

SMS / QMS Insights

For 135 / 121 Operators

Friday March 06, 2020



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Executive

OmniSMS[®]
Aviation Management System

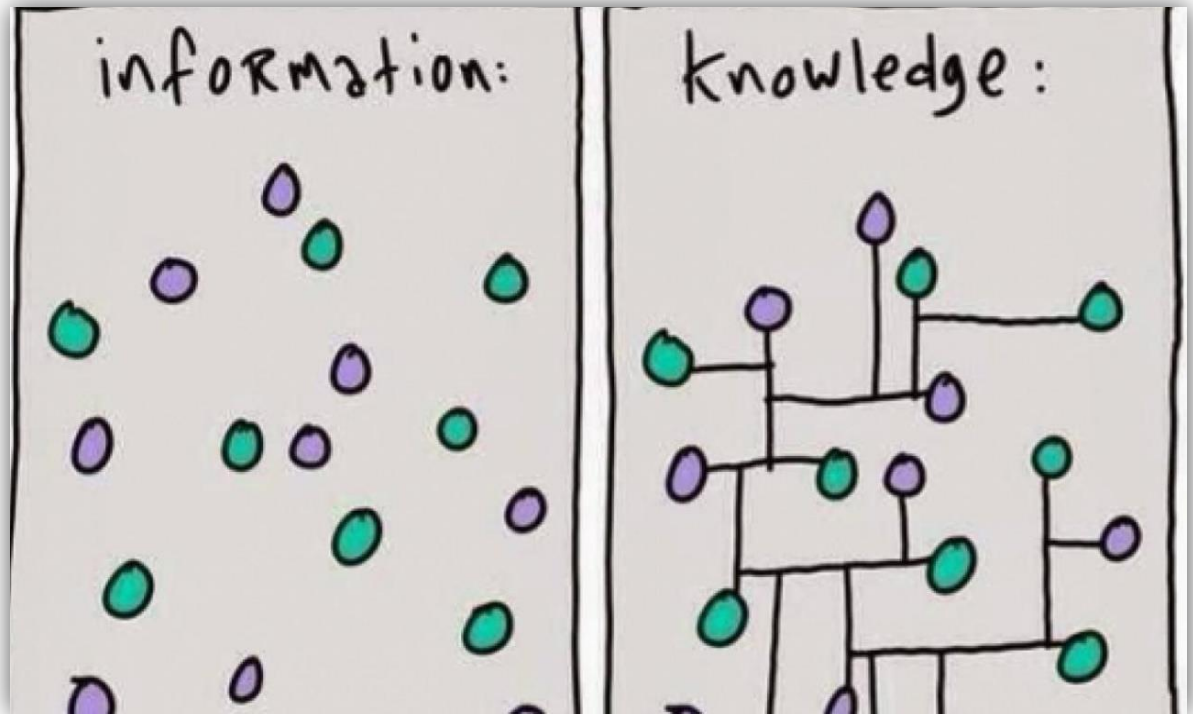
SMS / QMS Insights

Today's objectives:

Sharing information

Gaining knowledge

'Connecting the dots'



Through active discussion, please!

SMS / QMS Insights

Introductions

*Please tell us a little about yourself,
and 'where you are' with SMS...*



Today's Topics for Discussion

Planning and developing an effective SMS

FAA's Part 5 and the SMSVP standard

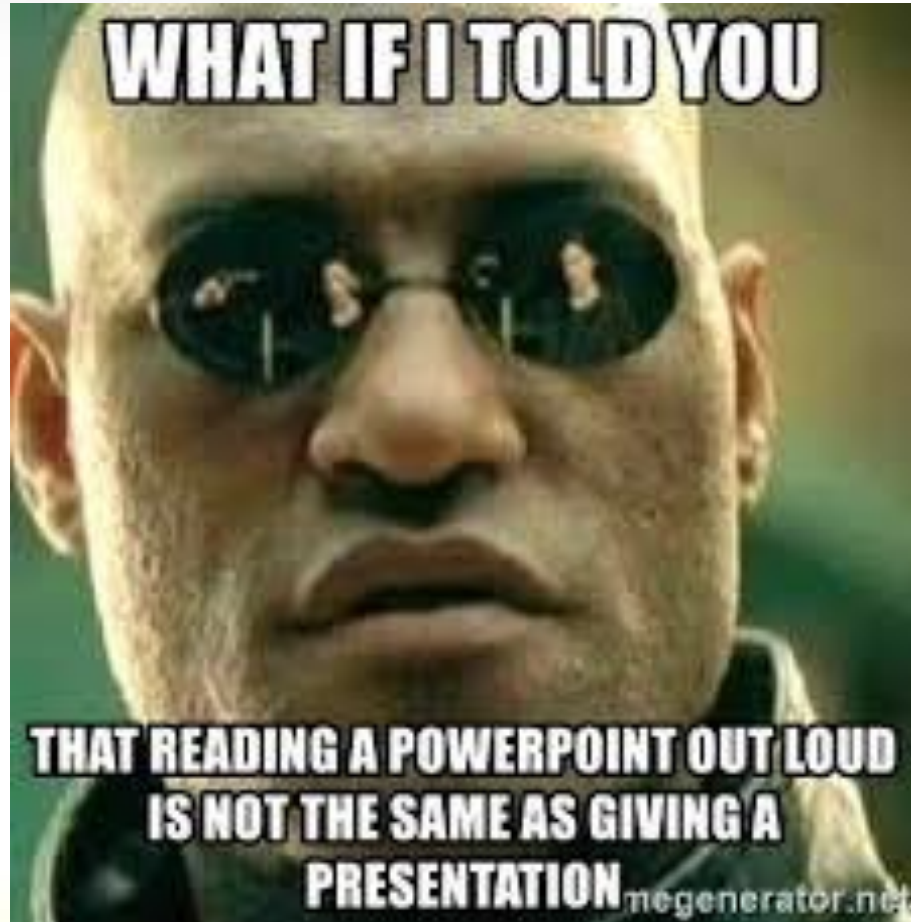
Performance measures and indicators

Barrier-based safety management

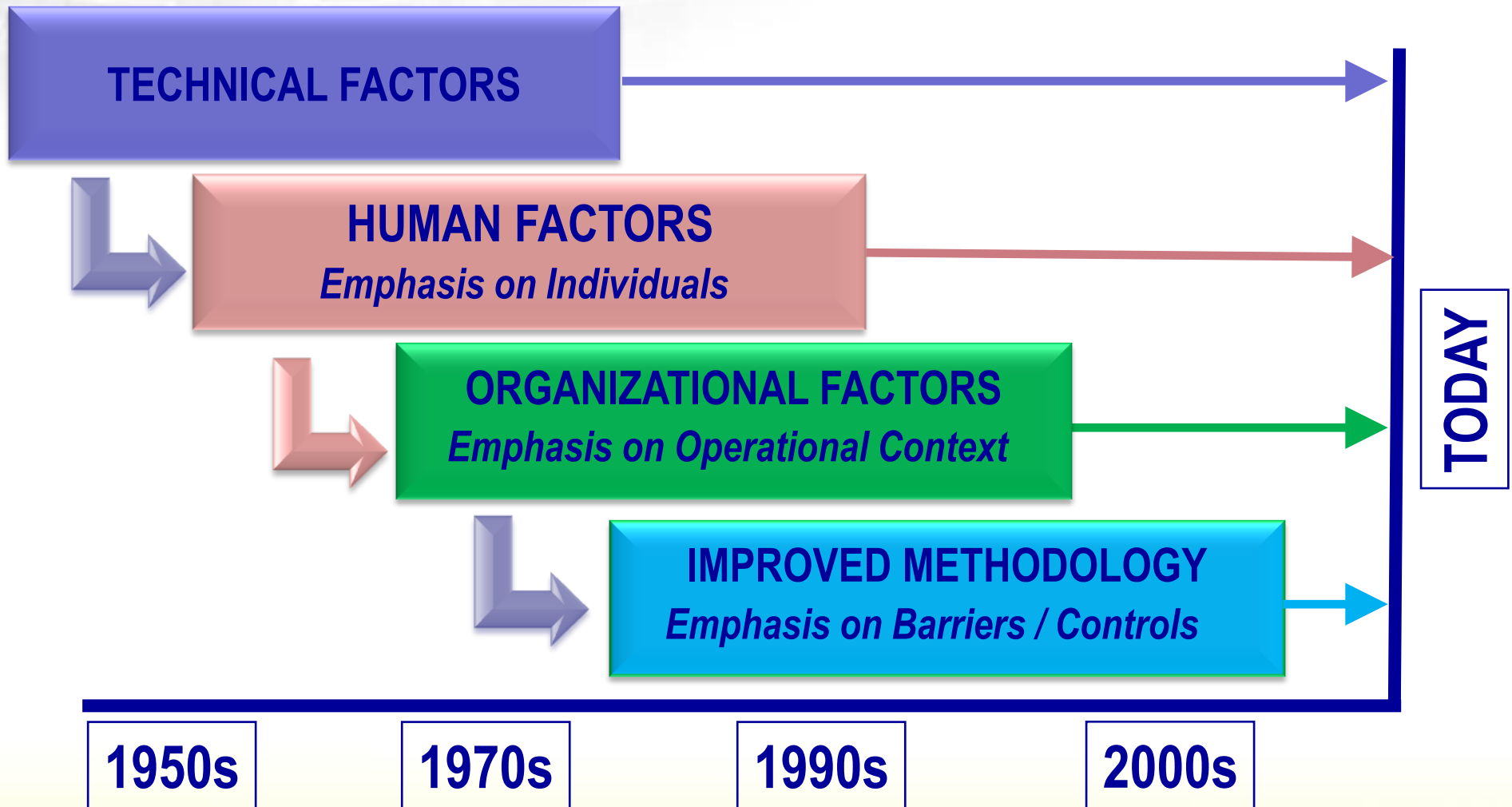
Integrated systems of management

The harmonized management system

Navigating the SMS / QMS Matrix



Evolution of Safety Management



An Effective SMS - How do we get there?

Implement SMS for the first time?

Retain Medallion safety programs?

Improve our current SMS?

Integrate other programs or systems of management?

Meet a higher SMS standard?



An Effective SMS - How do we get there?

Which standard should we meet?

ICAO's SMS Framework (SARPS)



IBAC's International Standard for Business Aircraft Ops (ISBAO)



Air Charter Safety Foundation

FAA's Part 5 / SMSVP Standard



An Effective SMS - How do we get there?

Develop the SMS internally with existing personnel

Hire an expert consultant to build it

Contract with the right SMS product / service provider(s)

Continue to improve upon existing systems / programs until we achieve the desired results



Examine closely what you are 'polishing'

An Effective SMS - How do we get there?

Management Team 'SMS Training' – Its purpose is:

To design and build an SMS?

(or)

To operate the SMS?



An Effective SMS - How do we get there?

ASRS? / ASIAs program?

ASAP / VDRP? FOQA / LOSA?

CASS (or) informal Mx QA?

Occupational health and safety?

Quality management w/ customer focus?



*Integrating safety programs and other systems of management
will improve efficiency and identify common causal factors*

An Effective SMS - How do we get there?

Avoiding the 'piece-meal' SMS

SMS / QMS requires a *systems approach* to design and build

Disparate components acquired from different external providers will properly interface



In a 'harmonized' SMS / QMS, all components interface with common terms, definitions, and data relationships

The Part 5 / SMS Voluntary Program standard

SMSVP is the right choice for Part 135 operators

To meet this standard, safety (process) attributes must be incorporated into system design:

Responsibility

Authority

Procedures

Controls

Interfaces

Process measures

Safety ownership

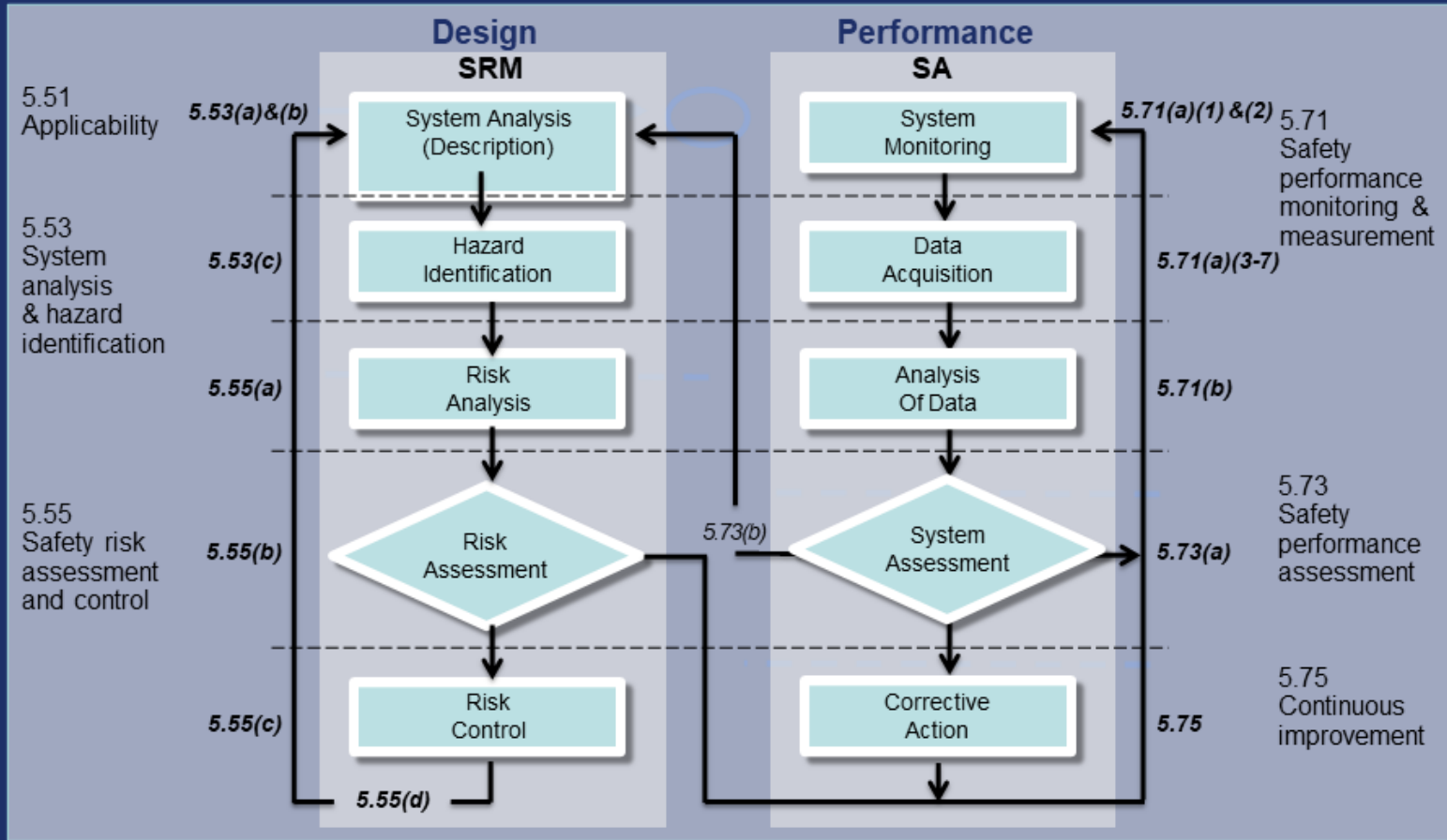


FAA

Source: [FAA Order 8900.1 Vol. 17, Chapter 1, Section 2](#)

The Part 5 / SMS Voluntary Program standard

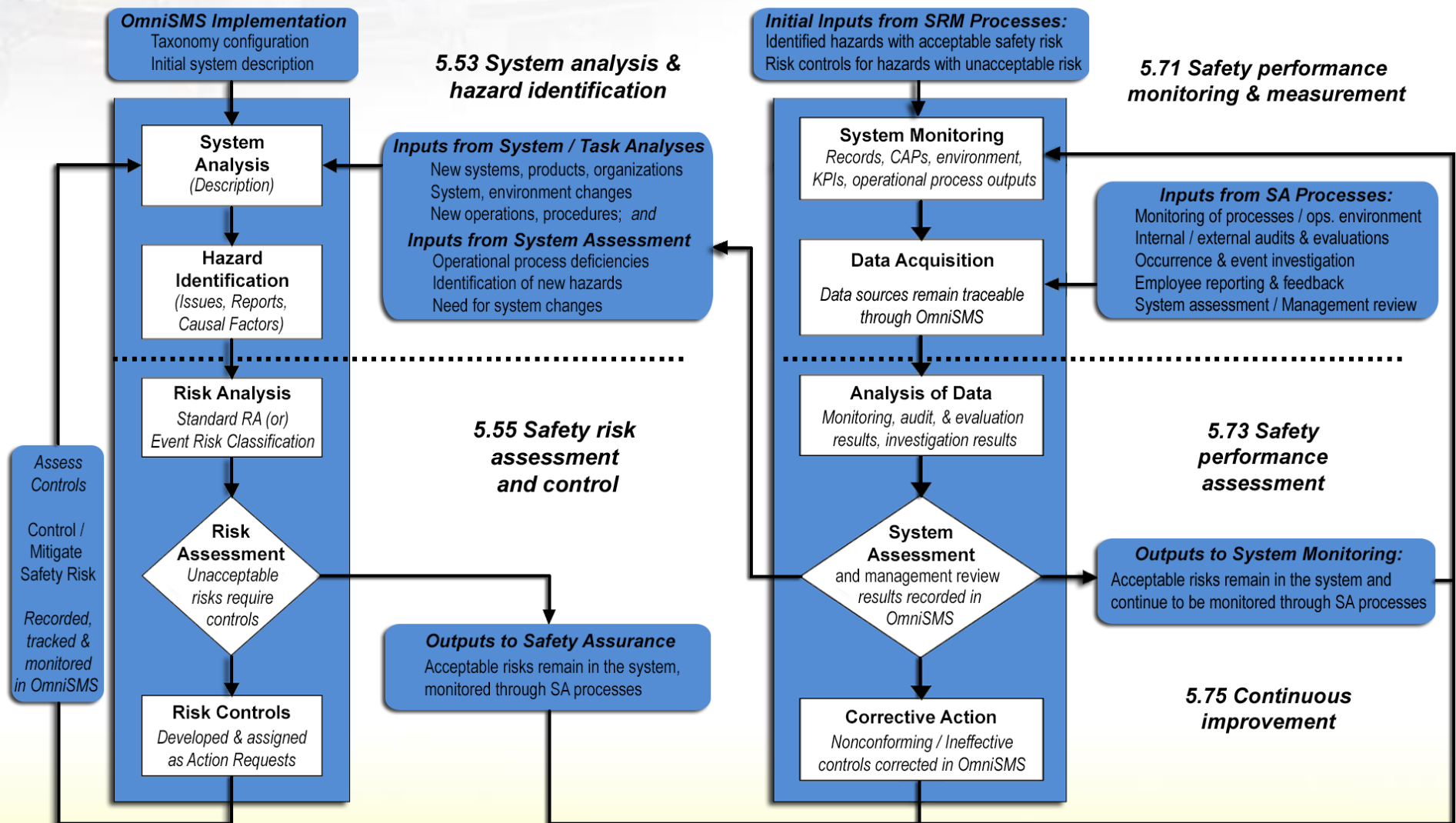
Safety Risk Management & Safety Assurance (14 CFR 5)



Federal Aviation
Administration

SL01-1-INT

The Part 5 / SMS Voluntary Program standard



Part 5 / SMSVP Standard and Data Structure

“SMS is a data-driven approach to safety”

To effectively utilize data, it must be structured

This means we need taxonomies

Align hazard taxonomies with your unique operating environment and activities -

Events / Hazards / Human Factors / Organizational Influences

Organize safety data in accordance with your organizational structure -

Departments / Employee groups

and

Functional Areas / Processes

Part 5 / SMSVP Standard and Data Structure

Your organization's functional areas and processes
(pre-defined by FAA's SAS and used by Data Collection Tools)

Title 14 CFR Part 135 (10 or More) (Peer Group B)

1.0 Organizational Management	2.0 Flight Operations	3.0 Operational Control	4.0 Technical Operations	5.0 Onboard Operations	6.0 Ground and Station Operations
1.1 Safety Programs (H) 1.1.2 (OP) Safety Program (Ground and Flight) 1.1.3 (AW) CASS 1.1.4 (AW) Reliability Program 1.1.6 (AW) Safety Program 1.2 Operations Management (L) 1.2.1 (OP) Part 119 Required Personnel 1.2.2 (OP) Manual Management 1.2.3 (OP) Computer-Based Recordkeeping System 1.3 Airworthiness Management (L)	2.1 Training & Qualification (M) 2.1.1 (OP) Training of Flight Crewmembers 2.1.2 (OP) Training of Check Airmen and Instructors 2.1.3 (OP) Simulators/Training Devices 2.1.4 (OP) Outsource Crewmember Training 2.1.5 (OP) Appropriate Airmen/Crewmember Checks & Quals 2.1.6 (OP) Advanced Qualification Program (AQP)	3.2 Flight Operations Engineering (M) 3.2.1 (OP) Aircraft Performance Operating Limitations 3.2.2 (OP) Use of Approved Areas, Routes, and Airports 3.2.3 (OP) Special Navigation Areas of Operation 3.2.4 (OP) RVSM Authorization 3.3 Flight Planning & Monitoring (H) 3.3.1 (OP) Operational Control	4.1 Training & Qualification (L) 4.1.1 (AW) RII Personnel 4.1.2 (AW) Maintenance Certificate Requirements 4.1.3 (AW) Maintenance/RII Training Program 4.2 Maintenance Planning and Monitoring (H) 4.2.1 (AW) Maintenance/Inspection Requirements 4.2.2 (AW) Maintenance/Inspection	5.1 Training & Qualification (M) 5.1.1 (OP) Training of Flight Attendants 5.1.2 (OP) Flight Attendant Duty/Rest Time 5.2 Cabin Operations (M) 5.2.1 (OP) Crewmember Duties/Cabin Procedures 5.2.2 (OP) Carry-on Baggage Program 5.2.3 (OP) Exit Seating Program 5.2.4 (OP) Passenger Handling	6.1 Training & Qualification (M) 6.1.1 (OP) Training of Station Personnel 6.1.2 (OP) Hazardous Material Training Program 6.2 Ground Handling (M) 6.2.1 (AW) Fueling 6.2.4 (OP) Line Station Operations/Ground Personnel Duties 6.3 Cargo Acceptance & Handling (H) 6.3.1 (OP) Carriage of Cargo 6.3.2 (OP) Hazardous

Source: FAA [Order 8900.1 Vol. 10, Chapter 1, Section 2: SAS](#)

Part 5 / SMSVP Standard and Data Structure

By structuring your data to align with SAS functional areas and processes* (subsystems and elements):

Other audit standards will ‘fit into’ this FAA-defined structure

More functional areas and processes can be added to accommodate other processes (ISO 9000 series)

(or)

Other special-use standards (e.g., CAMTS, C.A.S.E., etc.)

Your system will also be aligned with FAA’s Data Collection Tools

***Process: A set of interrelated or interacting activities which transforms input elements into outputs, respecting constraints, requiring resources, meeting a defined mission, corresponding to a specific purpose, adapted to a given environment. (Source: based on ISO 9000:2015)**

Part 5 / SMSVP Standard and Data Structure

DCTs assess design criteria and performance:

System or Subsystem Performance (SP DCT)

Element Performance (EP DCT)

Element Design (ED DCT)

FSIMS

- [8900.1 Contents](#)
- [Areas of Interest](#)
- [Library Subjects](#)
- [Index](#)
- [Publications](#)
- [Regulatory Guidance Library](#)

Flight Standards Information Management System

Publications - SAS FS Data Collection Tool (DCT)

Document Title
<input checked="" type="checkbox"/> SAS DCT SAS DCT Download for xml schema (9/15/2015)
<input checked="" type="checkbox"/> 1.0 Organizational Management SP 1.0 135C AW Organizational Management (17 - 12/19/18) SP 1.0 135C OP Organizational Management (15 - 12/19/18)

DCTs should be used not just for auditing your systems and elements (processes) but *during SMS system design* to assure FAA acceptance

Part 5 / SMSVP Standard and Data Structure

Another reason to use SAS DCTs:

When FAA comes to audit you

You will know exactly what to expect

You will be prepared!



Part 5 / SMSVP Standard and Data Structure

More reasons to use FAA's DCTs...

Processes already defined to support ISO 9000 / AS9100

DCTs are editable, updated, include SRRs, guidance refs.

SP 3.0 135D OP Operational Control			
Safety Attribute: Procedures,	Question Type: Process Observation,		
Scoping Attribute: (FAR PART = "135"), PM,	Rev. 8 12/19/2018 12:21:55	<input type="radio"/> Several instances when guidance requirements were not met	8900.1 Vol 3 Ch 48 Sec 1, AC-120-27, A096, A097, A098, 135.185, 135.63(c), 135.63(d), 91.9(a)
QID: 00013327, Response Details: SP DCTs (Both OP and AW), Status: Released		<input type="radio"/> Regulatory noncompliance	
		<input type="radio"/> Not Observable	
<div>New Window PDF MS Word Pub Data XML</div>			

FAA has developed and maintains detailed, comprehensive Internal Evaluation Program (IEP) checklists for you!

Part 5 / SMSVP Standard and Data Structure

Still more reasons to use SAS data structure / DCTs:

When performing root cause analysis

Events are grouped by functional area (FA)

Contributing factors are associated with functional areas

Causal factors are associated with each FA's process

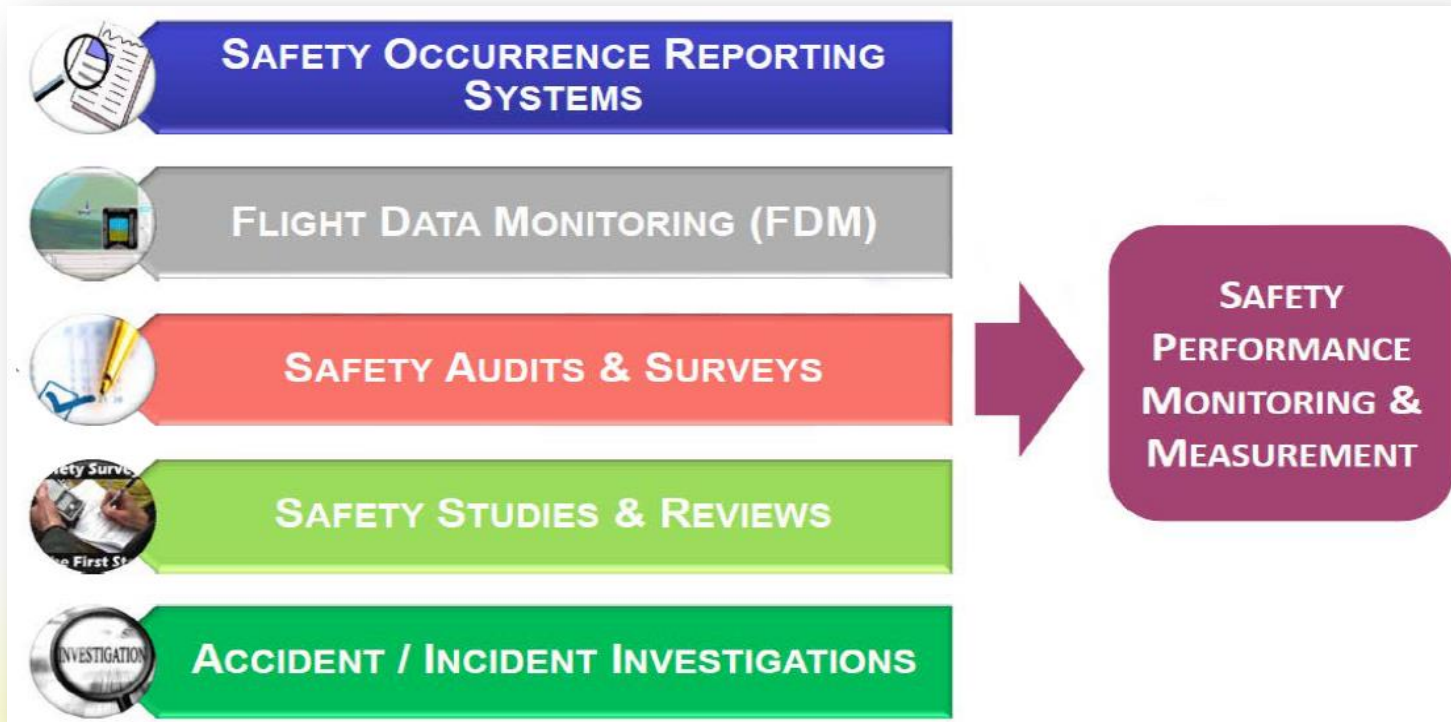
Risk controls and corrective actions are then associated with one or more processes.



Part 5 / SMSVP Standard and Data Structure

What it means is...

A 'process view' of safety / quality emerges from all data sources



Part 5 / SMSVP Standard and Data Structure

What it also means is...

When a *process audit* is performed (this is essentially what most DCTs are):

Controls impacting the process can be reviewed & assessed

Processes can be monitored

Process performance can be measured
(this is a recurring DCT question)

SP 3.0 135D OP Operational Control

Safety Attribute: Procedures, Question Type: Process Observation.

Scoping Attribute: (FAR PART = "135"), Rev. 8 12/19/2018 12:21:55 PM,

QID: 00013327, Response Details: SP DCTs (Both OP and AW), Status: Released

- Several instances when guidance requirements were not met
- Regulatory noncompliance
- Not Observable

8900.1 Vol 3 Ch 48 Sec 1, AC-120-27, A096, A097, A098, 135.185, 135.63(c), 135.63(d), 91.9(a)

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SMSVP Steps / Phases / Timeline

Letter of request for entry - (Order 8900.1 Vol 17 Ch 3)

Initial workshop; Implementation plan due in 12 months of wkshop

Preparation Phase

Prep gap analysis / implementation plan

CMT Implementation Plan Review Phase

Review of gap analysis / plan / SMSVP conformance

Documentation Validation Phase

FAA performs a *quality review* of SMS documents

Design Demonstration Phase

SMS must be implemented / validated within 36 months of wkshop

Continued Operational Safety (COS)

CMT uses COS job aids to assure continued safety

Performance Measurements / Indicators

Within the SMS, key performance indicators should

**Monitor and measure operational processes
(NOT just SMS processes)**

Be based on meaningful units of measure

Four essential types of KPIs help us measure

SMS performance

Operational performance

Safety performance (low and high-level)

Quality performance (low and high-level)

Performance Measurements / Indicators

SMS performance indicators (examples)

Reports received per employee group

Timely investigations

Risk controls implemented / corrected



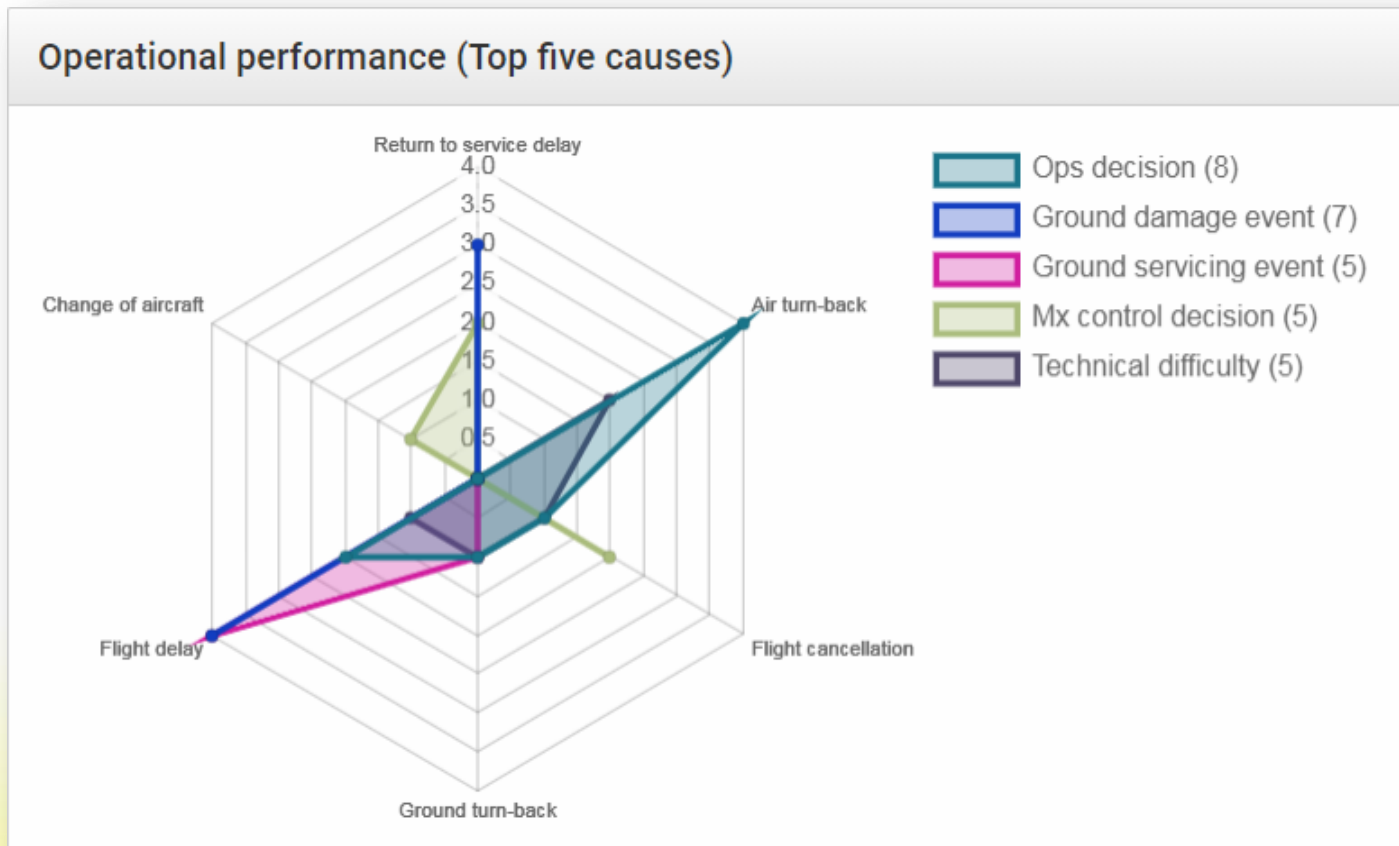
*These indicators can effectively be measured
using a 'per-month' unit of measure*

Performance Measurements / Indicators

Monitoring operational performance

For an operator, this means flight delays / interruptions

Events can also include return-to-service delays in Mx










Performance Measurements / Indicators

Operational performance indicators

Require a more accurate unit of measurement (examples):

Number of events per flight hour

Number of events per flight segment

KPI unit types 🛩️				
Month	Hours worked 	Hours flown dhc-7  	Hours flown c-206  	Total flights  
February 2019	-	-	-	-
January 2019	<input type="text" value="1378"/>	<input type="text" value="430"/>	<input type="text" value="170"/>	<input type="text" value="162"/>
December 2018	<input type="text" value="1598"/>	<input type="text" value="590"/>	<input type="text" value="296"/>	<input type="text" value="212"/>
November 2018	<input type="text" value="1517"/>	<input type="text" value="502"/>	<input type="text" value="244"/>	<input type="text" value="198"/>

In the context of SMS, 'operational performance' looks at the safety and quality-related causes of minor system failures

Performance Measurements / Indicators

Example:
Operational Key Performance Indicator (OKPI)
for ground damage

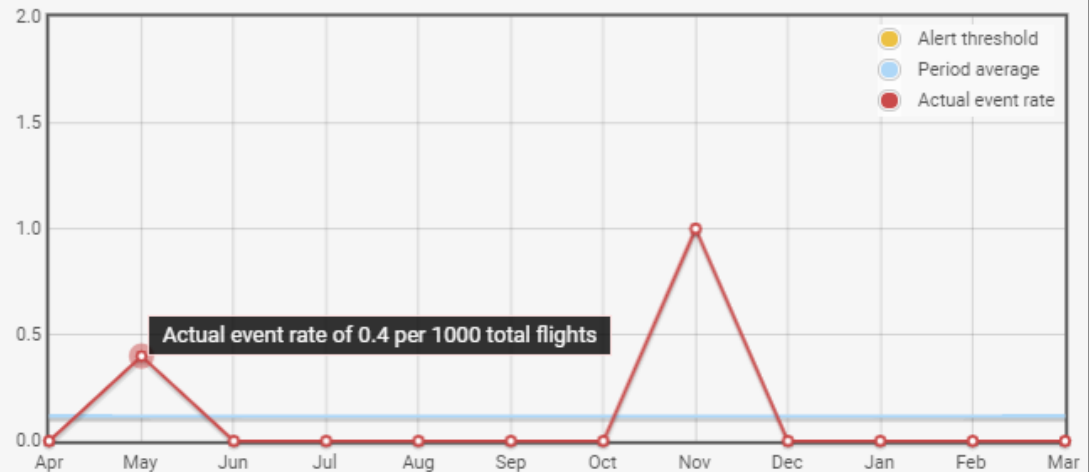
OKPI: Delays / Interruptions due to Ground Damage

Alert threshold: 0.3 per 1,000 total flights

Current average: 0.11 per 1,000 total flights

Performance goal: Reduce instances of delays or interruptions caused by ground damage to less than .1 event per 1,000 total flights

Previous 12 months



Contributing Reports

Date	Title	Event	Type	Cause
12 Sep 2018	Damage discovered on aft cargo door sill - N45565	Aircraft or Equipment damage	Flight delay	Ground damage event
16 May 2017	FOD damage to N23456 during scheduled inspection	Foreign Object Damage	Return to service delay	Ground damage event
22 Nov 2017	Towbar / Nose Strut damage to N234546	Aircraft or Equipment damage	Return to service delay	Ground damage event
03 Aug 2018	FOD damage in KSEA	Damage from FOD left on ramp	Flight delay	Ground damage event
12 May 2017	FOD damage - N44565 APU	Foreign Object Damage	Return to service delay	Ground damage event

Performance Measurements / Indicators

Example: OKPI for Mx-related delays and interruptions

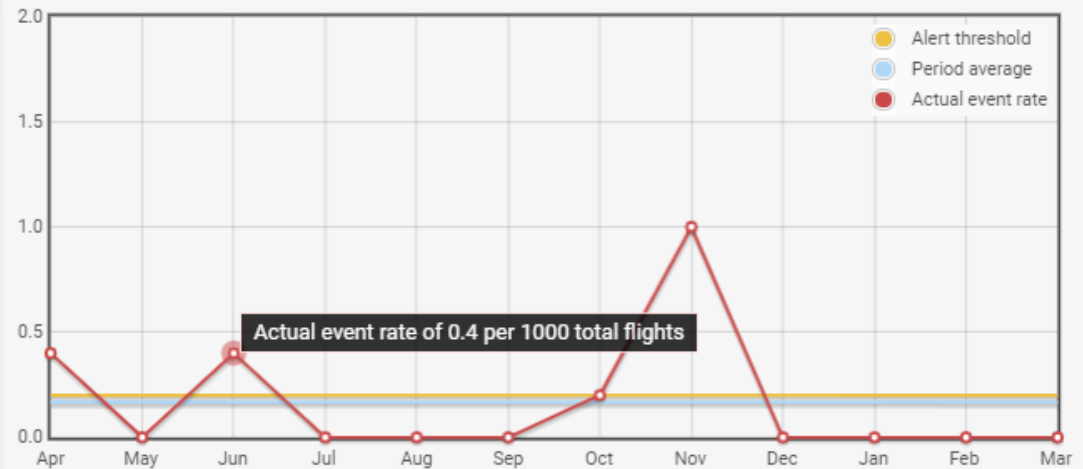
OKPI: Mx-related Flight Delays / Interruptions

Alert threshold: 0.3 per 1,000 total flights

Current average: 0.07 per 1,000 total flights

Performance goal: Reduce maintenance-related flight delays to less than 0.10 per 1,000 flights by April 30, 2019

Previous 12 months



Contributing Reports

Date	Title	Event	Type	Cause
27 Jun 2017	Inflight shutdown - ATR 42 arriving CYXE	Inflight engine shutdown (IFSD)	Air turn-back	Technical difficulty
06 Apr 2017	Overfly of N34338 Phased Inspection	Inspection overfly	Flight cancellation	Mx coordination decision
01 Oct 2018	Aircraft N44567 damaged while parked in front of main hangar	Aircraft or Equipment damage	Flight cancellation	Technical difficulty
27 Jun 2017	Tail rotor vibration after maintenance	Rotor systems malfunction	Return to service delay	Mx coordination decision
01 May 2018	N356SA RII item not signed off as inspected	-	Change of aircraft	Mx coordination decision

Performance Measurements / Indicators

Safety performance indicators

Tie SKPIs to your policy / objectives








Select the best unit type for the desired KPI

Per flight hour by aircraft type

Per total flight hours

Per no. of flights

Per hours worked

KPI unit types 🛩️				
Month	Hours worked 	Hours flown dhc-7  	Hours flown c-206  	Total flights  
February 2019	-	-	-	-
January 2019	<input type="text" value="1378"/>	<input type="text" value="430"/>	<input type="text" value="170"/>	<input type="text" value="162"/>
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Low-level SKPIs should capture precursors related to their undesired accident outcome

Performance Measurements / Indicators

Example: Safety Key Performance Indicator (SKPI) for runway excursion precursors

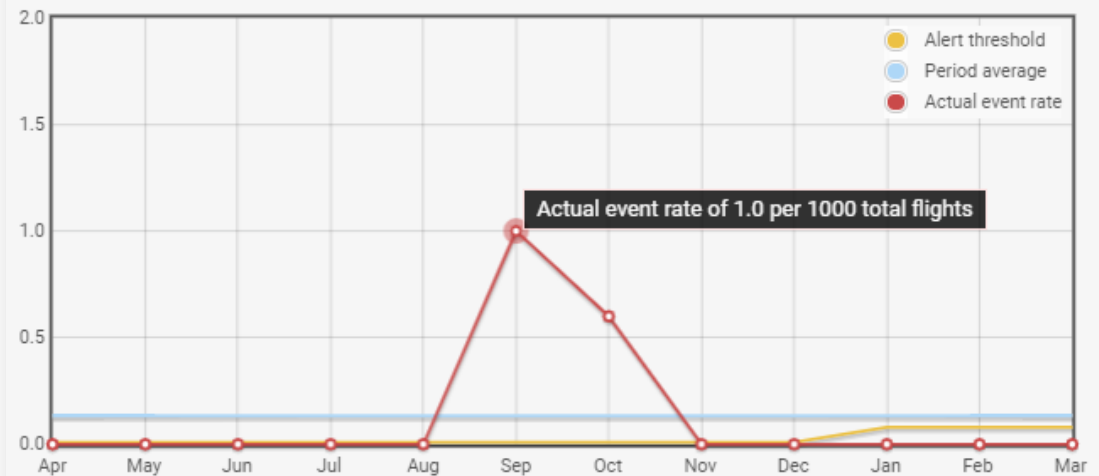
SKPI: Runway Excursion Precursor Events

Alert threshold: 0.4 per 1,000 total flights

Current average: 0 per 1,000 total flights

Performance goal: Reduce instances of runway excursion precursor events to .4 per 1,000 flight segments.

Previous 12 months



Contributing Reports

Date	Title
04 Mar 2017	High ROD between 500 - 100 Ft - Global 5000 (Precursor event)
01 Oct 2017	Near runway overrun / tire failures on landing at KSIT
28 Sep 2017	Long landing at KASE

Performance Measurements / Indicators

Example: SKPI for regulatory violations in maintenance

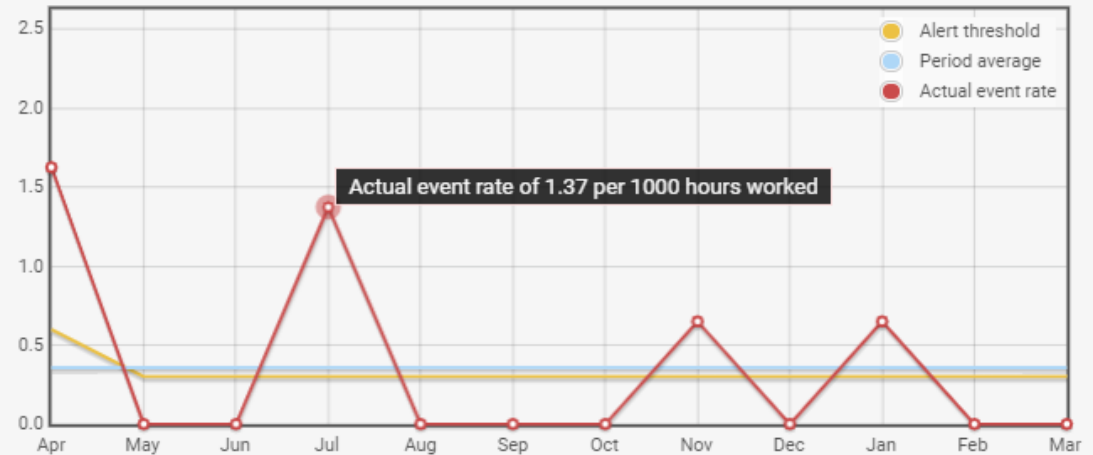
SKPI: Regulatory Violations in Maintenance

Alert threshold: 0.3 per 1,000 hours worked

Current average: 0.22 per 1,000 hours

Performance goal: Reduce instances of regulatory violations by maintenance personnel to less than 0.2 per thousand

Previous 12 months



Contributing Reports

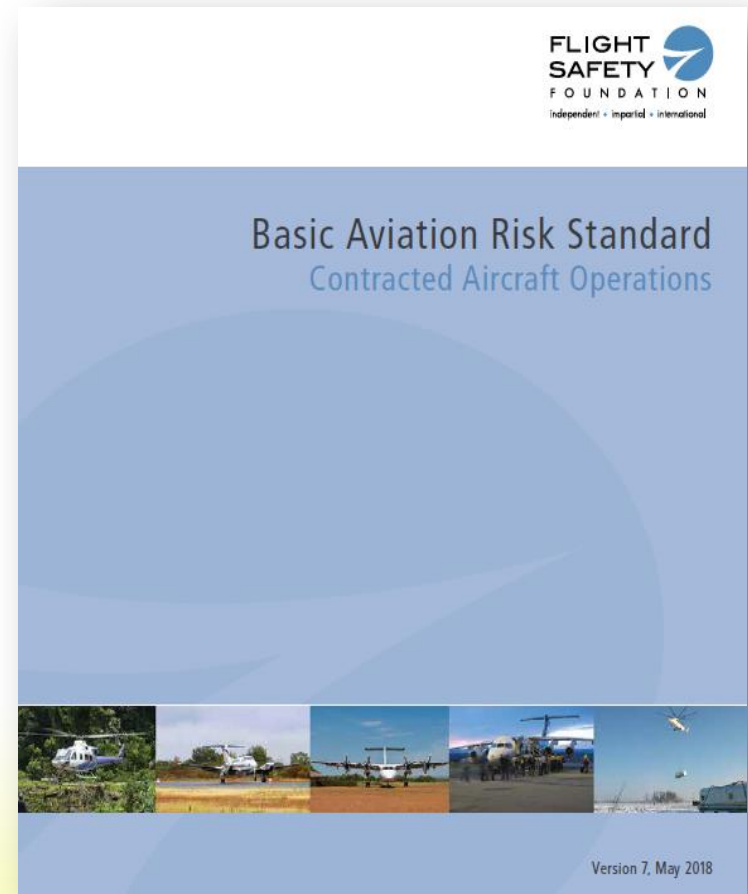
Date	Title	Event
29 Jan 2018	ASAP: Tech. Exceeded Duty Time During Non-routine Repair of N45565.	Unintentional
12 Dec 2018	Saturday Overtime Violation	Regulatory v
20 Sep 2018	Duty time exceeded in maintenance	Unintentional
27 Nov 2018	Untitled	Unintentional
04 Dec 2018	Mx Duty Time Violation	Routine viola

Barrier-based Safety Management

A list of barriers / controls in place with responsibility for continued performance is essential to an effective Safety Management System

Starting point: FSF's Basic Aviation Risk Standard (BARS)

An audit standard originally intended for contract ops.
Resource sector



Barrier-based Safety Management

BARS controls by threat as shown in a Bowtie model

Figure 1: BARS Bow Tie Risk Model – Schematic of Aviation Risk Management Controls and Recovery Measures.



Barrier-based Safety Management

The BAR standard includes *common controls*

Taxonomies work reactively

For Event Risk Classification

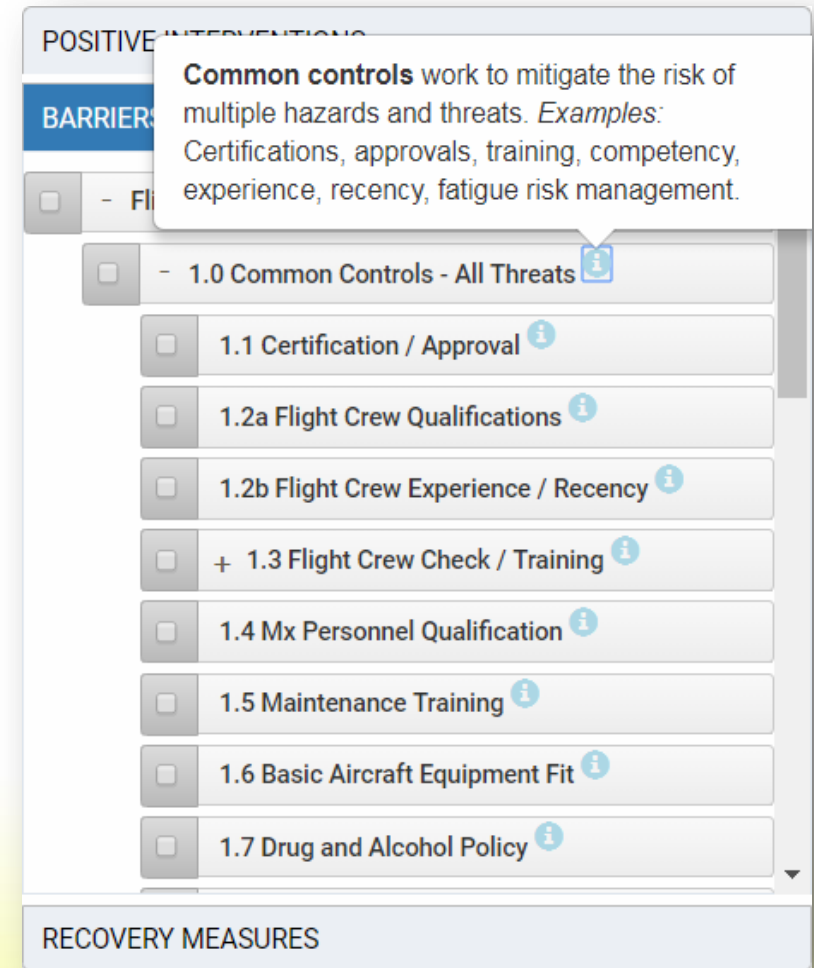
To improve risk assessments

Taxonomies work proactively

During Safety Issue studies

With Bowtie analysis

**During system descriptions to
stimulate thought processes**









Barrier-based Safety Management

BARS is readily adaptable to any type of operation

Organized by 'Threat'

**Specifies barriers
and controls to
mitigate various
threats**

*Example of BARS Threat 2.0
Runway Excursion adapted
to a Part 135 operator's SMS
database*

BARRIERS & CONTROLS	
<input type="checkbox"/>	- 2.0 Runway Excursion 
<input type="checkbox"/>	2.1 Airfield / helipad design 
<input type="checkbox"/>	Runway condition assessment
<input type="checkbox"/>	2.2 Airfield inspections 
<input type="checkbox"/>	2.4 Balanced field length 
<input type="checkbox"/>	2.5 Balanced field length – No performance charts 
<input type="checkbox"/>	2.6 Destination weather reporting 
<input type="checkbox"/>	Performance calculations
<input type="checkbox"/>	Runway excursion avoidance training

Now – Let's apply these taxonomies to our SMS

Barrier-based Safety Management

ARMS method of Operational Risk Assessment

Developed by the Aviation Risk Management Solutions (ARMS) working group, from 2007 to 2010

Purpose:

To overcome the problems associated with traditional risk assessment methods

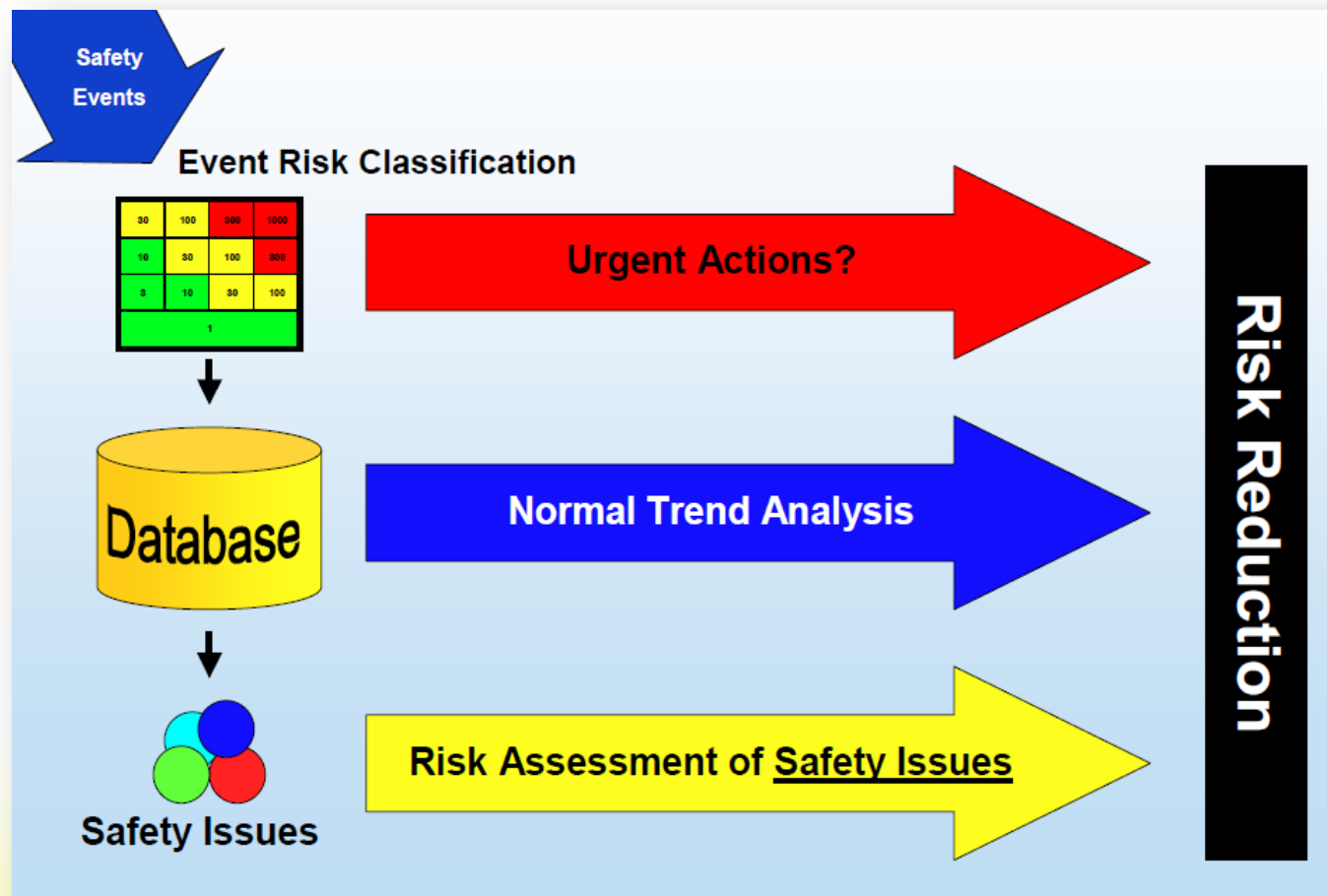
To simplify initial risk assessment by analyzing the barriers and controls that worked to prevent an accident

ARMS methodology has been adopted by airlines around the world

It's not just for the big guys!

Barrier-based Safety Management

ARMS risk assessment methodology overview



Barrier-based Safety Management

ARMS Event Risk Classification (ERC)

An effective method to screen incoming event reports

Methodology:

Simple and fast
Conceptually solid

Results:

Coherent
Useful
Understandable
by non-experts

Event Risk Classification is a new and better method of assessing the risk of events that have already occurred

Barrier-based Safety Management

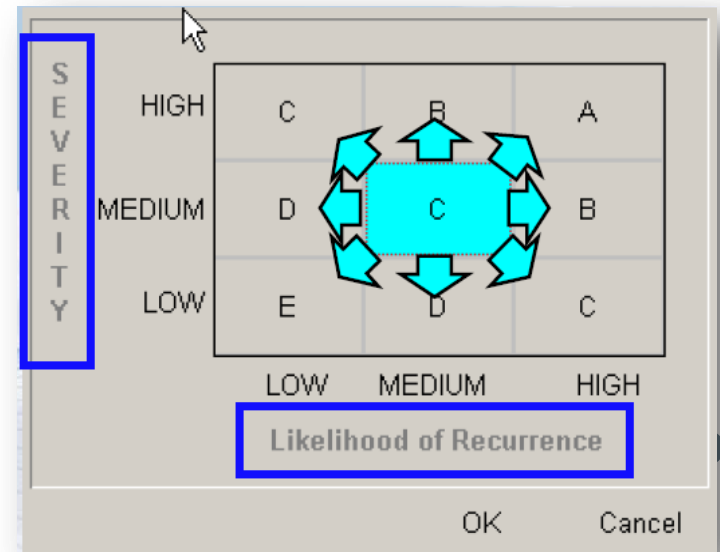
Problems with older methods - *fictitious example*

You learn about an event which occurred yesterday

A twin-engine turbine-powered aircraft with 110 pax aboard almost overran the runway end on landing at Sitka

Actual outcome: blown tires

Causes: unstable approach and reduced braking capability
a maintenance error



In the classic approach to risk assessment, you:

Assess 'severity' and 'likelihood'

Barrier-based Safety Management

Fictitious example of runway overrun (continued)

Severity of what?

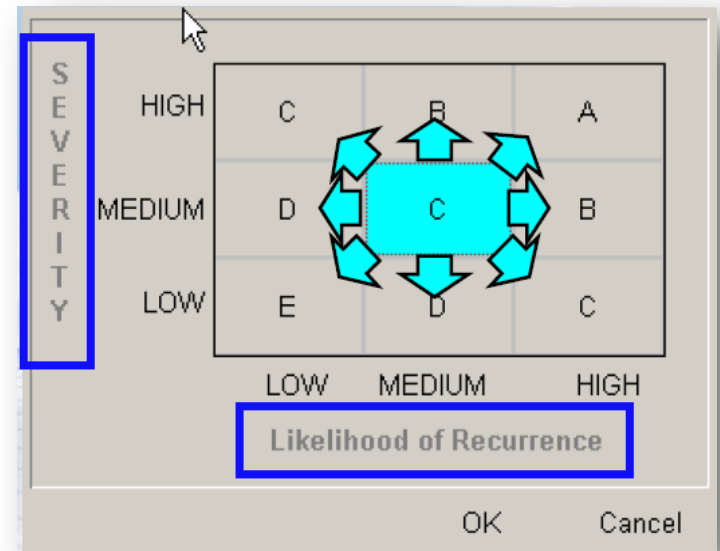
Actual outcome: blown tires?

Most likely accident scenario:
with some injuries
fatalities (if any)?

The worst-case scenario:
with 100% fatalities?

Shall we consider smaller A/C?
less pax? Cargo flights?

Other airports?



Barrier-based Safety Management

Fictitious example of runway overrun (continued)

Likelihood of what? (what risk*?)

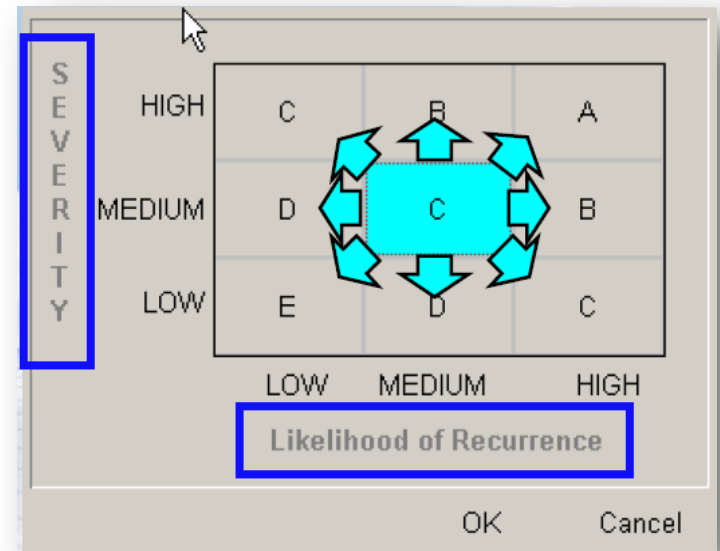
The same maintenance error?

Near-overshoot events?

Actual overshoot events?

Any aircraft type?

Any location?



**The ICAO definition of 'risk' refers to the "worst foreseeable situation", which usually equals 100% fatalities. But this is not the same as the "most credible accident scenario", which in real life may be a more useful concept.*

Barrier-based Safety Management

Conceptual confusion exists assessing historical events

Each actual outcome is unique

The many variables and chain of events will never happen again in exactly the same way

So we try to risk-assess a potential similar event...

But “similar” is very subjective

With many estimates

...and much speculation



Is it appropriate at all to be risk-assessing events that have already occurred?

Barrier-based Safety Management

A Better Way – ARMS Event Risk Classification (ERC)

SMS standards require us to investigate

Incidents

Accidents



Collectively known as 'Occurrences'

But the vast majority of reported events are:

Irregularities

Minor events (e.g., violations under ASAP)

Barrier-based Safety Management

A Better Way – ARMS Event Risk Classification (ERC)

Using a typical RA matrix, risk assessments are

Ambiguous

Subjective

Event Risk Classification is a better tool

ERC analyzes barriers that worked to prevent an accident

It requires minimal investigation, so it's fast

Let's see how it works – in 3 easy steps!




















Barrier-based Safety Management

ERC Example 1: shutdown

Step 1: Identify barriers that did not fail

Identify the interventions and barriers that prevented this event from escalating into an accident scenario. Ignore barriers that already failed; these will be studied in the investigation that follows. Consider only the barrier which worked, and any subsequent barriers still in place. Analyzing these barriers provides a more accurate assessment of the likelihood of an incident or accident scenario being realized.

Source: Event Risk (ER) classification - Methodology for Operational Risk Assessment - ARMS Working Group, 2010

Interventions / Barriers 		 
Barrier	Description	
10.2 Multi-engine aircraft design	2-engine redundancy	 
Failure anticipation	In-flight monitoring of engine parameters revealed impending engine failure	 
Applied training / SOPs	Engine shutdown & secure / single-engine approach procedures	 
Emergency procedures training	Crew trained and checked on engine failure procedures	 
Inflight action	Precautionary shutdown	 
Checklist	Crew used provided emerg. checklist for failed engine	 
CRM / ADM training	Captain applied CRM and instructed SIC to continue the approach while he secured the engine and monitored the SIC flying	 
Land as Precaution	Crew landed at nearest suitable airport	 

Inflight
















Add barrier

that

Barrier-based Safety Management

ERC Example 2: Near-overflow event

Step 1:
Shown here are the
barriers that worked
(i.e., the barriers that
remained in place
and helped prevent
the event from
escalating into an
accident scenario)

Interventions / Barriers 		Add barrier
Barrier	Description	
2.1 Airfield / helipad design	Engineered Materials Arresting System (EMAS) and Runway End Safety Area (RESA) safety nets in place	 
2.6 Destination weather reporting	Runway was reported as wet (acceptable for landing)	 
Runway excursion avoidance training	Both crewmembers trained and current	 
Runway condition assessment	Conditions assessed	 
Performance calculations	Landing performance calculations per AFM	 
2.4 Balanced field length	Ability to stop within 60% without reverse thrust	 
Applied training / SOPs	Application of emergency air brake	 

Barrier-based Safety Management

Step 2: Identify most credible accident outcome

Question 1

If this event had escalated into an incident or accident, what would have been the most credible outcomes?

Catastrophic Accident	Loss of aircraft or multiple fatalities (3 or more)
Major Accident	1 or 2 fatalities, multiple serious injuries, major damage to the aircraft
Minor Injuries or damage	Minor injuries, minor damage to aircraft
No accident outcome	No potential damage or injury could occur

Typical accident scenarios

Loss of control, mid air collision, uncontrollable fire on board, explosions, total structural failure of the aircraft, collision with

High speed taxiway collision, turbulence injuries

Pushback accident, minor damage

Any event which could not result in an accident, even if it had operational consequences (e.g. diversion, delay, individual sickness)

Question 2

What was the effectiveness of the remaining controls / barriers between this event and the most credible accident scenario?

Effective	Limited	Minimal	Not effective
50	102	502	2500

If this event had escalated into an incident or accident, what would have been the most credible outcomes?

- In your mind, try to escalate the event into an incident or accident.
- If it was virtually impossible that the event could have escalated into an incident or accident, then you are at the bottom row.
- If you can imagine credible incident / accident scenarios (even improbable ones!), then consider the most credible scenario and judge its typical outcomes in terms of injuries to people and damage or loss of assets. Then select the corresponding row in the matrix. The listed "typical accident scenarios" may be of help.

Reset

Close

Set ER Level

ARMS Event Risk Classification Question 1

Barrier-based Safety Management

Step 3: Determine effectiveness of remaining barriers

Question 1

If this event had escalated into an incident or accident, what would have been the most credible outcomes?

Typical accident scenarios

Effective: The safety margin was 'effective', typically consisting of several good barriers.

Limited: An abnormal situation, more demanding to manage, but with still a considerable remaining safety margin.

Minimal: Some barrier(s) were still in place but their total effectiveness was 'minimal'.

Not effective: An accident was not avoided, or the only thing separating the event from an accident was pure luck or exceptional skill, which is not trained nor required.

Question 2

What was the effectiveness of the remaining controls / barriers between this event and the most credible accident scenario?

Effective	Limited	Minimal	Not effective
50	102	502	2,000
10	27	101	500
	5	20	100

Reset

Close

Set ER Level

ARMS Event Risk Classification Question 2

Barrier-based Safety Management

EVENT: Near runway overrun / tire failures on landing at KBUR

Set the Event Risk level

Question 1 

If this event had escalated into an incident or accident, what would have been the most credible outcomes?

Catastrophic Accident	Loss of aircraft or multiple fatalities (3 or more)
Major Accident	1 or 2 fatalities, multiple serious injuries, major damage to the aircraft
Minor Injuries or damage	Minor injuries, minor damage to aircraft
No accident outcome	No potential damage or injury could occur

Typical accident scenarios

Loss of control, mid air collision, uncontrollable fire on board, explosions, total structural failure of the aircraft, collision with terrain





High speed taxiway collision, major turbulence injuries

Pushback accident, minor weather damage

Any event which could not escalate into an accident, even if it may have operational consequences (e.g. diversion, delay, individual sickness)

Question 2 

What was the effectiveness of the remaining controls / barriers between this event and the most credible accident scenario?

Effective 	Limited 	Minimal 	Not effective 
50	102	502	2500
10	21	101	500
3	5	20	100
1			

Reset

Close

Set ER Level

ARMS Event Risk Classification – Risk level set

Barrier-based Safety Management

ARMS Safety Issue risk assessment method

Proactive Safety Issues

Meet FAA's SMSVP 'SRM trigger' requirements

Begin with a system description and are clearly defined

Produce risk assessments that are less subjective

Can be used to assess future risks (change management)

Analyze barriers and controls currently in place

Are well-suited to the use of Bowtie analysis

*Reports of historical events / occurrences can be
linked to the associated Safety Issue*

Barrier-based Safety Management

ARMS Safety Issue definition:

“A manifestation of a hazard or combination of several hazards in a specific context. The Safety Issue has been identified through the systematic Hazard Identification process of the organization. An Issue could be a local implication of one hazard (e.g. de-icing problems with one particular aircraft type) or a combination of hazards in one part of the operation (e.g. operation to a demanding airport).”

Barrier-based Safety Management

Safety Issue is an important concept

**Typically the local, specific implication(s) of a hazard
(e.g. Windshear on approach to Galena)**

Or a combination of hazards present at once

**(e.g. Landing to Sitka (terrain, short runway,
displaced ILS, tailwind, wet runway, etc.)**

**(e.g. Mx tech working alone, outside, at night on a
slippery ramp in adverse weather conditions)**

Barrier-based Safety Management

Why is the 'Safety Issue' concept so important?

Several reasons:

Safety Issues can be precisely defined and therefore risk-assessed with minimal subjectivity

Safety Issues can be designed to meet Part 5 / SMSVP requirements for Safety Risk Management (SRM)

Safety Issues are proactive; they offer the most benefit for managing safety with your organization or department

Barrier-based Safety Management

Safety Issue: Runway Excursion

Overview

Issue type

Reason for issue

Identified hazard / concern

Identified hazard / concern

New system design

Change to existing system design

New operational procedure

Modification of existing operation / procedure

Operational environment change

Identified trend

Clear selection

Significant Safety Issue

Identified hazard / concern

Recent instances of continued landing after unstable approach to .01 per 1,000 flight segments.

Runway excursion is a top industry safety initiative per the Aviation Safety Foundation and is one of the UK's 'Significant Safety Initiatives'. A primary causal factor is failure to go around after unstable or de-stabilized approach.

System description ([Initial system description](#))

Apr 2017 @ 05:01


Suave

SMSVP 'triggers' for application of the Safety Risk Management (SRM) process

Barrier-based Safety Management


Safety Issue: Runway Excursion

Objective established for performance measurement

Overview 	
Issue type	Significant Safety Issue
Reason for issue	Identified hazard / concern
Objective(s)	Reduce instances of continued landing after unstable approach to .01 per 1,000 flight segments.
Explanation	Runway excursion is a top industry safety initiative per the Flight Safety Foundation and is one of the UK's 'Significant Seven'. A primary causal factor is failure to go around after an unstable or de-stabilized approach.
Data source	System description (Initial system description)
Date created	03 Apr 2017 @ 05:01
Created by	Rico Suave

Barrier-based Safety Management

Safety Issue: Runway Excursion - Risk Assessment

Risk Analysis/Assessment 

Add risk scenario

Hazard statement

Unstable approach / landing, excess energy during landing, decision error regarding go-around.

Edit hazard statement

Top event





Flight Safety > Undesired approach / landing
> Continued landing after unstable approach

Set top event

Highest Risk Assessment

Moderate - 22 (Seldom)

May be acceptable, but only with risk-mitigating strategies; requires risk controls and/or corrective actions to mitigate risk.

Risk scenario	Consequence	Risk assessments	
Contaminated runway, less-than-favorable braking action, crosswind and approach / landing instability result in loss of directional control.	Veer-off	Moderate - 21 (Seldom)	 
Unstable approach and landing with excess energy on wet or contaminated runway results in runway excursion.	Overrun	Moderate - 22 (Seldom)	 

Highest Risk Assessment


Moderate - 22 (Seldom)

May be acceptable, but only with risk-mitigating strategies; requires risk controls and/or corrective actions to mitigate risk.















































Barrier-based Safety Management

Safety Issue: Runway Excursion

Study of threats and barriers

Factors 

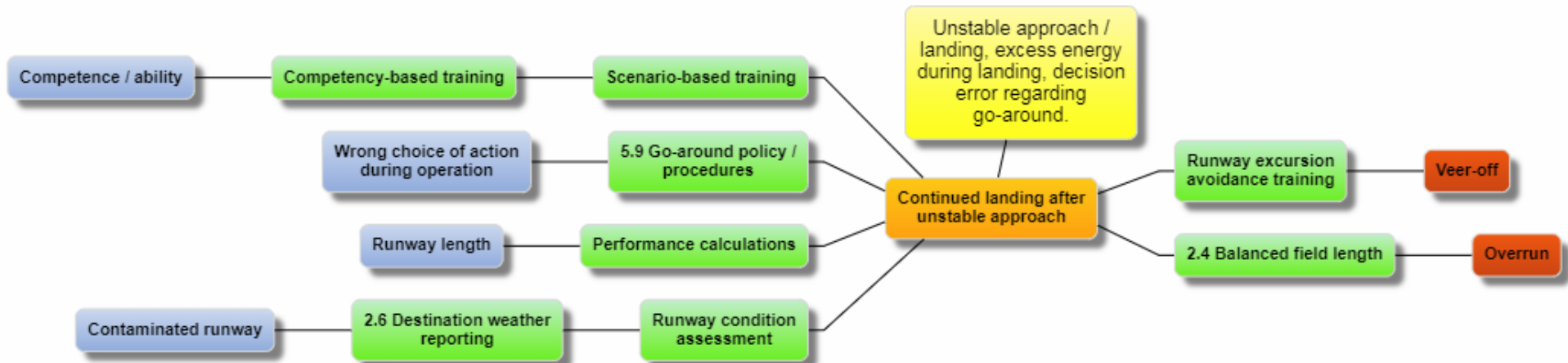
Add factor

	 Continued landing after unstable approach (This factor is the top event for this issue)		
	 Veer-off (This factor is an unwanted consequence)		
	 Runway excursion avoidance training		
	 Overrun (This factor is an unwanted consequence)		
	 2.4 Balanced field length		
	Competence / ability	<input type="text" value="Identified"/>	FLT 2.0
Crew competence			
	 Scenario-based training		
	 Competency-based training		
	Wrong choice of action during operation	<input type="text" value="Managed"/>	FLT 2.2.1 (OP)
Decision to continue approach / landing or go around			
	 5.9 Go-around policy / procedures		
	Runway length	<input type="text" value="Managed"/>	OC 3.2.1 (OP)
	 Performance calculations		
	Contaminated runway	<input type="text" value="Managed"/>	OC 3.3.2 (OP)
	 Runway condition assessment		
	 2.6 Destination weather reporting		

Barrier-based Safety Management

Safety Issue: Runway Excursion - In-depth Risk Analysis

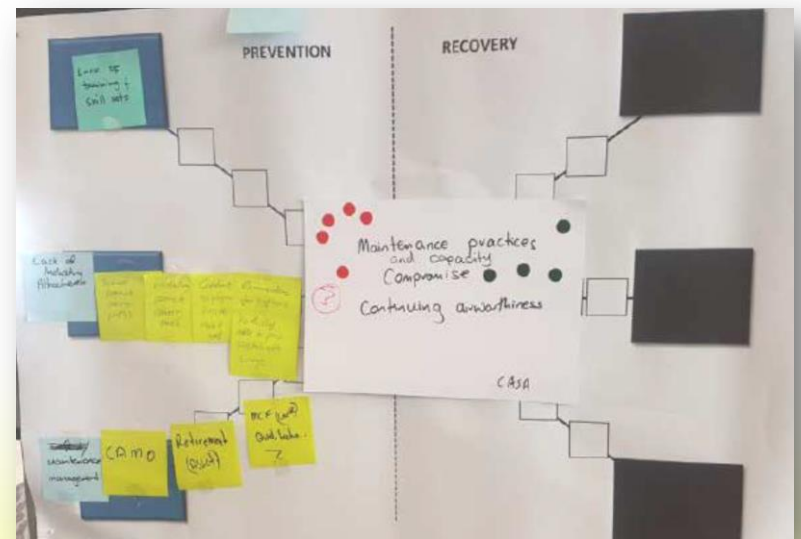
Bowtie analysis is the industry's leading tool for in-depth analysis of proactive safety issues



Barrier-based Safety Management

Bowtie analysis

Bowtie analysis can be done on paper!



Barrier-based Safety Management

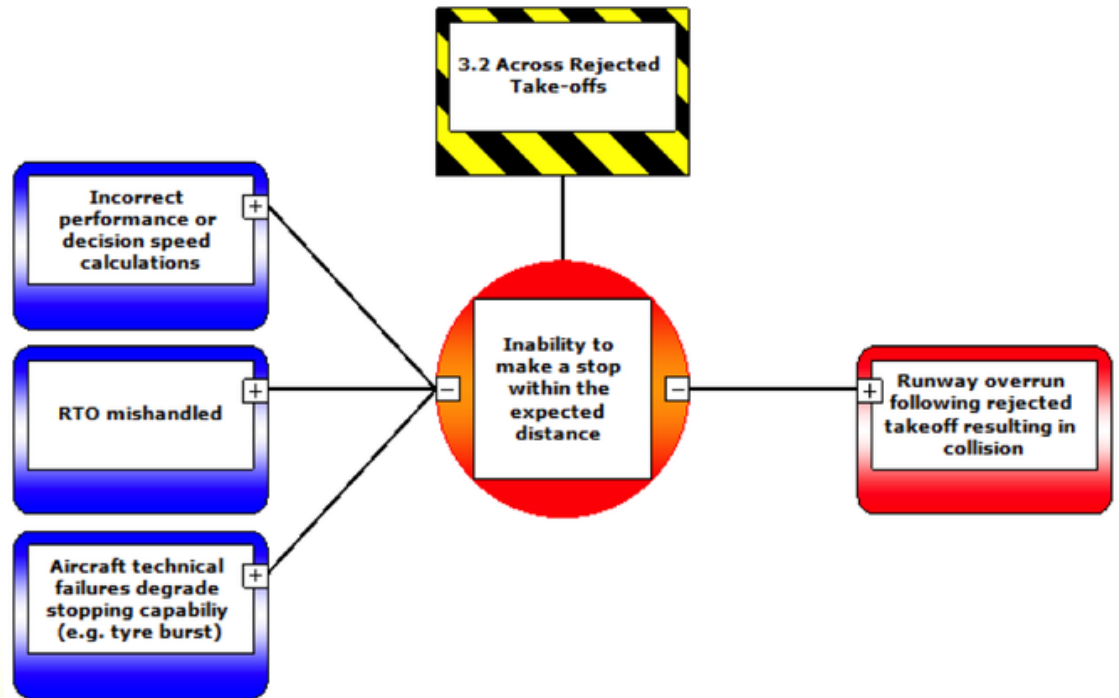
Bowtie analysis

Commercial software is available

Bowtie Pro

THESIS BowTie

BowtieXP



Search 'Bowtie' at www.caa.co.uk for more information

Integrated Systems of Management

Share data between various aviation safety programs and management systems, such as:

OSHA / EHS

Maintenance quality assurance (Mx QA)

ISO 9000 / AS9100 and TQM

Improve efficiency / SMS performance

Can eliminate 'silos' in SMS & Mx QA systems

Require configurable data structure and taxonomies

Won't work without properly structured data

Integrated Systems of Management

Support OHS / EHS management requirements

Manage illness / injury hazards and events

Manage environmental hazards and events

Perform risk assessments

Identify causal factors from all data sources



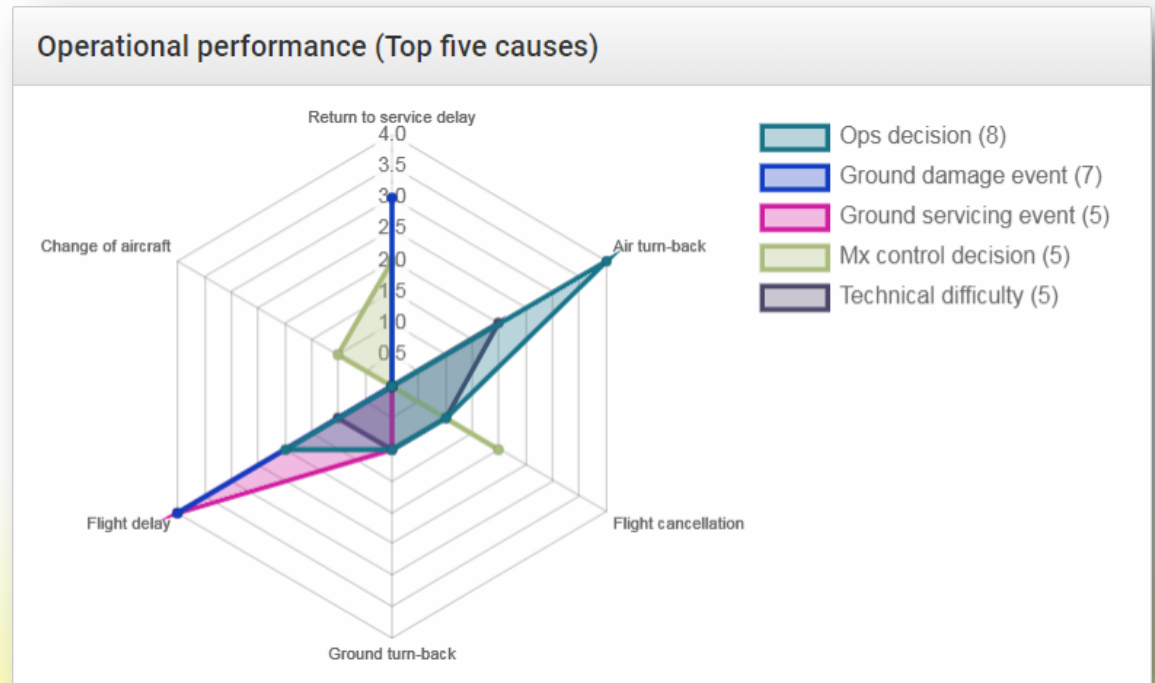
Integrated Systems of Management

Support Mx quality assurance (CASS)
By measuring Mx system performance

Flight delays and interruptions due to
technical difficulties / Mx control errors

Return-to-service delays and interruptions

Mx system errors /
failures that “flew
on the aircraft”



Integrated Systems of Management

Support Mx quality assurance (CASS)

**Through reporting and trending
system / component failures
and non-routine maintenance by:**

Aircraft reg. no.

Aircraft type

ATA code

Component applicability / part no.

Supplier / external provider

of



Integrated Systems of Management

Further support your Mx QA system

**With maintenance system
performance indicators**

Mx system errors

Quality escapes

Policy / procedure violations

**Including performance objectives,
thresholds and alerts per:**

Work-hour

Flight-hour

Number-of-flights



Integrated Systems of Management

**Support ISO 9000 quality management standards
(AS9100 for MROs / repair stations)**

Requires processes to be
identified and documented

Includes audits for
'process effectiveness'

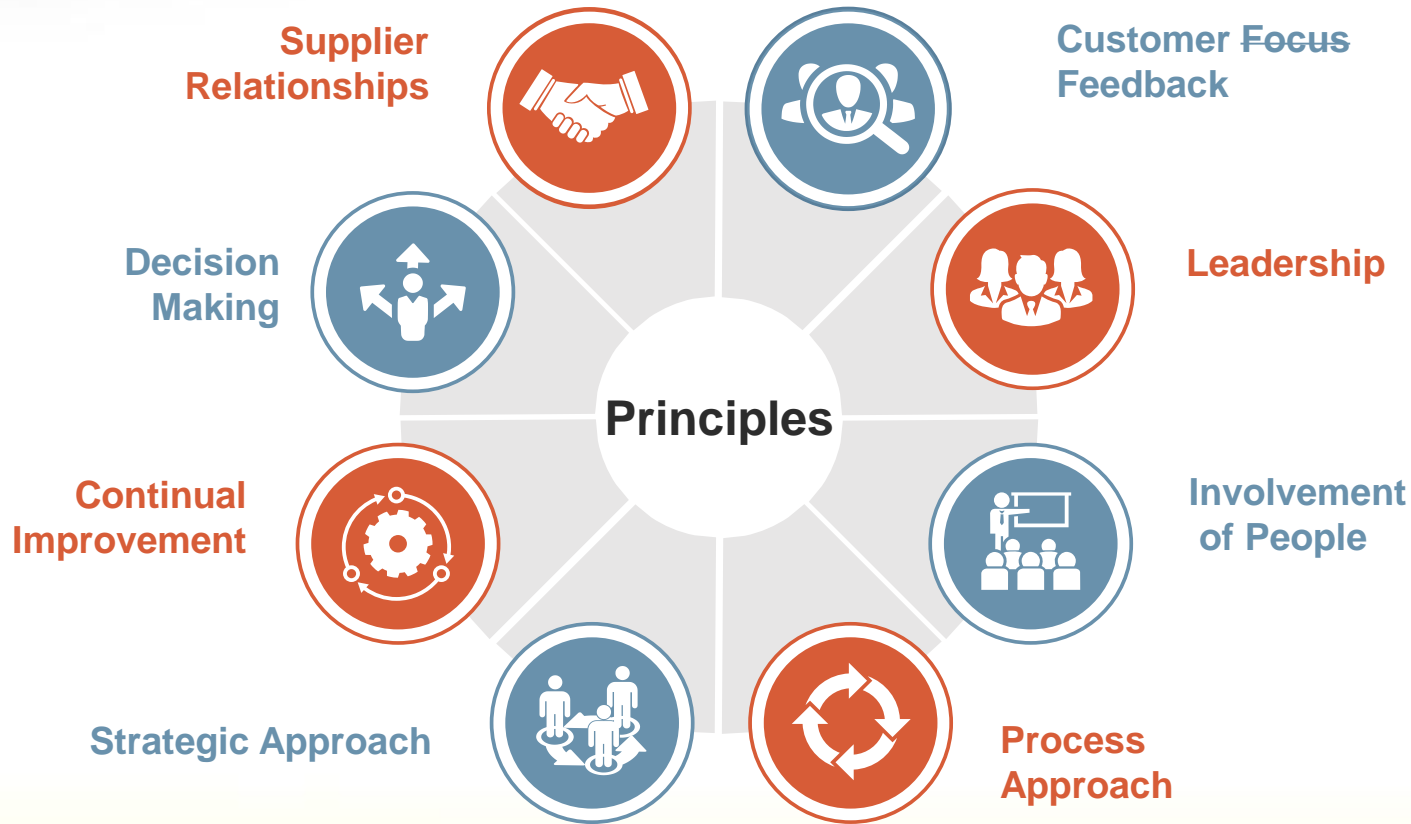
*So what do processes look like for
an MRO – or an operator's
maintenance organization?*



To find out, locate your SAS Peer Group under 8900.1 Vol 10 Ch 1 Sec 2: SAS

Integrated Systems of Management

Support Total Quality Management principles



A 'process approach' to SMS is also possible using FAA-defined processes designed specifically for commercial operators

Integrated Systems of Management

Can be developed to support Medallion legacy safety programs:

ASAP

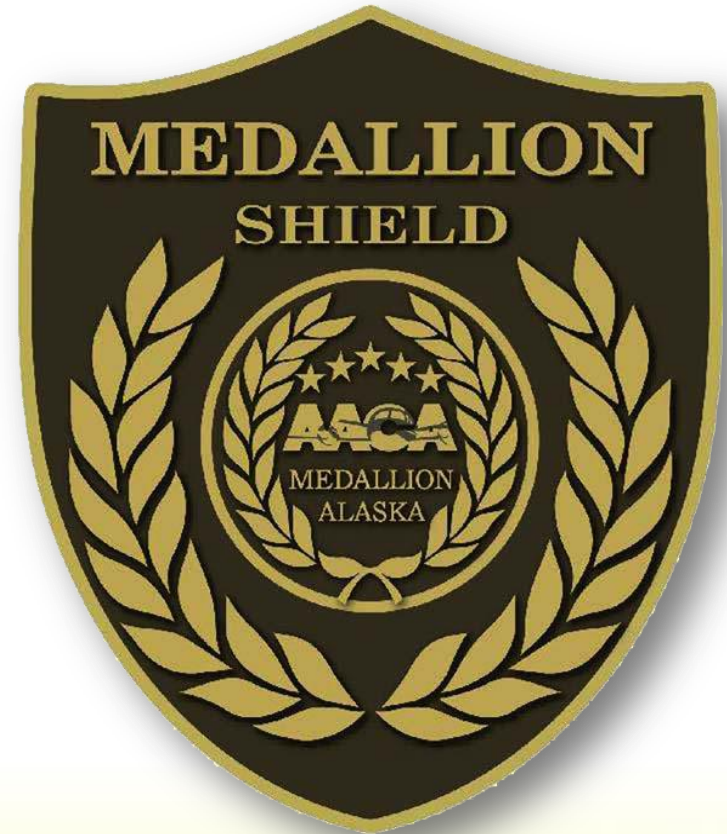
Operational Control

CFIT Avoidance

Internal Audit

Safety

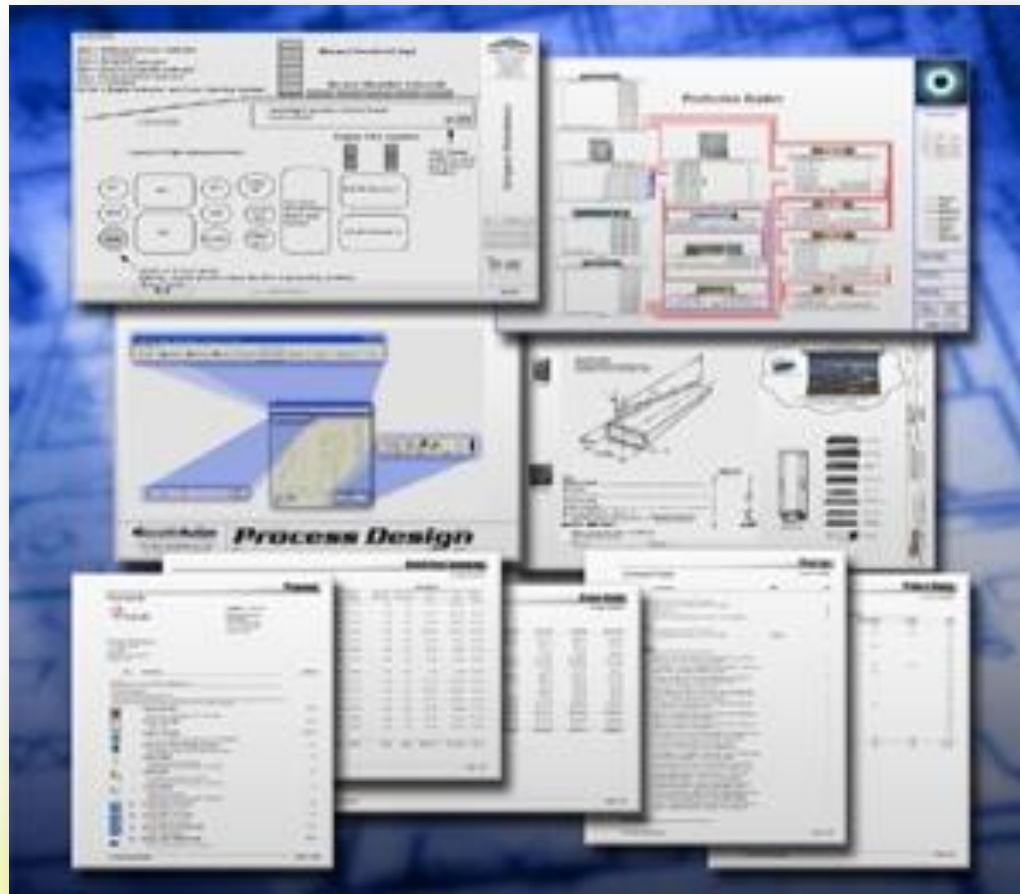
Maintenance / Ground service



The Harmonized Management System

Begins with good system design

Has components and elements that work together



The Harmonized Management System

Uses components / elements /
methods that interface properly

SMS software / matrices

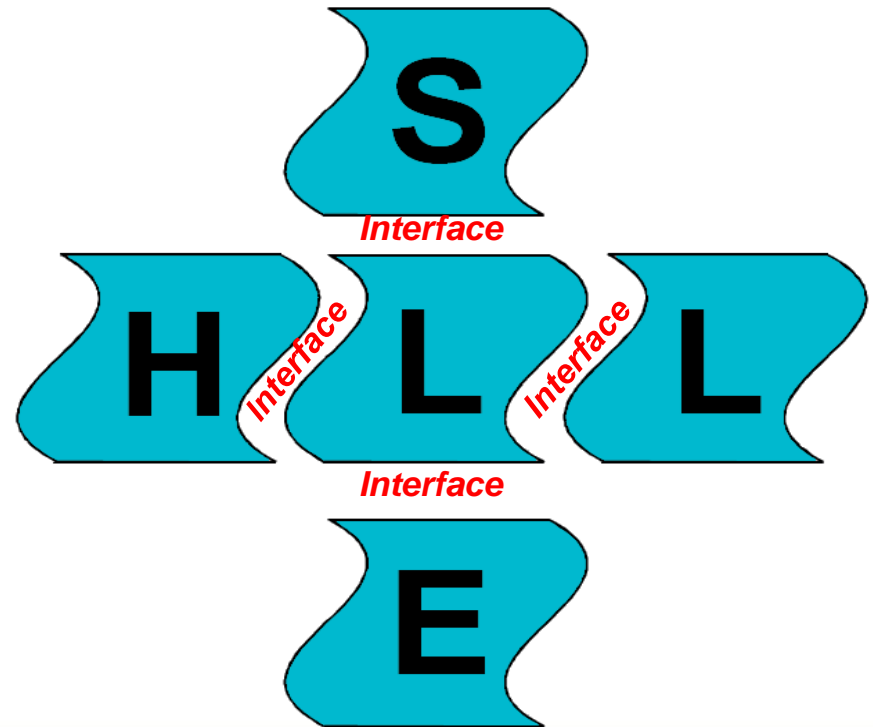
FRAT / GRAT tools

Root cause analysis tools

FOQA / LOSA threats / errors

SMS training

Documentation



Avoid the 'piece-meal' SMS!

The Harmonized Management System

Contains written guidance that should include:

Specific regulatory requirements (SRRs)

Safety attributes

Includes documents that interface and are maintained under separate cover

The revision process is simplified and more accurate

FAA's acceptance / approval process is faster and easier

Move to electronic documents (recommended practice)



The Harmonized Management System

Shares data from other safety programs





















For ASAP / VDRP

Includes taxonomies
types of violations

A 'work-around' is performed in a specific situation when an individual, crew or team lacks the necessary information / tools / equipment / conditions to complete a task or mission. In these cases the consequences and risk of violating published policies or procedures are recognized and the decision to proceed is determined by the best course of action.

If a person has not followed a work process or procedure that he/she should have, it's important to determine whether most other people are doing the same thing in the same situation. This is referred to as *normalized deviation*, or a 'norm'. Examples: Crew members routinely not following SOPs; Documented procedure—most people in the same situation do not follow the written process or procedure; Undocumented procedure—most people in the same situation do the procedure from memory, from their 'black book', or from another uncontrolled source of information.

EVENTS

- ☐ - Regulatory violation  
- ☐ Unintentional violation of regulation  
- ☐ Situational violation of regulation  
- ☐ Routine violation of regulation (Norm)  
- ☐ Intentional violation of regulation  
- ☐ Authorize unqualified individuals  
- ☐ Direct individuals to violate regulation  
- ☐ Failure to enforce regulations  
- ☐ - Policy / procedure violation 
- ☐ Unintentional violation of policy / procedure 
- ☐ Situational violation of policy / procedure ('Workaround') 
- ☐ Routine violation of policy / procedure (Norm) 


Important: Proposed Advisory Circular AC 120-66C looks at policy/procedure violations (not just regulatory) when determining reckless conduct!

The Harmonized Management System

Brings outside safety programs 'in-house'
For ASAP

**Includes ERC processes,
procedures and actions**

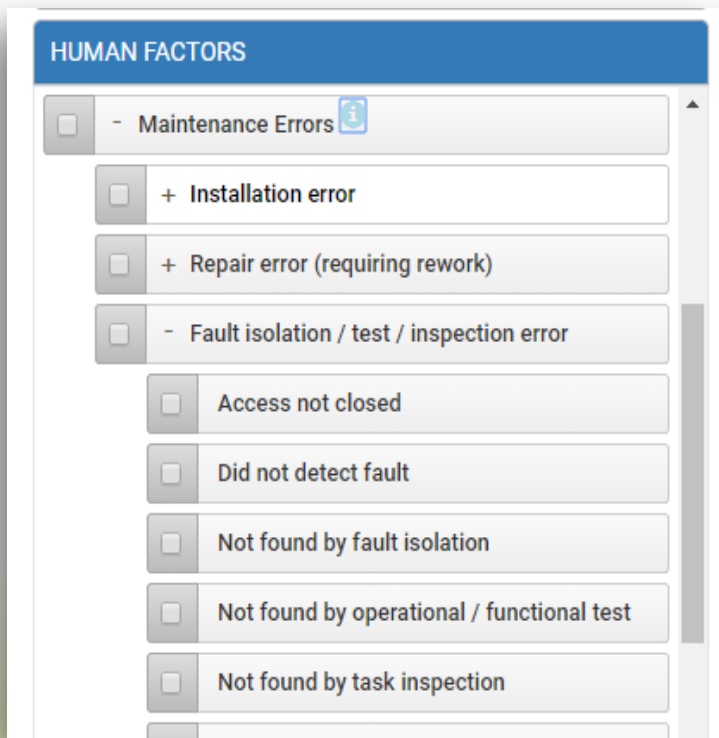
**Eliminates redundant
reporting requirements**

Event Review Committee actions 	
Date of ERC review	14 Mar 2017
ASAP report status	Accepted
Reasons for ERC decision	Timely, inadvertent, sole-source, 1st offence, employee shows remorse and a positive, constructive attitude to not re-offend.
Report type	Sole source
Remarks	No other evidence exists other than the employees's ASAP submission.
Was this report timely?	Yes
Remarks	Maint tech. informed his supervisor as soon as he realized he might have gone over duty time limits.


The Harmonized Management System

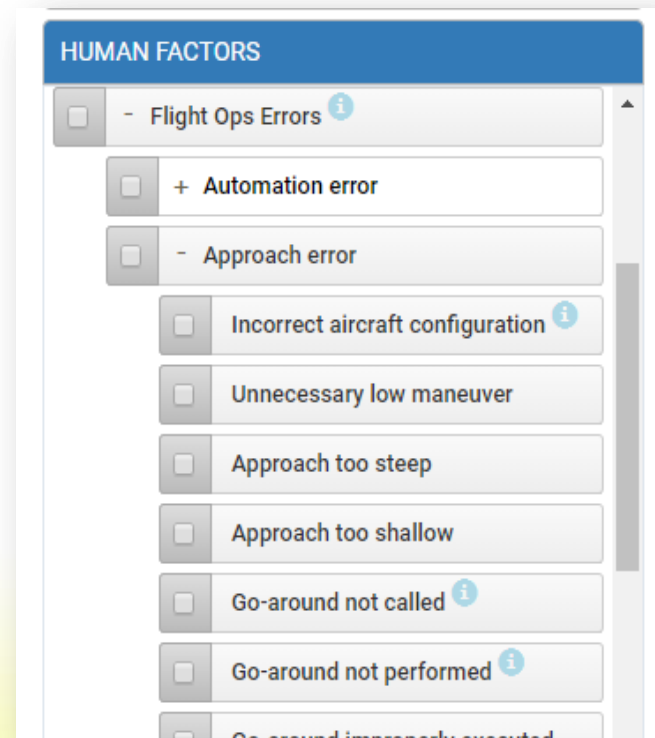
Incorporates data structure from other proven industry programs

For Boeing's MEDA / REDA / PEAT and LOSA programs
Taxonomies of threats and errors should be utilized







HUMAN FACTORS

- ☐ - Maintenance Errors 
 - ☐ + Installation error
 - ☐ + Repair error (requiring rework)
 - ☐ - Fault isolation / test / inspection error
 - ☐ Access not closed
 - ☐ Did not detect fault
 - ☐ Not found by fault isolation
 - ☐ Not found by operational / functional test
 - ☐ Not found by task inspection



HUMAN FACTORS

- ☐ - Flight Ops Errors 
 - ☐ + Automation error
 - ☐ - Approach error
 - ☐ Incorrect aircraft configuration 
 - ☐ Unnecessary low maneuver
 - ☐ Approach too steep
 - ☐ Approach too shallow
 - ☐ Go-around not called 
 - ☐ Go-around not performed 
 - ☐ Go-around improperly executed

The Harmonized Management System

Integrates other programs and data structures

For Fatigue risk management, FOQA and Medallion's CFIT avoidance / Operational control programs, etc.

Taxonomies of fatigue events and factors should be used

Taxonomies should include *precursors**



****Precursors are minor, reportable events that could lead to unwanted consequences (e.g., rejected takeoffs and long landings are precursors to runway excursion)***

Conclusion

Development of an effective SMS requires considerable investments of time and resources

The Part 5 / SMSVP standard is the right choice for 135 operators.

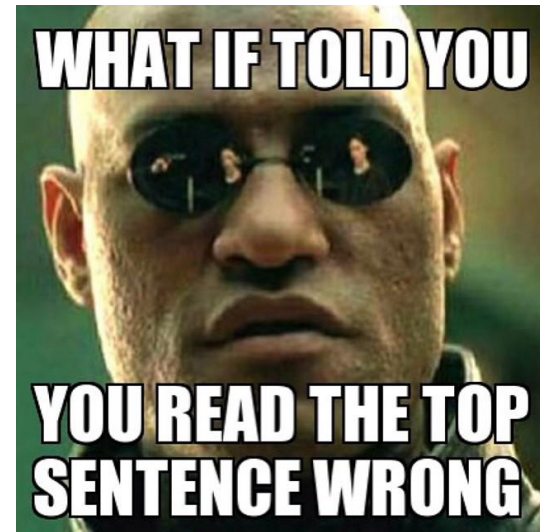
FAA-defined Peer Groups identify required processes for all systems of management, which can then be measured.

Our industry is moving to barrier-based safety management, which supports Event Risk Classification and management of Safety Issues. The BAR standard is a good place to start.

An integrated, harmonized management system that includes SMS, Mx quality / reliability, OHS, EHS, and supports future ISO 9000 series quality certifications is most efficient and effective.

Conclusion

Good presenters don't read from their PowerPoint slides.



Questions?

Thank you!



Paul Salerno Accountable
Executive

OmniSMS[®]
Aviation Management System