The management of risk and safety investigation - the need for an integrated approach

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The Aviation System: Output

Achievement of business and operational objectives while maximising the conservation of people and assets

- **In aviation, the concept of 'safety' is an integral dimension in achieving these system objectives.**
- **It is not an 'add on': it is woven into everything we do**

The application of the Reason Model in air safety investigation showed that adverse outcomes – accidents and incidents – are invariably the consequence of a malevolent combination of pre-existing, or latent, deficiencies in systemic factors and local triggering events and circumstances prevailing at the time of the occurrence

Lockhart River, Queensland, 7 May 2005

Figure 19: General view of the accident site looking toward the south-east

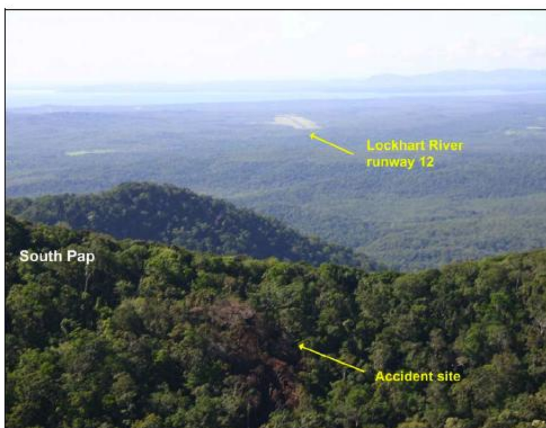


Figure 21: View along the direction of travel showing the rock outcrop and main wreckage in the background

The systemic approach to air safety investigation became an ICAO Standard in 1994

- The outcomes of the international adoption of a systemic approach to air safety investigation since1994 have been key drivers for the adoption of safety management systems as ICAO standards in civil aviation.

The systemic approach to safety investigation has consistently shown that, for almost every aviation accident or incident, civil or military:

- The primary contributing systemic factors were all present before it happened.
- In many cases, they were relatively common knowledge, and had often been formally documented.

- **In all cases, the primary systemic factors which contributed to the accident could, and should, have been identified and rectified before the accident, if an integrated safety management system had been "in place, operational, and effective"** ***(Hudson).***

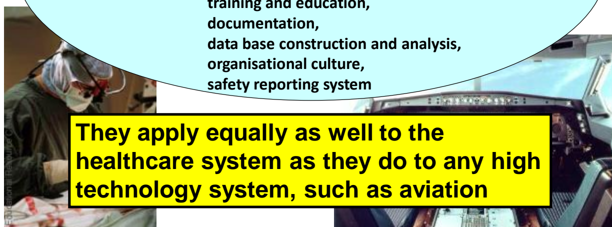
Figure 13 – A new section of Taxiway N1 centreline marking added and Runway 05R threshold markings (piano keys) being removed soon after the accident

"Systems for managing safety" versus "Safety management systems"

For many years aviation has had in place many traditionally independent systems for managing safety, and these have served us well – flight operations, maintenance, air traffic management

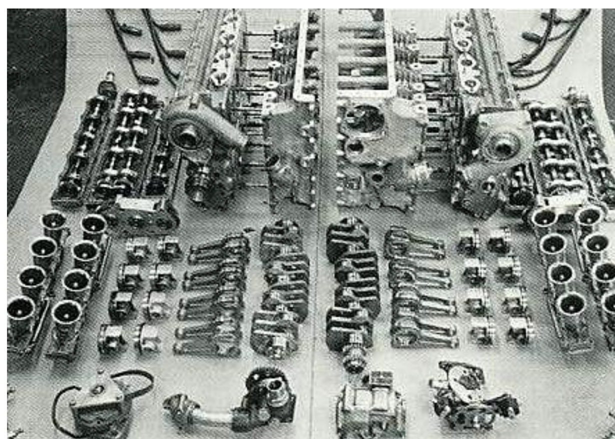
However, with few exceptions, we have not had in place fully integrated safety management systems

The basic structure and core components of safety management systems are generic

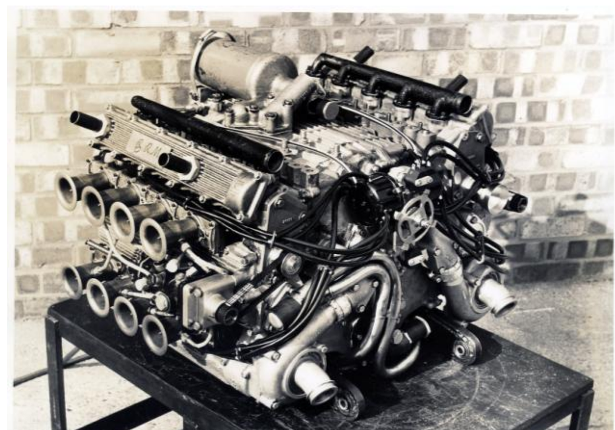


- senior management commitment,
- hazard identification and analysis,
- risk management,
- accident and incident investigation,
- audit and evaluation,
- proactive accident prevention programs,
- training and education,
- documentation,
- data base construction and analysis,
- organisational culture,
- safety reporting system

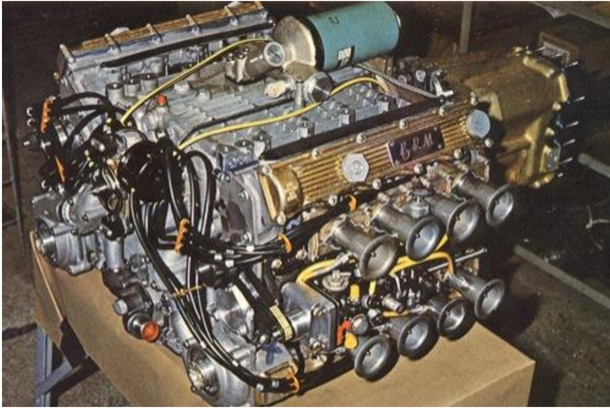
They apply equally as well to the healthcare system as they do to any high technology system, such as aviation



Consider an engine: you might have all the components...



But, until they are assembled, you do not have a functioning engine



The assembled engine then needs to be installed in a vehicle, to have a functioning system – in this case, a Formula 1 racing car

However, even a fully integrated system will fail if the design of the system itself is fundamentally flawed.

Safety Management System - more than just the components

- An airline may have present within it all of the elements of a safety management system
- However, if they do not function as an integrated system, it does not have an SMS – even though it might pass an SMS audit by the regulator
- This result would simply show that there is a serious deficiency in the audit protocol used by the regulator

- Many comprehensive, time-consuming, and extremely expensive investigations have served merely to identify independently pre-existing deficiencies in systemic factors, and to confirm their presence prior to the accident.

- This type of finding is almost always the same

  The "usual suspects" always turn up...

Examples of deficiencies in systemic (organisational) factors

- Inadequate Safety Management System.
- Lack of Management Commitment.
- Incompatible Goals
  - scheduling pressures vs safety.
- Poor Authority and Responsibility.
- Inadequate Communication.

Examples of deficiencies in systemic (organisational) factors

- Poor Risk Management.
- Inadequate Resources Management.
- Poor Training.
- Inadequate Design.
- Inadequate Specification/Requirements.
- Unsuitable Materials.

Examples of deficiencies in systemic (organisational) factors

- Inadequate Monitoring and Measurement.
- Poor Management of Change.
- Poor Contractor/Supplier Management.
- Inadequate Provision of Resources.
- Poor Documentation.

ROYAL AUSTRALIAN NAVY

NIAS ISLAND SEA KING ACCIDENT

BOARD OF INQUIRY REPORT

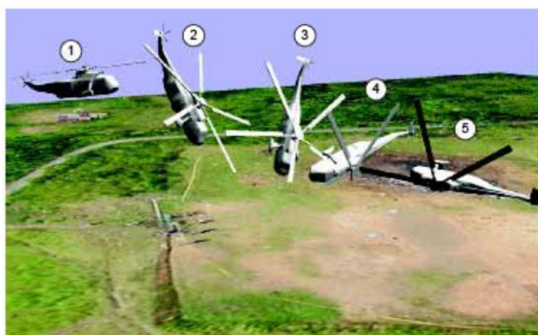


Figure 5.6: Five-Stage Accident Sequence Model

Figure 6.9: Photograph of the wreckage looking due south, showing the extent of fire damage and identifying some of the aircraft features.

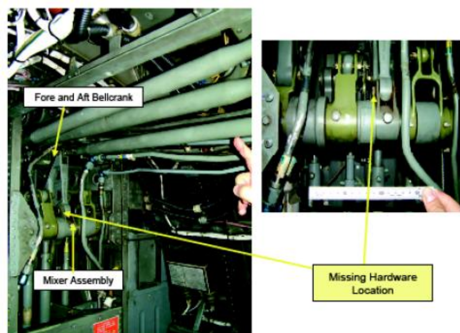


Figure 6.10: Mixing Unit location in the aircraft

The loss of RAF Nimrod XV 230: A Failure Of Leadership, Culture And Priorities
- by Charles Haddon-Cave QC

XV230

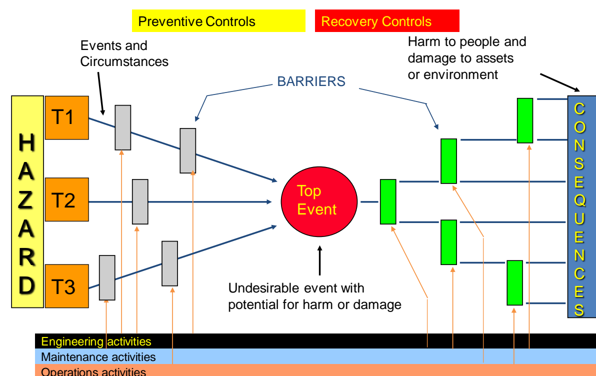
General malaise

The Nimrod Safety Case process was fatally undermined by a general malaise: a widespread assumption by those involved that the Nimrod was 'safe anyway' (because it had successfully flown for 30 years) and the task of drawing up the Safety Case became essentially a paperwork and 'tick the box' exercise.

New thinking in aviation safety management

- Changing our primary focus from the adverse events to:
  - the preventive controls that failed
  - the recovery controls that worked
- Why?
- Because the same sets of preventive and recovery controls are common to many generic categories of operational adverse events
  - breakdowns in separation, runway incursions, altitude busts, incorrect maintenance operations, etc

Basic Bow Tie Concept



The Bow Tie and safety management in flight operations

HAZARD
TOP EVENT
CONSEQUENCE
Breakdown in separation
Preventive Controls
Recovery Controls
AIRCRAFT
T1
T2
T3
ASOR 1
ASOR 2
ASOR 3
ASOR 4
MID AIR COLLISION
Engineering activities
Maintenance activities
Operations activities

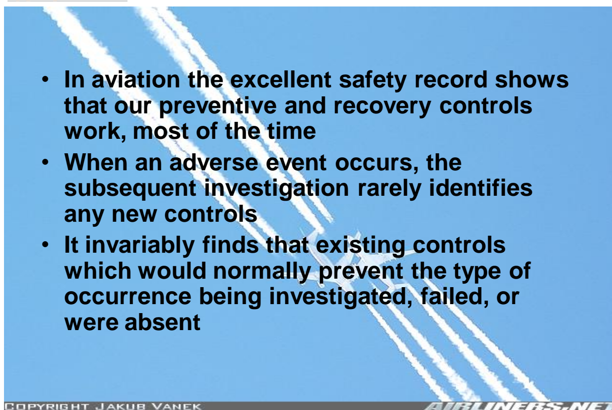
The Bow Tie and safety management in aircraft maintenance

HAZARD
TOP EVENT
CONSEQUENCE
Part fitted incorrectly
Preventive Controls
Recovery Controls
MAINTENANCE OPS
T1
T2
T3
ASOR 1
ASOR 2
ASOR 3
ASOR 4
AIRCRAFT UNAIRWORTHY
Engineering activities
Maintenance activities
Operations activities

- **The reactive investigation process and the proactive management of risk both consider the same controls:**
  - **The assessment and management of risk: before the occurrence**
  - **The investigation: after the adverse event**

Risk Management and Safety Investigation are two sides of the same coin

  - **Therefore, they require an integrated approach in managing the safety of the aviation system**



A new tool for the management of risk in aviation

The ARMS Methodology for Operational Risk Assessment in Aviation Organisations

Developed by the ARMS Working Group, 2007-2010

The objective for Operational Risk Assessment (ORA) is the assessment of operational risks in a systematic, robust and intellectually cohesive manner.

Operational Risk Assessment is needed in three different contexts:

1. Individual safety Events may reflect a high level of risk and consequently require urgent action. Therefore all incoming events need to be risk assessed.

   This step is called Event Risk Classification (ERC).

2. The Hazard Identification process may lead to the identification of Safety Issues, which need to be risk assessed to determine what actions, if any are needed.

   This step is called Safety Issue Risk Assessment (SIRA).

3. From time to time there will be a need to carry out Safety Assessments, typically related to a new or revised operational activity (e.g. new destination).

   The activity needs to be risk assessed at the planning stage, according to the “Management of Change” process of the company

- In all three cases, the risk assessment must consider the *potential* consequences in addition to the observed *actual* consequences of events.
- The methods used in the three cases should be compatible so that outputs from one can be used in another.

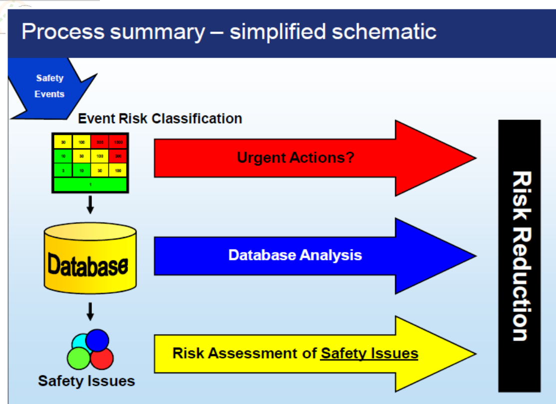


Figure 1. Simplified way to present the Risk Assessment process.

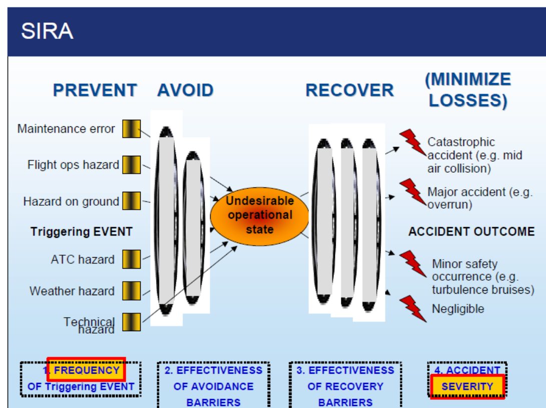


Figure 7. The model behind the Safety Issue Risk Assessment.

Conclusion

Aviation is adopting a new way of thinking about safety management

To improve air safety even further, the time has come to develop and adopt a fully integrated approach to the management of risk and safety investigation

It is a work in progress

The Healthcare system undoubtedly has many unique characteristics when compared to aviation

However, these differences should not be used as an excuse not to investigate and learn from the way safety is managed in the aviation system

Thank you