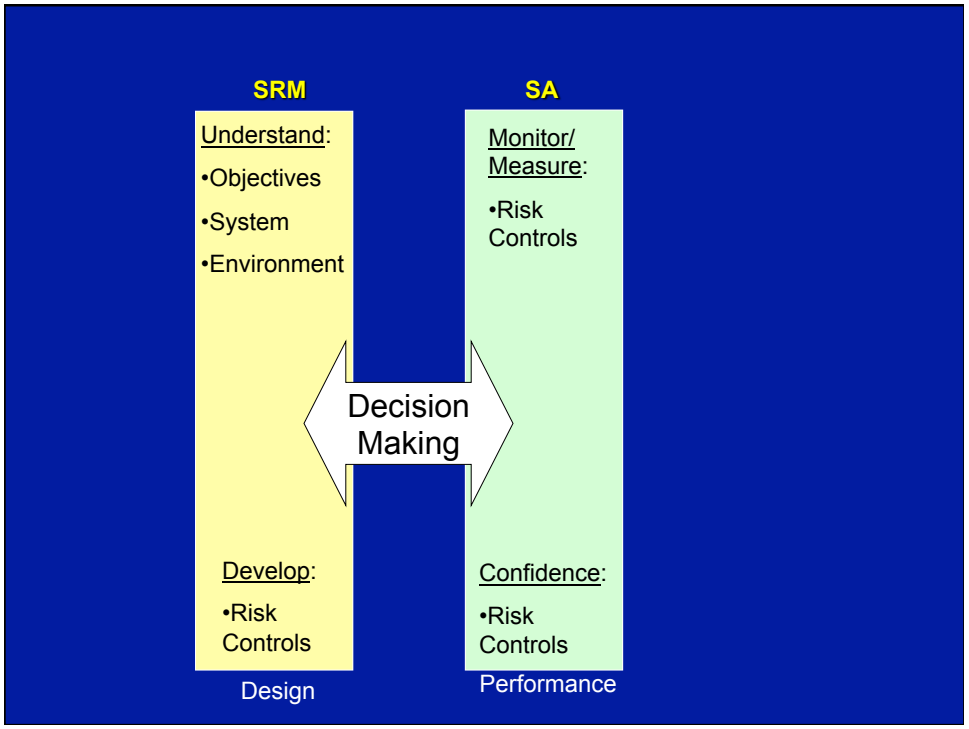
Definition

Safety Risk Management is a formal system of hazard identification, analysis and risk management essential in controlling risk to acceptable levels.

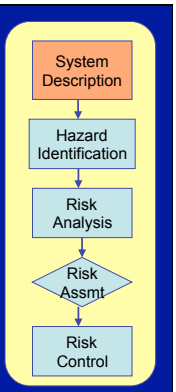
Levels of Risk Management

- Process Risk Management
  - Policy (What)
  - Procedure (How)
  - Controls (Measures)
- Operational Risk Management
  - Operational Control (Operations/Tasks)
  - Supervisory Control (Real time decision making)





System Description



What is a System & Task Analysis?

- It is a system design function.
- It is a predictive method of hazard identification.
- It is the foundation for sound safety analysis.

When is it used?

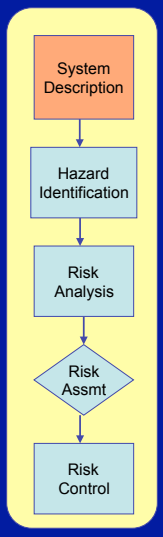
- Used during implementation phases of SMS.
- Used in conjunction with all operational changes.

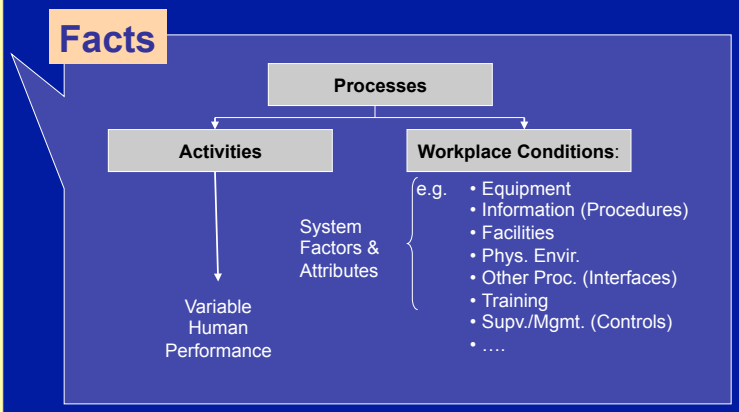
Who uses System & Task Analysis?:

- Personnel within the organization who form an appropriately diverse team:
  - Stakeholders
  - Subject Matter Experts

SRM

System Description





Typical Workplace Conditions

- Organizational processes: Manuals, Procedures, WI's, Computer programs
- Equipment: Human-Machine Interface, Facilities
- Operators: Individual performance
- Team: Team performance
- Organizational culture: Leadership, Communication, Safety Promotion

Ref: 1972 Elwyn Edward

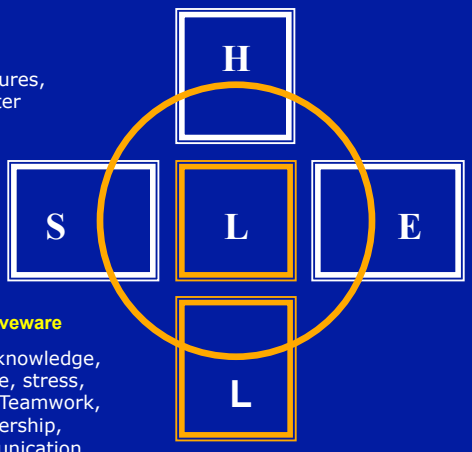
SHELL MODEL to describe Workplace Conditions

S : Software

Manuals, Procedures, WI's, Computer programs

H: Hardware

Tools, equipment, vehicles



L: Liveware

Health, knowledge, attitude, stress, culture, Teamwork, leadership, communication

E: Environment

Temp, humidity,

Noise, light

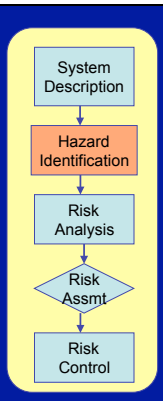
Ref: 1972 Elwyn Edward

Hazard Identification

A hazard is any real or potential *condition*…

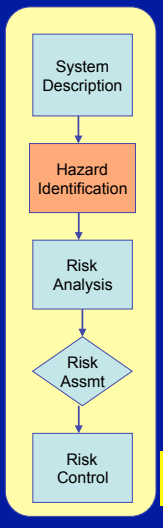
that can result in *injury*, *illness*, or *death* to people; *damage* to, or loss of, a system (hardware or software), equipment, or property; and/or damage to the operating environment.

ICAO Doc. 9859

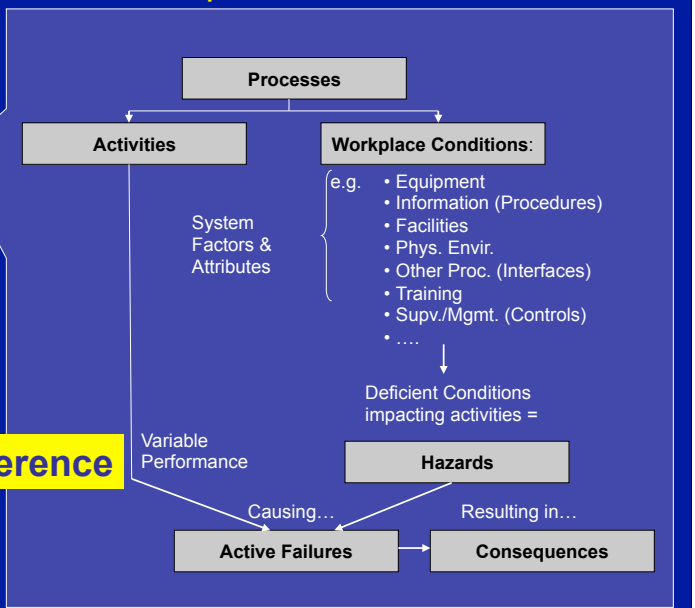


Hazard Identification from Workplace Conditions

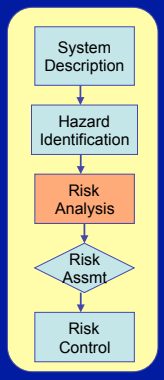
SRM



Inference



Risk Analysis

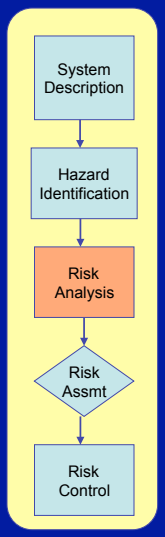


- Important to distinguish between:
  - *Hazard* – a condition
  - *Consequence* – result
  - *Risk* – likelihood & severity of the consequence

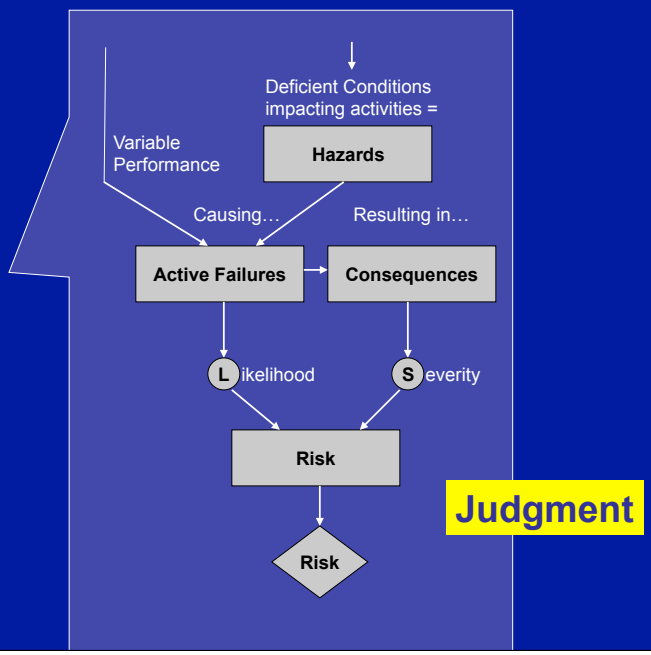
Analyzing risk considers both the likelihood and severity of any adverse consequences.

ICAO Doc. 9859

SRM

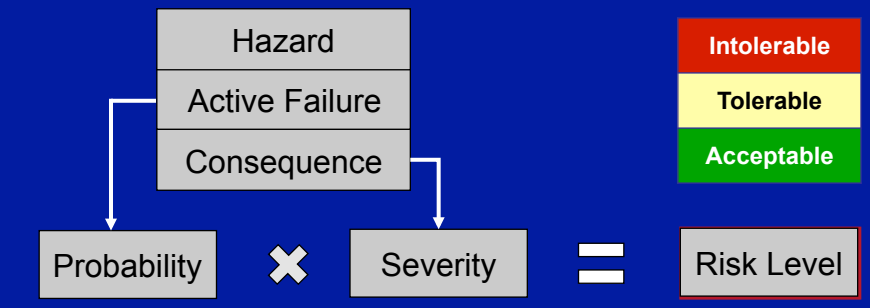


Moving From Hazard to Risk



Risk Analysis

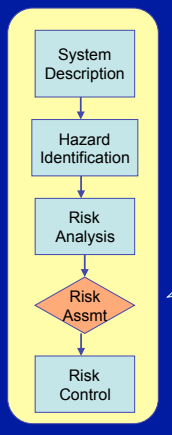
Risk is the composite of the predicted likelihood and the severity of each possible consequence of each identified hazard.



Adapted from ICAO Doc. 9859

Risk Assessment

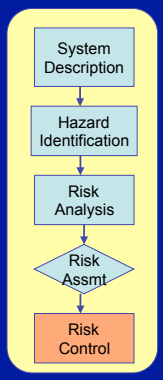
Risk assessment determines the level of risk to use in making a bottom line decision.



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

A risk matrix is a tool used for risk assessment. It can vary in form yet it accomplishes the same purpose.

Risk Control = Risk Mitigation

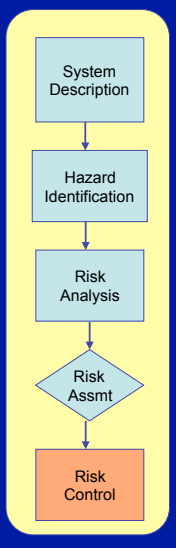


A major component of any safety system is the defenses (controls) put in place to protect people, property or the environment.

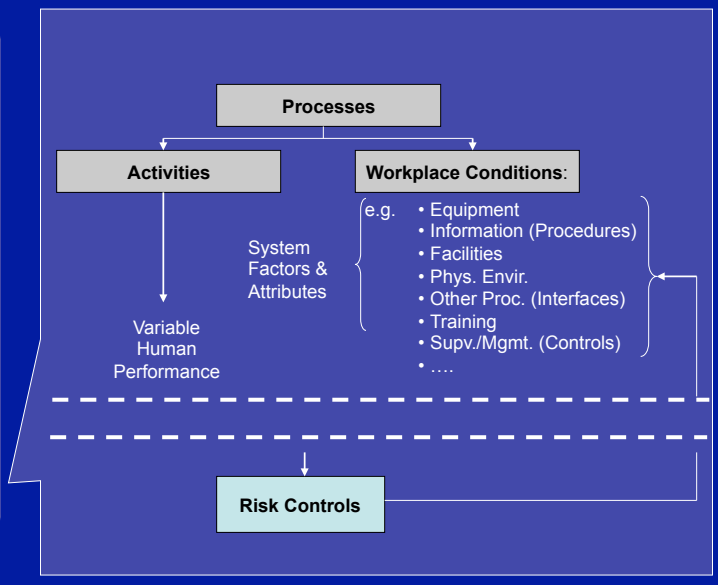
These defenses are used to reduce the likelihood or severity of the consequences associated with any given hazard or condition.

ICAO Doc. 9859

SRM

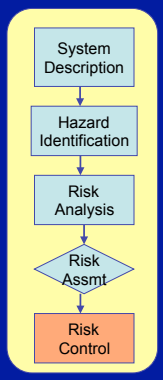


Risk Control / Mitigation



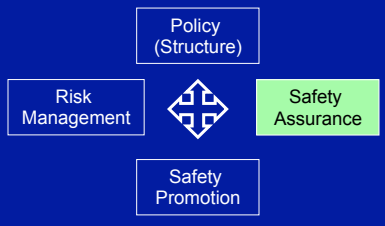
Risk Control
Order of Precedence:

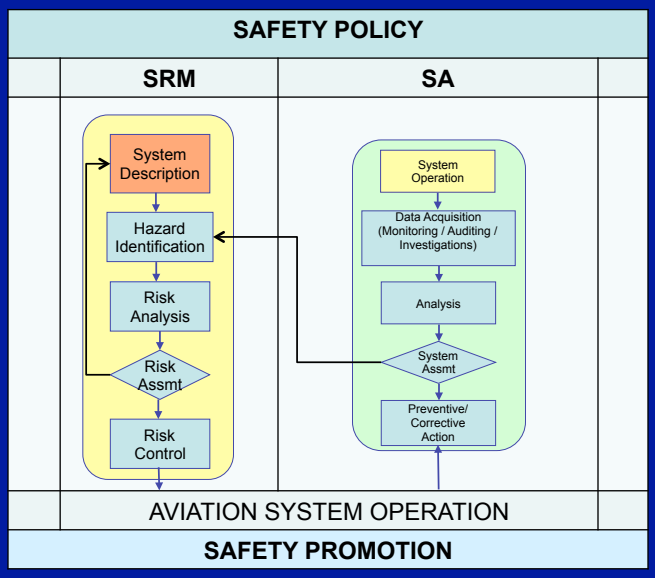
1. Modify the system (design hazard out)
2. Physical guards or barriers
3. Warnings or alert signal
4. Administrative controls
   - Procedures
   - Training



Block 3.0

Safety Assurance





Ref: SMS Framework – Revision 3 June 1, 2010

Objective of Safety Assurance

- Assurance: "something that gives confidence"[1]
- Safety Assurance: "something that gives confidence in safety risk controls."
- Once controls are identified, the SMS must assure they are continuously practiced and continue to be effective in a changing environment.

[1] Black's Law Dictionary

Safety Assurance Functions:

- Collect and analyze information to determine that process requirements are continuously being met.
- Assess performance and effectiveness of risk controls.
- Works in partnership with Risk Management.

AC 120-92

SA is *similar* to Q.A.

- QA focuses on product conformity & customer satisfaction.
- SA ensures that risk controls, once designed and put in place, perform in a way that continue to meet their safety objectives.

AC 120-92

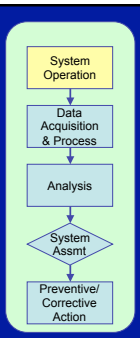
SA & QA:

"Once controls are in place, quality management techniques can be used to provide a structured process for ensuring that they achieve their intended objectives and, where they fall short, to improve them."

Note: Integration of management systems may be beneficial.

AC 120-92

SA System Operation



Written documentation to describe:

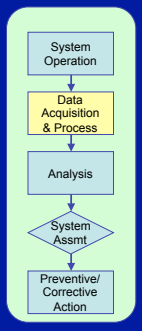
Who, What, When, Where, Why, How

The system operation includes:

- Monitoring of risk controls during operations; such as with audits and analysis.

AC 120-92, 6.1

Data Acquisition and Process

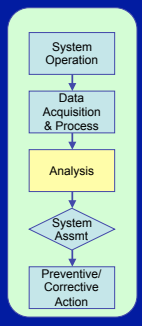


Types of Information Sources

1. Continuous Monitoring
2. Internal Audits
3. Internal Evaluation
4. External Audits
5. Investigations
6. Employee Reporting Systems

SMS Framework Elements 3.1.1 through 3.1.6

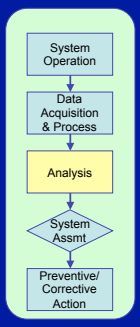
Analysis



- To be useful, information must be made understandable.
- Analysis is used to determine effectiveness of:
  1. Risk controls in the organization's operational processes, and
  2. the SMS.

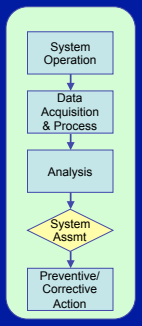
AC 120-92

Types of analysis



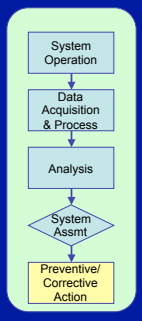
- Against criteria/objectives
- Patterns from multiple data points
- Trends over time
  - "Trends" is one of the most misused term in analysis
  - Must have stable, reliable processes & measures for a trend to be valid.

Safety System Assessment



- Are objectives being met?
- Risk controls failing due to:
  - Lack of supervision
  - Lack of resources
  - Lack of training
  - Poor job aids
- New Hazard/failed Risk Controls (redesign - back to SRM)
- Prioritize according to safety criticality (triage)

Preventive Actions & Corrective Actions



- Revised policies
- New procedures
- Equipment changes
- Enhanced training
- Schedule changes
- Assignment of responsible persons

Management Review

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

- The outputs of SRM & SA
- Lessons learned
- Need for changes

Continuous Improvement

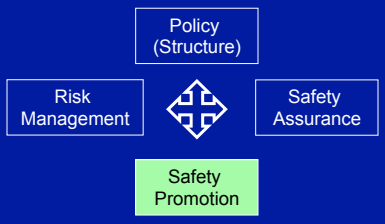
The organization shall continuously improve the effectiveness of the SMS through:

- Safety and Quality Policies
- Safety Objectives
- Audit & Evaluations
- Analysis of Data
- Corrective and Preventive Actions
- Management Reviews

AC 120-92

Block 4.0

Safety Promotion



Promotion: Definition

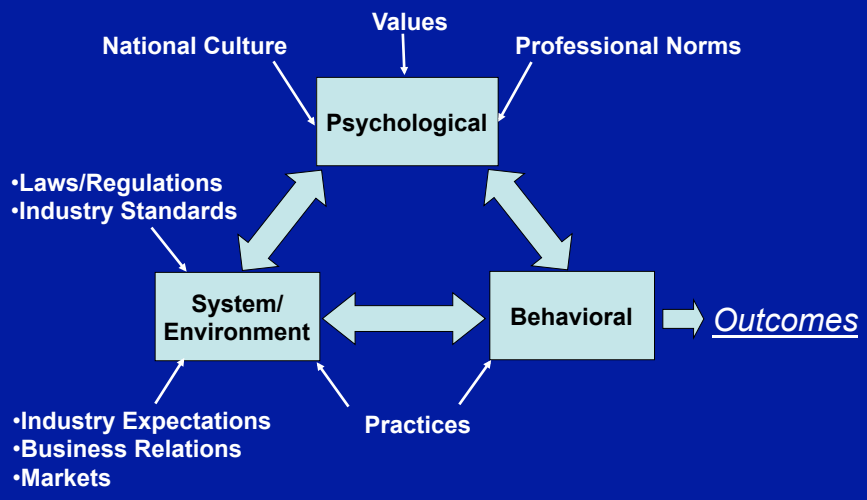
Safety promotion = a combination of:

- Safety Culture,
- Training and Knowledge
- Shared activities that support the implementation and operation of SMS throughout an organization

Organizations must promote safety as a core value with practices that support a positive safety culture.

AC 120-92, App. 1

Organizational Culture



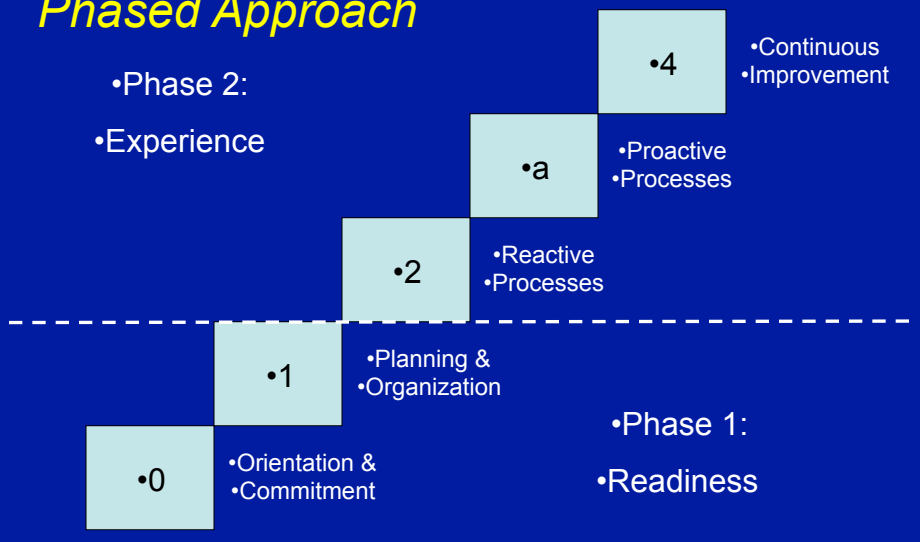
Commitment to SMS

- Documents alone will not guarantee development of a positive safety culture.
- Employees must see evidence of management commitment to SMS.

Management Attitudes
+ Actions
the most important factor.

ICAO Doc. 9859

SMS Implementation should follow a *Phased Approach*



Summary Wrap-up!

We…

- Presented a case for SMS
- Defined what SMS is and ahat is means
- Presented the 4 Pillars of SMS

We…

- Walked through each Pillar:
  - Safety Policy & Objectives
  - Safety Risk Management (SRM)
  - Safety Assurance (SA)
  - Safety Promotion

Safety Management Systems for Distributors

Questions?

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Thanks for attending!

and remember…

"To stop learning…. is to stop living."

George J. Ringger

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