Using Incident Investigation Tools Proactively for Incident Prevention.

Joanne De Landre
General Manager, Safety Wise Solutions
ANZSASI 2006 - Melbourne

Introduction

- Reducing Error
- Investigative Tools / Frameworks
- Incident Cause Analysis Method (ICAM)
- Proactive Application
- Aviation Case Study - NTSB
  - Learjet Accident in 1999.
- Conclusion

Reducing Error

- Can simply correcting the deficiencies found through incident investigations reduce error?
  - Modern safety theory suggests that relying on correcting deficiencies found through incident investigation as a means to reduce error is restrictive.
- Many incidents occur, not because they cannot be prevented, but because of:
  - Gaps in their safety systems,
  - Failing to learn or retain the lessons from past incidents.
- Future direction for incident prevention:
  - using investigation methodologies as a tool that integrate with and compliment pre-existing processes.

Investigation Tools/Frameworks

- Principle objective:
  - Prevent recurrence, reduce risk and advance health and safety performance.
- Provide guidance for the Investigation Team.
- Effectiveness in reducing error needs improvement.
  - Not focused on, therefore not truly effective at making organisations “safer”.
- Good investigative tools / frameworks are able to be used not only *reactively*, but also *proactively*.
- ICAM
  - Holistic tool.
  - Improve safety at an organisational level.

Incident Cause Analysis Method - ICAM

- ICAM stems from the work of Professor Reason and his modelling of organisational accidents.
- Systems approach - not only looks at *what* happened, but *why* it happened.
- Designed to ensure that the investigation is not restricted to the errors and violations of operational personnel.
- ICAM is an analysis tool that sorts the findings of an investigation into a structured framework consisting of four elements.

ICAM Model of Accident Causation

Objectives of ICAM

- The objectives of incident investigations using ICAM:
  - Establish the facts
  - Identify contributing factors and latent hazards
  - Review the adequacy of existing controls and procedures
  - Report the findings
  - Recommend corrective actions which can reduce risk and prevent recurrence
  - Detect organisational factors that can be analysed to identify specific or recurring problems
  - Identify key learnings for distribution
- It is **not** the purpose of an ICAM Investigation to apportion blame or liability.

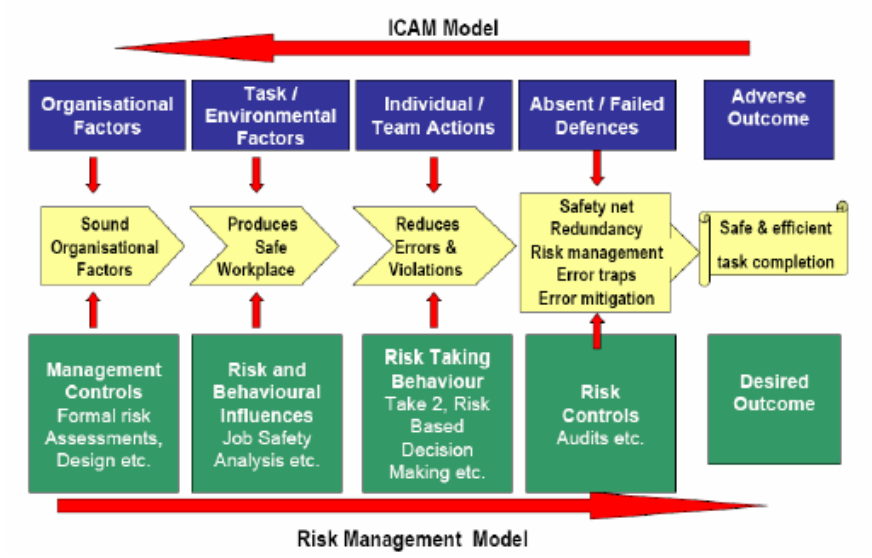
Applying ICAM Proactively

- Extremely effective reactive tool
  - Development of safety performance improvement strategies.
- Future direction – proactive use of the model.
- For incident reduction to occur, precursors to error must be identified and rectified.
- Error management systems needed to:
  - Reduce error,
  - Mitigate the consequences of error; and
  - Proactively prevent incidents.

ICAM Error Management Strategy

- 3-way strategy to manage workplace errors.

Applying ICAM Proactively



Case Study

- ICAM is used widely for the investigation of incidents throughout the aviation, rail, mining, marine, medical and petroleum industries.
- Aviation Case Study - demonstration of how the proactive use of ICAM may have identified precursors to error, effectively breaking the links that led to the accident.
- Learjet Accident
  - 25th October 1999
  - Near Aberdeen, South Dakota USA
  - Pax included Professional Golfer, Payne Stewart.

Accident Summary

- Learjet Model 35 (N47BA) flown from Sanford on the morning of the accident to Orlando Florida, where passengers boarded.
- Flight departed Orlando for 'Love Field' in Dallas, Texas with two pilots and four passengers at approx. 0919 hours.
  - Planned flight time: 2 hours
  - Fuel - Aircraft had approx. 4 hours & 45 minutes flying time.
- Air Traffic Control cleared the aircraft to FL 390 at 0944 hours
  - aircraft was NW of Gainesville, Florida, climbing through 37,000 ft.

Accident Summary

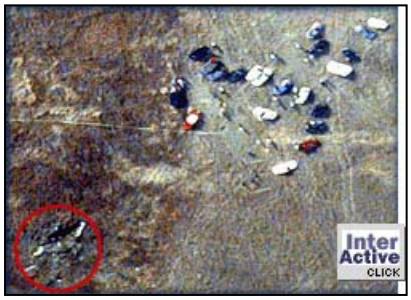
- ATC lost radio contact with the flight at this point.
- The aircraft proceeded on a northwest heading at approximately 45,000 ft.
- Alarm raised – aircraft intercepted by military aircraft.
  - Pilots reported the forward windshields seemed to be frosted over or covered with condensation.
  - No structural anomalies or other unusual conditions noted.
- At 1326 hours, the Learjet departed controlled flight and spiralled to the ground
  - All occupants sustained fatal injuries
  - Aircraft destroyed

Accident Summary

- Diagram shows planned route and deviation.

Accident Summary

- Aerial photograph to the right displays emergency vehicles parked near the site - Learjet wreckage circled in red.



- Investigators at the accident site.

Accident Summary

- Rescue workers at the accident site

- FAA Investigator at the accident site.

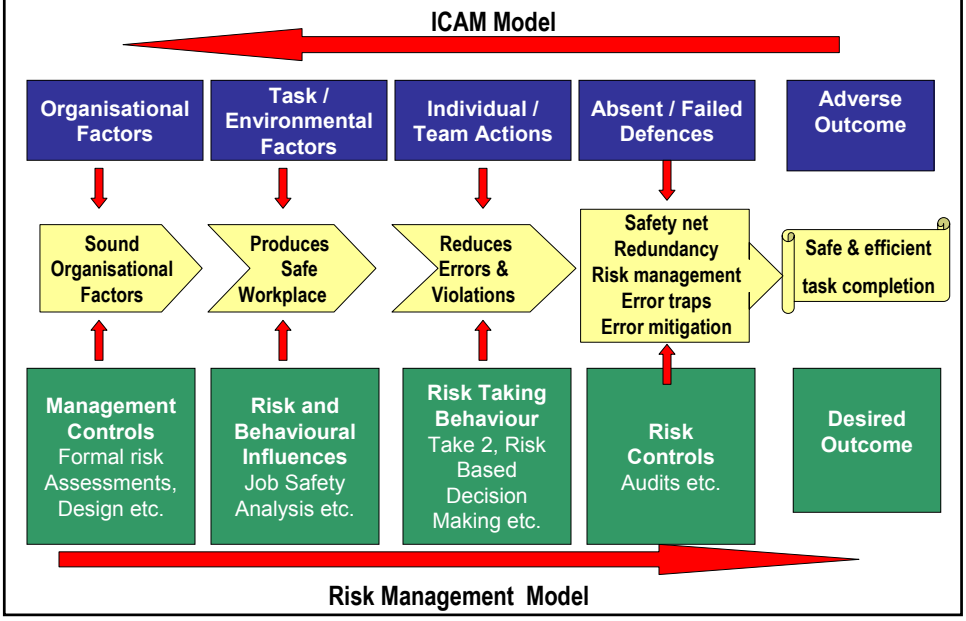
Investigation Challenges

- NTSB
  - Difficult investigation – much of the physical evidence destroyed.
  - As the aircraft impacted at nearly supersonic speed and at an extremely steep angle, none of its components remained intact.
  - The airplane was not equipped with a flight data recorder and it had only a 30-minute cockpit voice recorder, which was of limited use during the investigation.
  - All of the investigators involved in the investigation were also investigating other accidents. The Investigator-in-Charge was working on four other investigations in addition to this one.

Probable Cause of Accident

- NTSB Findings:
  - Incapacitation of the flight crew members as a result of their failure to receive supplemental oxygen following a loss of cabin pressurisation, for undetermined reasons.
  - The Safety Board was unable to determine why the flight crew could not, or did not, receive supplemental oxygen in sufficient time and/or adequate concentration to avoid hypoxia and incapacitation.
- ICAM applied to the accident based on the contributing factors identified in the NTSB Report.

Reactive Use of Model



Application of ICAM

- Absent / Failed Defences
  - Unable to maintain cabin pressurisation
  - Lack of bleed air supply to the cabin
  - Closed flow control valve (supplying warm air to windshield)
  - Timeliness/warning for donning oxygen masks
  - Oxygen quality/quantity
  - Incomplete standardised manual and procedures
  - Previous inconsistencies in application of SOP's
  - Crew pairing of inexperienced captain and first officer
  - Limited flying time on type by Captain
  - Maintenance procedures not adhered to, some verbal, incomplete written, some not signed off.

Application of ICAM

- Individual / Team Actions
  - Crew did not don oxygen masks in a timely manner
  - Crew did not detect the onset of hypoxia

Application of ICAM

- Task / Environmental Conditions
  - Loss of cabin pressurisation
  - Flow control valve closed
  - Limited time of type
  - Altitude
  - Low pressure evident in cabin (via alarm)
  - Ambiguity surrounding effectiveness of alarm system
  - Lack of supplemental oxygen
  - Hypoxia / Incapacitation

Application of ICAM

- Organisational Factors
  - Deficient monitoring/ auditing of maintenance item completion
  - Equipment not fit for purpose- suspected valve problems with closure of flow control valve.
  - Process of managing the introduction of new aircraft.
  - Incident reporting system deficiencies.
  - Inadequate procedures for checking quality and quantity of on board emergency oxygen bottle.
  - Deficiencies in maintenance control – use of MEL etc.
  - No evidence of risk appreciation process used.

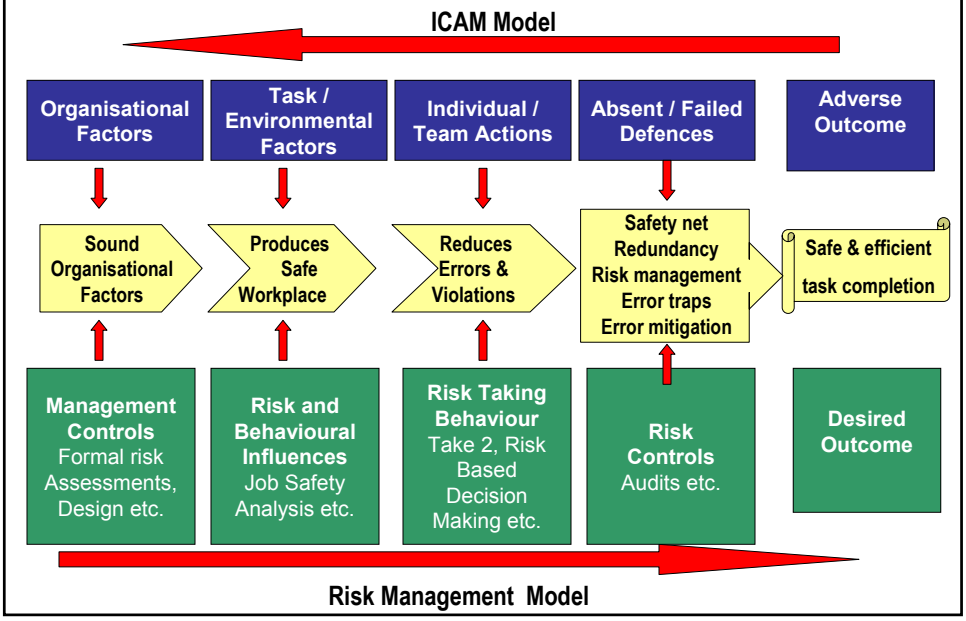
Application of ICAM

- Organisational Factors cont…

.

  - Ambiguous monitoring by management of resources, climate and processes of a safe working environment.
  - Incomplete corporate commitment to safety.
  - Failure to revise maintenance strategy.
  - Failure to appreciate the risk exposure or vulnerability within the organisation.
  - No follow-up from previously failed defenses – identification, tracking and resolving maintenance items and adverse trends.

Proactive Use of Model



Identifying the Precursors

- Application of a proactive tool may have been able to identify the precursors and break the error chain.
- Given the contributing factors found and the types of issues that are typically found during the proactive application of ICAM:

.

  - Poor follow through on work procedures.
  - Incomplete standardised manual and procedures.
  - Monitoring / audit processes.
  - Change management issues (new aircraft).
  - Crew pairing
  - Risk Management
  - Procedures for checking quality/quantity of oxy bottle.

Benefit of Proactive Approaches

- Proactive error mangement strategy that leads to overall incident reduction is beneficial and can be measured in both tangible and intangible means.
- The proactive use of tools such as ICAM can provide safety learnings without the costs associated with an incident.
- By designing error tolerant workplaces that will reduce error, organisations have the potential to mitigate error consequences and therefore, proactively prevent incidents.
- Shift in focus from investigation findings to preventative safety.

- *"Our investigation and corrective actions tend to be based on the amount of damage and injury – which is random. We don't really have prevention programs; we have accident correction programs."*

  – Richard Wood (1997). Aviation Safety Programs – A Management Handbook.

Conclusion

- Correcting the deficiencies found using standard reactive incident investigation methods should reduce and manage the errors that led to a particular incident.
- However, to reduce the precursors to error and fundamentally improve the safety of an organisation, a more proactive approach is required.
- The proactive use of investigation methodologies may enable the precursors to error to be identified and remedied prior to actual occurrences….. saving time, money and perhaps lives.

Further Details

Joanne De Landre

General Manager - Safety Wise Solutions

Email:

jo.delandre@safetywisesolutions.com

Mobile: 0414 804 771