Principles of Error Management

Human Error and Just Culture

Presented to: Blackhawk Aerospace Technologies LLC
By: Mitch Lutze-Morris
Date: 04/04/2023

Produced by AFS-850
The FAA Safety Team (FAASTeam)

Federal Aviation Administration

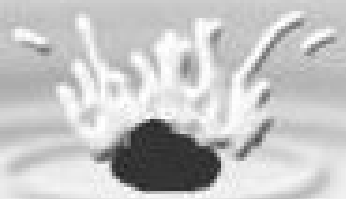
We have left undone those thinges whiche we aught to have done, and we have done those thinges whiche we aught not to have done.

Book of Common Prayer, 1559

The Four "Ps"

Philosophy

Policy



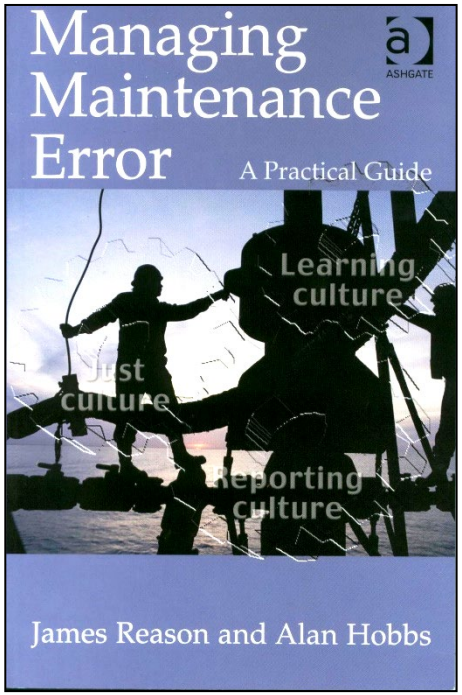
Procedures

Practices

“Aviation in itself is not inherently dangerous, but to a degree even greater than the sea is terribly unforgiving of any carelessness, incapacity, or neglect.”

Capt. A.G. Lamplaugh, British Aviation Insurance Corp. 1930

Human Error is Both Universal and Inevitable



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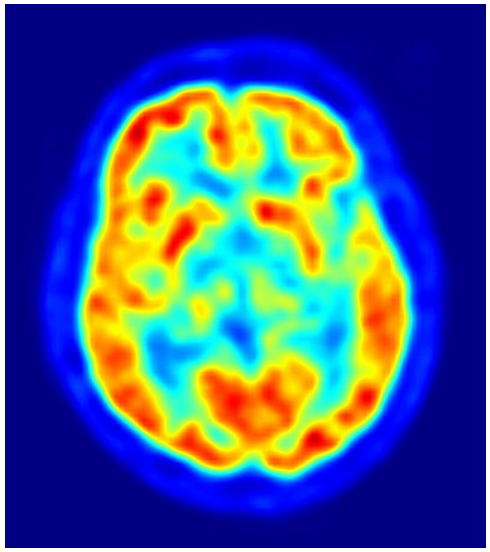
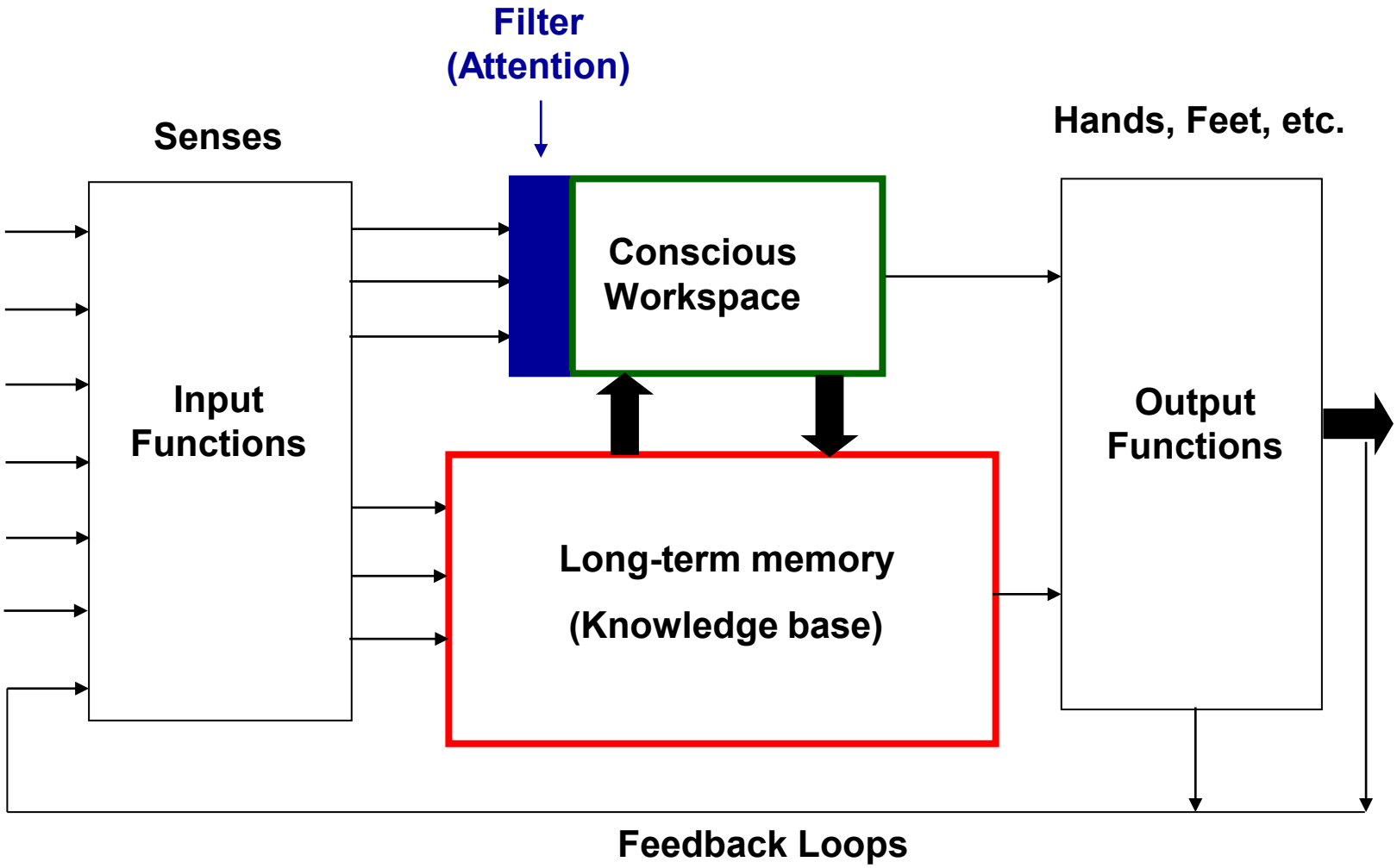


It is the Downside of Having a Brain

James Reason & Alan Hobbs (2003)



A Simplified "Blueprint" of Mental Functioning

James Reason & Alan Hobbs (2003)

Conscious Workspace

- General Problem Solver
- Limited Capacity
- Contents Available
- Sequential Processing
- Slow and Laborious
- Essential for new Tasks

Long-term Memory

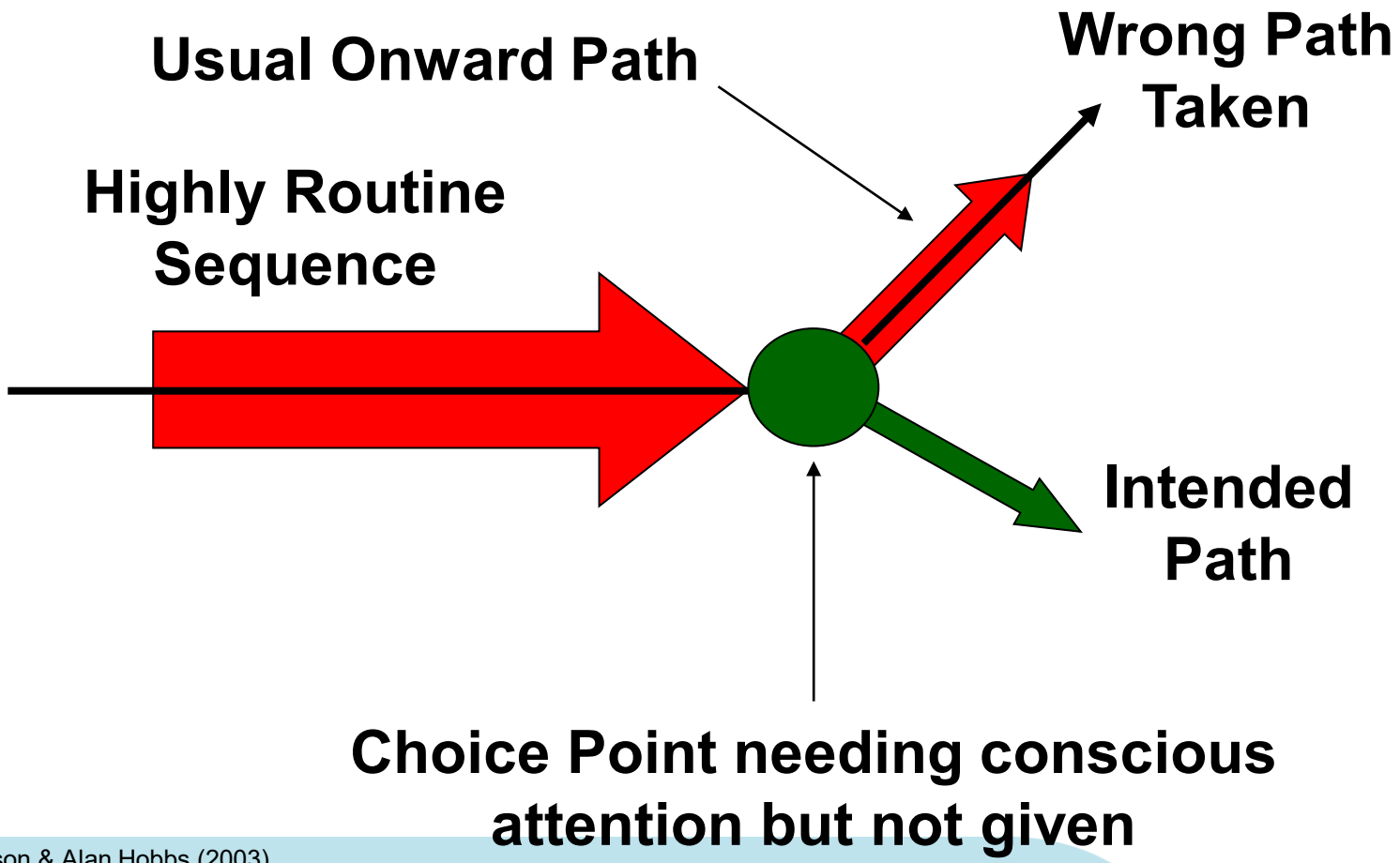
- Vast Collection of Experts
- No Limits to Size or Duration
- Unconscious
- Parallel Processing
- Rapid and Effortless
- Handles Familiar Routines and Habits

Trial and Error

Programming

James Reason & Alan Hobbs (2003)

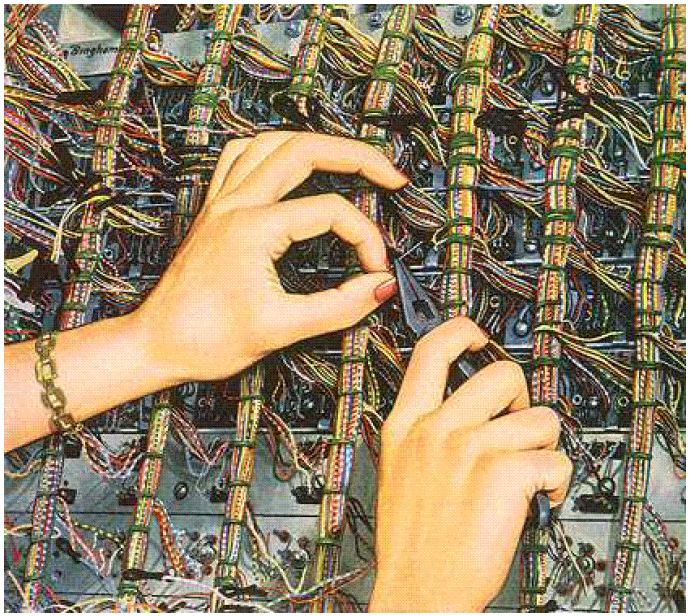
Skill Based Error



James Reason & Alan Hobbs (2003)

Bad News

We are “hardwired” to make errors



Good News

Errors are not intrinsically bad

James Reason & Alan Hobbs (2003)

Increase Awareness Manage

Human Error + Unforgiving Workplace = Disaster

You cannot change the human condition, but you can change the conditions in which humans work.

James Reason & Alan Hobbs (2003)

The Best People Can Make the Worst Mistakes

El Paso, Texas
January 16, 2006

James Reason & Alan Hobbs (2003)

Helios Flight 522

Helios Flight 522

TV Remote

Boeing 737 Pressurization Control

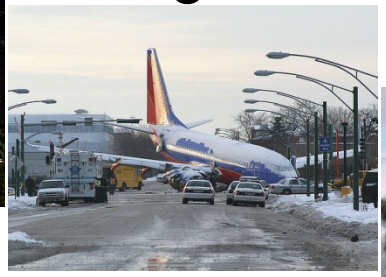
This technician's mistake would effect how many people?

853 passengers and 20 crew members

Many Errors Fall into Recurrent Patterns

Little Rock 6/1/1999

Chicago 12/8/2005



Cleveland 2/18/ 2007

Honduras 5/31/2008

Ottawa 2/17/2008

Jamaica 12/23/2009

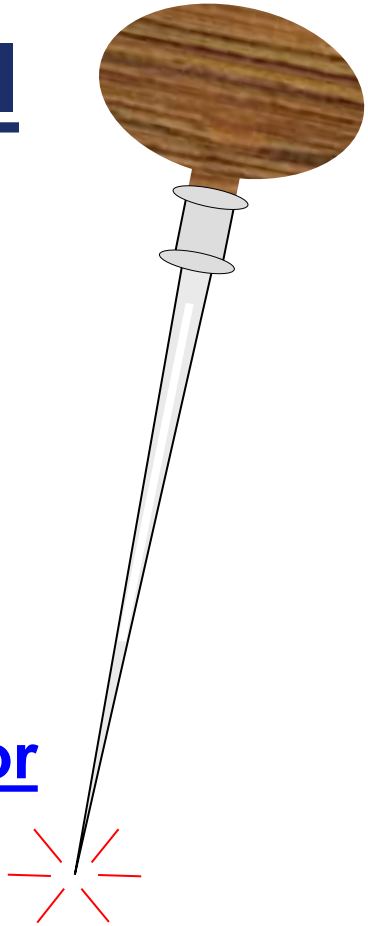
James Reason & Alan Hobbs (2003)

Person Model

- Name
- Blame
- Shame
- Retrain
- Write Another Procedure

Fire the Perpetrator
Pilot/Technician

We Ask Who?



System Model

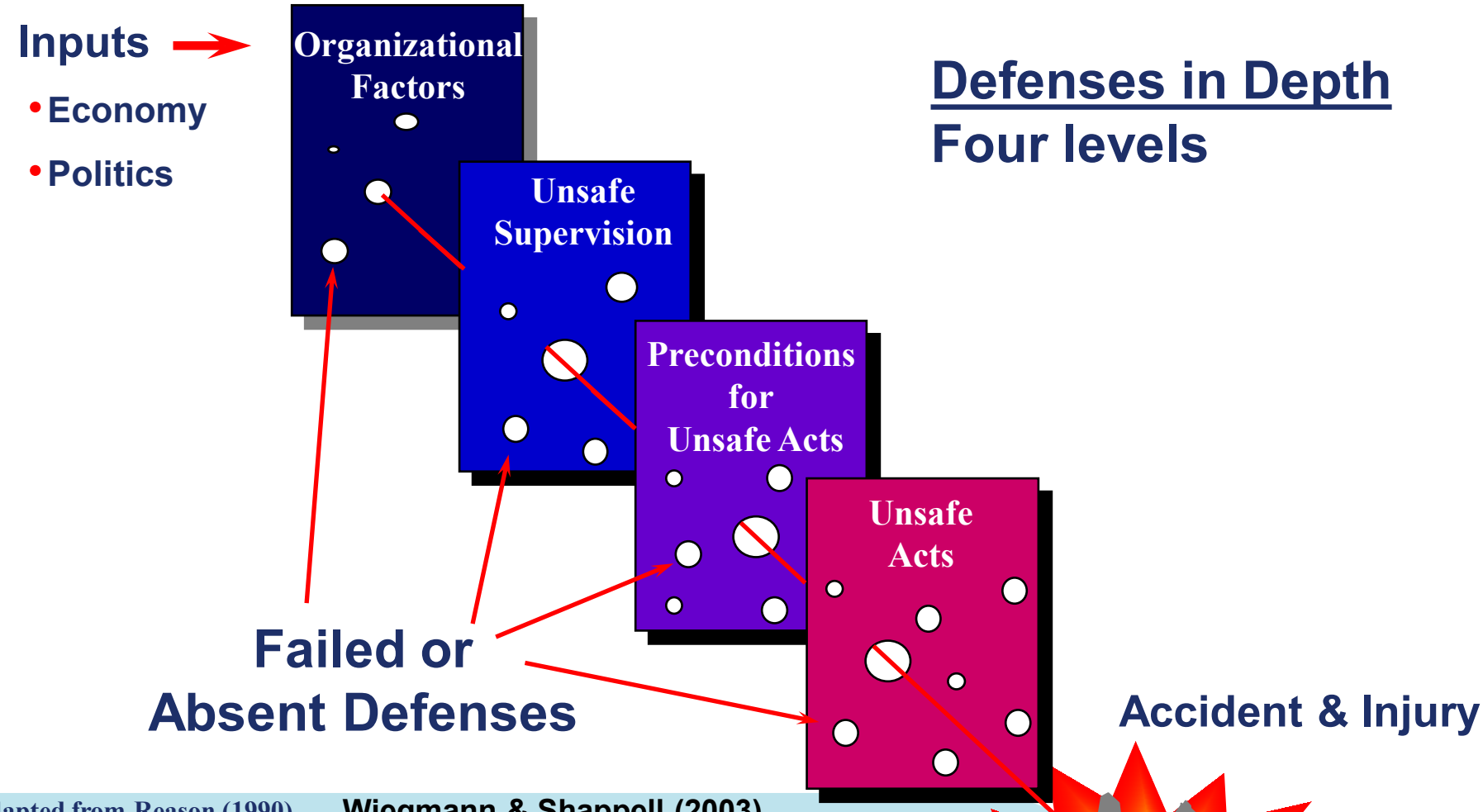
- Remedial Attention focused on the task and the work place
- Organization
- Supervision

Managing the Manageable

We Ask Why?

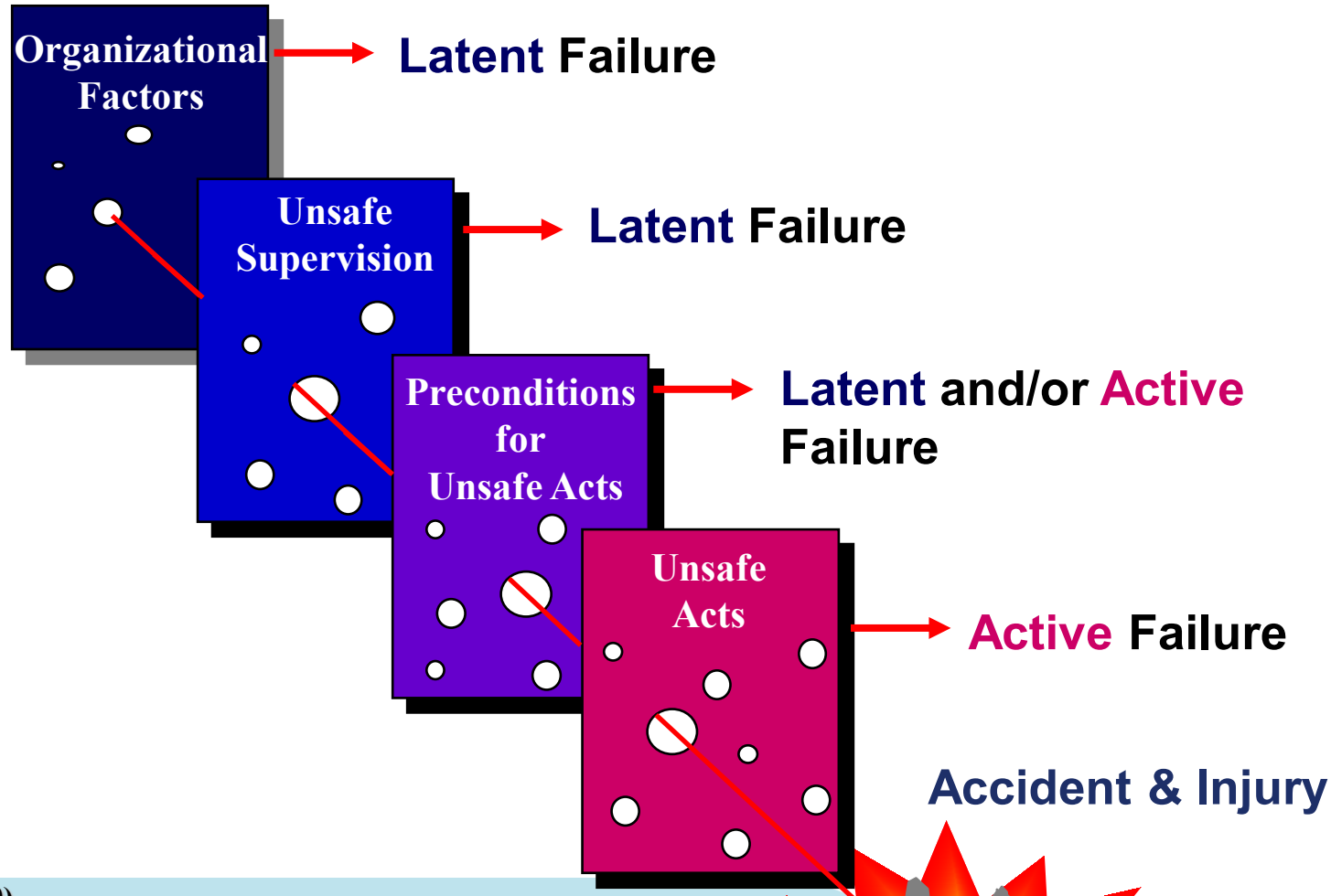
James Reason & Alan Hobbs (2003)

"Swiss-cheese" Model of Human Error



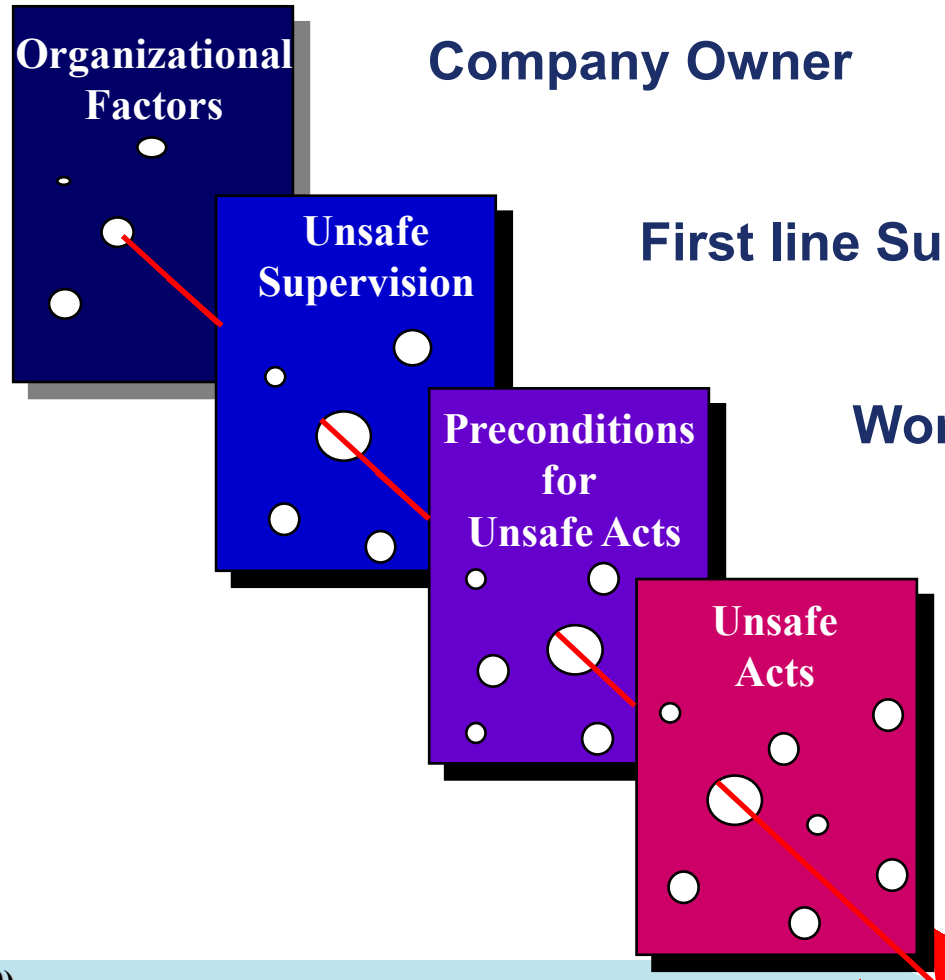
Adapted from Reason (1990) Wiegmann & Shappell (2003)

Failures - Latent and Active



Adapted from Reason (1990)

System Population



Company Owner

First line Supervisor

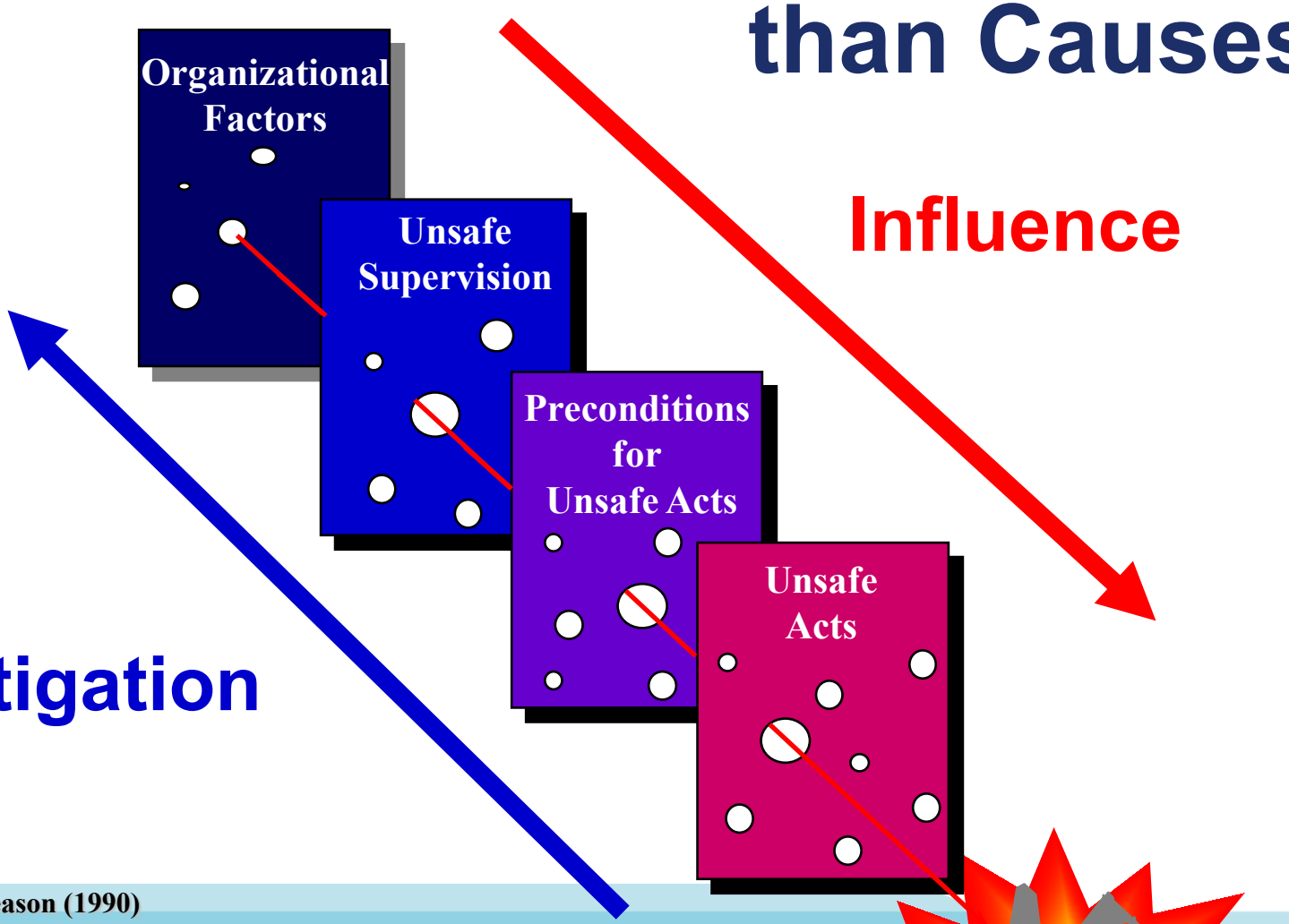
Workplace/Environment

Airman

Accident & Injury

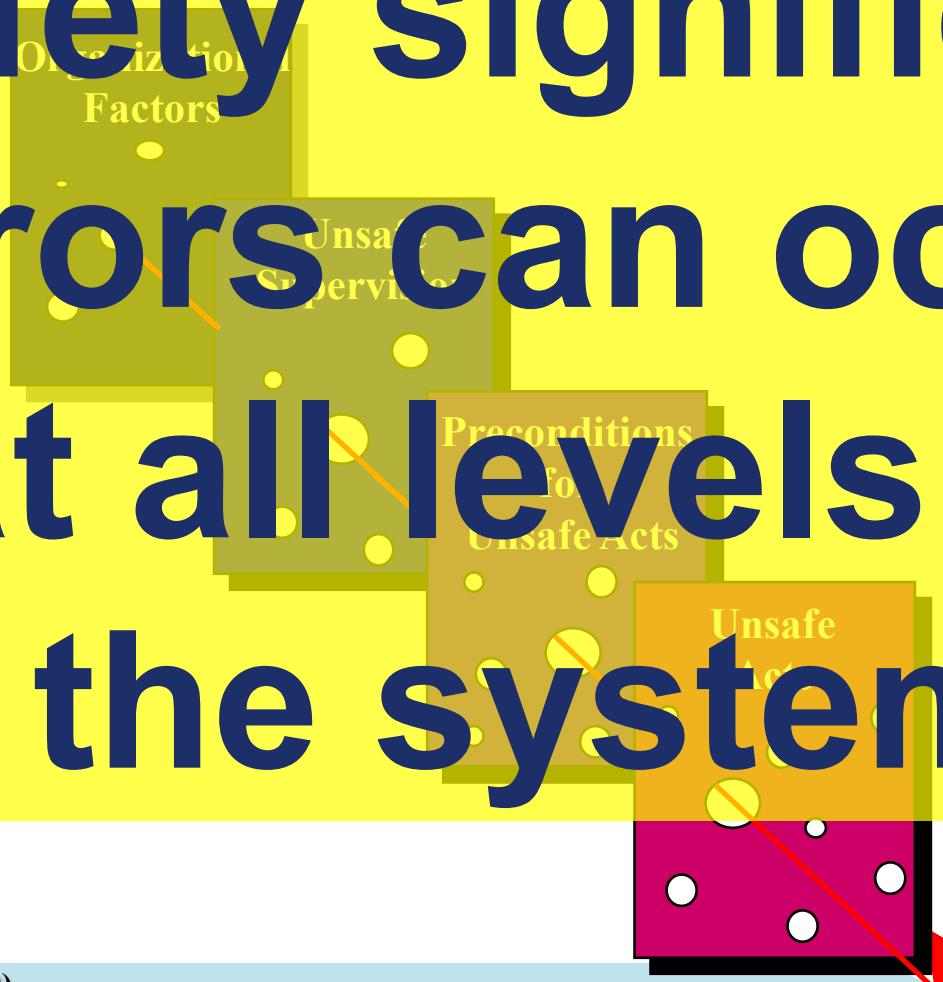
Adapted from Reason (1990)

Errors are Consequences Rather than Causes



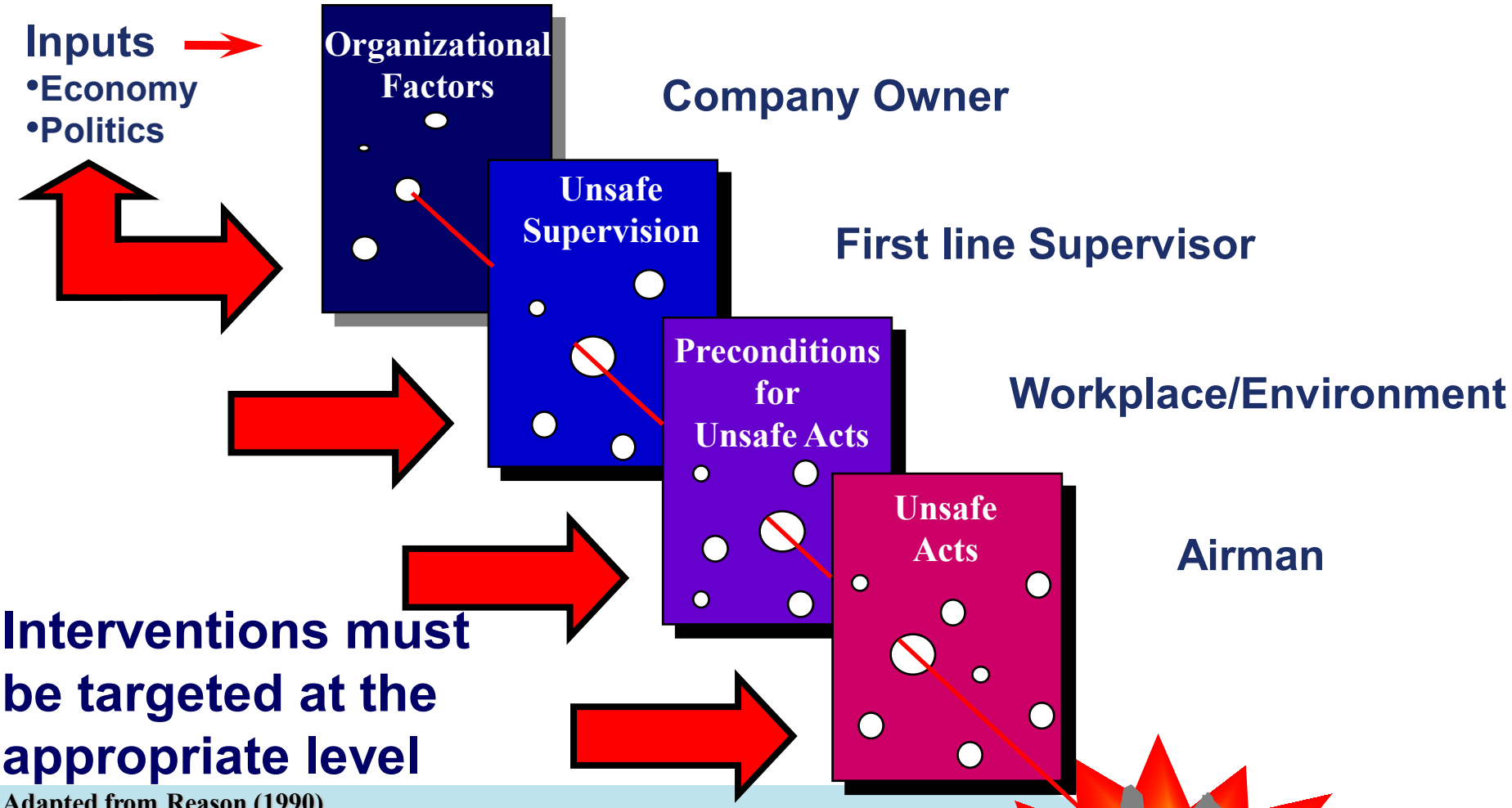
Adapted from Reason (1990)

Safety significant errors can occur at all levels of the system



Adapted from Reason (1990)

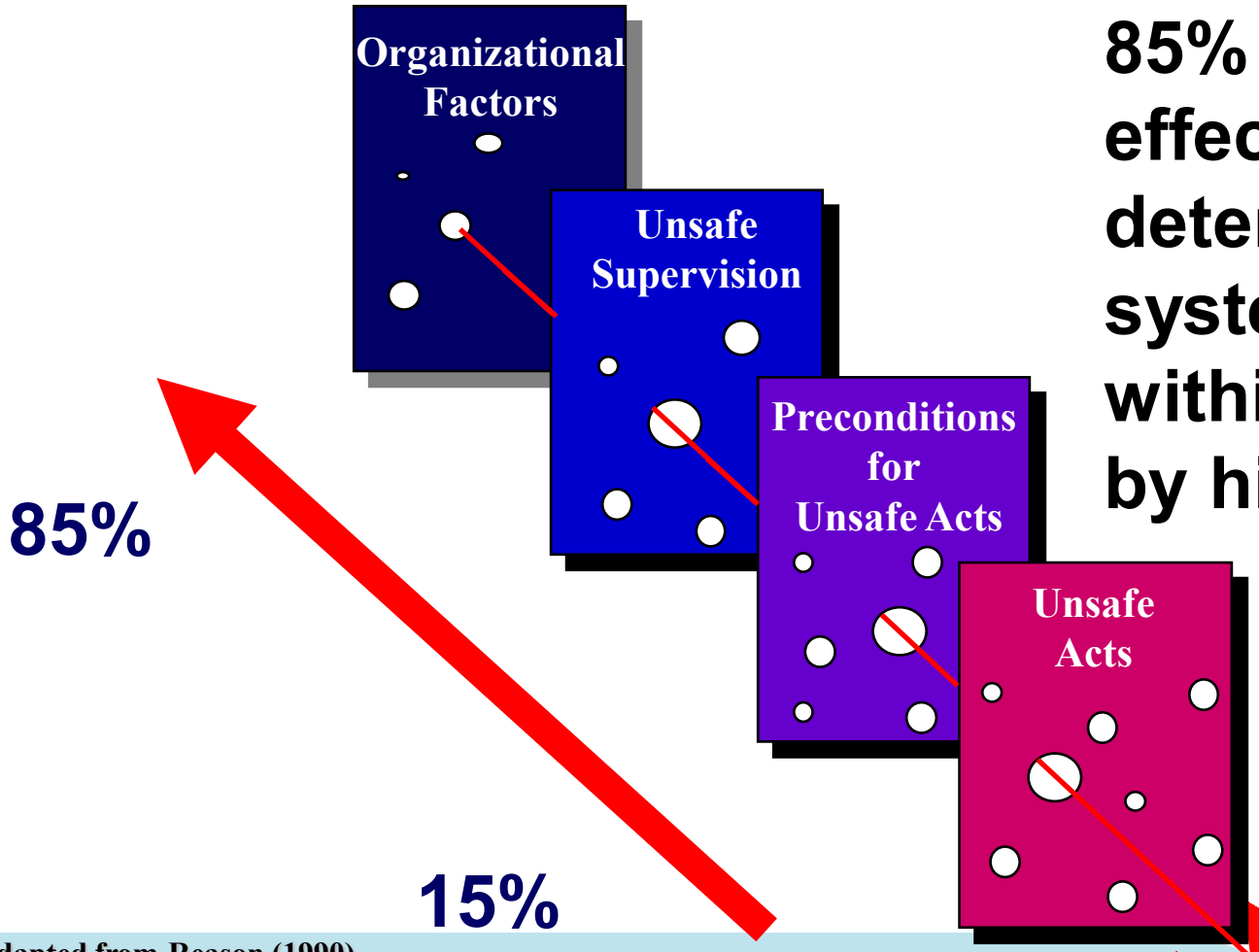
There is no one best way



Interventions must be targeted at the appropriate level

Adapted from Reason (1990)

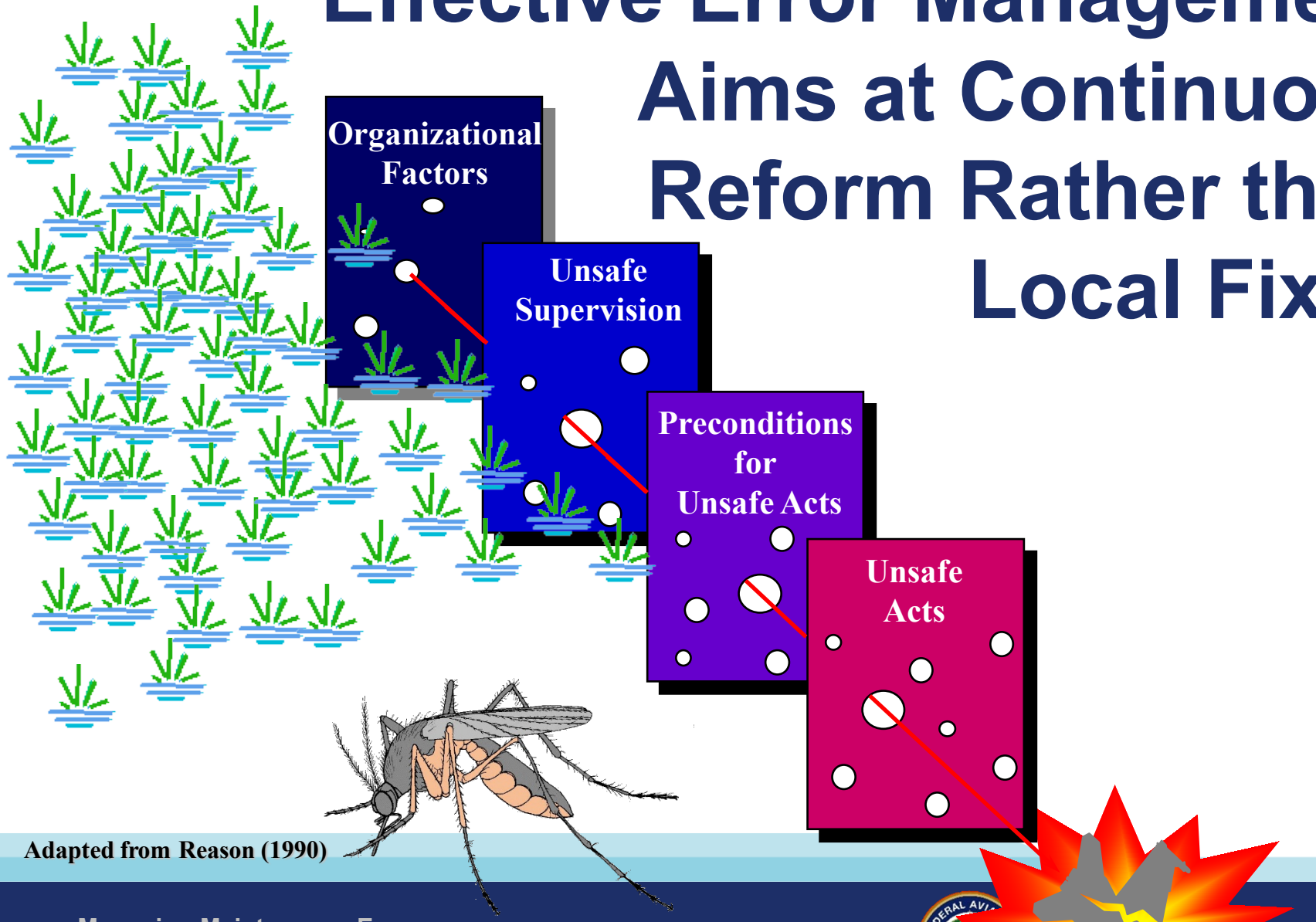
W. Edwards Deming's 85/15 Rule



85% of a worker's effectiveness is determined by the system he works within, only 15% by his own skill

Adapted from Reason (1990)

Effective Error Management Aims at Continuous Reform Rather than Local Fixes

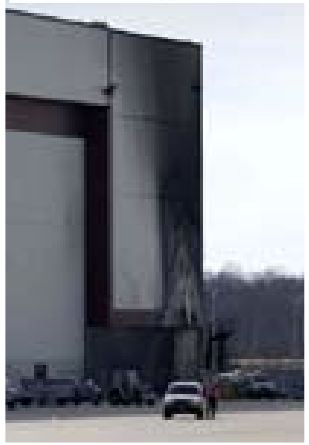


Adapted from Reason (1990)

Charlotte, North Carolina 2003

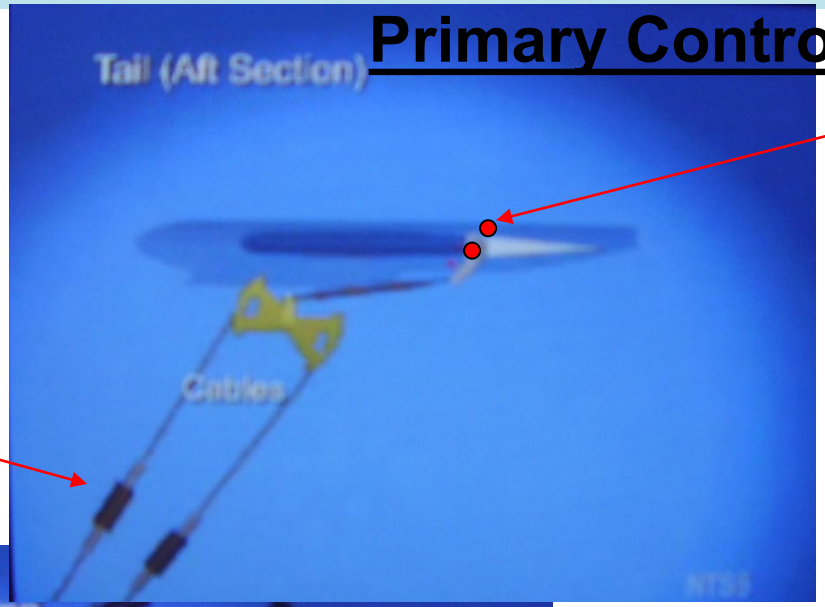
On January 8, 2003, about 08:47 AM, a US Airways Express flight 5481, a Beechcraft 1900D, N233YV, crashed shortly after takeoff from runway 18R at Charlotte-Douglas International Airport, Charlotte, North Carolina.

SOURCE: US Airways; Mesa Air

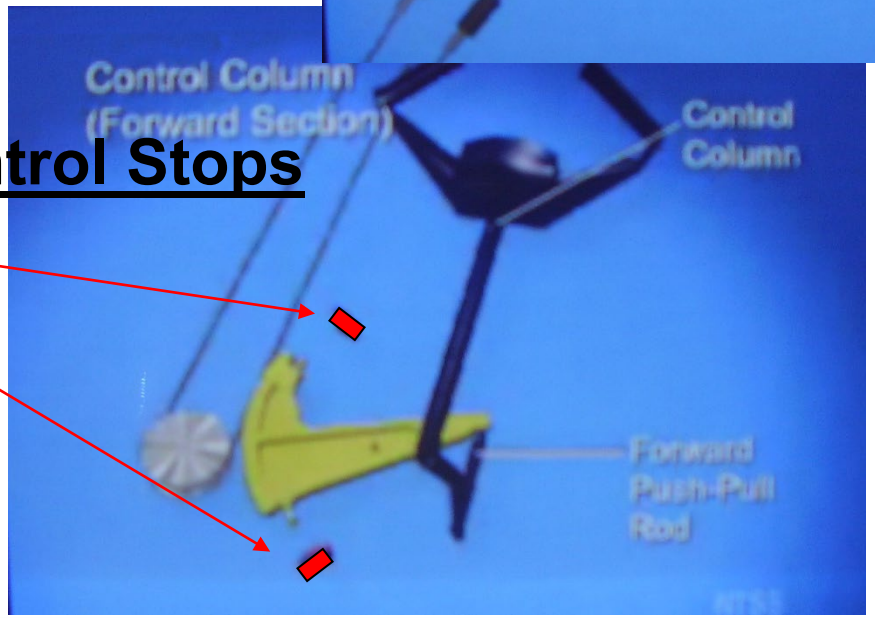


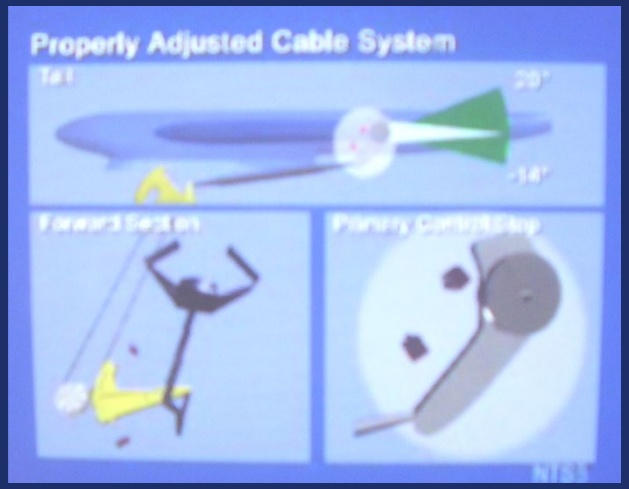
Primary Control Stops

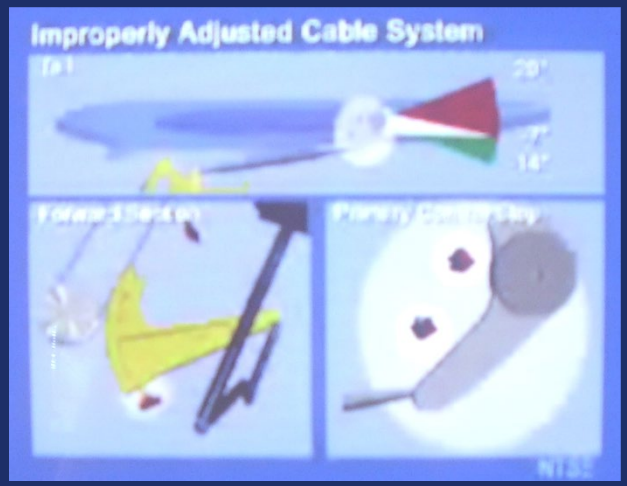
Turnbuckles

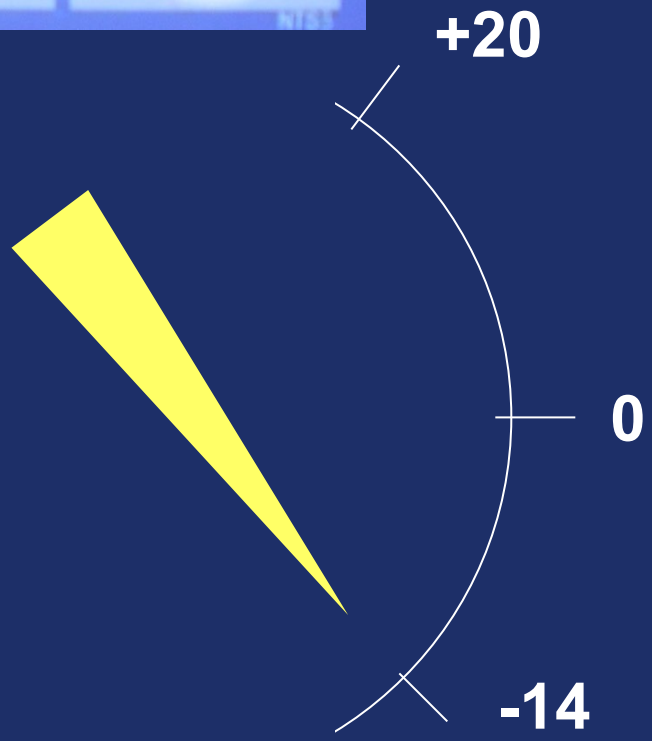


Secondary Control Stops




Properly Adjusted Cable System


Improperly Adjusted Cable System


+20
0
-14


+20
0
-7
-14

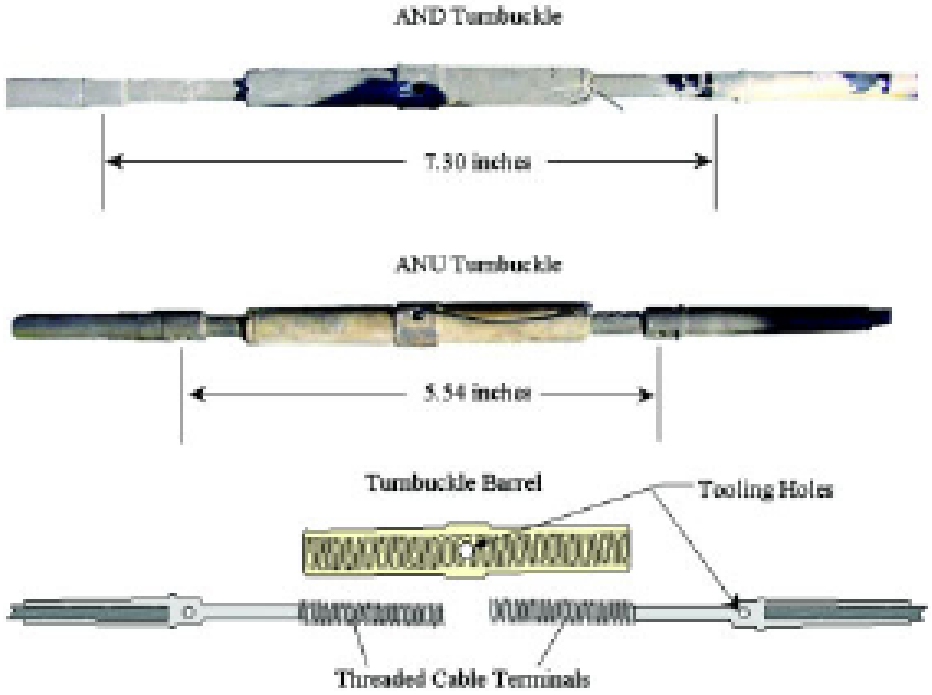


Figure 8. Turnbuckles as found in the wreckage.

The AND turnbuckle was extended 1.76 inches more than the ANU turnbuckle. After the accident, Air Midwest surveyed its entire fleet of 42 Beech 1900D airplanes, which represented 25 percent of the 164 Beech 1900D airplanes active in the North American fleet. Air Midwest data submitted to the Safety Board indicated that, on average, the AND turnbuckle was extended 0.04 inch less than the ANU turnbuckle.

"Insufficient training and supervision resulted in the mechanic making mistakes that led to the incorrect rigging and the restricted downward elevator travel."

Crewmembers:

Name	Age	Domicile (Base)
Captain Katie Leslie	26	Arlington, Texas
First Officer Johnathan Gibbs	28	Scotts Valley, California

Passengers:

Name	Age	Hometown
Caitlin Albury	13	Marsh Harbor, Bahamas
Nicholas Albury	21	Marsh Harbor, Bahamas
Robin Albury	38	Marsh Harbor, Bahamas
Sreenivasa Badam	24	India
Mark Congdon	-	Baltimore, Maryland
Keith Coyner	45	Coral Springs, Florida
Forrest Stephen Demartino	48	Dayton, Ohio
Sylvain Dubois	-	Fort Lauderdale, Florida
Richard E. Fonte	29	Jacksonville, North Carolina
Gary Gezzer	44	Fort Lauderdale, Florida
Steven J. Krassas	39	Richmond, Virginia
Richard R. Lyons	56	Lynnfield, Massachusetts
Ima Pearson	-	Las Vegas, Nevada
Christiana Shepherd	18	Boston, Massachusetts
Joseph M. Spiak	46	Boston, Massachusetts
Ganeshram Sreenivasan	23	India
Paul Stidham,	46	Columbia, Maryland
Michael Otto Sullivan	44	Philadelphia, Pennsylvania
Ralph Sylvia	-	Ashland, Virginia

Beechcraft 1900D Maintenance Program Manual — Date: 08/25/00 — Page: A.149

SIXTH DETAILED INSPECTION PROCEDURES CHECKLIST COPY

#	ZONE	DESCRIPTION	STAMP Mech	STAMP Insp
		AFT FUSELAGE AND EMPENNAGE		
	SB2504	C/W BEECH SB 2504 AS REVISED (ACFT.UE1-UE113)	N/A	
1	280 281 311 312 330 340 320	SKIN - Inspect skin for condition and loose or missing rivets. If damage is found, check adjacent structure	AM 714	DI 701
2		STRUCTURE - Check for cracks, loose or missing rivets and concealed damage.	AM 714	DI 701
3	181 311 312	FLIGHT CONTROL COMPONENTS, CABLES AND PULLEYS - Inspect the control system components (pushrods, turnbuckles, and fittings, castings, etc for bulges, splits, bends or cracks.)	AM 704	DI 701
		Check control cables, pulleys and associated equipment for condition, attachment, alignment, clearance, and proper operation.	AM 704	DI 701
		Inspect cables for broken strands or evidence of corrosion per *BE Chapter 20-04-00.	AM 704	DI 701
		Check cable tension per *BE Chapter 27. Temperature 55 degrees F. 3/16" Elevator Cable Tension: UP 57 DOWN 62. 1/16" Elevator Tab Cable Tension: 30. 3/16" Rudder Cable Tension: LT 75 RT 75. 1/16" Rudder Tab Cable Tension: 20.	AM 704	DI 701
4	311 312	PLUMBING - Inspect plumbing for condition and attachment.	AM 704	DI 701

62
57
119

Figure 1. Detail six work card at the time of the accident.

FORM BH001 — DATE 01/06/03 — AIRCRAFT MAINTENANCE RECORD — PAGE 3 of 5 — COPY

AIRCRAFT #: UE233 N233YV MAKE/MODEL: BEECHCRAFT MOD. 1900D

ACFT F.H.N: 22638 ACFT T.T: ACFT CYCLES:

DISCREPANCY — NATURE OF ACTION

13 Rt eng ignitor worn — R+R Ignitors on Rt Eng IAW B1900 74-00 ops ck normal — PT/SN: CH 34055 — DATE: 1-6-03 — MECH: AM 708 — INSP: N/A

RII 14 Left fuse fuel filter Red change — L/H fuel filter cartridge removed, replaced IAW BMM 28-10-10, leak ops ck normal — DATE: 01-05-03 — MECH: AM 708 — INSP: DI 701

15 Quill shaft sheared — Removed quill shaft, transcribed to ADL 24163 — DATE: 1-06-03 — MECH: AM 714 — INSP: N/A

RII 16 Elevator rig pin installed — Removed elevator rig pin IAW BMM 27-30-00 ops check normal — DATE: 1-06-03 — MECH: AM 714 — INSP: DI 701

RII 17 Rudder rig pin installed — Removed rudder rig pin IAW BMM 27-20-00 ops check normal — DATE: 1/5/03 — MECH: AM 704 — INSP: DI 701

RII 18 Elevator cable tension low — Adjusted elevator cable tension per BMM 27-30-02 ops check normal — DATE: 1/5/03 — MECH: AM 704 — INSP: DI 701

Figure 2. Aircraft maintenance record of nonroutine items for January 6, 2003, at the Huntington, West Virginia, maintenance station.

So, what do we do to these guys?

A. Revoke their certificates

B. Fire them

C. Nothing

D. Retrain them

Console people who make mistakes

Coach people who exhibit risky behavior

Discipline reckless people

"Insufficient training and supervision resulted in the mechanic making mistakes that led to the incorrect rigging and the restricted downward elevator travel."

Workcard was not specific

Maintenance Manual lacked the procedure to accomplish the workcard task

Rigging Procedure did not include a functional check

Lack of experience

"Insufficient training and supervision resulted in the mechanic making mistakes that led to the incorrect rigging and the restricted downward elevator travel."

Lack of training

Lack of Supervision

Fatigue/Shiftwork

Aircraft was aft loaded

FAA's average weight is about 15 lbs. light

MX training is not FAA accepted

People cannot easily avoid those actions they did not intend to commit

James Reason & Alan Hobbs (2003)

Bad Apple Theory

~~Old view~~ Current

System is basically safe

Erratic people undermine it

Need to be:

- -Controlled
- -Punished
- -Exiled

(Sidney Dekker 2006)

New view

System is not basically safe

People are well meaning

Human error is Systematically connected to features of people's:

- -Tools
- -Tasks
- -Organization
- -Environment

Accountability

Backward

Find the bad apple

Punish

Dismiss

Liability

Prosecution

Suspend/Revoke

Forward

Fix the problem

Clean up the mess

Learn

Change

Invest Resources

Deflect Blame

Build trust

Sidney Dekker (2007)

TEAMWORK

Error management is about making good people excellent

Safety Management Systems (SMS) Coming to General Aviation

The Certificate Holder's documented commitment to safety, which defines its safety objectives and the accountabilities and responsibilities of its employees regarding safety.

describing the system, identifying the hazards, and analyzing, assessing, and controlling safety risk.

systematically to ensure the performance and effectiveness of safety risk controls and that the organization meets or exceeds its safety objectives through collecting, analyzing, and assessing information.

communicating safety information to support an organization's safety performance and safety culture.

https://www.faa.gov/about/initiatives/gasafetyoutreach

Questions?

Training and Peace of Mind

- **Technical Training**
- **Safety Related Training**
- **Document in My AMT**