# SMS Overview from FAA, Flight Standards

Presented to: NTSB Public Aircraft Forum

Presented by: FAA Flight Standards Service

SMS Program Office

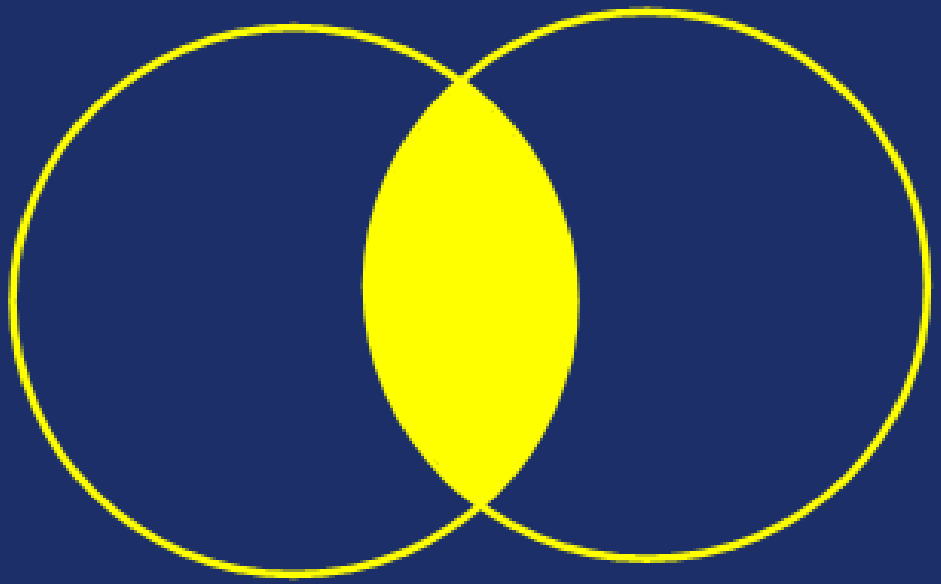
Date: November 30, 2011

Federal Aviation Administration

# Attributed to Dr. Malcolm Sparrow

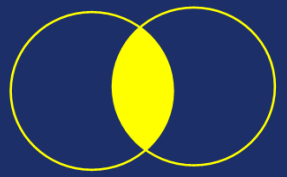
Things that are illegal

Things that cause harm



# How Can We Ignore These Facts?

| | |
|---|---|
| 03/22/09: | FedEx MD-11 at Narita |
| 02/25/09: | Turkish Airlines B737-800 at Amsterdam |
| 02/12/09: | Colgan 3407 (Continental Connection) at Buffalo |
| 01/27/09: | Empire (dba FedEx) at Lubbock |
| 01/15/09: | US Airways 1549 at New York |
| 12/20/08: | Continental B737-500 at Denver |
| 02/18/07: | Shuttle America (Delta Connection) ERJ-170 Cleveland |
| 12/16/07: | Air Wisconsin (US Airways Express) CRJ-200, Providence |
| 08/27/06: | Comair CRJ-2 at Lexington |



# The ICAO View of SMS

- **A systematic approach to managing safety**
  - includes the necessary organizational structures, accountabilities, policies and procedures
- **Providers are responsible for establishing an SMS**
- **States are responsible for the acceptance and oversight for providers' SMS**


ICAO Annex 6
ICAO Doc. 9859 (SMM)

**ICAO**
**State Safety Program (SSP)**

- Annex 6
- ICAO Doc 9859, SMM

***AVS***
**FAA Aviation Safety Office**
**Safety Program = AVS SMS**

- Order 8000.369; FAA SMS Guidance
- Order VS8000.367; AVS SMS Requirements

***AVS LOB's***

***AFS***
**Flight Standards**

- AC 120-92A; SMS for Aviation SP
- AFS Developmental Guidance

***Service Providers SMS***

- Safety Management System

# SMS *Framework*; AC 120-92A, App. 1

***1.0 Safety Policy & Objectives:***

**Elements:**

1.1 Safety Policy
1.2 Management Commitment & Accountabilities
1.3 Key Safety Personnel
1.4 Emergency Preparedness and Response
1.5 SMS Documentation and Records


***2.0 Safety Risk Management:***

**Elements:**

2.1 Hazard identification and analysis
- Process 2.1.1 System and task analysis
- Process 2.1.2 Hazard identification

2.2 Risk assessment and control
- Process 2.2.1 Analyze safety risk
- Process 2.2.2 Assess safety risk
- Process 2.2.3 Control safety risk

***3.0 Safety Assurance:***

**Elements:**

3.1 Safety Performance Monitoring & Measurement
- Process 3.1.1 Continuous monitoring
- Process 3.1.2 Internal audits by operational depts.
- Process 3.1.3 Internal evaluation
- Process 3.1.4 External audit
- Process 3.1.5 Investigation
- Process 3.1.6 Employee reporting and feedback
- Process 3.1.7 Analysis of data
- Process 3.1.8 System assessment

3.2 Management of Change

3.3 Continual Improvement
- Process 3.3.1 Preventive/corrective action
- Process 3.3.2 Management review

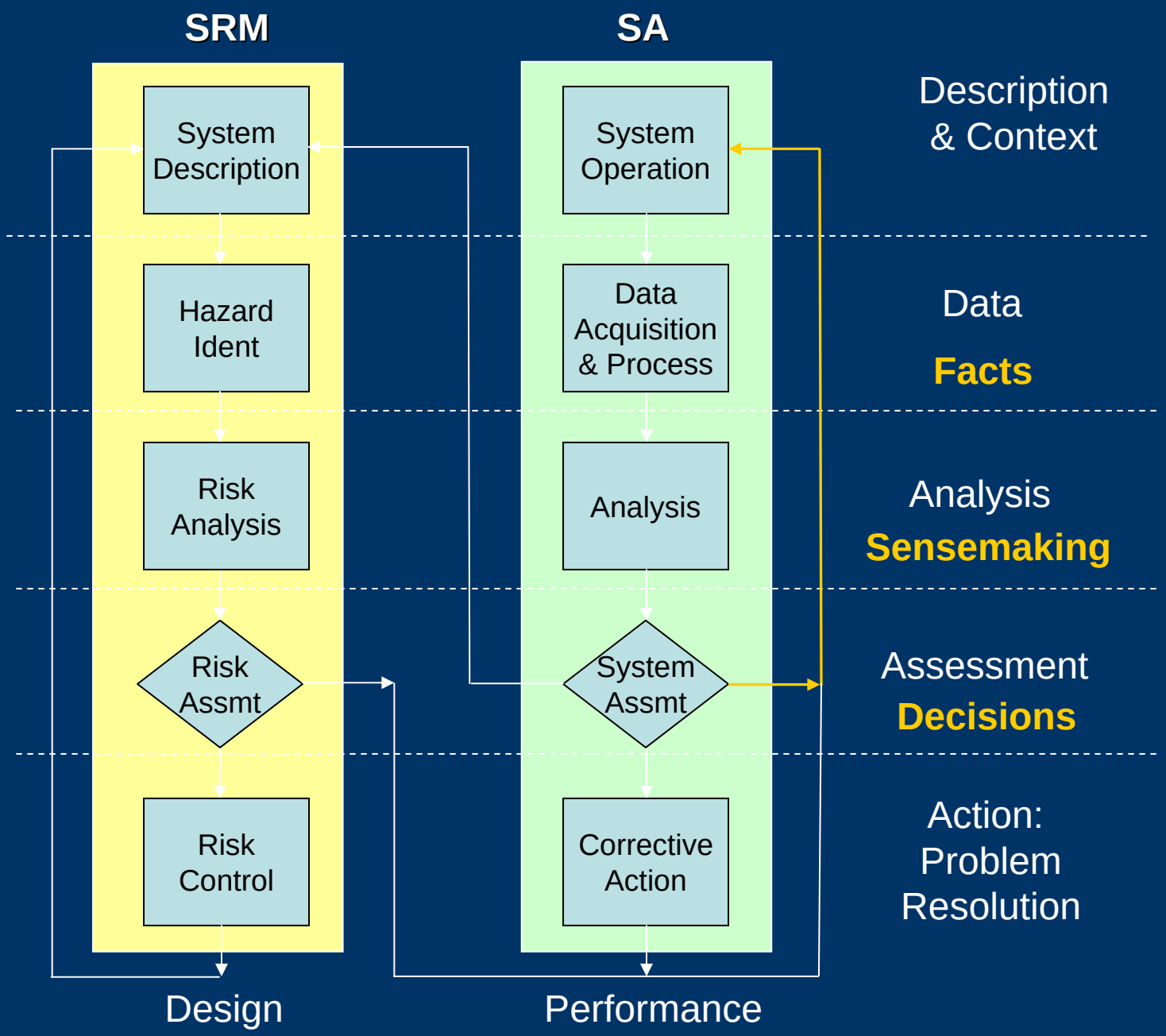
***4.0 Safety Promotion:***

**Elements:**

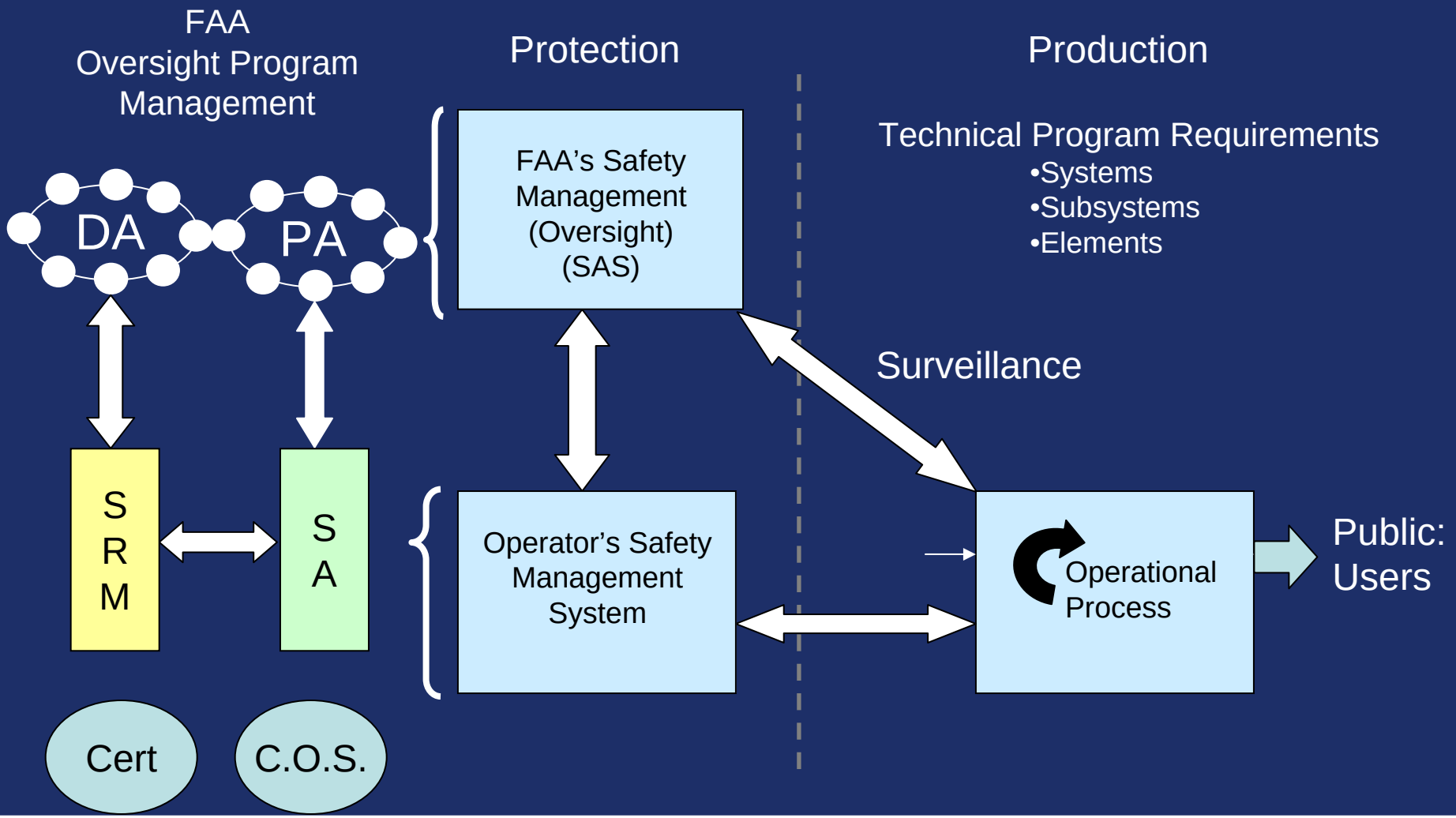
4.1 Competencies and Training
- Process 4.1.1 Personnel requirements
- Process 4.1.2 Training

4.2 Communication and Awareness

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



# Oversight and SMS

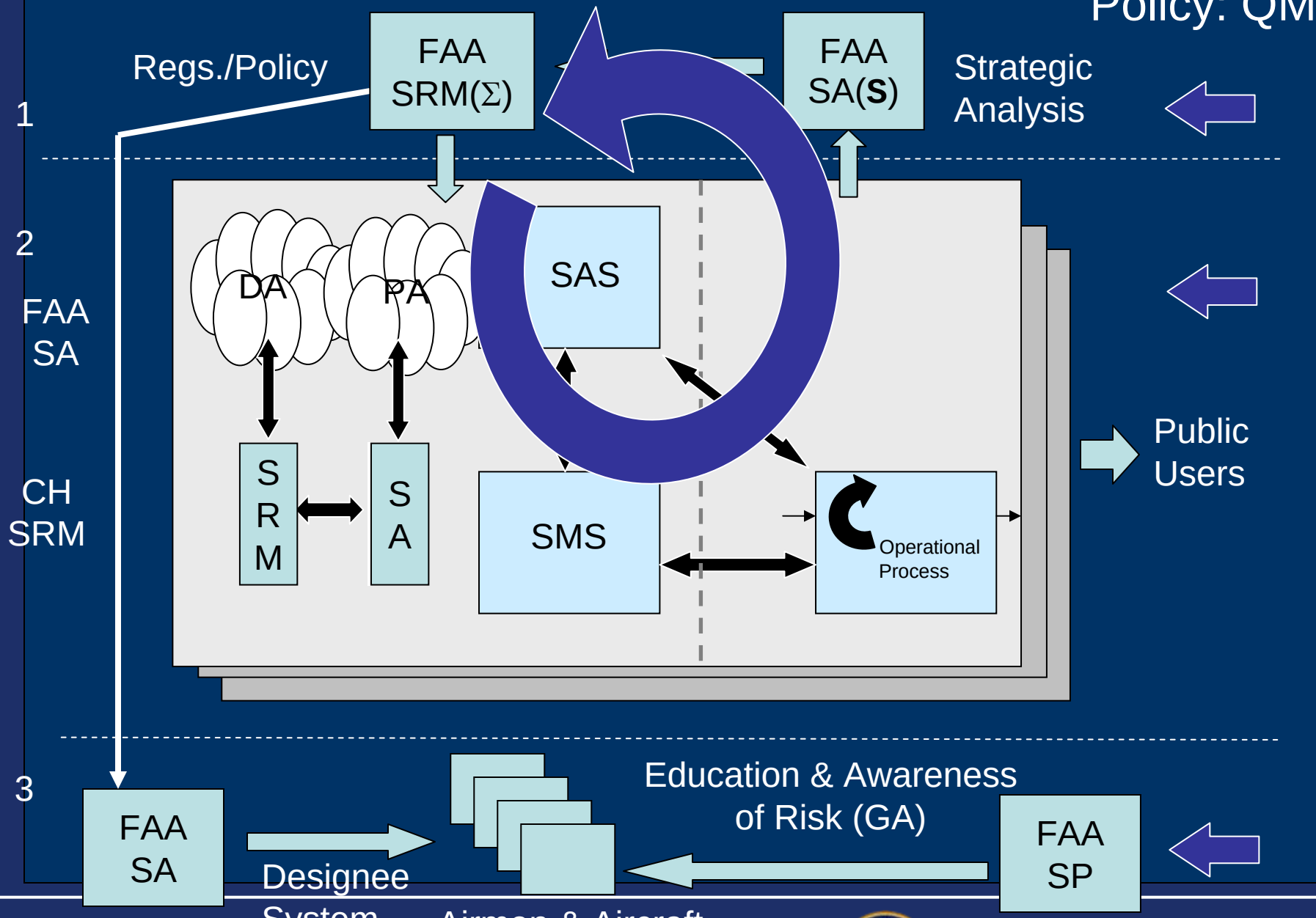


1 National Airspace System Level

2 Service Provider/Organizational Level

3 Individual (Airman/Aircraft) Level

# Policy: QMS


Regs./Policy
FAA SRM(Σ)
FAA SA(S)
Strategic Analysis
1
2
FAA SA
CH SRM
DA
PA
SAS
SRM
SA
SMS
Operational Process
Public Users
3
FAA SA
Designee System
Education & Awareness of Risk (GA)
FAA SP
Airmen & Aircraft

# Culture

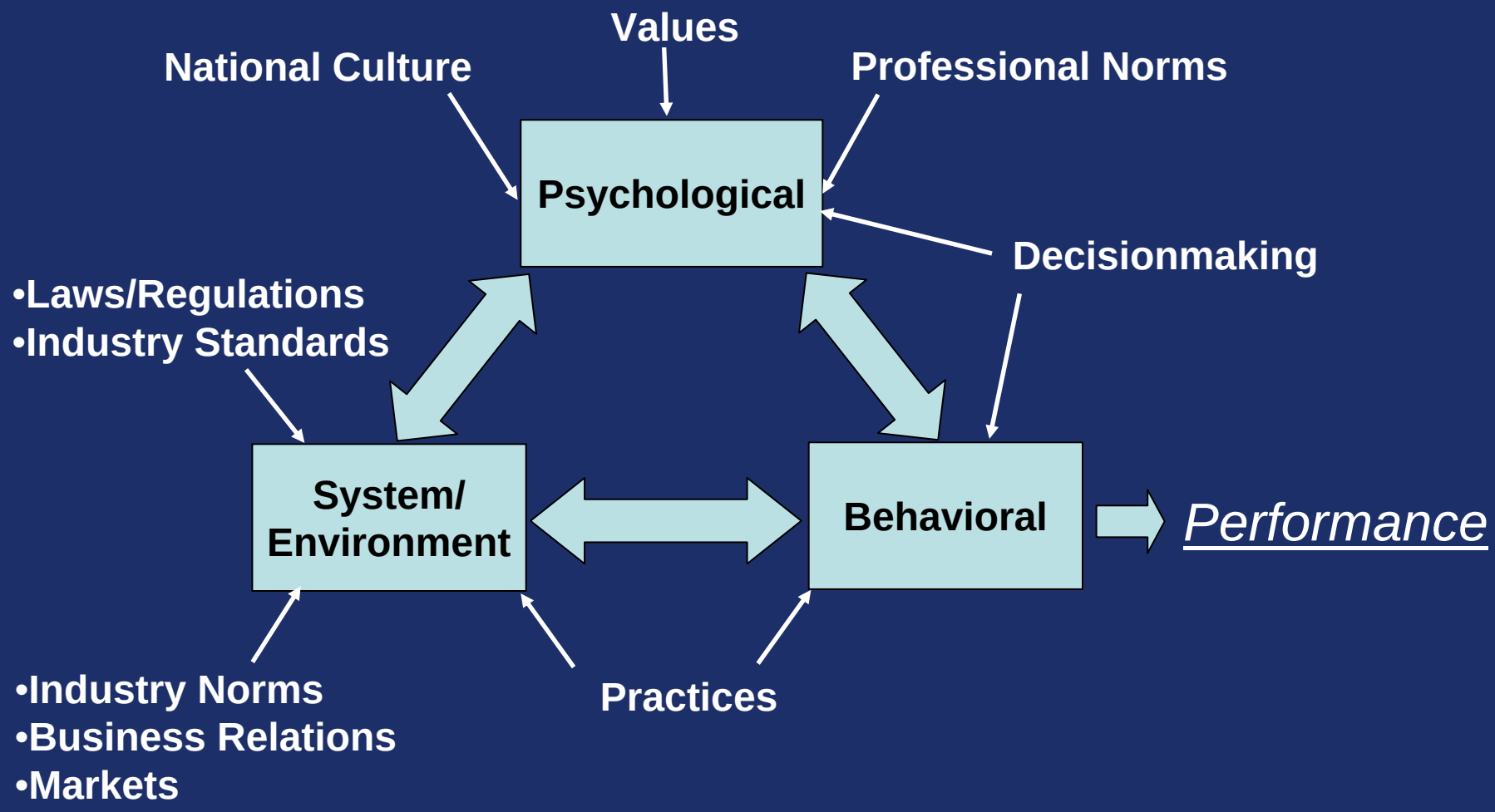
# Safety Culture: A Brief History

## Continental Express Flight 2574, 1991

NTSB Board member John Lauber in dissenting opinion suggests probable cause of this accident due to: "the failure of Continental Express management to establish a corporate culture which encouraged and enforced adherence to approved maintenance and quality control procedures."


47 screws removed from the horizontal stabilizer during maintenance the night before and, following a shift change, were not replaced.

# Organizational Culture



# NM State Police Agusta S.p.A. A-109E

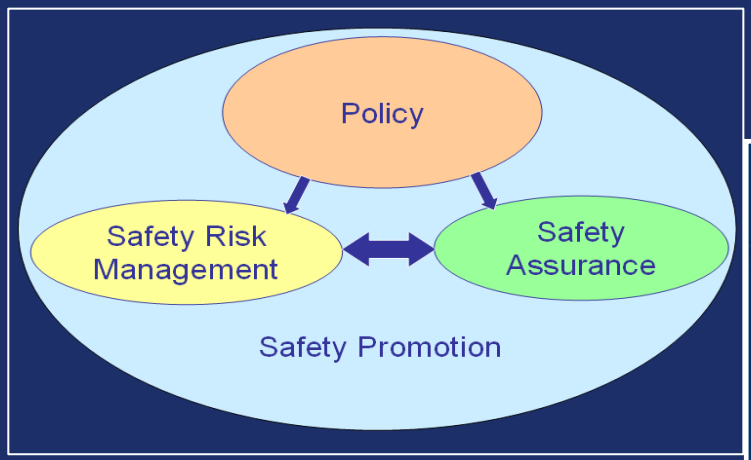
# How can we “create” or change a culture?

- Can we tell people how to think or feel?
- Can we tell people how to behave?
- Shape the environment in which people work!

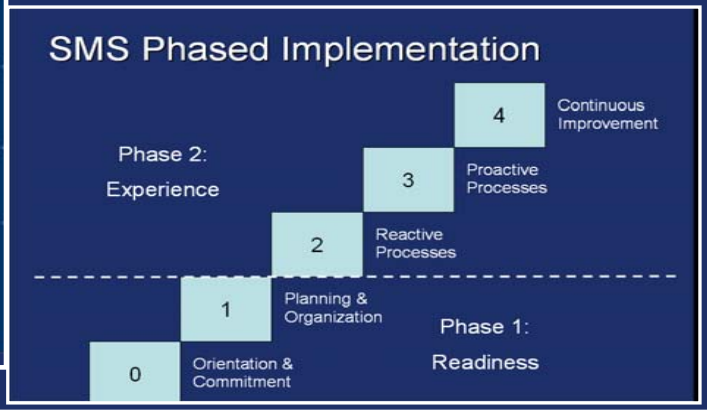
# Safety Management System

## Provides a systematic way to:

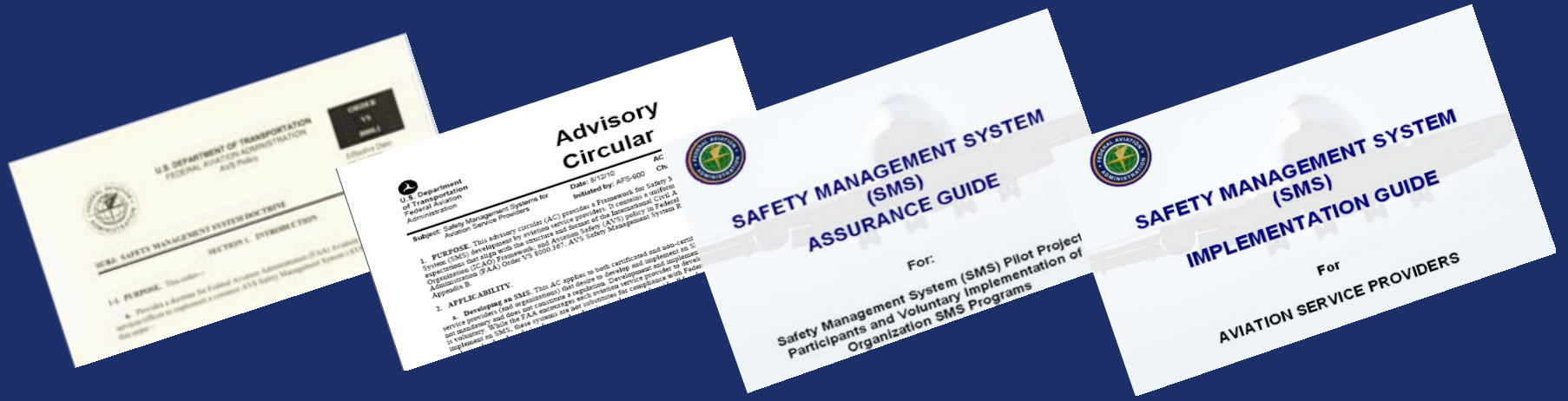
1. Identify hazards and control risk
2. Provide assurance that risk controls are effective
3. Allows for Phased Implementation



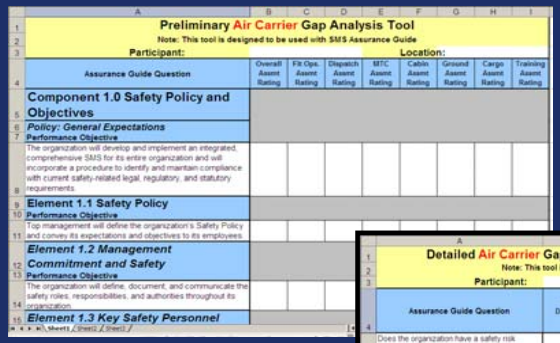


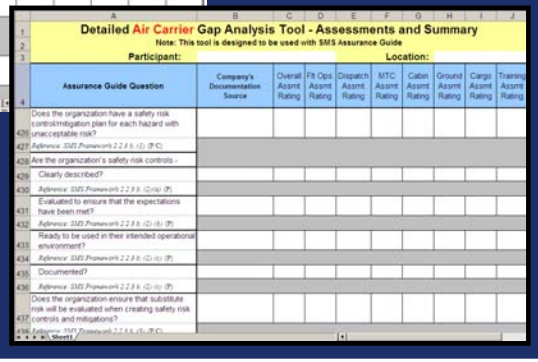


# FAA SMS Guidance and Tools

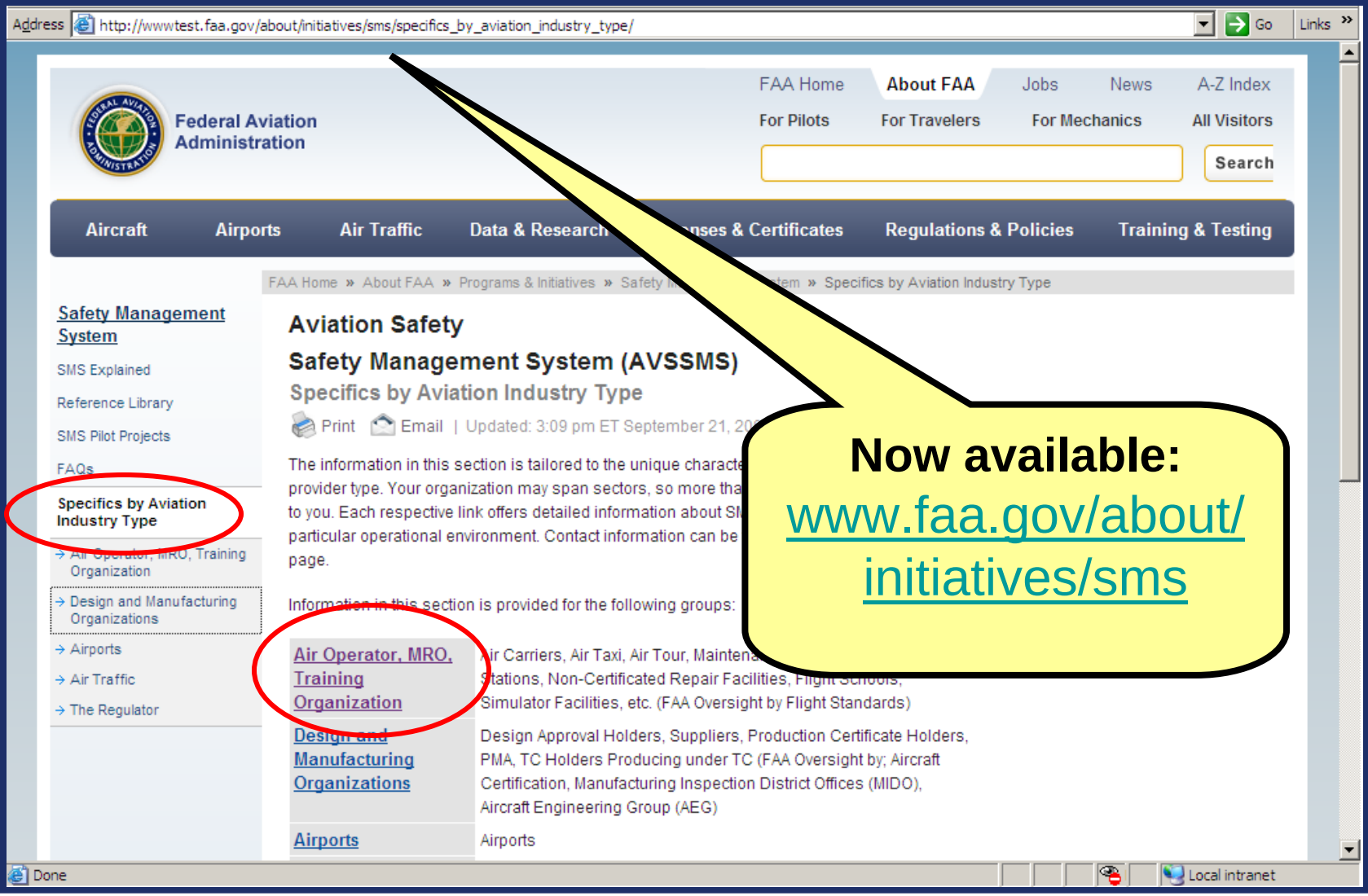



- **FAA Order 8000.369: FAA SMS Guidance**
- **VS 8000.367: AVS SMS Requirements Document**
- **SMS Standard: AC 120-92A, Appendix 1**
- **Voluntary Implementation Guidance (multiple documents)**



# FAA SMS Web Site



# SMS Voluntary Implementation: SMS Pilot Project

- Pilot Project activities commenced in 2007
- Voluntary SMS development for
  - **14 CFR Parts 121, 135, 145**
- AFS combined effort
- Objectives are to Develop:
  - Implementation strategies,
  - Oversight interfaces, and
  - Gain experience for FAA and Service Providers

# Collaboration - SMS
# Focus Group (SMS FG)

## 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
- Last FG meeting over 200 (Over 130 in PP)

# SMS Rulemaking update

- **Part 121**
  - Per P.L. 111-216
  - Due Aug 1, 2012, implementation Sep 30, 2012
- **Part 135**
  - Approx 3 year minimum development time
  - Approx 2014-15
- **Part 145**
  - Challenges in regulation evaluation

**The following is an excerpt from FAA Administrator, Randy Babbitt's speech, Shared Vision for Safety Conference, June 2, 2010 (San Diego)**

"I know that there are those who complain that they're too small for SMS. Or that it's too costly. Or that they don't have time. One by one: no one and no company is too small for SMS. The cost of SMS is far less than the cost of an accident.

"Saying that you don't have time for SMS is the functional equivalent of saying that you don't have time for safety. At its essence, SMS forms a real triangle of safety. You identify the problem, you analyze it, you come up with a solution, you train to the solution, and then you check how you're doing."

# Parting words…

- The quality of an SMS doesn't depend on how extensive, expensive, or sophisticated the data and analysis processes are…
- SMS isn't a manual on the shelf or an annual audit…
- SMS is about how well decisions are made.

Build trust

Gain knowledge

K.I.S.S. but don't M.I.S.S.

***"Carelessness and overconfidence are more dangerous than deliberately accepted risk"***
**Wilbur Wright, 1901**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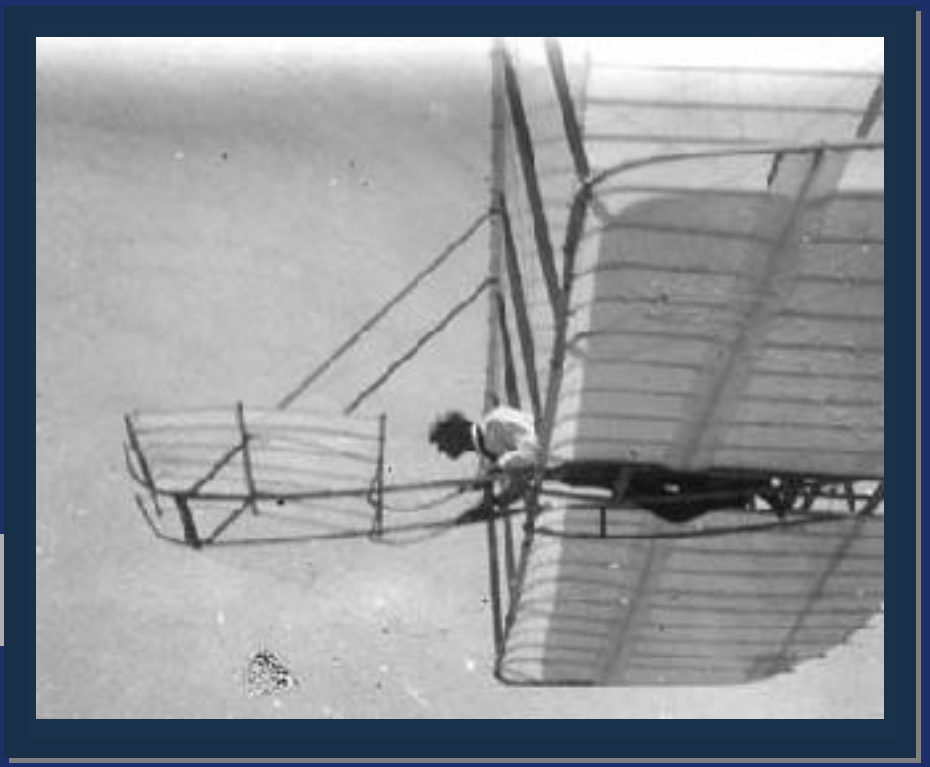
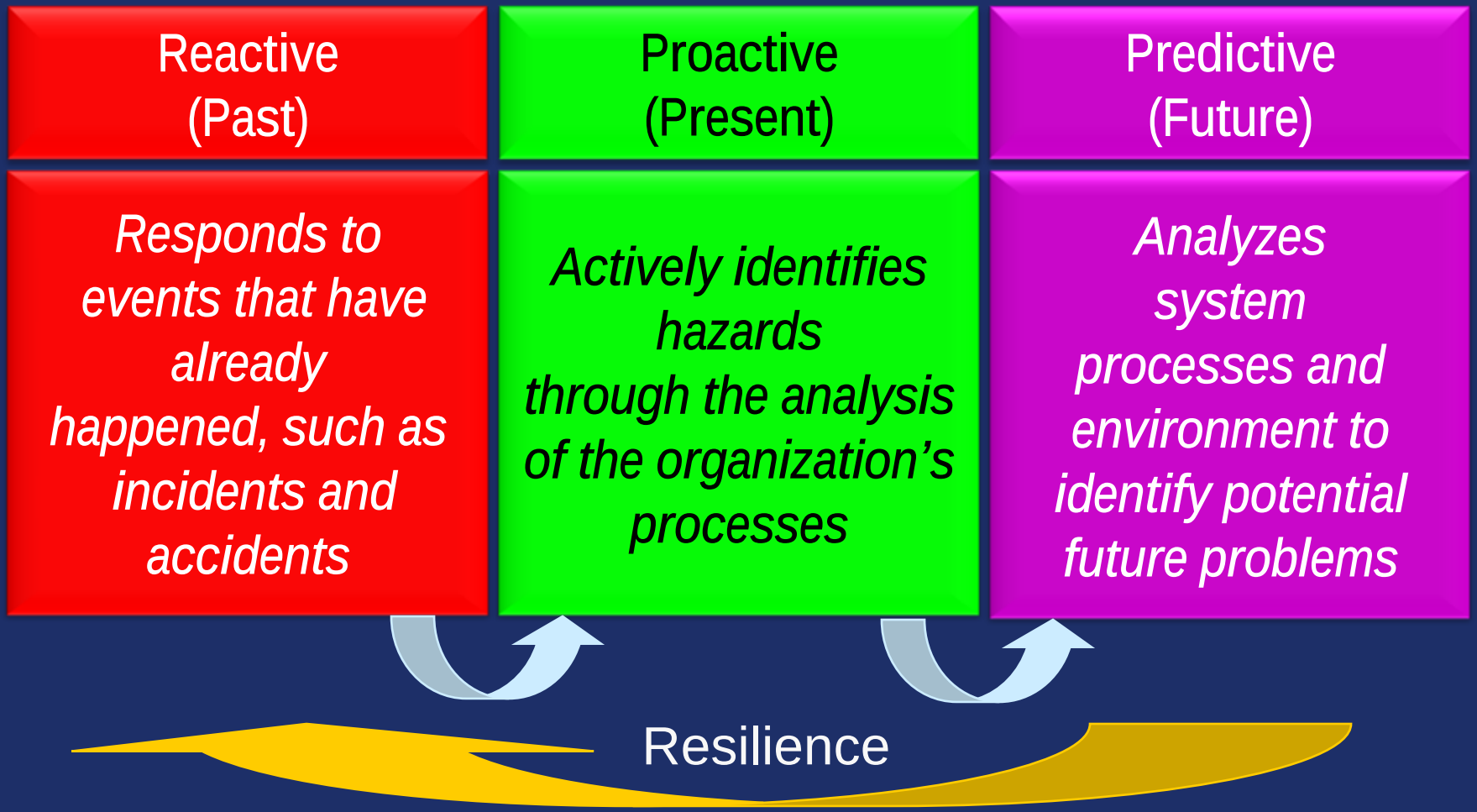
Wilbur Wright gliding, 1901
Photographs: Library of Congress



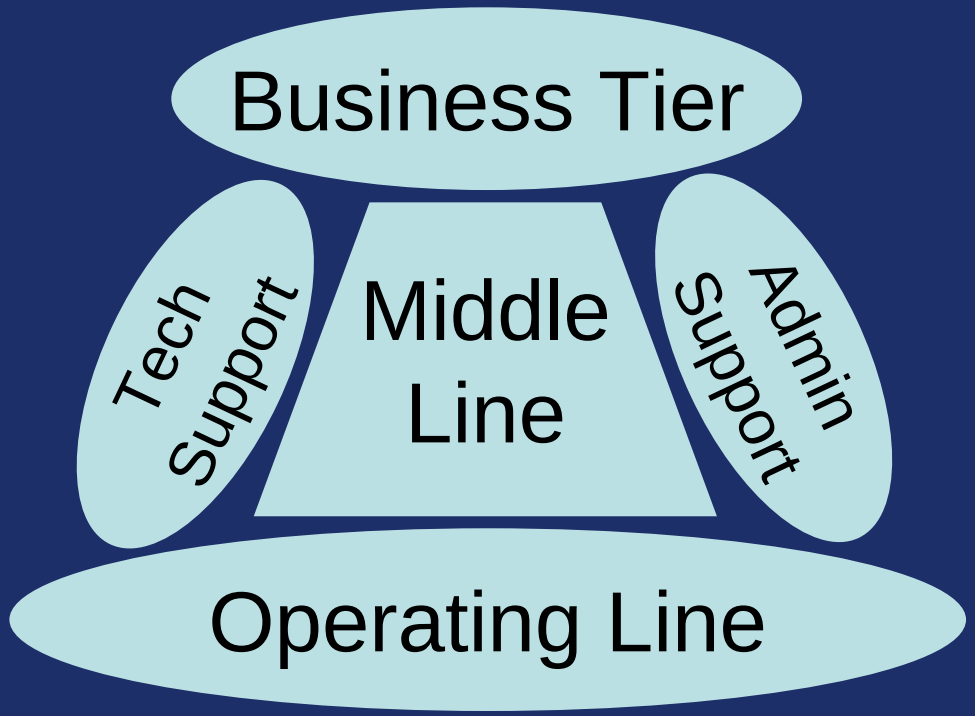
**The following additional segments provide more information, as time and interest permit, and are provided to be printed and distributed, even if not delivered during the Nov 2011 Forum.**

# Safety Management Systems

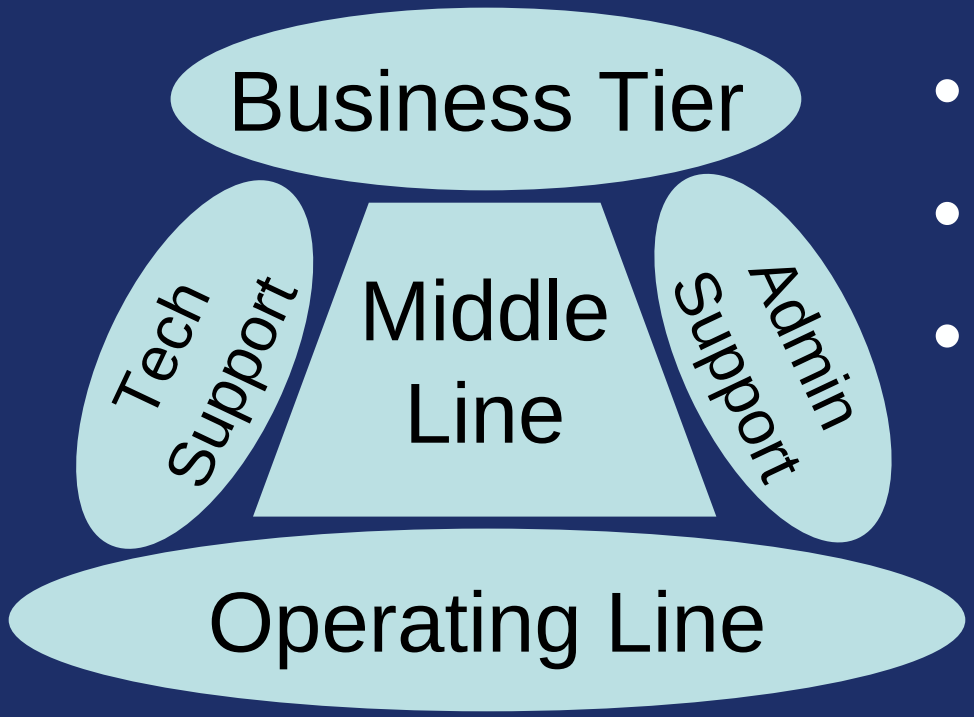
# Safety Management Strategies



# Who “owns” the SMS?



# Who?




- Sets goals
- Allocates resources
- Directs activities
- Conducts the activities

# Top Management ("Business Tier")

- **The Organization will Identify an Accountable Executive**
- **Accountable Executive Criteria:**
  - Final authority over operations
  - Controls financial resources required for operations
  - Controls human resources required for operations
  - Retains ultimate responsibility for the safety performance of operations under the certificate

# Accountable Executive Duties

- Ensure proper implementation of SMS
- Develop and sign safety policy
- Communicate safety policy throughout the organization
- Regularly review safety policy
- Regularly Review the safety performance of the organization and direct actions necessary to address substandard safety performance

# What do we mean by “accountability?”

- Blame?
- A scapegoat?
- That’s “backward accountability”
- We want “forward looking accountability”
- Taking responsibility for reporting
- Willingness to admit mistakes
- Taking responsibility for change

# Technical Management ("Technical Tier")

- (119.65(a)): "…sufficient qualified management and technical personnel to ensure the highest degree of safety in its operations."
- 119.65(d)(3): [shall] "…discharge their duties to meet applicable legal requirements and to maintain safe operations."
- The SMS provides a structured system of processes to meet these requirements.

# Duties of Technical Management

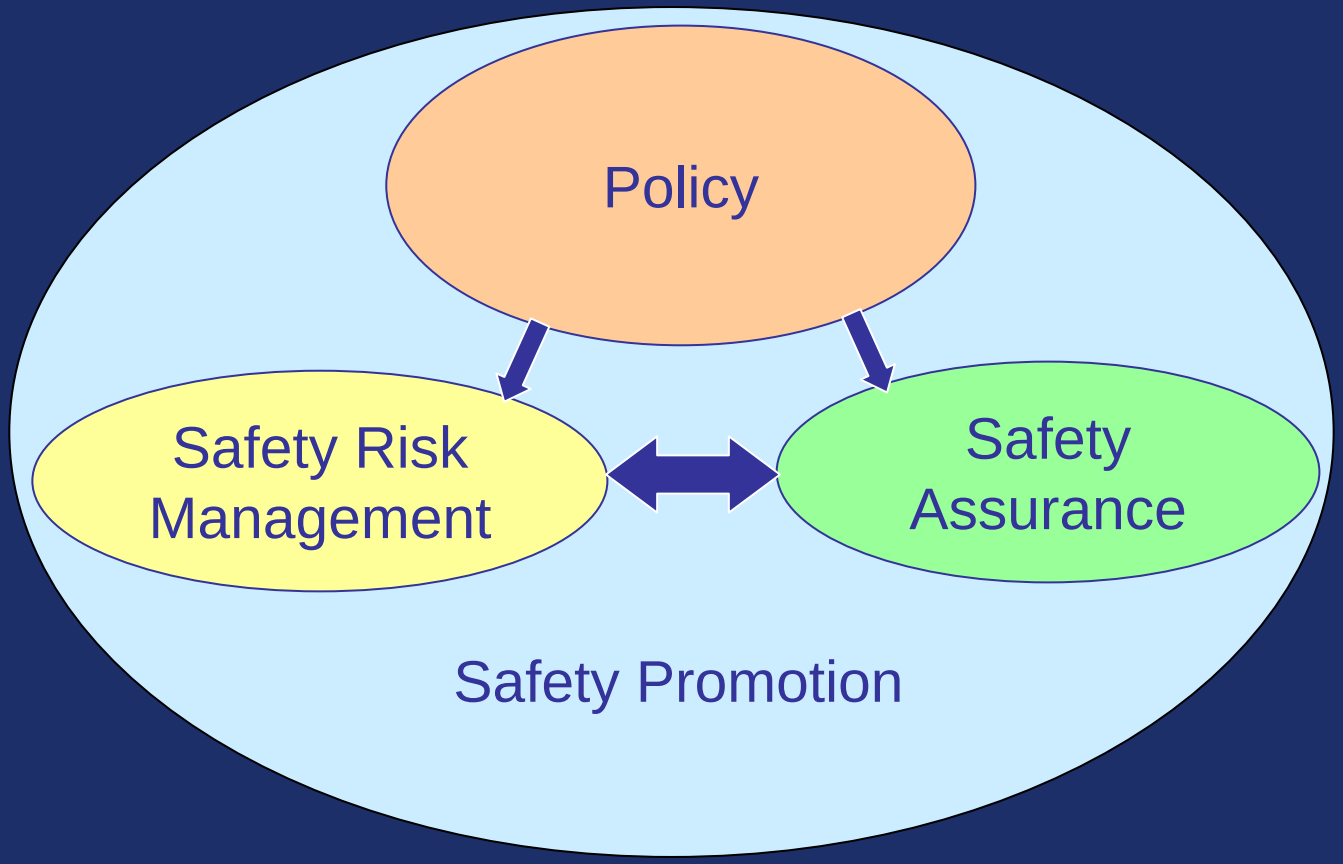
- **In order to:**
  - "…ensure the highest degree of safety"
  - "…maintain safe operations"
- **Managers' duties defined:**
  - Hazard identification
  - Safety risk assessment
  - Assuring the effectiveness of safety risk controls

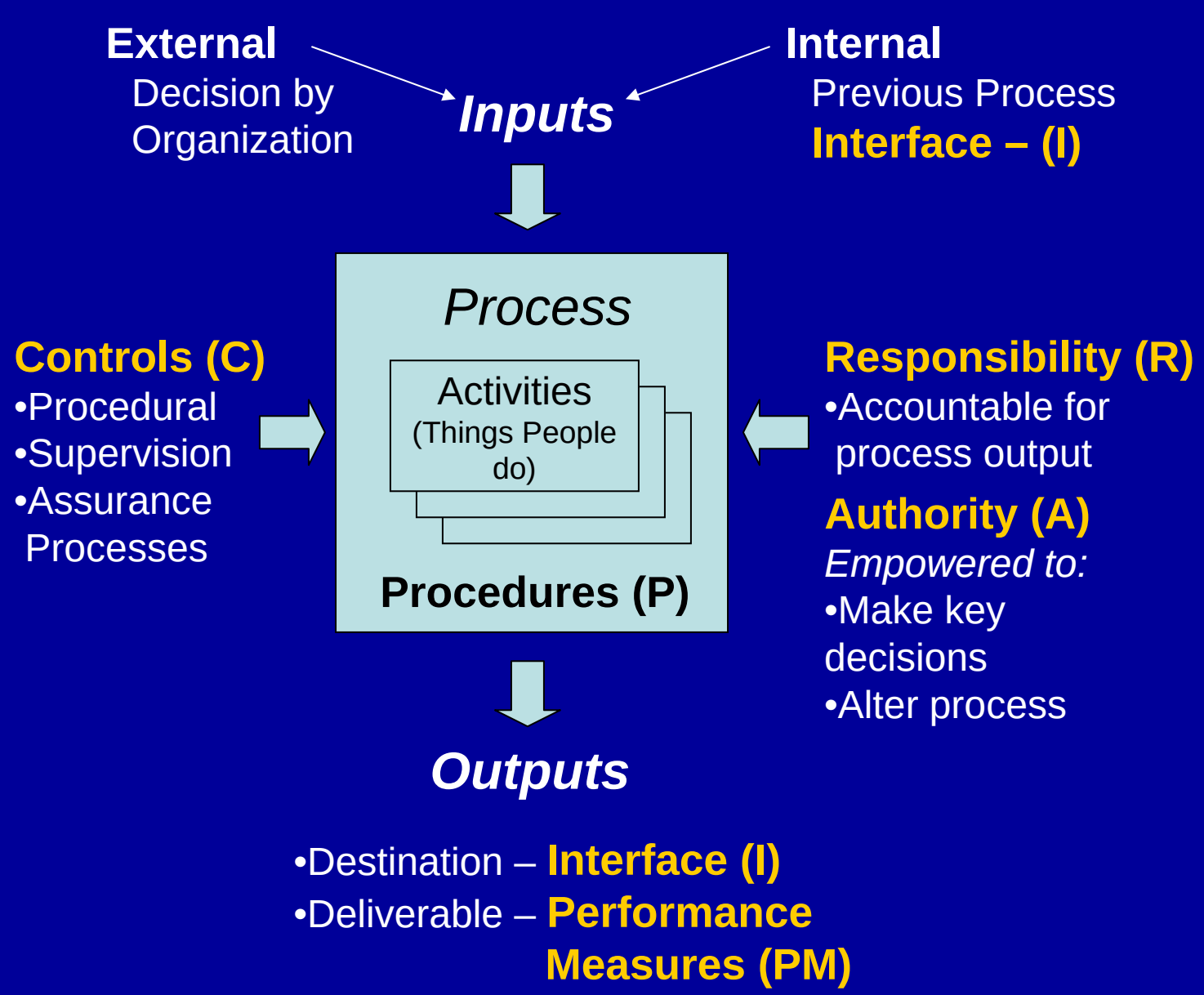
# Duties of Management Representative (Safety Management Process Support)*

- **Facilitating** hazard identification
- Safety risk **analysis**
- **Monitoring** the effectiveness of safety risk controls

* e.g. DOS, SMS Manager(s)

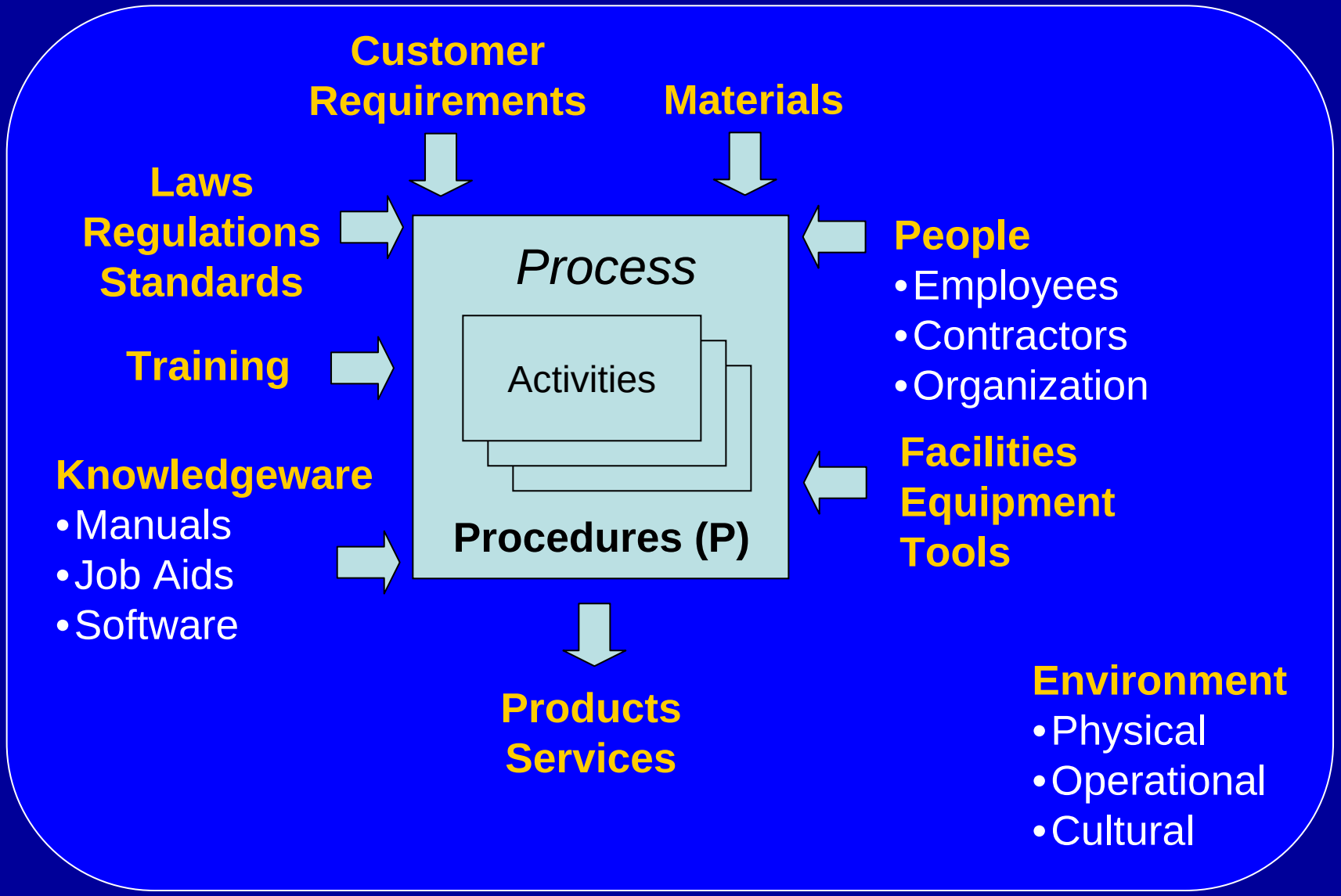
# SMS Components (“Pillars”)




External
Decision by Organization
Inputs
Internal
Previous Process
Interface – (I)
Process
Activities
(Things People do)
Procedures (P)
Controls (C)
•Procedural
•Supervision
•Assurance Processes
Responsibility (R)
•Accountable for process output
Authority (A)
Empowered to:
•Make key decisions
•Alter process
Outputs
•Destination – Interface (I)
•Deliverable – Performance Measures (PM)



# Processes


Customer Requirements
Materials
Laws Regulations Standards
Training
Knowledgeware
•Manuals
•Job Aids
•Software
Process
Activities
Procedures (P)
People
•Employees
•Contractors
•Organization
Facilities Equipment Tools
Products Services
Environment
•Physical
•Operational
•Cultural

# More on SRM & SA

Federal Aviation Administration

Presented to: NTSB Public Aircraft Forum

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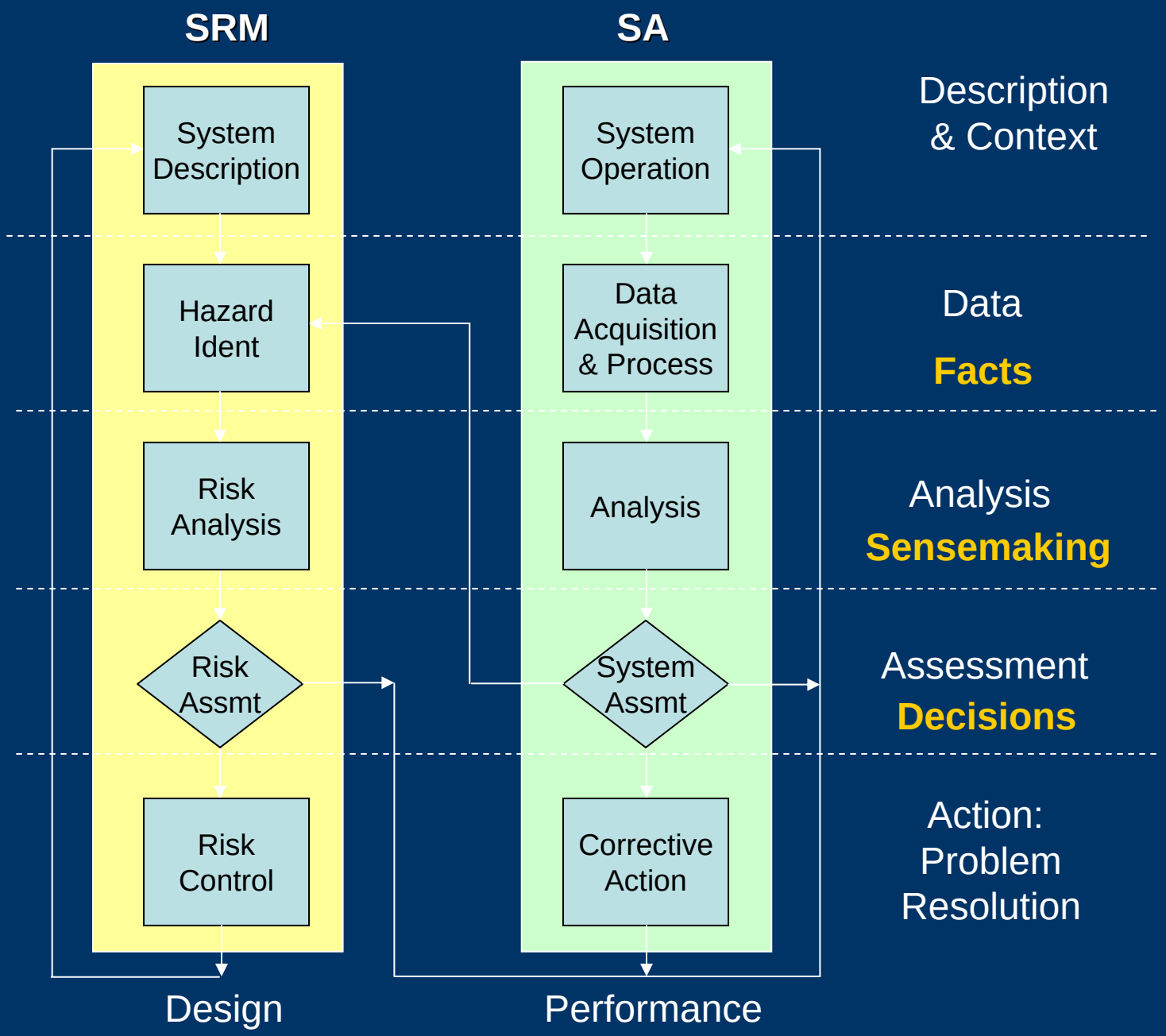
SMS Program Office

Date: November 30, 2011

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

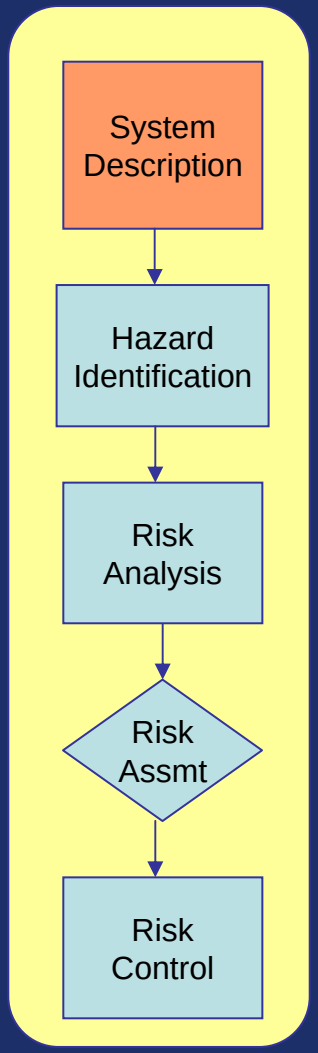


# SMS Concepts: Risk Management

- Understanding the system and environment
- Identifying hazardous conditions
- Assessing risk
- Applying risk controls

SRM

# System Description




## Facts

**Processes**

**Activities**

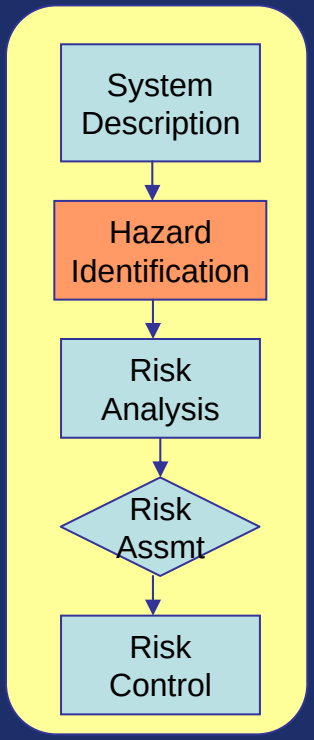
Variable Human Performance

**Workplace Conditions**:

System Factors & Attributes

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

# Hazard Identification



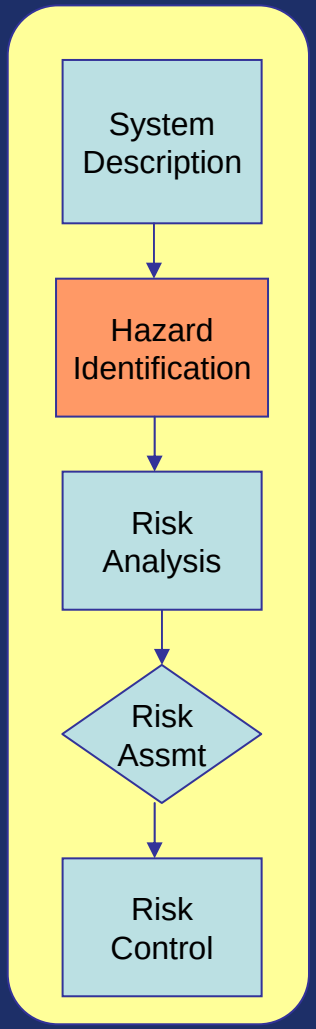

A hazard is any real or potential *condition*…

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

# SRM

# Hazard Identification from Workplace Conditions




**Inference**

**Processes**

**Activities**

**Workplace Conditions**:

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

System Factors & Attributes

Deficient Conditions impacting activities =

**Hazards**

Variable Performance

Causing…

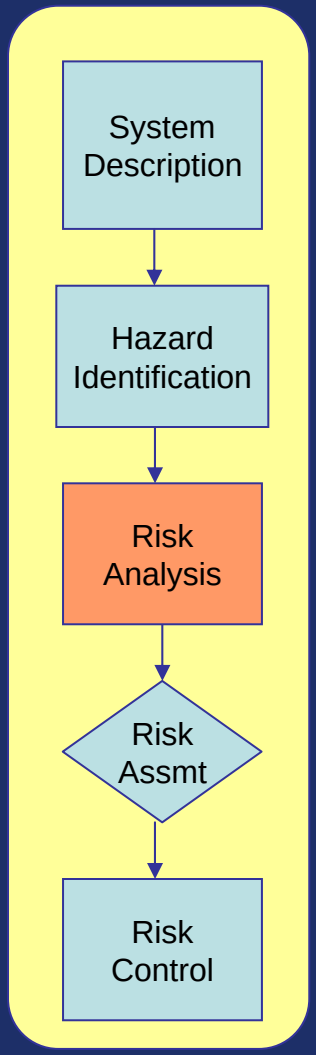
Resulting in…

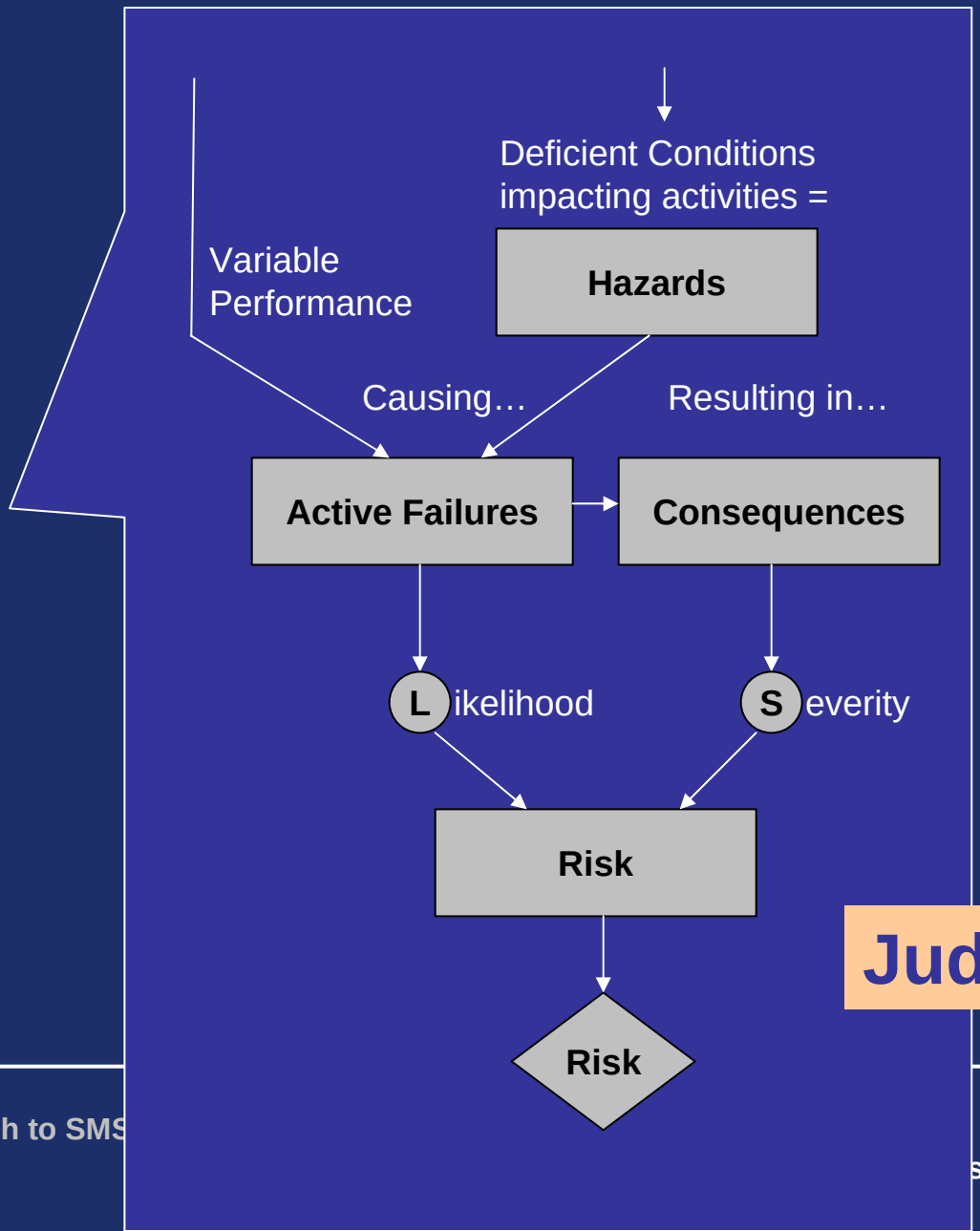
**Active Failures**

**Consequences**

# SRM

# From Hazard to Risk

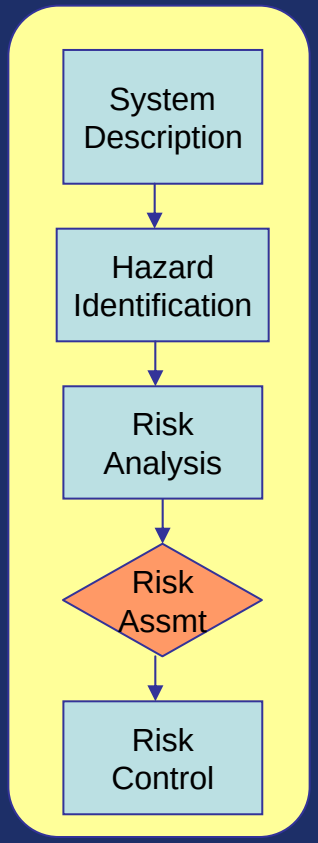



**Judgment**

# Risk Assessment

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

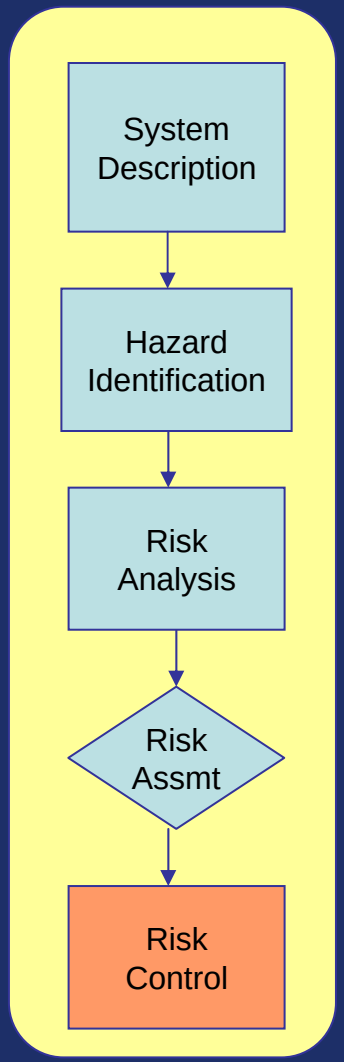



| Risk Likelihood | | Risk Severity | | | | |
|---|---|---|---|---|---|---|
| | | Catastrophic A | Hazardous B | Major C | Minor D | Negligible E |
| Frequent | 5 | 5A | 5B | 5C | 5D | 5E |
| Occasional | 4 | 4A | 4B | 4C | 4D | 4E |
| Remote | 3 | 3A | 3B | 3C | 3D | 3E |
| Improbable | 2 | 2A | 2B | 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/Mitigation

## SRM




**Processes**

**Activities**

**Workplace Conditions**:

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

System Factors & Attributes

Variable Human Performance

**Risk Controls**

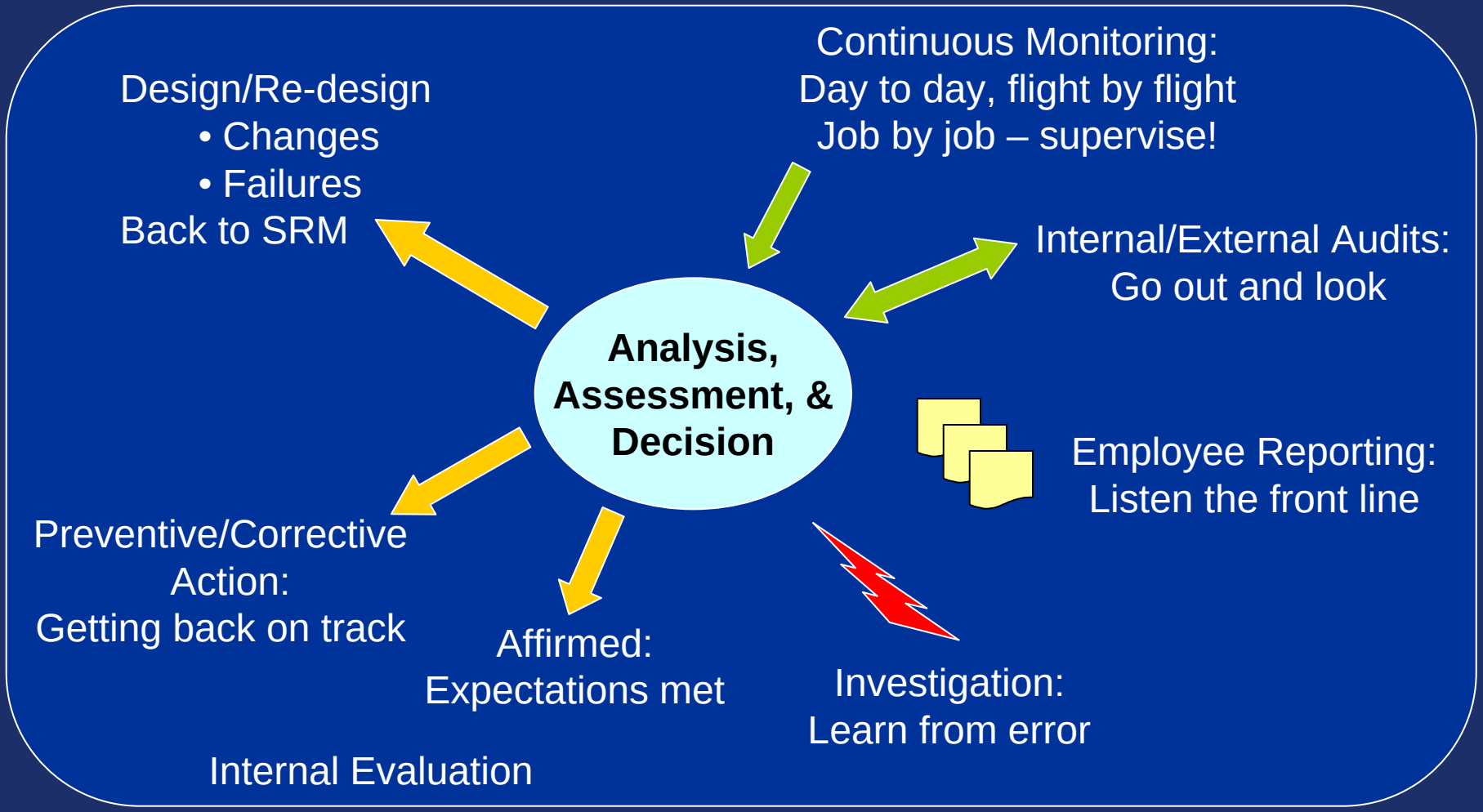
# SMS Concepts: Assurance

- 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

# Staying Informed: The SA Process



# More on Culture

# Safety Culture

- **Is there really such a thing as a "*safety culture*?"**
- **If so, what does it look like?**
- **If I don't have one, how do I get it?**
- **Why do we care about "culture" anyway?**

# Safety Culture: A Brief History

## Chernobyl, 1986

International Atomic Energy Agency noted a "Poor Safety Culture" as a factor in the accident.

# Safety Culture: A Brief History

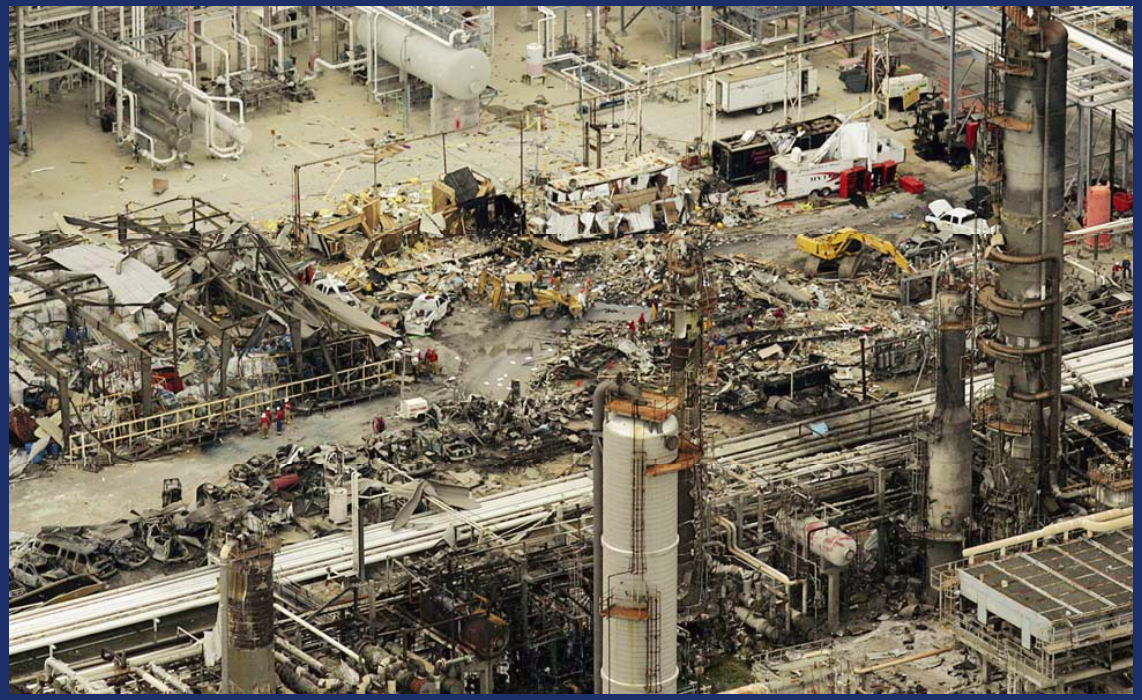
## Continental Express Flight 2574, 1991

NTSB Board member John Lauber in dissenting opinion suggests probable cause of this accident due to: "the failure of Continental Express management to establish a corporate culture which encouraged and enforced adherence to approved maintenance and quality control procedures."


47 screws removed from the horizontal stabilizer during maintenance the night before and, following a shift change, were not replaced.

# BP Oil Refinery: Texas City, TX

March 23, 2005 Chemical Safety Board found that BP Texas city managers did not “create an effective reporting and learning culture…”



# BP/Transocean Deepwater Horizon

Transocean's SMS had significant deficiencies that rendered it ineffective…

…a culture that could be described as:

Running it until it breaks…

…going through the motions.

# Elements of Organizational Cultures

- **Psychological**: How we think and feel (assumptions and values)
- **Behavioral**: What we do (practices)
- **System/Environmental**: Tools, equipment, facilities, information (artefacts)

# Levels of Culture

- Artifacts
  - Surface behaviors
  - Symbols
- Espoused values
  - What we say we do
  - Values that we want
- Deep Assumptions
  - Automatic, unconscious drivers of behavior

# Informed Decision Making

- Reporting Culture: Seek information (knowing the problems is better than punishing the victim)
- Just Culture: Don’t shoot the messenger (the next mistake may be your own)
- Flexible Culture: Be willing to change
- Learning Culture: Learn from experience

# High Reliability Organizations (HROs)

- Preoccupation with failure (track small failures)
- Reluctance to (over)simplify
- Sensitivity to operations
- Commitment to resilience (ability to recover)
- Deference to expertise

# Can we change a culture?

- First question – do we need to change?
- What do we really want to change?

# Example – “Just Culture”

What (shared) values already define “us?”

- **Integrity?**
- **Loyalty?**
- **Hard work for important goals?**
- **Justice?**
- **Trust?**

We already have the important values…

We may need to look at some of our assumptions.

# How can we “create” or change a culture?

- Can we tell people how to think or feel?
- Can we tell people how to behave?
- Shape the environment in which people work!

# More on SRM and SA in the Proposed Rule

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Presented by: FAA Flight Standards Service

SMS Program Office

Date: November 30, 2011

# SMS Rulemaking update

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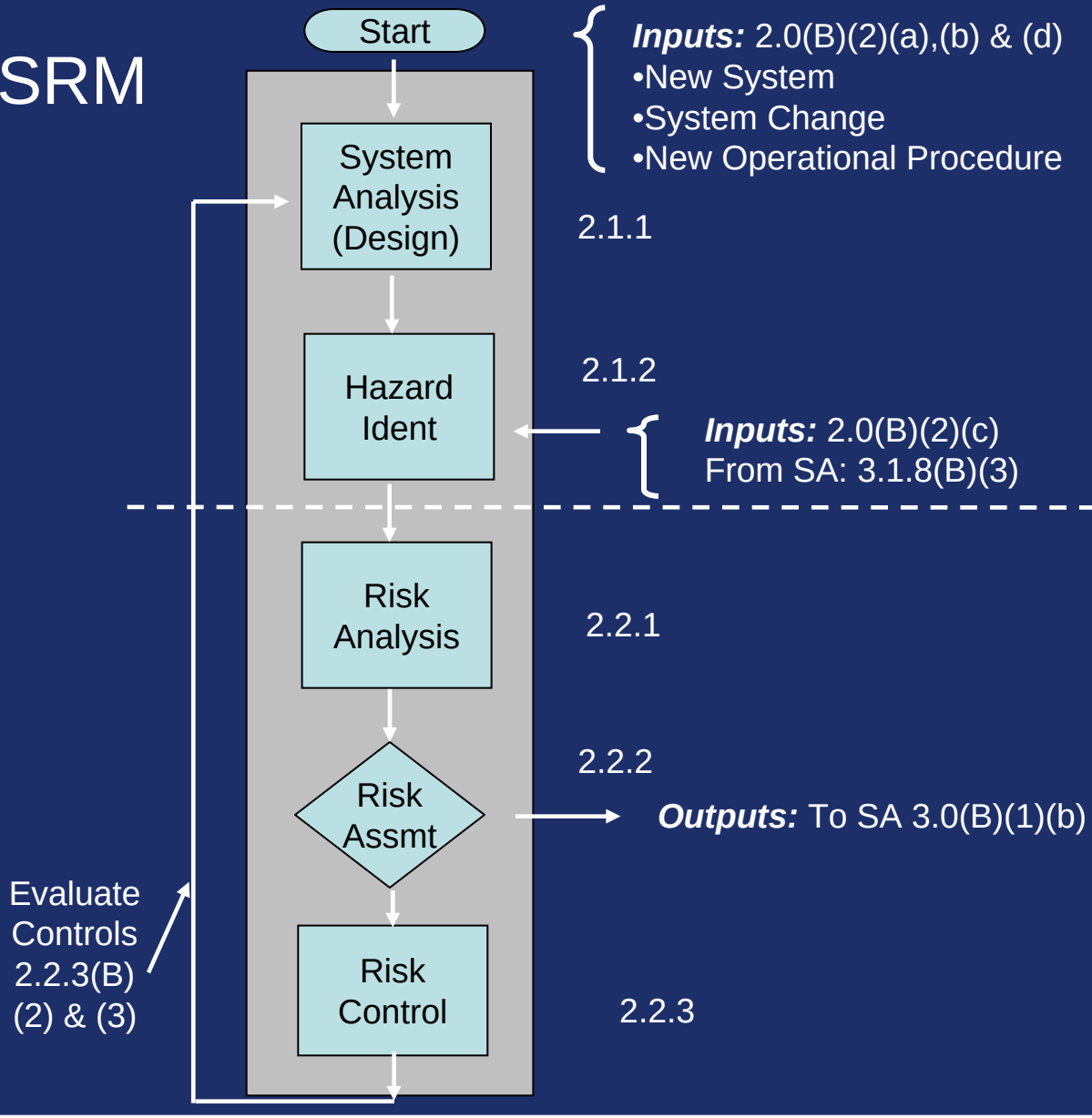
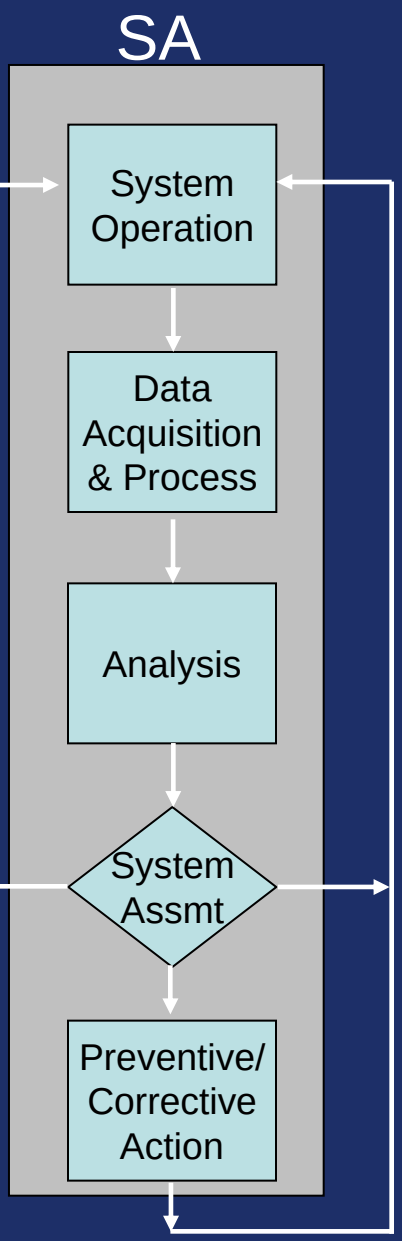
  - Challenges in reg eval

# SRM




## 2.1 Hazard Identification & Analysis

## 2.2 Risk Assessment & Control




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

Per 2.1.1 including Risk Controls per 3.1.3

## 3.1 Safety Performance Monitoring and Measurement

*

- 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

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

## 3.3 Change Management

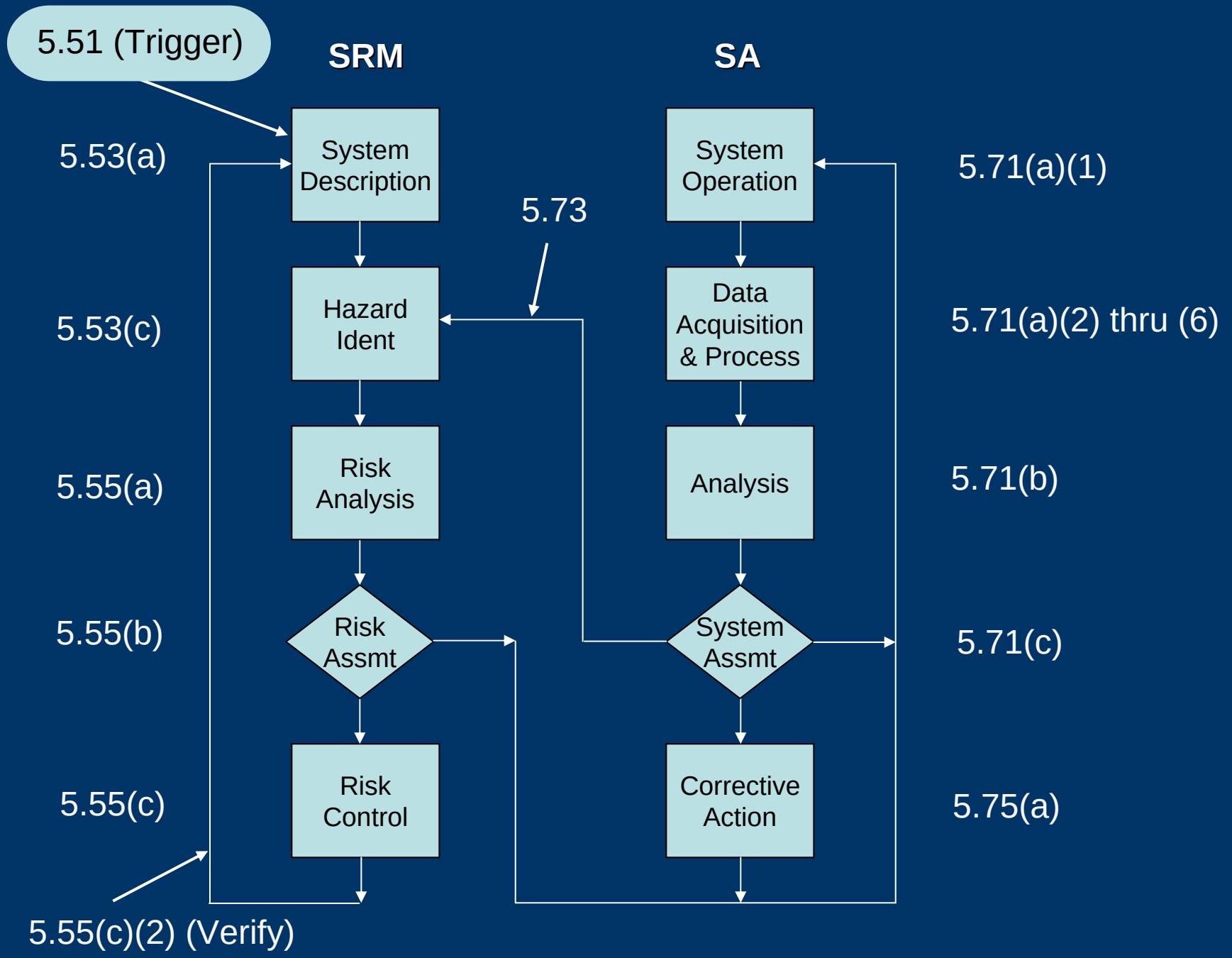
***Outputs:*** 3.1.8(B)(3)
To SRM 2.0(B)(2)(c)

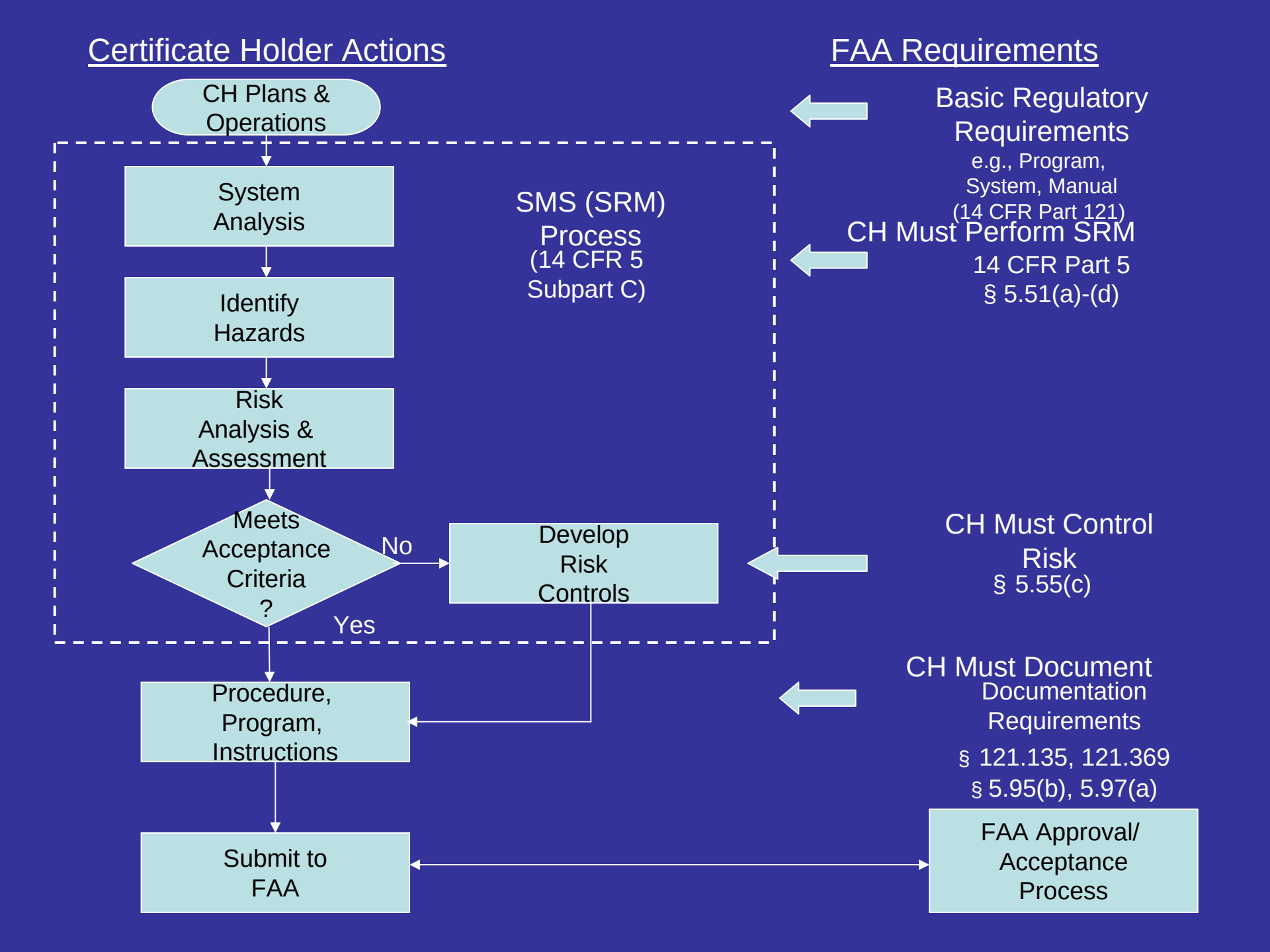
3.1.8 System Assessment
3.3.2 Management Review

## 3.3 Continuous Improvement

3.3.1

* 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.

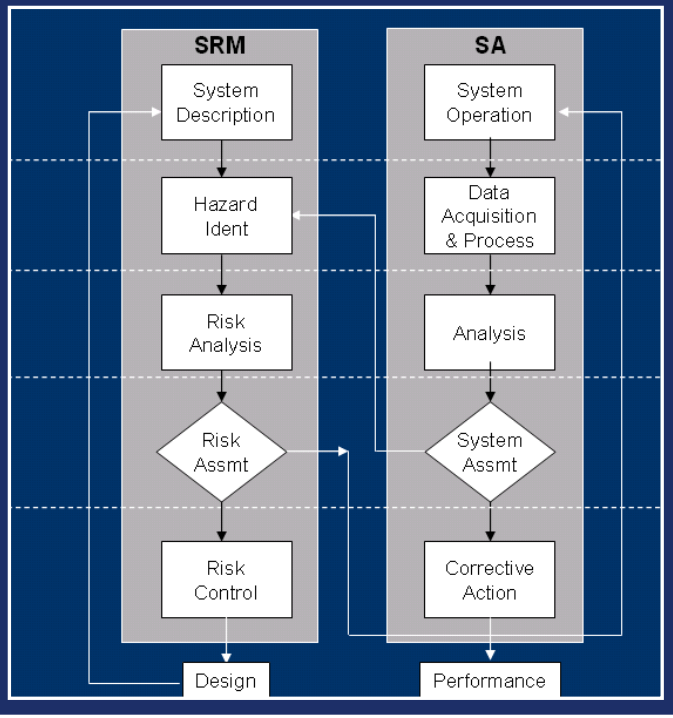

5.51 (Trigger)
SRM
SA
5.53(a)
System Description
System Operation
5.71(a)(1)
5.73
5.53(c)
Hazard Ident
Data Acquisition & Process
5.71(a)(2) thru (6)
5.55(a)
Risk Analysis
Analysis
5.71(b)
5.55(b)
Risk Assmt
System Assmt
5.71(c)
5.55(c)
Risk Control
Corrective Action
5.75(a)
5.55(c)(2) (Verify)


Certificate Holder Actions
FAA Requirements
CH Plans & Operations
System Analysis
Identify Hazards
Risk Analysis & Assessment
Meets Acceptance Criteria ?
No
Yes
Develop Risk Controls
Procedure, Program, Instructions
Submit to FAA
SMS (SRM) Process
(14 CFR 5 Subpart C)
Basic Regulatory Requirements
e.g., Program, System, Manual
(14 CFR Part 121)
CH Must Perform SRM
14 CFR Part 5
§ 5.51(a)-(d)
CH Must Control Risk
§ 5.55(c)
CH Must Document
Documentation Requirements
§ 121.135, 121.369
§ 5.95(b), 5.97(a)
FAA Approval/ Acceptance Process

# Safety Management System

## Provides a systematic way to:

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

***"Carelessness and overconfidence are more dangerous than deliberately accepted risk"***
**Wilbur Wright, 1901**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Wilbur Wright gliding, 1901
Photographs: Library of Congress