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
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
United States Approach to SMS

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

- ICAO State Safety Program (SSP)
  - Annex 6
  - ICAO Doc 9859, SMM

- AVS LOB’s

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

- Service Providers SMS
  - Safety Management System
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

**SRM**
- System Description
- Hazard Ident
- Risk Analysis
- Risk Assmt
- Risk Control

**SA**
- System Operation
- Data Acquisition & Process
- Analysis
- System Assmt
- Corrective Action

**Description & Context**
**Data Facts**
**Analysis Sensemaking**
**Assessment Decisions**
**Action: Problem Resolution**

**Design**
**Performance**
Oversight and SMS

FAA Oversight Program Management

Protection

- FAA's Safety Management (Oversight) (SAS)

Production

- Technical Program Requirements
  - Systems
  - Subsystems
  - Elements

Surveillance

Operator's Safety Management System

Public: Users

- Operational Process

United States Approach to SMS
1 National Airspace System Level

2 Service Provider/Organizational Level

3 Individual (Airman/Aircraft) Level
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

- National Culture
  - Laws/Regulations
  - Industry Standards

- Psychological
  - Values
  - Professional Norms

- Decisionmaking
  - Practices

- System/Environment
  - Industry Norms
  - Business Relations
  - Markets

- Behavioral
  - Performance
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

United States Approach to SMS
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)
Now available: [www.faa.gov/about/initiatives/sms](http://www.faa.gov/about/initiatives/sms)
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

Contact:
Don Arendt, Ph.D.
(703) 661-0516 (LL)
(703) 338-7746 (Cell)
don.arendt@faa.gov

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

United States Approach to SMS

Federal Aviation Administration
Safety Management Strategies

Reactive (Past)
Responds to events that have already happened, such as incidents and accidents

Proactive (Present)
Actively identifies hazards through the analysis of the organization’s processes

Predictive (Future)
Analyzes system processes and environment to identify potential future problems

Resilience
Who “owns” the SMS?

- Business Tier
- Middle Line
- Operating Line
- Tech Support
- Admin Support

United States Approach to 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")

- Policy
- Safety Risk Management
- Safety Assurance
- Safety Promotion
Federal Aviation Administration

United States Approach to SMS Controls (C)
- Procedural
- Supervision
- Assurance

Processes (P)

Responsibility (R)
- Accountable for process output

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

External Decision by Organization

Inputs

Process

Activities (Things People do)

Outputs

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

Internal Previous Process Interface – (I)

External

Inputs

Procedures (P)
Federal Aviation Administration

United States Approach to SMS

- Customer Requirements
- Materials
- Laws
- Regulations
- Standards
- Training
- Knowledgeware
  - Manuals
  - Job Aids
  - Software
- People
  - Employees
  - Contractors
  - Organization
- Facilities
  - Equipment
  - Tools
- Environment
  - Physical
  - Operational
  - Cultural

Process
- Activities
- Procedures (P)
- Products
- Services
More on SRM & SA

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SMS Program Office

Date: November 30, 2011
Safety Risk Management (SRM) and Safety Assurance (SA) Workflow

SRM

- System Description
- Hazard Ident
- Risk Analysis
- Risk Assmt
- Risk Control

SA

- System Operation
- Data Acquisition & Process
- Analysis
- System Assmt
- Corrective Action

Description & Context
Data Facts
Analysis Sensemaking
Assessment Decisions
Action: Problem Resolution

Design Performance
SMS Concepts: Risk Management

- Understanding the system and environment
- Identifying hazardous conditions
- Assessing risk
- Applying risk controls
United States Approach to SMS

System Description

Facts

Processes

Activities

Workplace Conditions:

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

Variable Human Performance

System Factors & Attributes

SRM

System Description

Hazard Identification

Risk Analysis

Risk Assmt

Risk Control
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

- System Description
- Hazard Identification
- Risk Analysis
- Risk Assmt
- Risk Control

Inference

Processes

Activities

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

Deficient Conditions impacting activities =

System Factors & Attributes

Variable Performance

Causing...

Hazards

Active Failures

Resulting in...

Consequences
United States Approach to SMS

SRM

From Hazard to Risk

System Description
Hazard Identification
Risk Analysis
Risk Assmt
Risk Control

Deficient Conditions impacting activities =
Variable Performance
Hazards

Causing…
Resulting in…

Active Failures
Consequences

Risk

Likelihood
Severity

Risk

Judgment
Risk Assessment

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

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

SRM

System Description

Hazard Identification

Risk Analysis

Risk Assessment

Risk Control

Processes

Activities

Variable Human Performance

System Factors & Attributes

Workplace Conditions:

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

Risk Controls

Risk Control/Mitigation

SRM Risk Control/Mitigation

System Description

Hazard Identification

Risk Analysis

Risk Assessment

Risk Control

Processes

Activities

Variable Human Performance

System Factors & Attributes

Workplace Conditions:

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

Risk Controls

Risk Control/Mitigation
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

Analysis, Assessment, & Decision

Continuous Monitoring:
Day to day, flight by flight
Job by job – supervise!

Internal/External Audits:
Go out and look

Employee Reporting:
Listen the front line

Investigation:
Learn from error

Affirmed:
Expectations met

Preventive/Corrective Action:
Getting back on track

Design/Re-design
• Changes
• Failures
Back to SRM

Internal Evaluation
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

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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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   SMS Program Office

Date: November 30, 2011
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 reg eval
2.1 Hazard Identification & Analysis

- **Inputs:** 2.0(B)(2)(a),(b) & (d)
  - New System
  - System Change
  - New Operational Procedure

2.2 Risk Assessment & Control

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

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

- **Evaluate Controls:** 2.2.3(B)(2) & (3)

United States Approach to SMS
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

3.1.8 System Assessment
3.3.2 Management Review

3.3 Change Management

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

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

Per 2.1.1 including Risk Controls per 3.1.3

3.3.1 Continuous Improvement

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.

How is this going to be analyzed? By whom?
Federal Aviation Administration

United States Approach to SMS System

Description

System Operation

Hazard Ident

Risk

Ident

Analysis

Risk Assessment

Risk Control

Data Acquisition & Process

Analysis

System Assessment

Corrective Action

5.51 (Trigger)

5.53(a)

5.53(c)

5.55(a)

5.55(b)

5.55(c)

5.75(a)

5.51 (Trigger)

5.53(a)

5.53(c)

5.55(a)

5.55(b)

5.55(c)

5.55(c)(2) (Verify)

5.55(c)(2) (Verify)

5.71(a)(1)

5.71(a)(2) thru (6)

5.71(b)

5.71(c)

5.75(a)
Certificate Holder Actions

CH Plans & Operations

System Analysis

Identify Hazards

Risk Analysis & Assessment

Meets Acceptance Criteria?

Yes

Develop Risk Controls

Procedure, Program, Instructions

Submit to FAA

No

CMS (SRM) Process (14 CFR 5 Subpart C)

FAA Requirements

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

Contact:
Don Arendt, Ph.D.
(703) 661-0516 (LL)
(703) 338-7746 (Cell)
don.arendt@faa.gov

Wilbur Wright gliding, 1901
Photographs: Library of Congress