Evolving Approaches to Managing Safety and Investigating Accidents

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Presentation Outline

• Personal experiences
• Accident causation and prevention - Concepts
• Development of Safety Management Systems (SMS)
  – Hazard identification
  – Incident reporting
  – Safety Measurement
• Role of the Transportation Safety Board (TSB)
• Swissair 111
Early Thoughts on Safety

Standard operating procedures followed +
Attention paid to what’s being done +
Mistakes not made and rules not broken +
Equipment does not fail =

Things are safe
Balancing Competing Priorities
Reason’s Model

Defences Inadequate

Productive Activities Unsafe Acts

Preconditions Psychological Precursors of Unsafe Acts

Line Management Deficiencies

Decision-Makers Fallible Decisions

Occurrence

Limited Window of Occurrence Opportunity

Active Failures & Latent Unsafe Conditions

Active Failures

Latent Unsafe Conditions

Latent Unsafe Conditions

Latent Unsafe Conditions
Desirable characteristics of organizations effectively managing safety

Dr. Ron Westrum, 1998

- Emphasis on organizational safety
- Collective Efficacy
- Task-Resource Congruence
- Free-Flowing and Effective Communications
- Clear Mapping of Safety Situation
- Organizational Learning
- Clear Lines of Authority and Accountability

Westrum, R (1998), Review commissioned by NAV CANADA
## Desirable characteristics of organizations effectively managing safety (cont.)

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Sidney Dekker
Understanding Human Error

• Safety is never the only goal

• People do their best to reconcile different goals simultaneously

• A system isn’t automatically safe

• Production pressures influence peoples’ trade-offs

Sidney Dekker
Understanding Human Error (cont.)

• Human Error is systematically connected to features of people’s tools, tasks and operating environment

• People operate within an organization
  – Organizations determine the environment, tools, training and resources

SMS: Hazard identification

Organizations must proactively identify hazards and seek ways to reduce or eliminate risks

Challenges:

• Difficulty in predicting all possible interactions between seemingly unrelated systems – complex interactions \(^1\)

• Inadequate assessment of risks posed by operational changes – drift into failure, limited ability to think of ALL possibilities \(^2, 3\)

• Deviations of procedure reinterpreted as the norm \(^4\)

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SMS: Incident Reporting

Challenges:

- Determining which incidents are reportable
- Analyzing ‘near miss’ incidents to seek opportunities to make improvements to system
- Voluntary vs. mandatory, confidential vs. anonymous
- Punitive vs. non-punitive systems
- Who receives incident reports
SMS: Organizational Culture

- SMS is only as effective as the organizational culture that enshrines it

- Work groups create norms, beliefs and procedures unique to their particular task, thus becoming the work group culture.

- Undesirable characteristics may develop: lack of effective communication among safety-critical groups, over-reliance on past successes, lack of integrated management across organization.

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2 Columbia Accident Investigation Report, Vol. 1, August 2003
SMS: Accountability

• Recent trends are towards criminalization of human error

• Sidney Dekker, *Just Culture*
  – Safety suffers when operators punished

  – Organizations invest in being defensive rather than improving safety

  – Safety-critical information flow stifled for fears of reprisals

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Elements of a “Just Culture”  
(Dekker 2007)

• Encourages openness, compliance, fostering safer practices, critical self-evaluation

• Willingly shares information without fear of reprisal

• Seeks out multiple accounts and descriptions of events

• Protects safety data from indiscriminate use

• Protects those who report their honest errors from blame

Elements of a “Just Culture”  
(Dekker 2007) (cont.)

- Distinguishes between technical and normative errors based on context

- Strives to avoid letting hindsight bias influence the determination of culpability, but rather tries to see why people’s actions made sense to them at the time

- Recognizes there is no fixed line between culpable and blameless error

About the TSB

• Independent organization investigating marine, pipeline, rail and air occurrences

• Finds out what happened and why

• Makes recommendations to address safety deficiencies

• Not a regulator or a court

• Does not assign fault or determine civil or criminal liability
About the TSB (cont.)

• Reason’s Model adopted in early 90s
  – Multicausality
  – Human error within broader organizational context

• Integrated Safety Investigation Methodology (ISIM)
  – Determining if full investigations are warranted based on potential to advance safety
  – Use of various human and organizational factors frameworks (Westrum, Snook, Vaughan, Dekker)
Swissair Flight 111

- Pilots smell an abnormal odour in the cockpit at 10:11 PM ADT.
- Pilots decide to divert to Halifax at 10:15 PM ADT.
- Pilots declare an emergency at 10:24 PM ADT.
- Communication and navigation radios and other systems lost at 10:25 PM ADT.
- Arrive at Halifax International Airport at 10:31 PM ADT.
- Water impact at 10:31 PM ADT.
Swissair Flight 111
In-Flight Fire Leading to Collision with Water
September 2, 1998, near Peggy’s Cove, NS
Material Flammability

• Material used for insulation was found to be flammable, despite meeting regulatory requirements

• Flammability standards themselves not stringent enough and did not represent realistic operating environments

• Standards focused primarily on materials in the cabin - lower standards for materials used elsewhere in aircraft

• Manufacturer stopped using MPET insulation and issued service bulletin recommending its removal, but no action mandated to remove it by FAA
8 Flammability Recommendations

• More rigorous flammability testing standards
• Removing materials failing standards from service
• Improving certification requirements to better represent realistic operating conditions and systems interactions

Action Taken

• Directives mandated removal of MPET insulation
• New flammability test criteria established
• Guidance material developed for more accurate and consistent interpretation of test standards
Flammability – Outstanding Action

- Comprehensive review of remaining types of insulation
- Quantification and mitigation of risks associated with all materials that failed new flammability standards
- Establishment of test regime to evaluate aircraft electrical wire failure characteristics
- Evaluation of how aircraft systems and their components could exacerbate existing fire
Summary

• Adverse outcomes from complex interactions of factors difficult to predict

• People at all levels in an organization create safety

• ‘Near-misses’ must be viewed as “free opportunities” for organizational learning

Summary

• Accident investigators must focus on what made sense at the time, not be judgmental, avoid hindsight bias²

• Accountability requires organizations and professionals to take full responsibility to fix problems³, ⁴
