The Safety Space
Track Record

Hull loss per million departures
Pilot Error / Human Factor

1959

2012

- crew
- aircraft
- maintenance
- weather
- airport/ATC
- other
Classical Pilot Error
Solution

20.900
From SHELL...

Source: Frank Hawkins

*Human Factors in Flight*

... via Tripod ./ Swiss Cheese ...

Source: Wagenaar, Hudson and Reason

*Cognitive Failures and Accidents*

... and Bow-Tie ...

Source: Patrick Hudson  *Safety Reporting in Aviation*
… with PDCA and Six Sigma to SMS

Food for Thought, not for Operations.
Real World Operations

- Safety is created by Physical Acts  
  - not by procedures
- Procedures are a Must-Have  
  - but not sacrosanct
- The World is Fundamentally Unpredictable  
  - Fallible Human  - Guardian Angel

Checklists
Procedures
Teamwork
Three Guiding Principles …

1. Rules are Tools

2. Safety is Part of a Whole

3. Resilience is the Backstop

… Six Building Blocks:
Guiding Principle One:

Rules are Tools

Building Blocks 1-4
If you choose to break the rules, you choose not to work here.
Compliance: Does Punishment Help?

- **Slips**
  - Do what you *did not* intend to do

- **Omissions**
  - *Don’t* do what you intended to do

- **Mistakes**
  - Misunderstood, therefore done wrong

- **Violations**
  - Deliberate Deviation
    - Deviation seems to be **Better**
    - Cost seems to be **Unnecessary**
    - Deviation seems **Unavoidable**
Just Culture

Occurrence

Action / Omission Traceable to Actor

- yes

Violation of Rules

- yes

Gross Negligence or Criminal Act

- yes

Punishable

- yes

Occurrence without breach of rules

SMS/QMS for the single purpose of improving

Occurrence

SMS/QMS for the single purpose of improving

Honest Mistake or Optimizing

Judicial System
The Analysis Challenge

Best: Understand

Outside

Better: Analyze

Primitive: Punish

Hindsight

Source: Sidney Dekker

*The Field Guide to Understanding Human Error*

Ashgate (2006)
Solidified Experience

- Policy
- Generic problem
- Human factors
- Unsafe act

Regulators
Actors
Solidified Distrust

Policy

Regulators

Unsafe act

Human factors

Generic problem
Rules as Solidified Experience

- Safety
- Quality
- Efficiency

Best Practice Procedures

CYA Procedures

Time
The First Four Building Blocks

1. Just Culture
2. Occurrence Reporting
3. In-depth Analysis
4. Rules and Procedures as Solidified Experience
Guiding Principle 2: Safety is Part of the Whole

Building Block 5
Operational Reality

Limited Time - Information Incomplete - Must Act

Action Successful

Action Wrong

Action Too Late

Efficiency

Thoroughness

Trade-Off

Source: Erik Hollnagel

The ETTO Principle

Ashgate (2009)
A Common Misperception

"Safety is our number one priority"

Search

About 1,690,000 results (0.11 seconds)
The Real World

Safety can **Never** be the first priority
The Knotted Rubber Band

State Oversight  
Safety Culture  
Protection

Too Much Cost  
Safety Space  
Too Much Risk

Efficiency  
Production

Source: James Reason

The Human Contribution

Ashgate (2008)
Guiding Principle 3: Resilience as Backstop

Building Block 6
Resilience

- Hardware
  - redundant, fail-safe

- Procedures
  - reality check, branching

- People
  - knowledge, skills, tools
**Individual Knowledge and Skills**

<table>
<thead>
<tr>
<th>Basic training</th>
<th>Recurrent training</th>
</tr>
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<tbody>
<tr>
<td>Initial training</td>
<td><strong>Simulator</strong></td>
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<td>Type rating</td>
<td>- Recurrent: twice per year</td>
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<td>- Prof-check: twice per year</td>
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<td><strong>Real Life</strong></td>
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<tr>
<td></td>
<td>- Line-check: once per year</td>
</tr>
</tbody>
</table>

- Recurrent: twice per year
- Prof-check: twice per year
- Line-check: once per year
Tools for the Fallible Human

- Checklists
  - simple but critical acts

- Standard Operating Procedures
  - best practices

- Teamwork
  - use all available eyes, ears and knowledge

Knowledge and Skills based
Into the Future

The Roadmap
Thank you!

Resilience

Part of a Whole

Rules are Tools

Incident Reporting

In-depth Analysis

Just Culture

Resilience

Management System

Tasks, Procedures, Responsibilities, Documents