Introduction to Safety Management System (SMS)

Flight Standards and Industry Roles

Presented By: Flight Standards Service

Agenda

- Overview

- Safety Fundamentals & Case for SMS

- SMS Fundamentals - Overview

  - Policy Component

  - Safety Risk Management Component

  - Safety Assurance Component

  - Safety Promotion Component

- Standards, Tools and Implementation

Overview

What SMS is not and what it is…

What it isn't:

A substitute for compliance

A substitute for oversight

A replacement for system safety

A requirement for a new department

What it is:

Compliance is integral to safety management

An effective interface for safety management

SMS completes the systems approach

A set of decision making processes for senior and line management

What is safety?

- Freedom from harm (Dictionary def'n.)

- Safety is not equivalent to risk free (U.S. Supreme Court, 1980)

- "Risk management" is a more practical term than "safety." (Jerome Lederer ~1928)

- Carelessness and overconfidence are more dangerous than deliberately accepted risk (Wilbur Wright, 1901)

- Practical safety is *risk management*

Definition of Safety

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

ICAO Doc 9859

Safety Management Systems

"SMS"

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

ICAO Doc. 9859

Federal Aviation Administration

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

SMS, ATOS and QMS

Does SMS =ATOS?

- **S**MS
  – Management system
  – Only service provider can manage

- A**T**OS
  – Oversight system
  – Used to meet regulator responsibilities

Does SMS = QMS?

- **Same principles but different objectives**

- **QMS Objective**
  – Customer satisfaction

- **SMS Objective**
  – Aviation safety

ICAO Annex 6

- "From 1 January, 2009, States shall require, as part of their safety programme, that an operator implement a safety management system acceptable to the State of the Operator…"

- The U.S. has filed a difference with ICAO

- Currently, there are no FAA authorized procedures to accept of approve Service Providers' SMS's
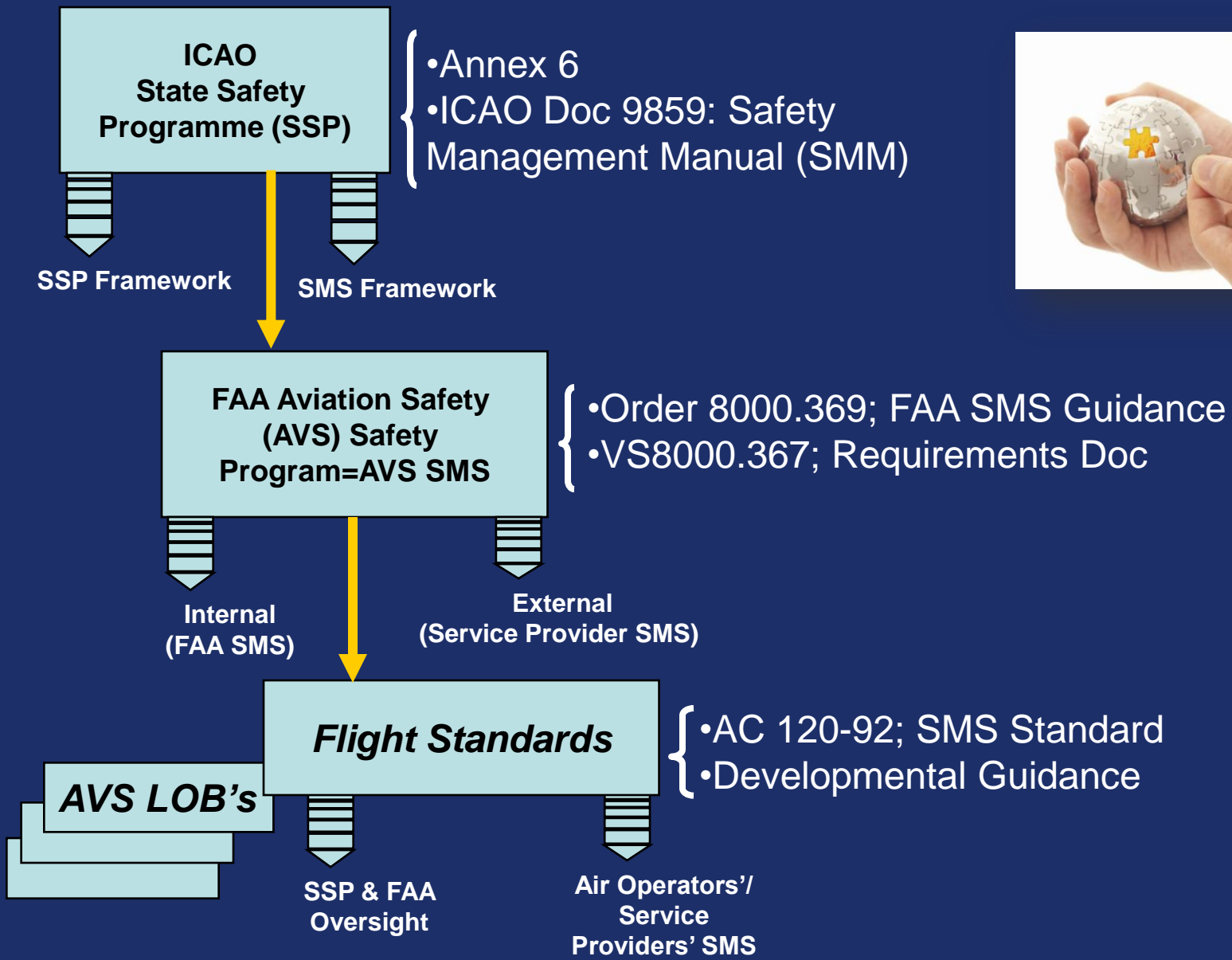
Federal Aviation Administration
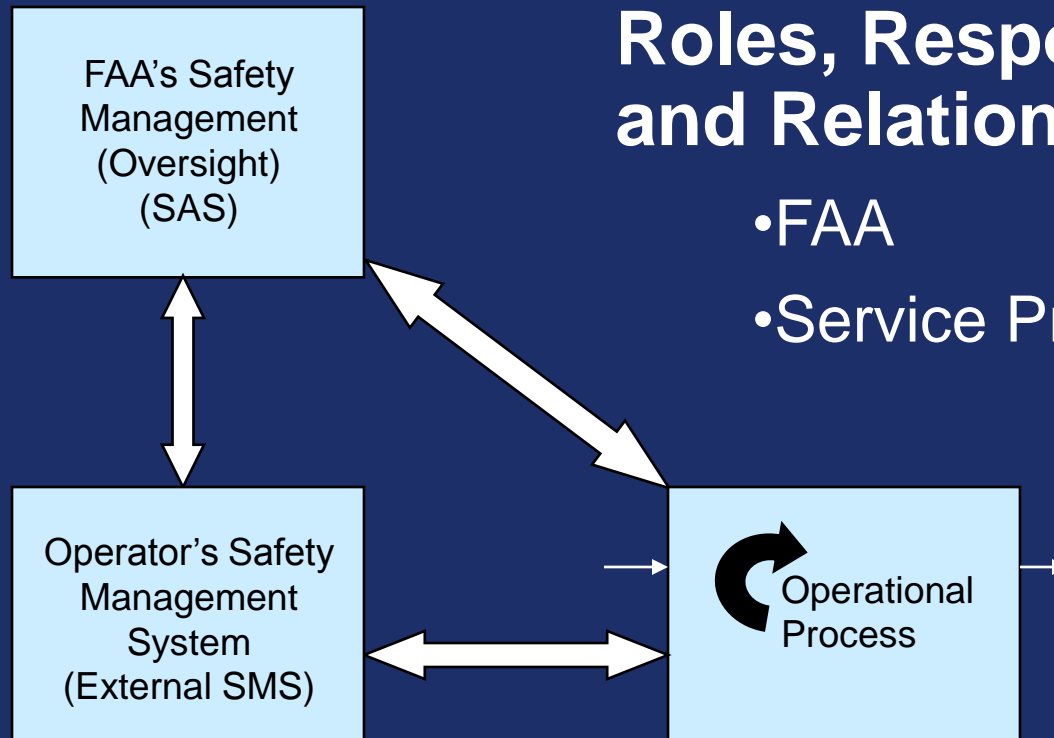
ICAO: State's "safety programme"

- **Definition:**
  - An integrated set of regulations and activities aimed at improving safety.
  - Includes SMS requirements for aviation service providers

- **The AVSSMS is the U.S. safety program**
  - FAA Oversight
    - Regulations, Standards & Policy
    - Assurance (ex; Certification, Surveillance, etc.)
  - Service Provider SMS Requirements

ICAO State Safety Programme (SSP)
- Annex 6
- ICAO Doc 9859: Safety Management Manual (SMM)

SSP Framework

SMS Framework

FAA Aviation Safety (AVS) Safety Program=AVS SMS
- Order 8000.369; FAA SMS Guidance
- VS8000.367; Requirements Doc

Internal (FAA SMS)

External (Service Provider SMS)

Flight Standards
- AC 120-92; SMS Standard
- Developmental Guidance

AVS LOB's

SSP & FAA Oversight

Air Operators'/ Service Providers' SMS

Clarifying the "3 R's":

FAA's Safety Management (Oversight) (SAS)

Operator's Safety Management System (External SMS)

Operational Process

Roles, Responsibilities and Relationships:

- FAA
- Service Providers

Safety Fundamentals
&
Case for SMS

What is the Fundamental Objective of a Business Organization?

To achieve its production objectives!

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 constitutes a management challenge.**

Protection and Production

- **Safety Requirements**
  - Title 49 USC…44702 "…the duty of an air carrier to provide service at the **highest level of safety in the public interest**"

- **Economic Requirements**
  - [Proposed operation must be] "…consistent with **public convenience and necessity**"
  - [Company must be] "…**fit, willing and able** to provide the service proposed"

Safety Management System

- **Infuses safety into all parts of the system**
  - People
  - Tools
  - Procedures
  - Materials
  - Equipment
  - Software

Management levels

Resources   Resources

Protection   **Production**
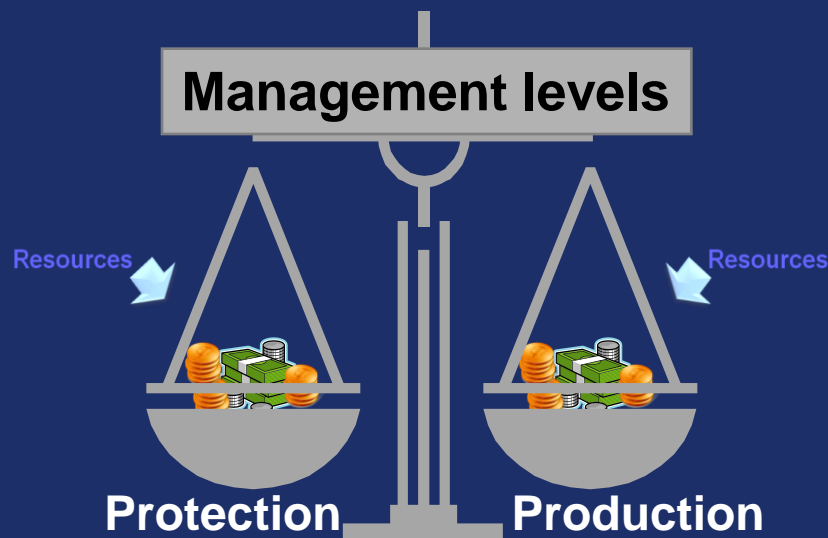
- **To maintain the balance of production and protection**

Accidents and Incidents Cost!

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**
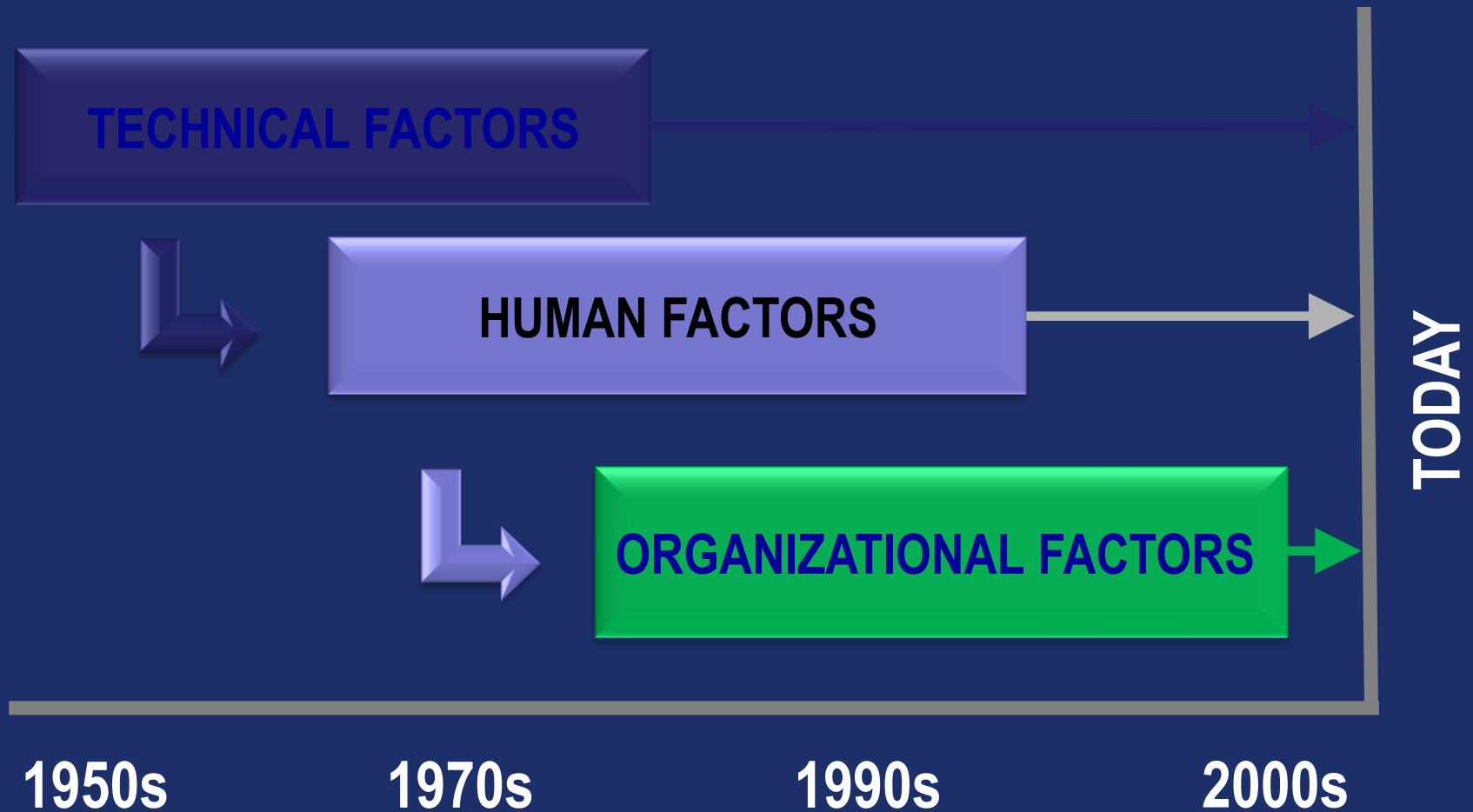- **Misplaced/stranded passengers**
- **Negative media exposure**

Income lost

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

Ramp Damage Has Big Price Tag For Airlines

Parts prices only

Aileron & Tab Assembly $183,545
Outboard Flap Assembly $255,845
Inboard Flap Assembly $224,872
Elevator Assembly $264,708
Cargo Door $58,327
Main Entry Door $171,220
Radome $19,712
L.E. Slat Assembly $52,863
Wingtip Assembly $28,872
TAT Probe $6,583
AOA Vane $4,300
Pitot Static Probe $5,157
Side cowl $161,407
Inlet Cowl $329,203
Inlet Cowl Segment $5,151

BOEING 737-300

Traditional approach – Preventing accidents

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

Identifies:

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

But not always discloses:

WHY?   **HOW?**

Human Error and Operations

- **Human error: a contributing factor in most aviation occurrences.**

- **Even competent personnel commit errors.**

- **Errors are a normal component of any system where humans and technology interact.**

Types of Errors (Active Failures)

- **Perception Errors**
  - "I didn't see it," or "I didn't notice the difference…"
- **Memory Lapses**
  - "I forgot to do it…"
- **Slips**
  - "I didn't mean to do that…"
- **Wrong Assumption**
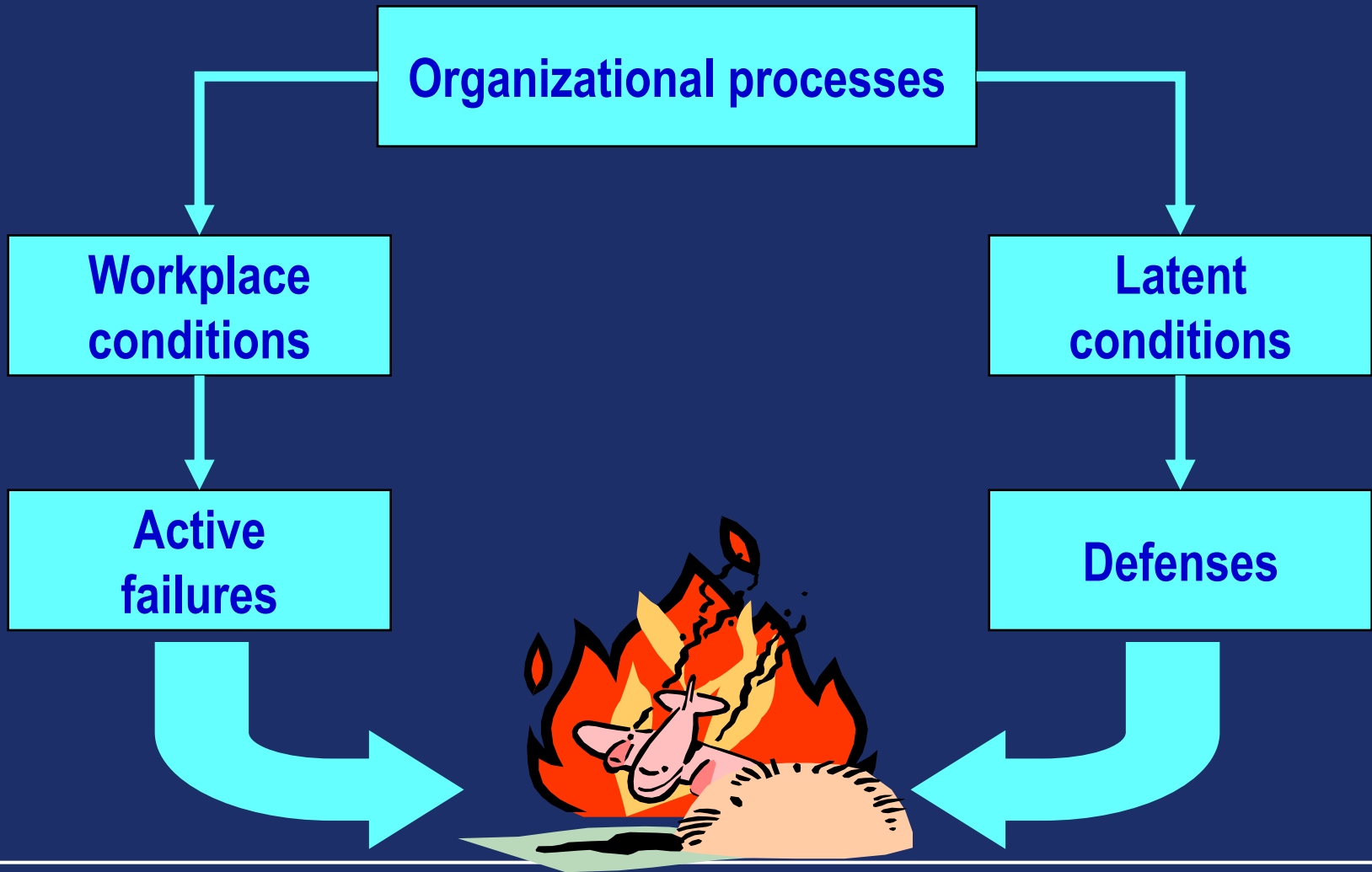 - "I assumed that the situation was different…"

Alan Hobbs, ATSB (2008)

Errors (cont.)

- **Technical Misunderstandings**
  - "I tried to do it right but I didn't understand what I had to do…"

- **Procedure Violations**
  - "Nobody follows that procedure here…."
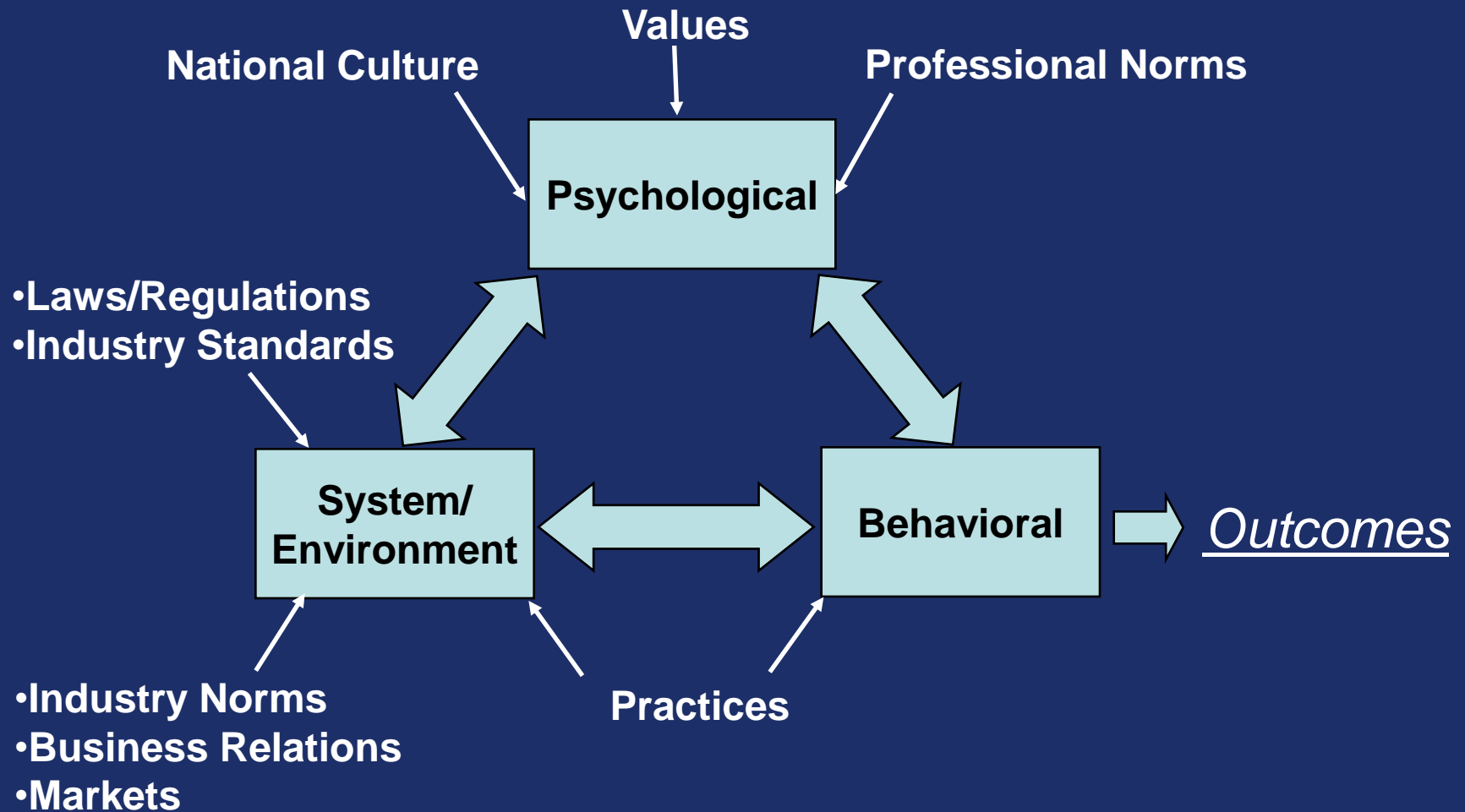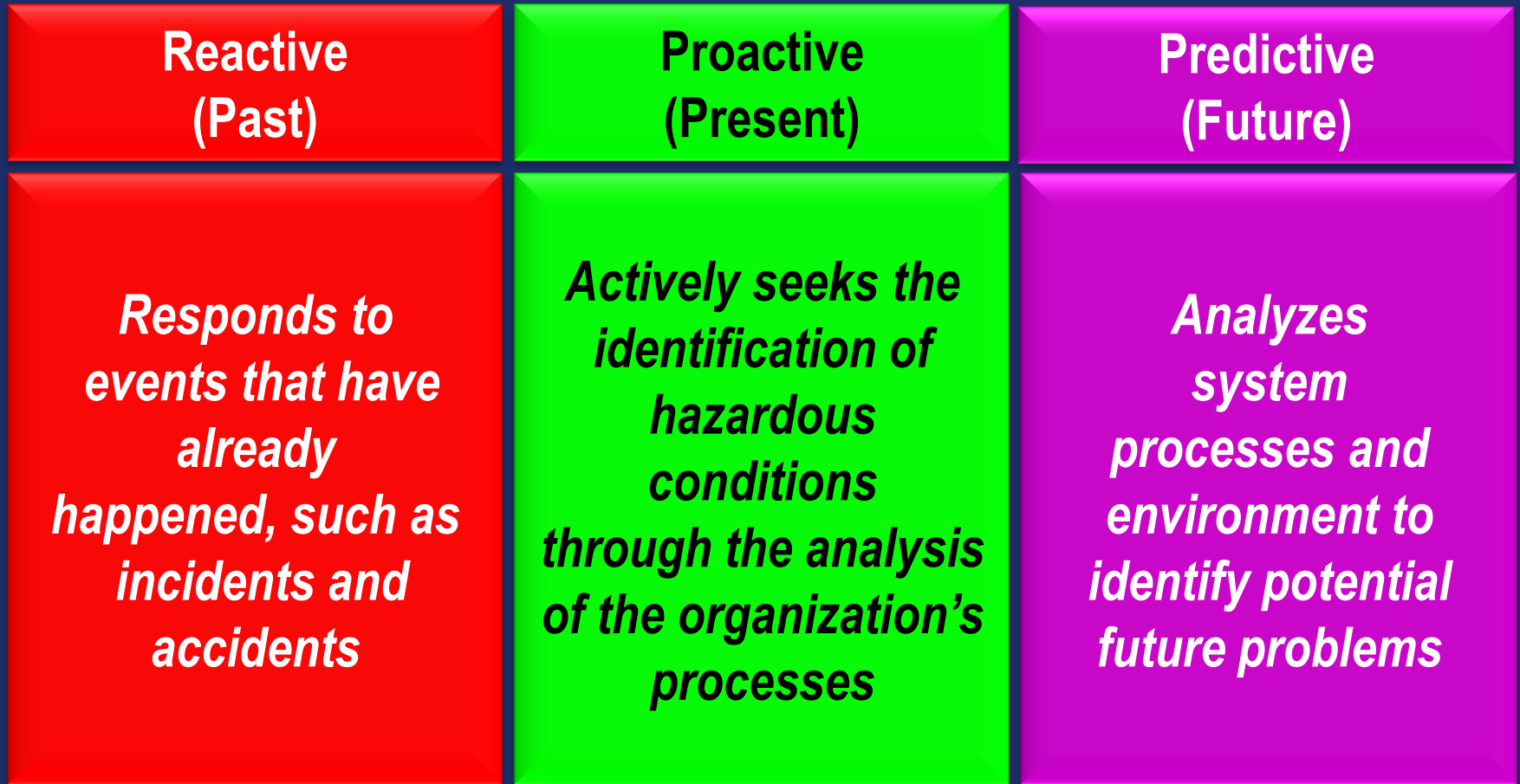 - "We can't get the job done if we do all that…"

Alan Hobbs, ATSB (2008)

Organizational Accidents

Organizational processes

Workplace conditions

Latent conditions

Active failures

Defenses

Organizational Culture

Values

National Culture

Professional Norms

Psychological

•**Laws/Regulations**
•**Industry Standards**

System/ Environment

Behavioral

Outcomes

•**Industry Norms**
•**Business Relations**
•**Markets**

Practices

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*

SMS Fundamentals
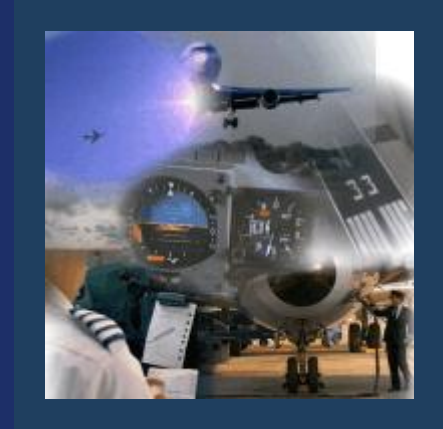
SMS Concepts

- **Applying Risk Management**

- **Assuring Safety Risk Controls**

- **Oversight of Design and Performance of Systems**

  – Design Assurance

    - Using Assessment tools

  – Performance Assurance

    - Using Assessment tools

SMS Concepts: Risk Management

- Understanding the system and environment

- Identifying hazardous conditions

- Assessing risk

- Applying risk controls

SMS Concepts: Assurance

- Assurance: "something that gives **confidence**"[1]

- Quality assurance: "... focused on **providing confidence** that quality **requirements** are being met"[2]

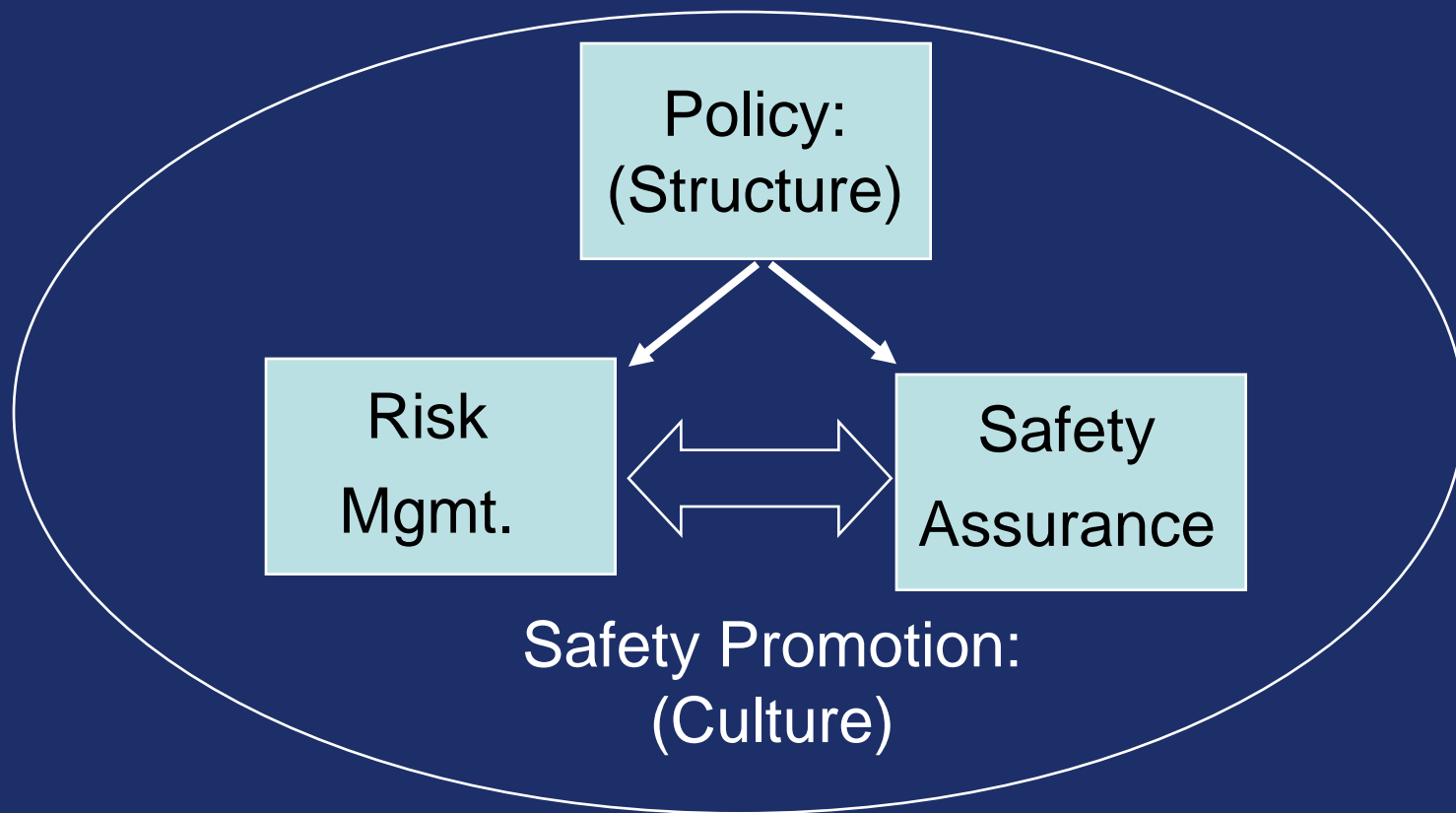- Likewise, Safety Assurance relates to **safety requirements**
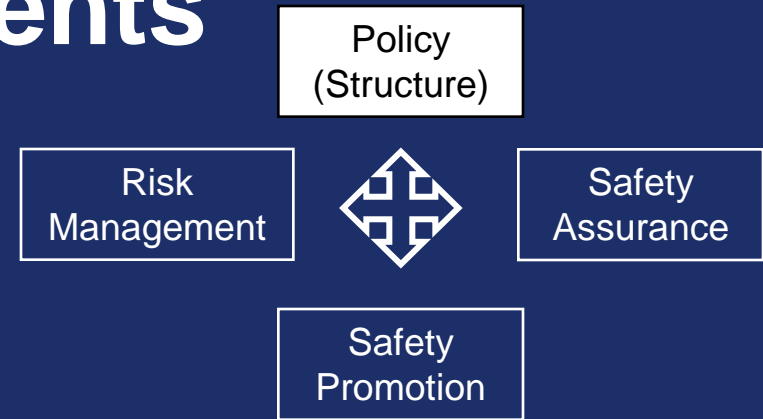

[1] Black's Law Dictionary

[2] ISO 9000-2000

SMS Components ("Pillars")

Policy: (Structure)

Risk Mgmt.

Safety Assurance

Safety Promotion: (Culture)

The 4 SMS Components

Policy
(Structure)

Risk
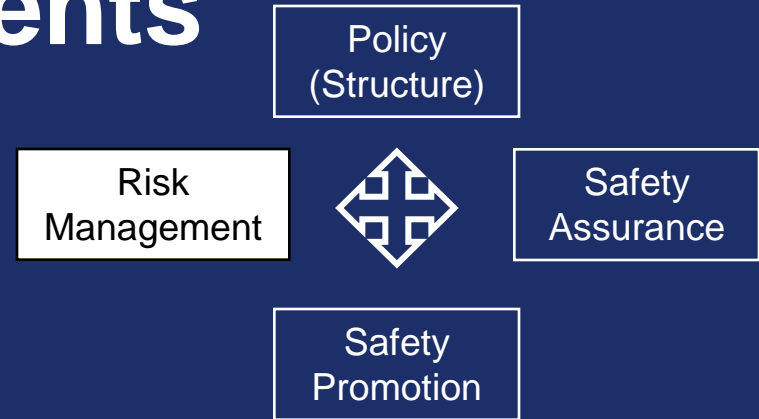Management

Safety
Assurance

Safety
Promotion

1. Policy

- **All management systems must define policies, procedures, and organizational structures to accomplish their goals.**

- **Policy establishes the structure of the SMS.**

The 4 SMS Components

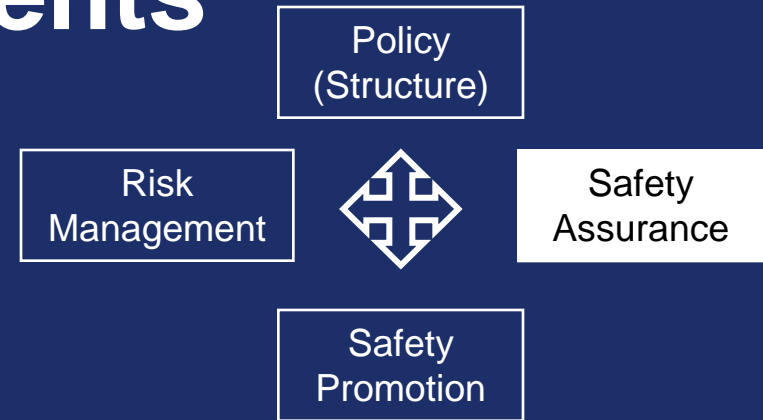|		
	Policy (Structure)	
Risk Management	◆	Safety Assurance
	Safety Promotion	

2. Safety Risk Management.

- **A formal system of hazard identification, analysis and risk management is essential in controlling risk to acceptable levels.**

The 4 SMS Components

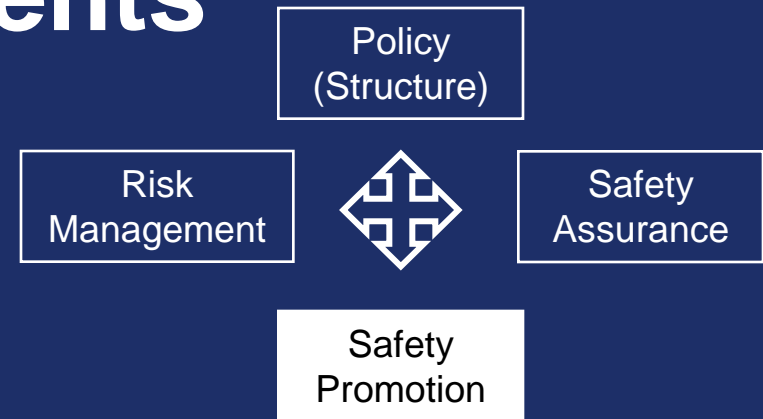|	Policy (Structure)	
Risk Management	◈	Safety Assurance
	Safety Promotion	

3. Safety Assurance.

- Once controls are identified, the SMS must assure they are continuously practiced and continue to be effective in a changing environment.

The 4 SMS Components

Policy (Structure)
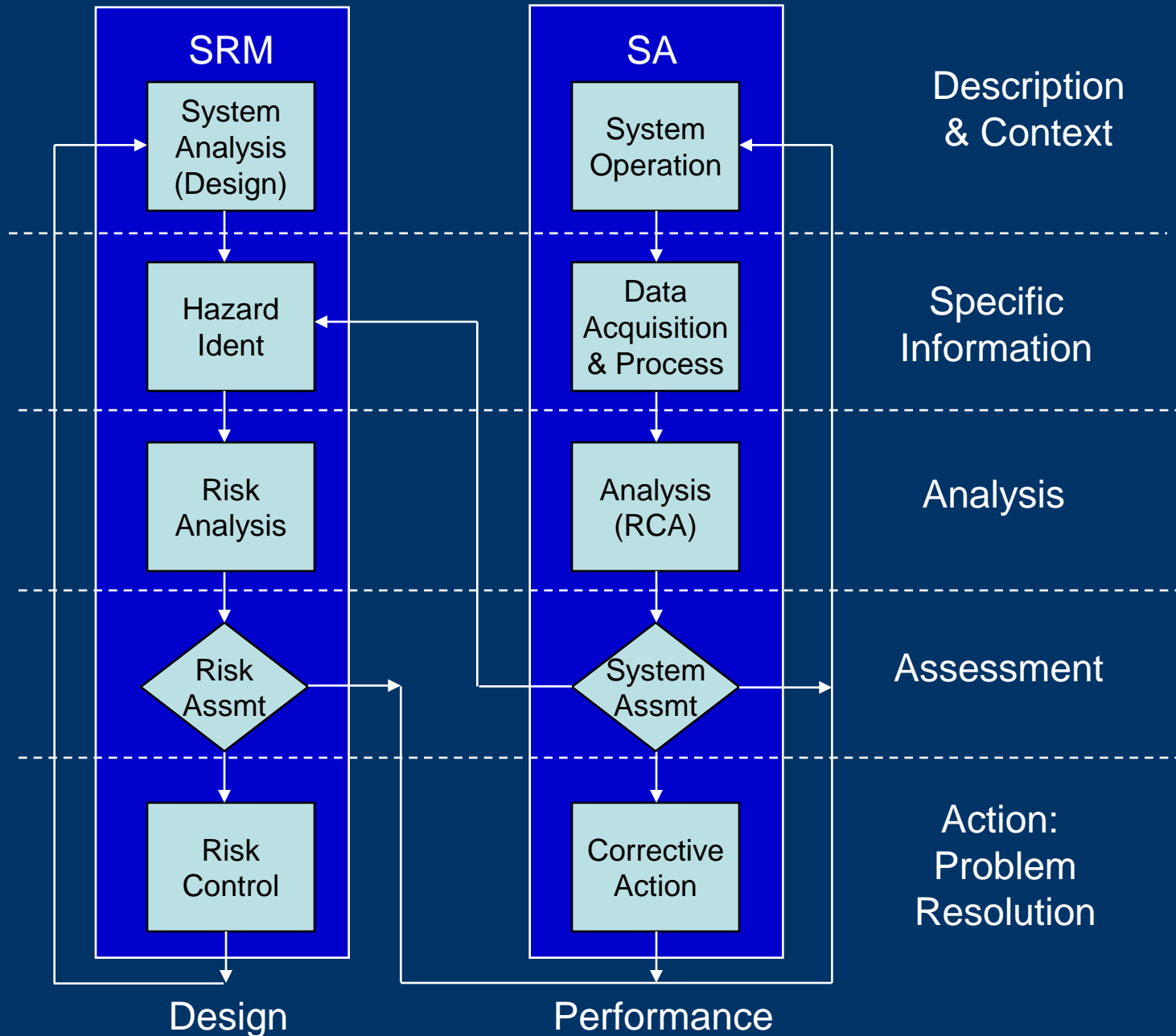
Risk Management

Safety Assurance

Safety Promotion

4. Safety Promotion.

- **The organization must promote safety as a core value with practices that support a positive safety culture.**

Safety Risk Management (SRM) and Safety Assurance (SA) Workflow

Oversight and SMS

FAA
Oversight Program
Management

Protection

Production

DA   PA

FAA's Safety
Management
(Oversight)
(SAS)

Technical Program Requirements
•Systems
•Subsystems
•Elements

S R M

S A

Operator's Safety
Management
System

Surveillance

Operational
Process

Public:
Users

Cert   C.O.S.
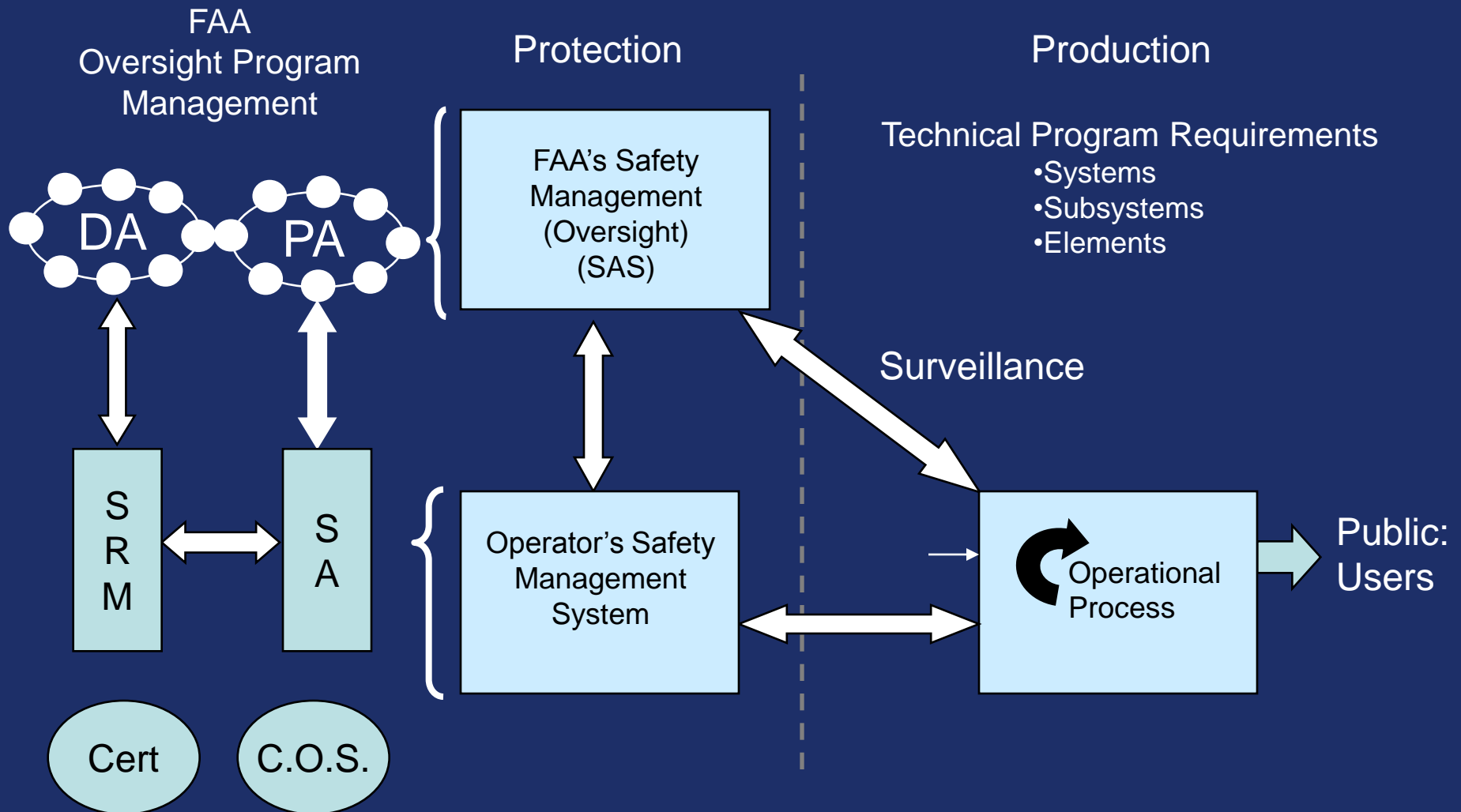
1   National Aviation System Level

- -

2   Service Provider/Organizational Level

- -

3   Individual (Airman/Aircraft) Level
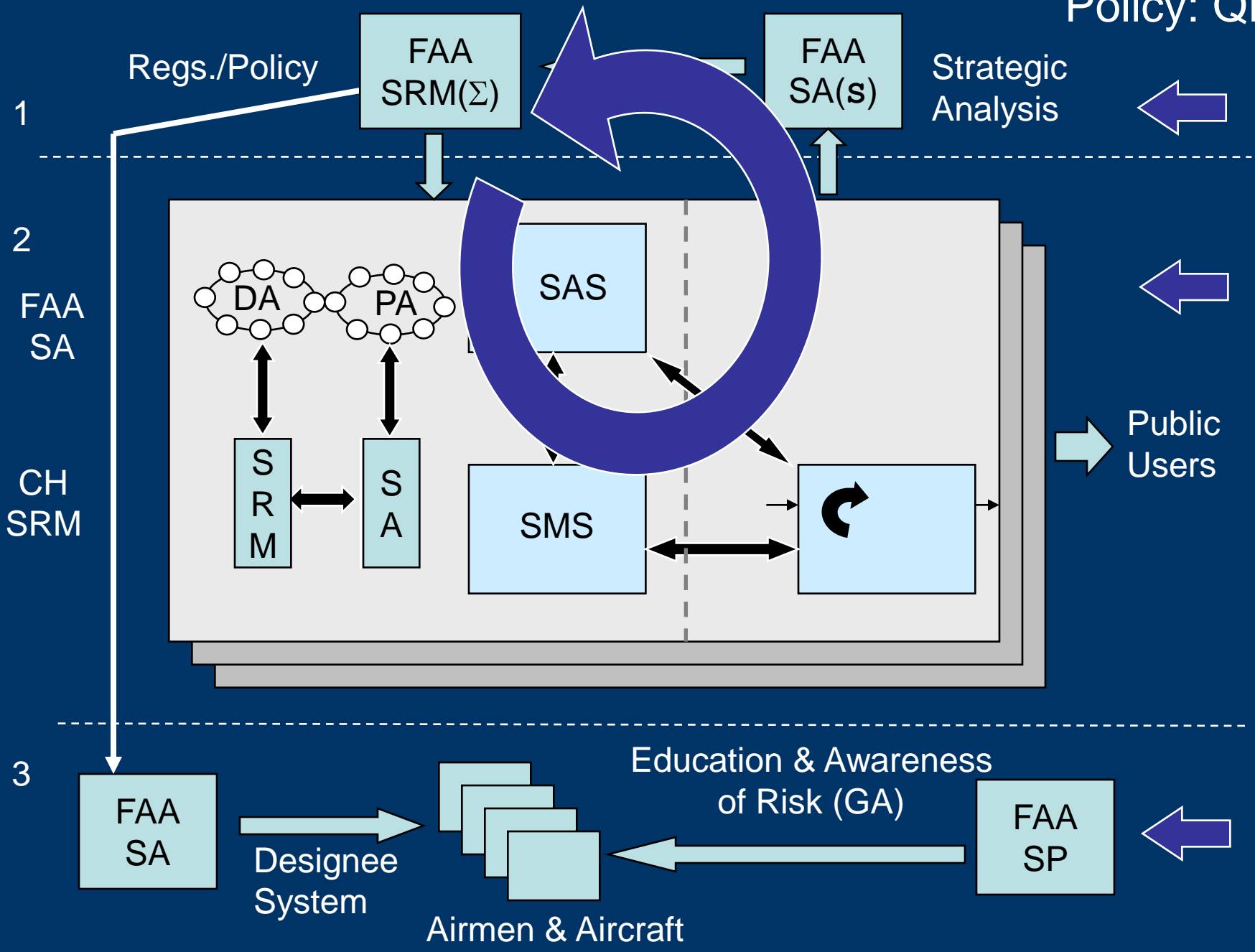
Roles, Responsibilities & Relationships
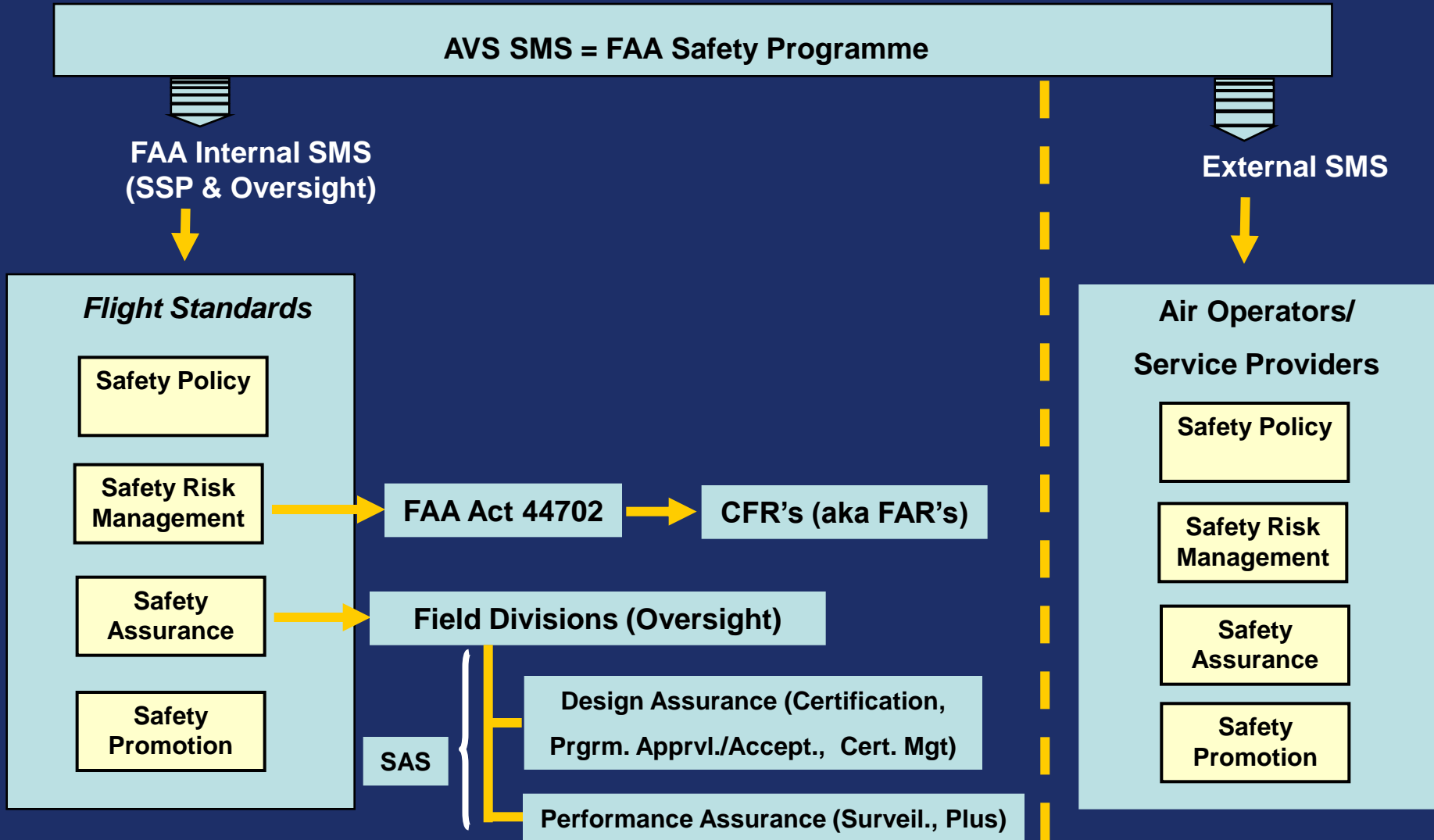
AVS SMS = FAA Safety Programme

FAA Internal SMS (SSP & Oversight)

External SMS

Flight Standards

- **Safety Policy**
- **Safety Risk Management**
- **Safety Assurance**
- **Safety Promotion**

FAA Act 44702 → **CFR's (aka FAR's)**

Field Divisions (Oversight)

SAS

Design Assurance (Certification, Prgrm. Apprvl./Accept., Cert. Mgt)

Performance Assurance (Surveil., Plus)

Air Operators/ Service Providers

- **Safety Policy**
- **Safety Risk Management**
- **Safety Assurance**
- **Safety Promotion**

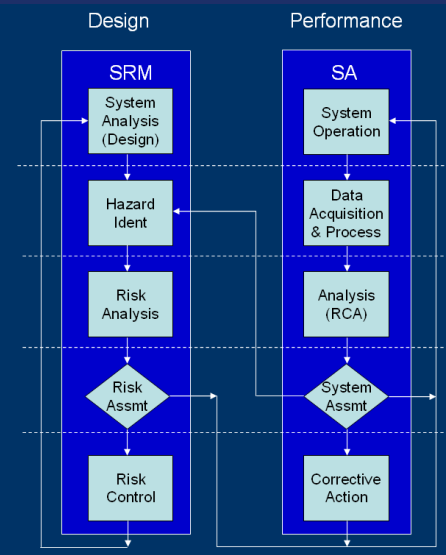**Federal Aviation Administration**

SL-44

Safety Management System

Provides a systematic way to:

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

SMS Components ("Four Pillars")

SMS Details:

Policy Component

SMS Policy

- **Establishes management commitment and objectives – *what* the management wants**

- **Sets up framework of organizational structures, accountabilities, plans, procedures, and controls to meet 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 – like all management decision making

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 Policy Component

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

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Policy: Other Responsibilities

- **Emergency response**

  – Develop and implement procedures to respond to accidents and incidents
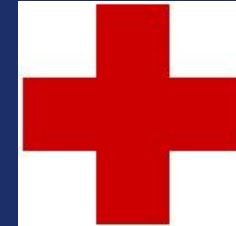
- **Control of Documents and Records:**

  – Have a clearly defined document maintenance process

  – Implement and maintain a safety management plan

Safety Policy Requirements:

- Commitment to:
  - Implement an SMS
  - Continually improve safety
  - Manage safety risk
  - Comply with statutory & regulatory requirements
- Establish clear standards of acceptable behavior
- Documented
- Communicated
- Periodically reviewed

Organizational Structure

- Top management with ultimate authority and responsibility

- Top management requirement to provide resources

- Defined lines of supervision and control

- Defined safety responsibilities for all employees

- Designated management official to ensure effectiveness of SMS (e.g. DOS)

Accountability Defined

Accountability = Obligation or willingness to account for one's actions

A SMS shall clearly define lines of safety accountability throughout the *provider* organization, including direct accountability for safety on the part of senior management.

ICAO Doc. 9859

Federal Aviation Administration

SL-54

Accountability vs. Liability

- SMS promotes an environment that stimulates open reporting

- This includes and active involvement of all personnel, starting with top management in safety problem-solving

- Barring negligence or deliberate disregard for safety, SMS does not promote blame for error

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

System Attributes

Processes must have safety requirements built into their design.

a) **Responsibility: accountable for quality of activities**

b) **Authority: power to accomplish required activities**

c) **Procedures: clear instructions for members of the organization**

d) **Controls: supervisory controls on processes to ensure activities produce the correct outputs**

System Attributes

In addition, there are process measures and interfaces.

e) **Process Measures**: measurement of both processes & their products

f) **Interfaces**: Recognizing interrelationships between individuals and organizations within the company as well as with contractors, vendors, customers, and other organizations

System Attributes in Management

- **The six attributes are the essence of management:**

  - Planning: Procedures

  - Organizing: Procedures, Responsibilities & Interfaces

  - Directing: Responsibilities & Authority

  - Controlling: Process Measures & Controls

- **Now also documented in the ICAO SMM**

SMS Documentation

- System documentation conveys management expectations and work instructions to employees

- May be a stand-alone manual or integrated into existing documentation systems

SMS Details:

Data Quality

Decision Making: Data, Analysis, and Assessment

- **Reports (Facts): what exists or is happening now**

- **Inferences (Interpretations)**

  – What's likely to happen in the future, based on what's happening now

  – Conclusions based on facts

- **Judgments: value, quality assessments (e.g. good, bad, acceptable, unacceptable) of what is or will exist or happen**

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 of crew errors will increase
- **Judgment (Risk Assessment):**
    - Unacceptable risk

Attributes of Data and Measures

- **Validity:**

  – Does the data/measure address the subject desired?

  – Does it only address the subject desired?

  – How completely does it cover the subject desired?

- **Reliability:**

  – Are data points about the same thing comparable?

  – Are data points collected by different observers comparable?

Data and measures must be reliable to be valid but reliable data is not always valid

Training and careful preparation of tools can increase reliability of data

SMS Details:

Safety Risk Management Component

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Definitions

Safety management systems provide a **systematic** way to **control risk** and to provide **assurance** that those risk controls are effective.

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

System/Task Analysis (Design)

What is 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.
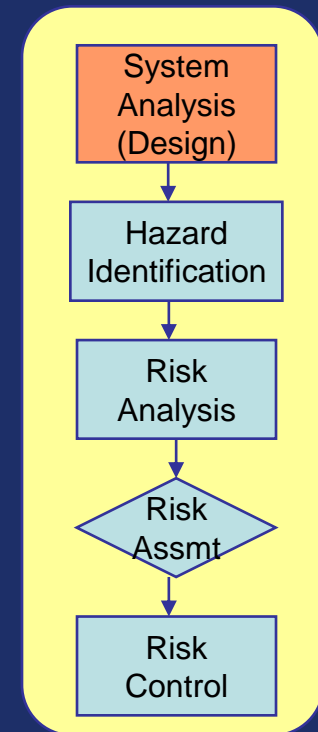
When is it used?

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

Who uses System & Task Analysis?:
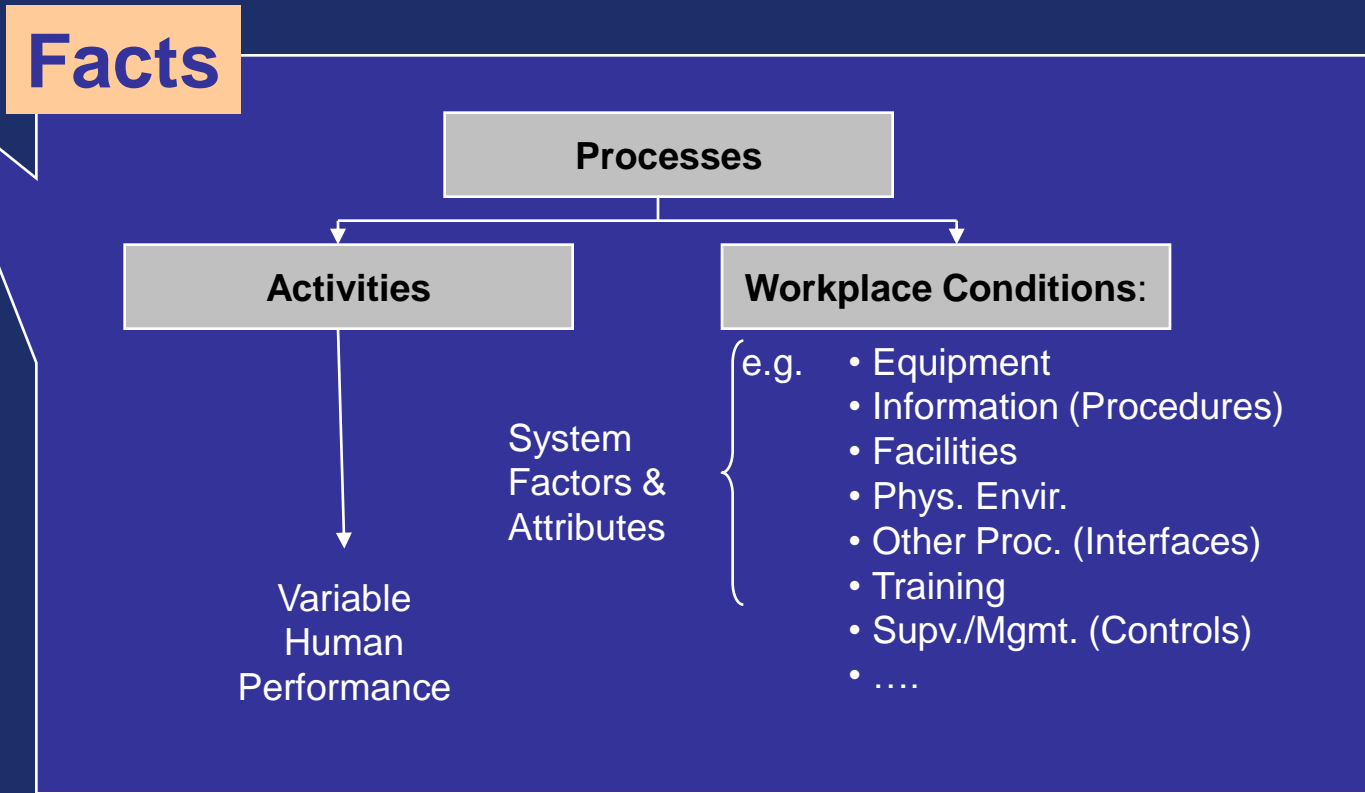
- Personnel within the organization who form an appropriately diverse team:
  - Stakeholders
  - Subject Matter Experts

ICAO Doc. 9859

System Analysis (Design) → Hazard Identification → Risk Analysis → Risk Assmt → Risk Control

SRM

System & Task Analysis

Facts

SRM flow:
- System Analysis (Design)
- Hazard Identification
- Risk Analysis
- Risk Assmt
- Risk Control

Processes

Activities

Workplace Conditions:

Variable Human Performance

System Factors & Attributes

e.g.
- Equipment
- Information (Procedures)
- Facilities
- Phys. Envir.
- Other Proc. (Interfaces)
- Training
- Supv./Mgmt. (Controls)
- ....

Typical Workplace Conditions

- Equipment: Human-Machine Interface, Facilities

- Operators: Individual performance

- Crew/team performance

- Organizational culture

- Company/regulator factors

Strauch, Barry (2004). Investigating Human Error

Process (System) Attributes

- Responsibility

- Authority

- Procedures

- Controls

- Process Measures

- Interfaces
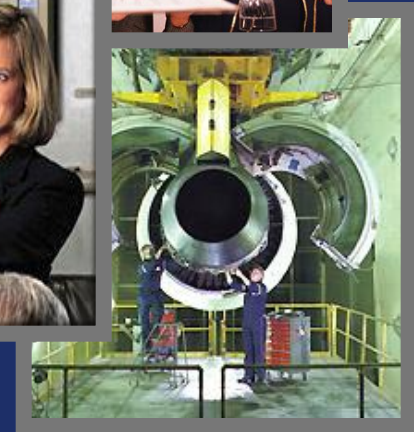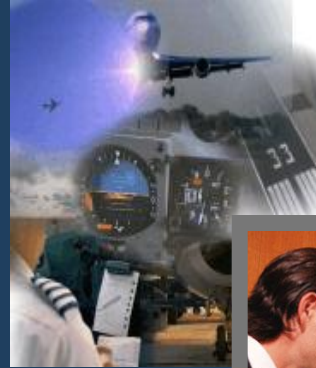
Conditions Related to Error

- Time pressure

- Procedures and documentation

- Teamwork/documentation

- Shift turnovers/crew briefings

- Group norms

- Fatigue management (shifts/circadian problems)

Alan Hobbs, ATSB (2008)

Conditions Related to Error (cont.)

- Lack of System Knowledge

- Equipment/facilities

- Human-machine interface (e.g. design for maintainability)

Activities and Conditions: Deicing

| Activities/Tasks and Actors What and Who		Workplace Conditions System and Environment
Select type of fluid		Day/Night
(Check holdover time)		Precipitation/cold
Position at Aircraft		Employee demographics
Communicate with crew		
Apply Fluid		
Depart Ramp Area		

Hazard Identification

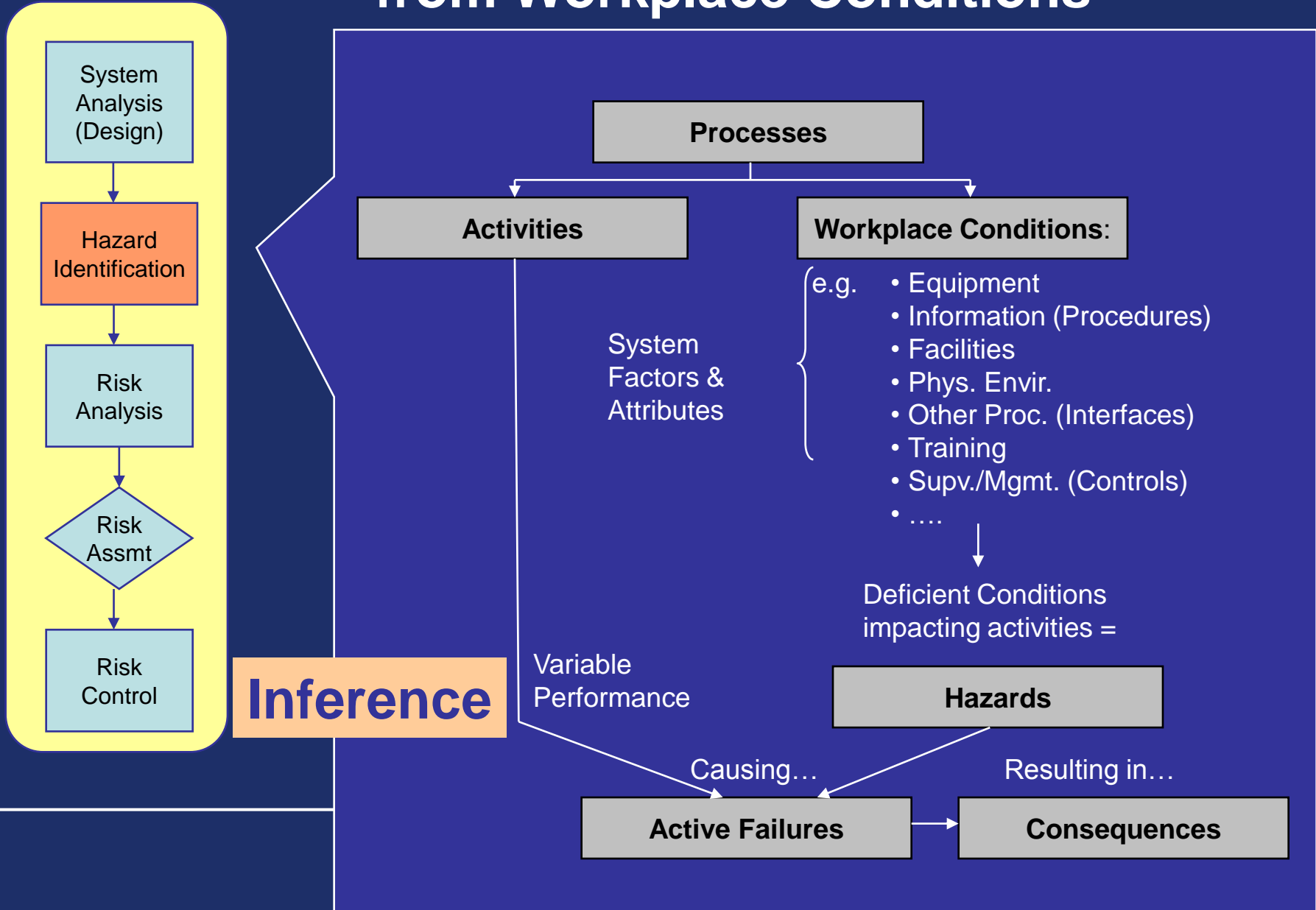A hazard is any real or potential *condition*…

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

System Analysis (Design) → Hazard Identification → Risk Analysis → Risk Assmt → Risk Control
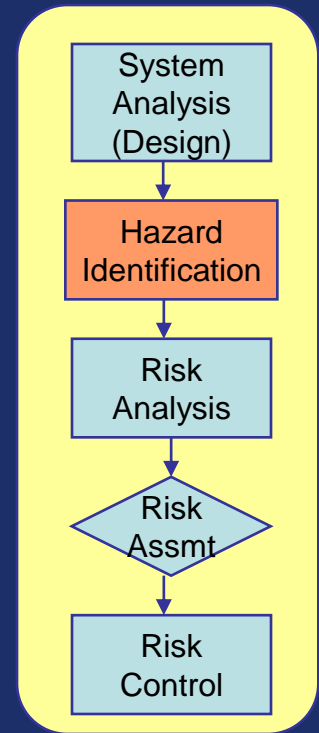
SRM

Hazard Identification from Workplace Conditions

```
┌─────────────┐
│   System    │
│  Analysis   │
│  (Design)   │
└─────────────┘
       │
┌─────────────┐
│   Hazard    │
│Identification│
└─────────────┘
       │
┌─────────────┐
│    Risk     │
│  Analysis   │
└─────────────┘
       │
    ◇ Risk ◇
    ◇ Assmt ◇
       │
┌─────────────┐
│    Risk     │
│   Control   │
└─────────────┘
```

Inference

Processes

Activities

Workplace Conditions:

System Factors & Attributes

e.g.
- Equipment
- Information (Procedures)
- Facilities
- Phys. Envir.
- Other Proc. (Interfaces)
- Training
- Supv./Mgmt. (Controls)
- ….

Deficient Conditions impacting activities =

Variable Performance

Hazards

Causing…

Resulting in…

Active Failures → **Consequences**

Risk Analysis

- Important to distinguish between:

    - *Hazard* – a condition

    - *Consequence* – result

    - *Risk* – likelihood & severity of the consequence

- Analyzing risk involves the consideration of both the likelihood and the severity of any adverse consequences.

ICAO Doc. 9859

System Analysis (Design)

Hazard Identification

Risk Analysis

Risk Assmt

Risk Control

SRM

From Hazard to Risk

System Analysis (Design) → Hazard Identification → Risk Analysis → Risk Assmt → Risk Control

Variable Performance

Deficient Conditions impacting activities = **Hazards**

Causing… → **Active Failures** → Resulting in… → **Consequences**

Active Failures → Ⓛikelihood

Consequences → Ⓢeverity

Ⓛikelihood + Ⓢeverity → **Risk** → **Risk**

Judgment
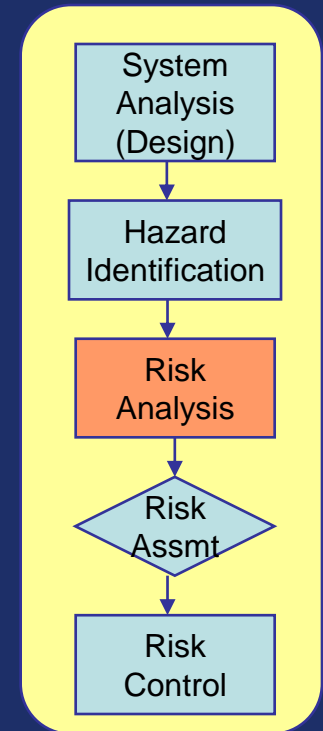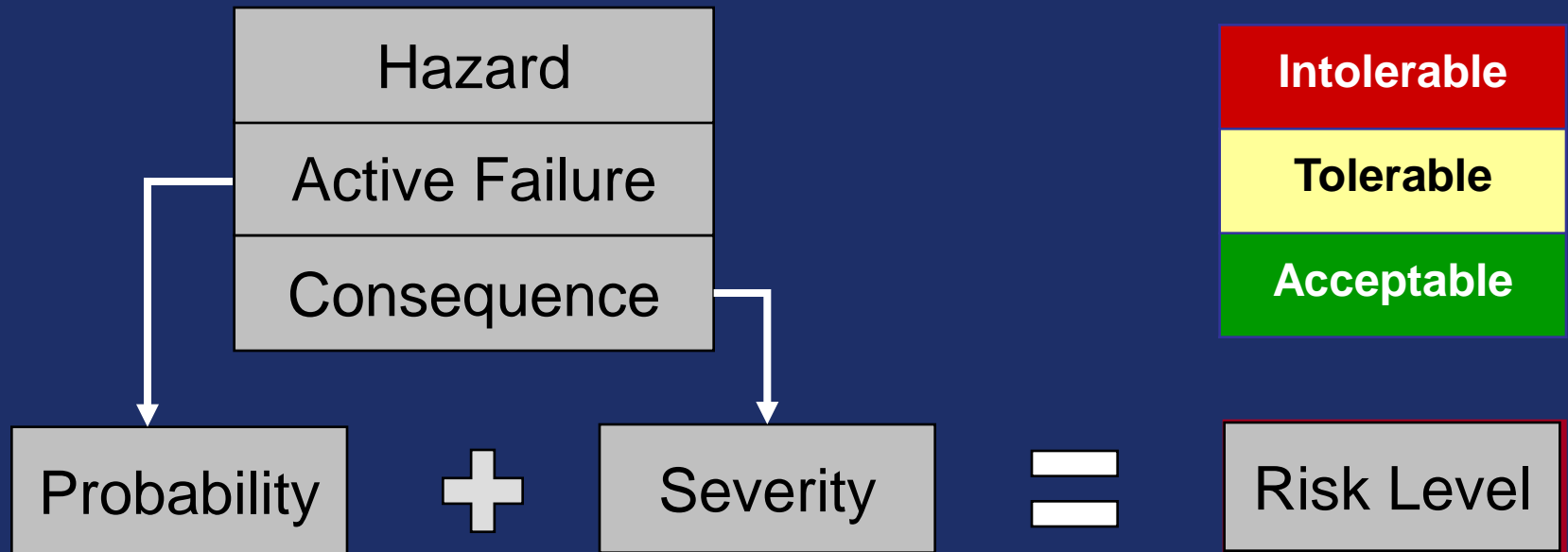
Failures and Consequences

Active failures Direct results of conditions		Potential Consequences (e.g. accident/incident severity)
Incorrect Fluid Type		Take-off accidents due to ice
Hold-over time too long		
Incomplete deicing		

Risk Analysis

Risk is the composite of the predicted likelihood or probability and the severity of each possible consequence of each identified hazard.
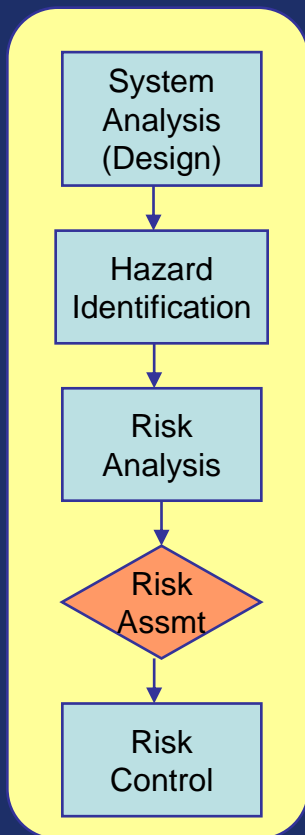
Hazard
Active Failure
Consequence

Intolerable
Tolerable
Acceptable

Probability **+** **Severity** **=** **Risk Level**

Adapted from ICAO Doc. 9859

Risk Assessment

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

```
System Analysis (Design)
        ↓
Hazard Identification
        ↓
Risk Analysis
        ↓
Risk Assmt
        ↓
Risk Control
```

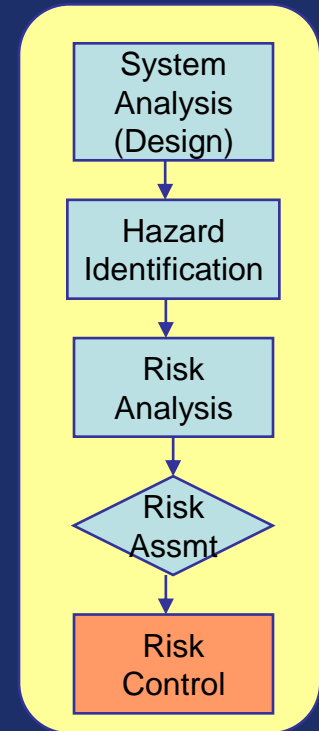| Risk Likelihood		Risk Severity				
		Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent	5	5A	5B	5C	5D	5E
Occasional	4	4A	4B	4C	4D	4E
Remote	3	3A	3B	3C	3D	3E
Improbable	2	2A	2B	2C	2D	2E
Extremely improbable	1	1A	1B	1C	1D	1E

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

System Analysis (Design)

↓

Hazard Identification

↓

Risk Analysis

↓

Risk Assmt

↓

Risk Control

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SRM

Risk Control/Mitigation

SRM flow:
- System Analysis (Design)
- Hazard Identification
- Risk Analysis
- Risk Assmt
- Risk Control

Risk Control/Mitigation:

Processes
→ Activities
→ Workplace Conditions:

Activities → Variable Human Performance

System Factors & Attributes

Workplace Conditions e.g.
- Equipment
- Information (Procedures)
- Facilities
- Phys. Envir.
- Other Proc. (Interfaces)
- Training
- Supv./Mgmt. (Controls)
- ….

Risk Controls

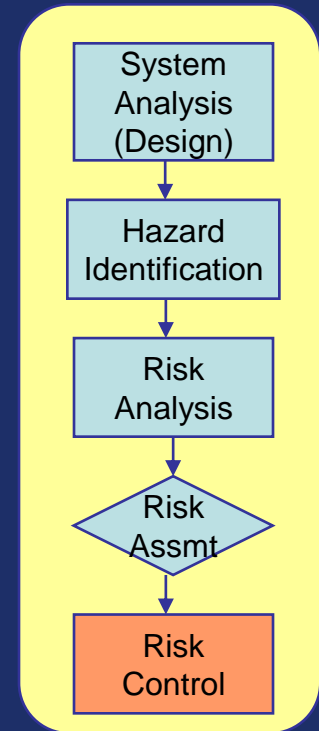**Federal Aviation Administration**

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

| System Analysis (Design) |
| Hazard Identification |
| Risk Analysis |
| Risk Assmt |
| Risk Control |

Regulations as Risk Controls

- **Rulemaking (FAA SRM)**
  - Identified Hazard in the Aviation System
  - Risk Control: Regulation = limits of *acceptability*

- **Compliance (Operator's SRM)**
  - Operator's Program Design = Risk *Acceptance*
    (still must comply with regulatory requirements)
  - Design Assurance (FAA) – Certification functions

System Analysis (Design)

Hazard Identification

Risk Analysis

Risk Assmt
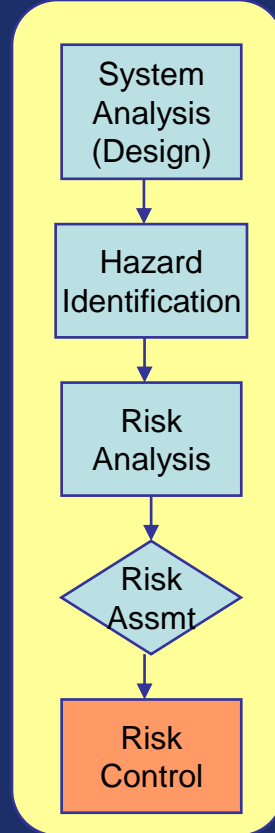
Risk Control

Continuing Operational Safety (COS)

- Risk controls must be continually monitored to ensure their viability. This is accomplished through Continuing Operational Safety (COS)

- **COS = Ongoing compliance through:**
  - Safety Assurance (Operator)
  - Performance Assurance - Surveillance (FAA)

SMS Details:

Safety Assurance Component

SMS Concepts: Assurance

- Assurance: "something that gives confidence"[1]

- Quality assurance: "... focused on providing confidence that quality requirements are being met"[2]

- Likewise, Safety Assurance relates to safety requirements

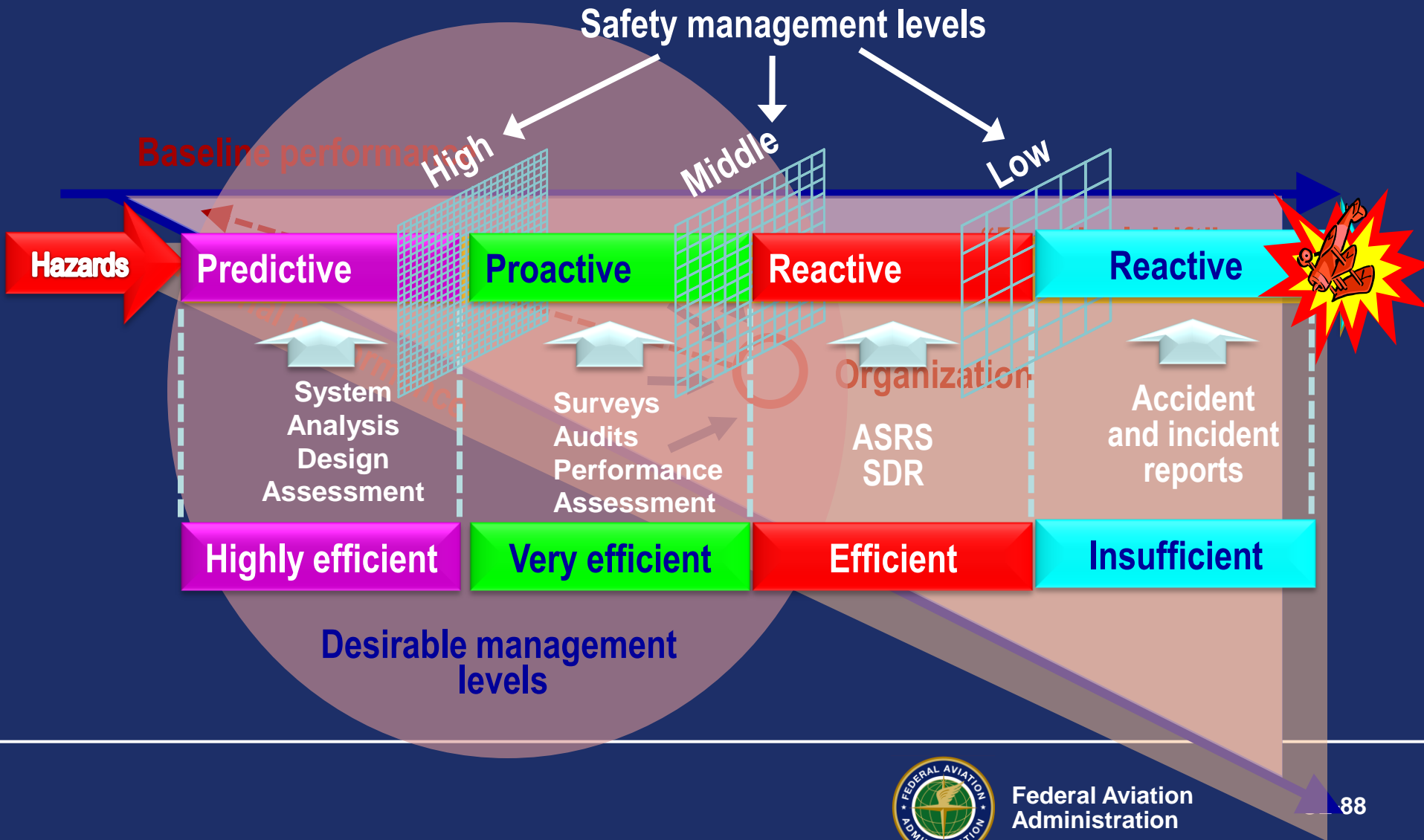[1] Black's Law Dictionary

[2] ISO 9000-2000

SM Strategies – Intervention Levels & Tools

Safety management levels

Baseline performance

High   Middle   Low

Hazards

Predictive	Proactive	Reactive	Reactive

System
Analysis
Design
Assessment

Surveys
Audits
Performance
Assessment

ASRS
SDR

Accident
and incident
reports

Highly efficient	Very efficient	Efficient	Insufficient

Organization

Desirable management levels

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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.

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System Operation

Written documentation to describe:

Who, What, When, Where, Why, How

The system operation includes:

1) Monitoring of risk controls during operations;

2) System description, including risk controls added during SRM which form the basis for SA functions such as audits and analysis.

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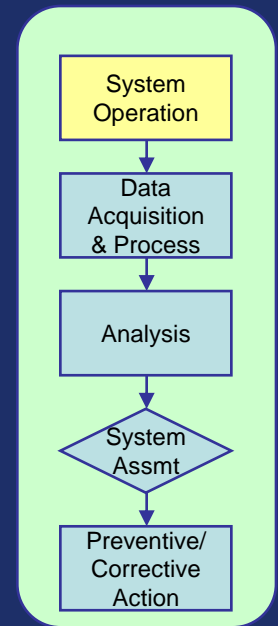
SL-92
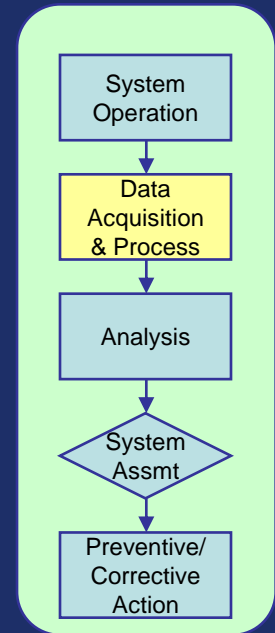
Data Acquisition & Process

Information Sources

1. Continuous Monitoring

2. Internal Audits

3. Internal Evaluation

4. External Audits

5. Investigations

6. Employee Reporting Systems

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System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action

Continuous Monitoring

Where SRM and SA interface - risk controls

Line managers of operational departments:

- Accomplish continuous monitoring of day-to-day activities & processes

- Have direct responsibility for process control

- Must ensure that processes in their areas function as designed.

System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action
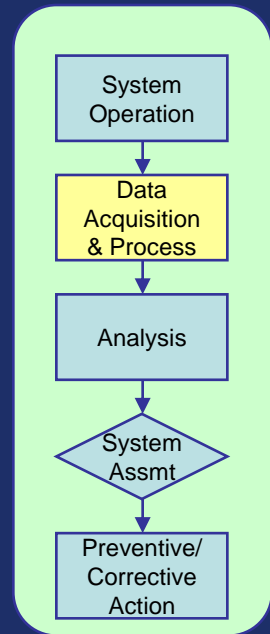
Continuous Monitoring - Operational Data Sources

- Flight dispatch records

- Flight schedules

- Financial data

- Crew schedules and records

- Warranty return reports

- Aircraft discrepancy reports

- Flight cancellation and delay reports
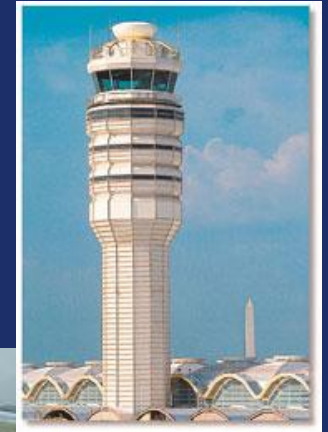
Internal Audits

The day-to-day responsibility for safety management rests with those who "own" the technical processes.
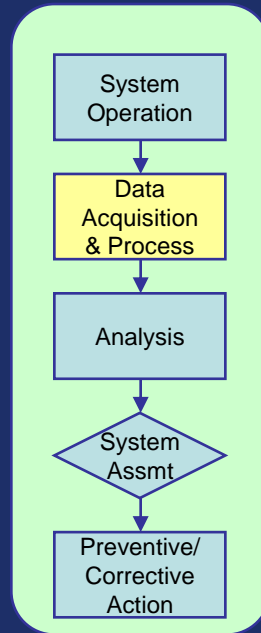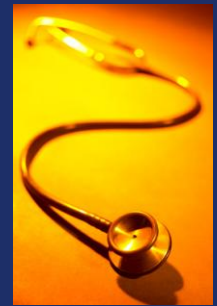
This is where:

- deficiencies in processes contribute to risk

- audits provide feedback to process owners

- direct supervisory control and resource allocation can help to maintain effectiveness of risk controls

System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action

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Internal Evaluation

- Performed by a functionally independent person or organization (e.g. QA, Safety)

- A process-oriented control function

- Backs up the internal audit function

- Uses sampling to validate SA processes

System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action
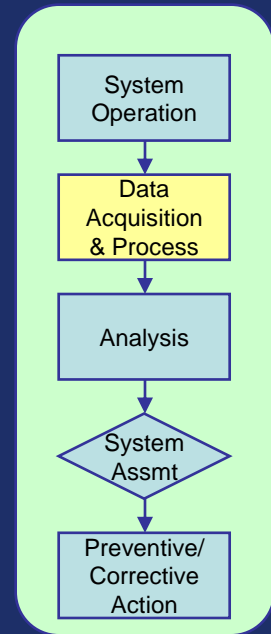
External Audits

Conducted by:

- Code-share partners

- Industry organizations (e.g. C.A.S.E.)

- Third parties: consultants

- The regulator (FAA) = "Safety Oversight"

System Operation → Data Acquisition & Process → Analysis → System Assmt → Preventive/Corrective Action
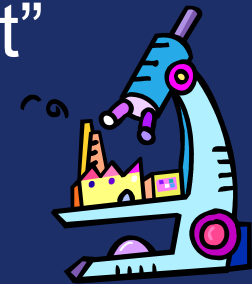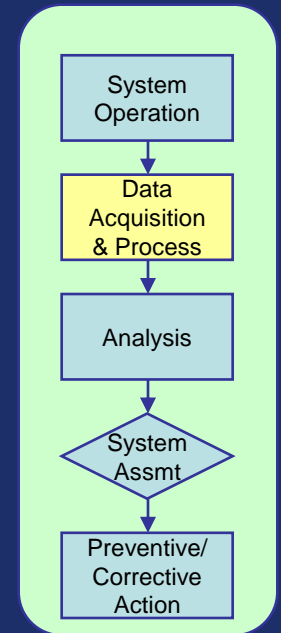
Safety investigations

- For continuity – put the event behind us

  - To put losses behind

  - To reassert trust and faith in the system

  - To resume normal activities

  - To fulfil political purposes

- For improved system reliability

  - To learn about system vulnerability

  - To develop strategies for change

  - To prioritize investment of resources

System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action
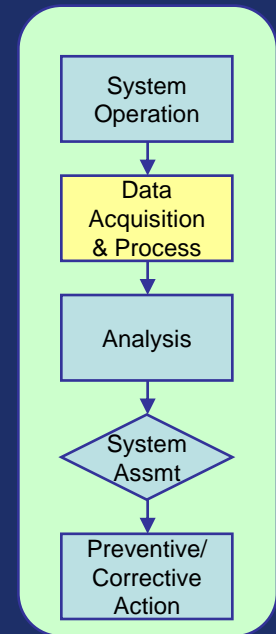
Employee Reporting

- Employee safety reporting & **feedback** system is required.

- Must provide confidentiality.

- Employees must be encouraged to use the system.

- Data may identify emerging hazards.

- Data must be included in analysis.

AC 120-92, App. 1

System Operation → Data Acquisition & Process → Analysis → System Assmt → Preventive/ Corrective Action
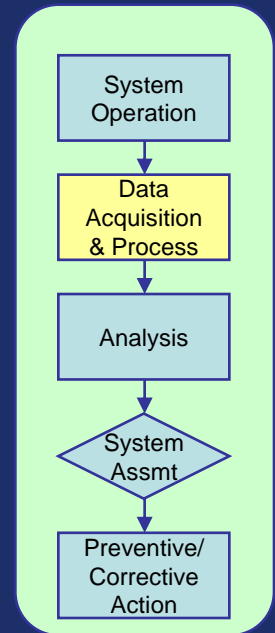
Analysis

- 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.

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System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action
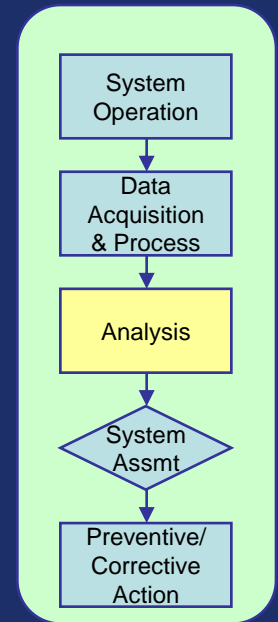
System Assessment

- Are objectives being met? ("Happy loop")
- 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)

System Operation

Data Acquisition & Process

Analysis

System Assmt

Preventive/ Corrective Action
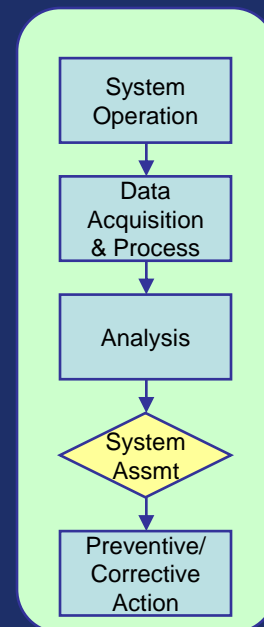
Preventive/Corrective Actions

- Revised policies

- New procedures

- Equipment changes

- Enhanced training

- Schedule changes

- Assignment of responsible persons

System Operation
Data Acquisition & Process
Analysis
System Assmt
Preventive/ Corrective Action
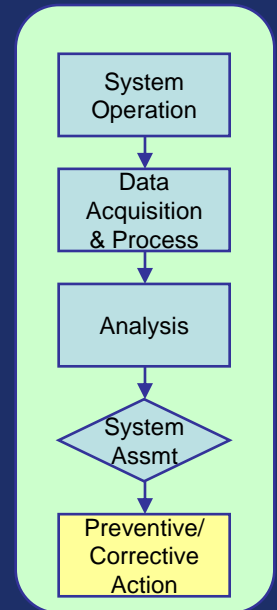
Management Review

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

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SMS Details:

Safety Promotion Component

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Promotion: Definition

Safety promotion = a combination of:

- Safety Culture,

- Training and

- Knowledge Sharing

activities that support the implementation and operation of SMS in an organization

Organizations must promote safety as a core value with practices that support a positive safety culture. AC 120-92, App. 1

Culture

Management ⟷ **Employees**

Communication

Informed: People understand the hazards & risks

Learning: The company learns from mistakes. Staff are updated on safety issues by management.

Just: Employees know what is acceptable & unacceptable behavior.

Reporting: All personnel freely share critical safety information.

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To Support a Sound Safety Culture:

1. Senior management commitment

2. Senior management visibility

3. Safety accountability framework

4. Safety policy, goals, objectives, standards, and performance

5. Effective employee safety reporting system

6. Safety information system

7. Resource commitment

Training and Communication!

- Employees must understand the SMS

- Employees benefit from safety lessons learned

- Explain why particular actions are taken

- Develop awareness of hazards

- Foster open reporting of safety concerns

- Initial and ongoing training

Example Safety Promotion Video

Personnel Competencies and SMS Training

- **Identification of competency requirements**

- **Selection and hiring criteria and standards**

- **Training**

- **Skill competency**

  - Initial training

  - Recurrent training

  - Continuous communication

ISD Processes

SMS Processes

Analyze
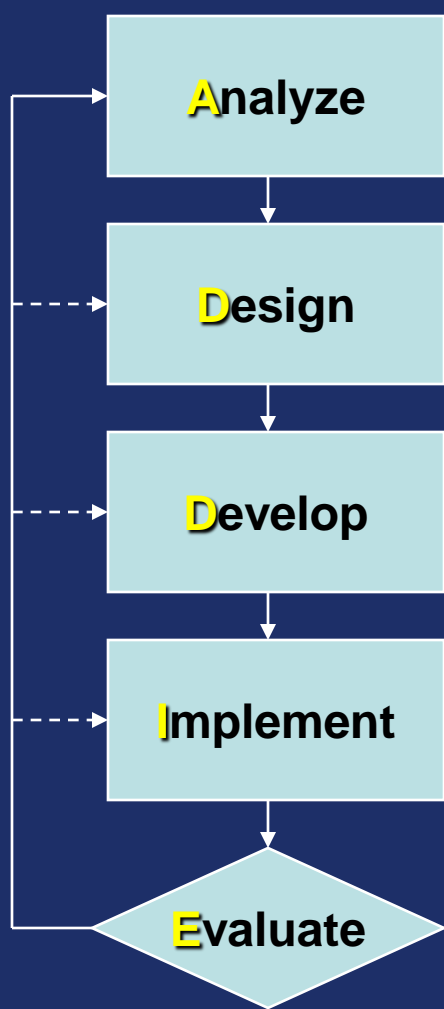
SRM: System/ Task Description & Analysis
- Safety Critical Job Tasks
- Competencies (KSA's, etc)
- Target audience characteristics

Design

- Training Tasks
- Qualification Standards **(SRM risk Control)**
- Courseware

Develop

- Medium
- Lessons, Exercises, Activities
- Tests, Evaluations

Implement

SA: Monitoring
- Training Delivery
- Records
- Testing/Qualifying

Evaluate

SA: Assessment
- Student Evaluation/critique
- Instructor Critique
- OJT & performance observations

Processes

Activities | Workplace Conditions:

System/Task Analysis

Facts

System Factors & Attributes

Variable Human Performance

e.g.
- Equipment
- Information (Procedures)
- Facilities
- Phys. Envir.
- Other Proc. (Interfaces)
- Training
- Supv./Mgmt. (Controls)
- ....
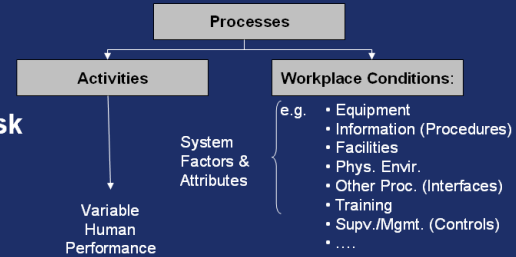
Commitment to SMS

- 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 Guidance, Tools and Implementation

SMS Guidance and Tools
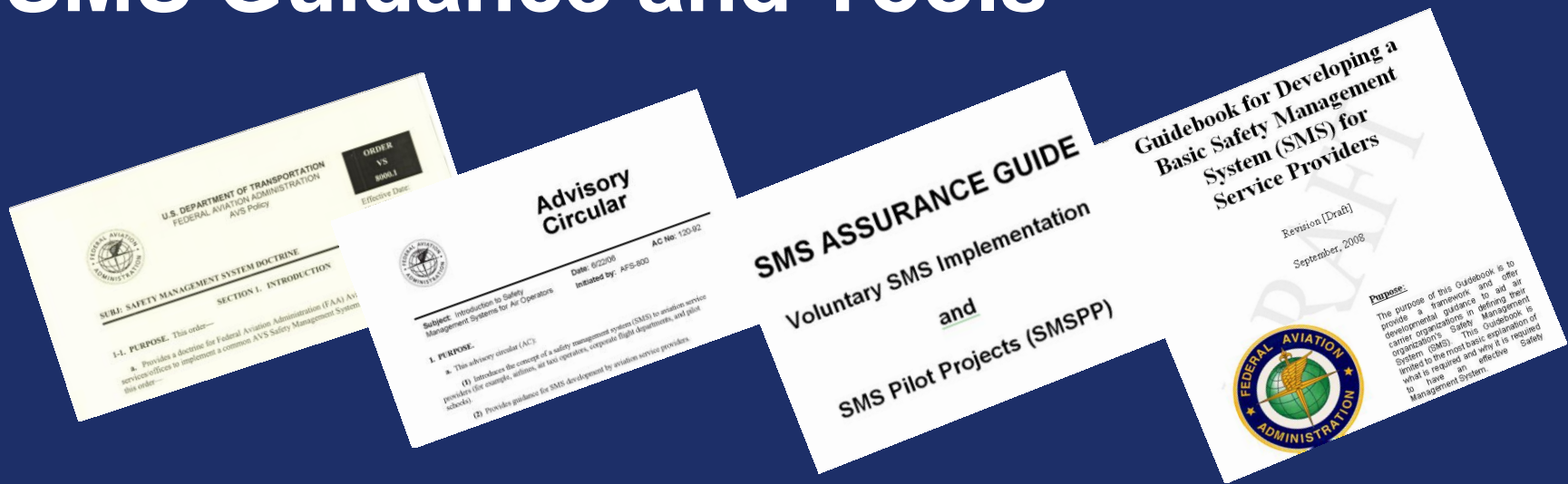
- ICAO Doc 9859: Safety Management Manual (SMM)

- FAA Order 8000.369: FAA SMS Guidance

- VS 8000.367: AVS Requirements Document

- SMS Standard: AC 120-92 Appendix 1

- Voluntary Implementation Guidance

ICAO and FAA SMS Framework

Policy
(Structure)

Safety Risk
Management

Safety
Assurance

Safety Promotion
(Culture)

Elements:

Elements:

1.1 Safety Policy

Elements:

4.1 Competencies and Training

Process 4.1.1 Personnel requirements

Process 4.1.2 Training

4.2 Communication and Awareness

3.2 Management of Change

3.3 Continual Improvement

SRM

Start

System Analysis (Design) — 2.1.1
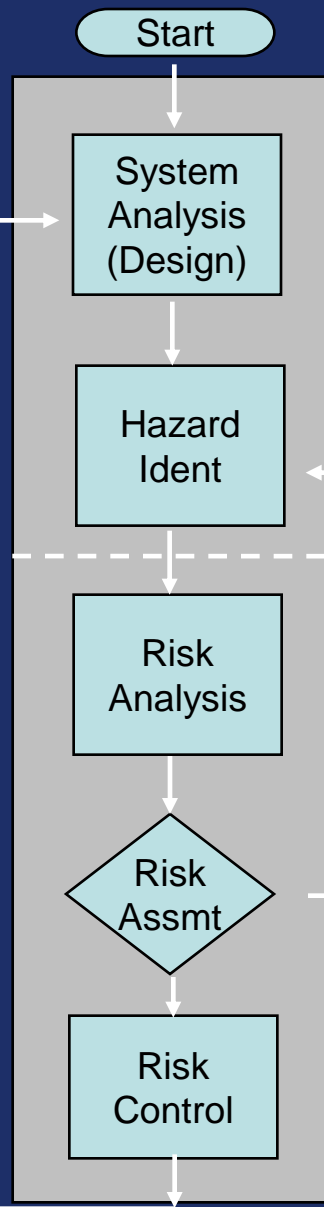
Inputs: 2.0(B)(2)(a),(b) & (d)
• New System
• System Change
• New Operational Procedure

2.1 Hazard Identification & Analysis

Hazard Ident — 2.1.2

Inputs: 2.0(B)(2)(c)
From SA: 3.1.8(B)(3)

2.2 Risk Assessment & Control

Risk Analysis — 2.2.1

Risk Assmt — 2.2.2

Outputs: To SA 3.0(B)(1)(b)

Risk Control — 2.2.3

Evaluate Controls 2.2.3(B) (2) & (3)

SA

3.1 Safety Performance Monitoring and Measurement

Inputs:
From SRM 2.2.2(B)
& 2.2.3 (B)(2)(b)
To SA:
3.0(B)(1)(b)

System Operation

Per 2.1.1 including
Risk Controls per 3.1.3

Data Acquisition & Process

3.1.1 Continuous Monitoring
3.1.2 Internal Audits
3.1.3 Internal Evaluation
3.1.4 External Evaluation
3.1.5 Investigations
3.1.6 Employee Reporting

Analysis

3.1.7 Analysis of Data { How is this going to be analyzed? By whom?

System Assmt

Outputs: 3.1.8(B)(3)
To SRM 2.0(B)(2)(c)

3.1.8 System Assessment
3.1.10 Management Review

Preventive/ Corrective Action

3.1.9

* Note: Each data source should be traceable through analysis (3.1.7(B)(1)), assessment and Corrective Action (3.1.9(B)(1) where necessary.

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External
Decision by
Organization

Inputs

Internal
Previous Process
Interface – (I)

Process

Controls (C)
•Procedural
•Supervision
•Assurance
 Processes

Activities

Procedures (P)

Responsibility (R)
•Accountable for
 process output

Authority (A)
Empowered to:
•Make key
decisions
•Alter process

Outputs

•Destination – **Interface (I)**
•Deliverable – **Performance
  Measures (PM)**

Process 2.1.2 Identify Hazards

Performance **Objective**
The service provider will identify and docu...
harm or damage to equipment or property in ...
acceptability.

Design Expectations

Input

Does the ser... provider's documen...
process obtaine... ...the System and ...
identified from the ...ssurance pro...
deficiencies (3.1.8 (B)...
SMS Framework 1.5 B) 1) f)...

Management Responsibility...

Does the service provider's docu...
identification process?
SMS Framework 1.2 A) Old – SMS Sta...

Procedure

Does the service pro...er's haz...
entire scope of the syst...
SMS Framework 2.1.2 B) 1) a)...

Outputs and Measures

Does the service provider's d...
process and the analysis and ass...
SMS Framework 1.5 B) 1) f) Old – SMS...

Does the service provider's docume...

Bottom Line Assessment
Has the service provider identified an...
physical harm or damage to equipme...
acceptability?

Each Element/Process has a Performance Objective that defines the expected outcome

Design expectations are then defined that outline characteristics

Inputs tell us where the process starts:

Management Responsibility tells us:
• Who is accountable for process

Finally, the "Bottom Line Assessment" takes us back to the objective – will/does the process achieve its intended outcome? (Affirmation)

...of accomplishment (Process Measures)

• Destination of the output (Interfaces)

Some critical processes also have Controls

SMS Implementation

- Should follow a *Phased Approach*

- The processes underlying the four components will be modularized

- "Growth" or "increasing maturity" will then be emphasized for each process and the system as a whole

SMS Voluntary Implementation: Pilot Projects

- Pilot Project activities commenced in 2007

- Voluntary SMS development

- AFS combined effort

- Objectives are to Develop:
  - Implementation strategies,
  - Oversight interfaces, and
  - Gain experience for FAA and Service Providers

SMS Implementation Process

4 — Continuous Improvement

3 — Proactive Processes

2 — Reactive Processes

1 — Planning & Organization

0 — Orientation & Commitment

SMS Transition Assistance Team (STAT)

- **Provides Standardization and Assistance to operators and CMT's in voluntary SMS projects**

- **Under direction of AFS SMS Program Office (PO)**

  – **Team members currently from:**

  - **SMS PO**

  - **FAASTeam**

  - **HQ Policy Divisions**

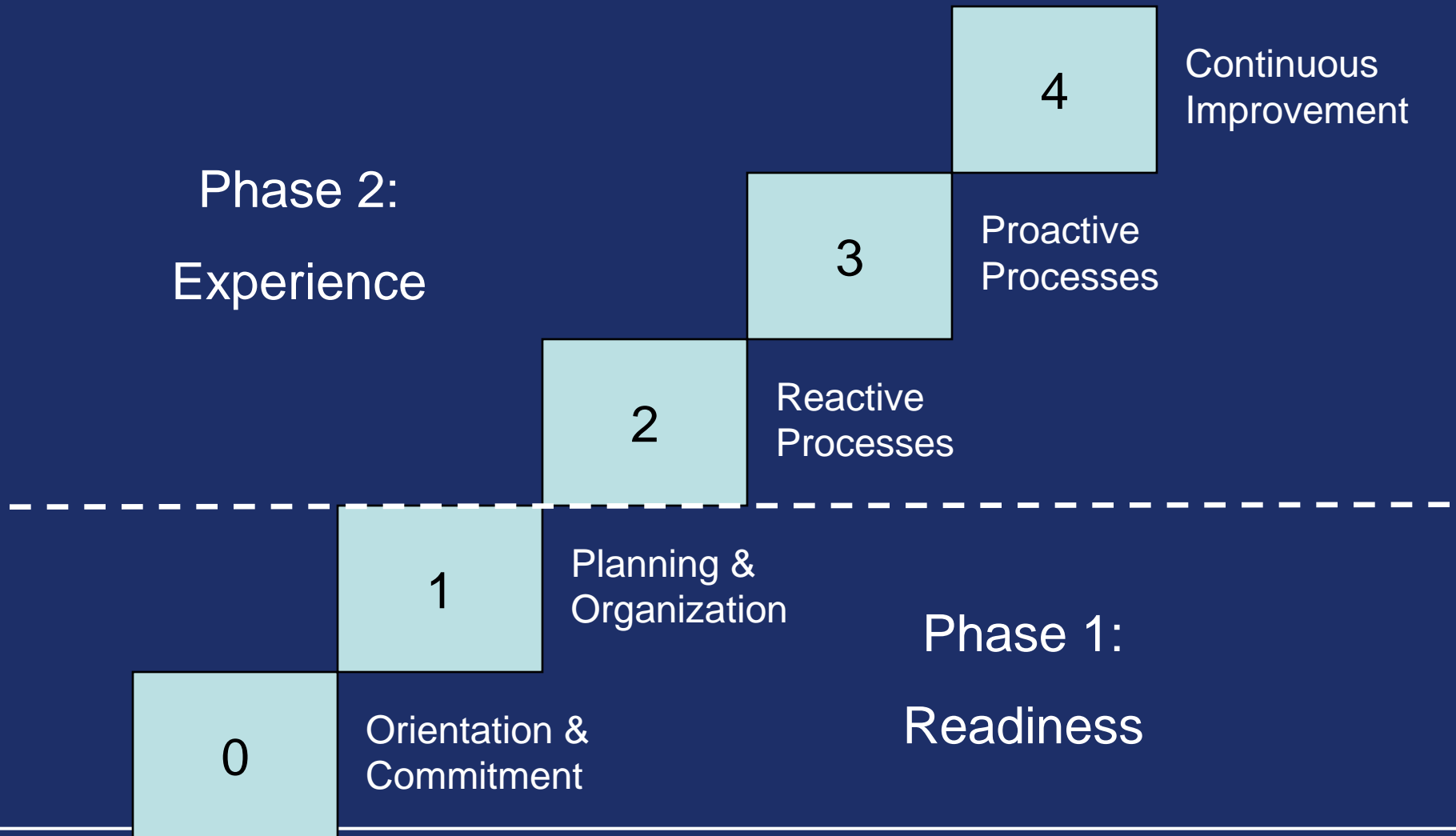- **All activities coordinated with appropriate certificate oversight offices**

Safety Management System Focus Group (SMSFG)

Voluntary implementation user's group

- **Provides a two-way communications mechanism between SMS PO and participants in voluntary implementation**

- **Provides a forum for knowledge sharing among participants**

SMS Studies and Analysis

Phase 2:

Experience

Continuous Improvement

4

Proactive Processes

3

Reactive Processes

2

Planning & Organization

1

Phase 1:

Readiness
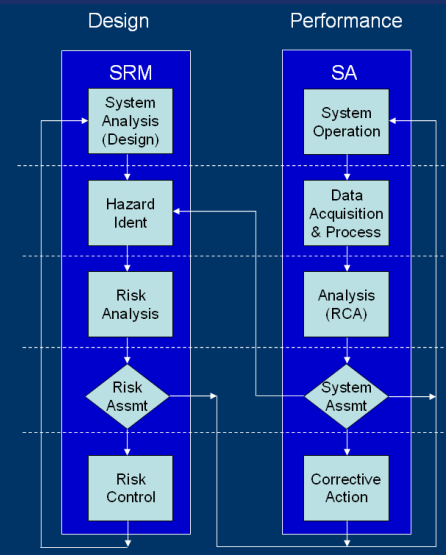
Orientation & Commitment

0

Organizations

Summary

Safety Management System

Provides a systematic way to:

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

SMS Components ("Four Pillars")

Roles, Responsibilities & Relationships

AVS SMS = FAA Safety Programme (SSP)

FAA Internal SMS (SSP & Oversight)

External SMS

Flight Standards

- **Safety Policy**
- **Safety Risk Management**
- **Safety Assurance**
- **Safety Promotion**

FAA Act 44702 → **CFR's (aka FAR's)**

Field Divisions (Oversight)

SAS

Design Assurance (Certification, Prgrm. Apprvl./Accept., Cert. Mgt)

Performance Assurance (Surveil., Plus)

Air Operators/ Service Providers

- **Safety Policy**
- **Safety Risk Management**
- **Safety Assurance**
- **Safety Promotion**

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Safety Management System Provides

1. Increased Safety

2. International Harmonization

3. Improved Organizational Effectiveness

"Carelessness and overconfidence are more dangerous than deliberately accepted risk"
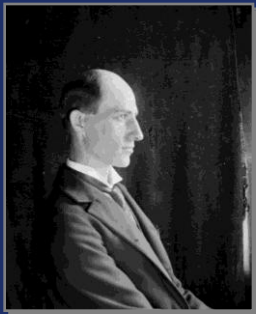**Wilbur Wright, 1901**

Contact:

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(703) 661-0516

don.arendt@faa.gov

Wilbur Wright gliding, 1901
Photographs: Library of Congress

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