Airline Reliability Program & SMS – Reactive to Predictive

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QANTAS Engineering
So this is what getting it right looks like
But Sometimes We Get It Wrong
Question 1

Could this have been prevented?

I think we can all agree and say:

YES
Question 2

Can such an incident be predicted?

Hmmmmmmmmmm

Well that is another question altogether
Reactive Error Management

Traditional learning comes from a Reactive process

But, can we learn what the underlying and causal factors are before such an event occurs?
Reactive to Predictive – Let’s Consider the Possibilities

- What we have learnt from 100 Years of Aviation
- What influence has our own maintenance & safety culture had
- Changes made in maintenance culture – last ten years
- Moving to Proactive Error & Violation Management
- Effects on Reporting & Risk
- The Challenge – moving from Reactive to Proactive to Predictive
- Mitigation by Risk
- Predictive Mitigation Example
- Conclusion

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Firstly Let’s Consider What We Have Already Learnt

What have we learned over 100 years of Aviation

Human Beings & Aeroplanes
don’t always go well together
Safety/Complexity – Trade Off
Queensland and Northern Territory Aerial Services (QANTAS) was registered in 16 November 1920.

- 1 Chairman (he had the money)
- 2 Pilots
- 1 Mechanic
- 1 Aeroplane
So let’s Have a Look Back in Time

Trans Australian Airlines (TAA) born from the Australian National Airways Commission

- 2 DC3s
- Ex Qantas Operations Manager
- Government Backing

Lester Brain, 1st General Manager
Arthur Coles – Commission Chairman

DC4 Skymaster 1946
Aircraft Maintenance Culture

- Early Years
  - Big Country/Big World
  - Long Distances
  - Maintenance Must do became “Can Do”
Aircraft Maintenance Cultural Heritage – Complexity in People In Australia
Aircraft Maintenance Cultural Heritage – Complexity in People From Overseas
Understanding Maintenance Culture

Training & Experience
National Culture
Professional Culture
Company Culture

Management Behaviour
Reporting Culture
Just Culture
Change Management

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• Historical Approach

Aircraft Maintenance Cultural Heritage – Maintenance Error

- Maintenance Event
- Maintenance Event Caused by Error
- Who made the Error
- Punitive Action
• Results of Historical Approach:
  - Hiding Errors due to fear of punitive action
  - Hiding Errors due to embarrassment
  - Hiding Errors due to Pride
  - No reporting of safety and quality issues
  - Reporting to Regulator via confidential reporting
  - No organisational learning or accountability
Now Then – What about the last Ten Years in QANTAS Engineering Safety Management

From these beginnings

To 2005
Moving from Reactive to Proactive

A few examples of proactive measures in Qantas Engineering:

• Human Factors and Error Management Training including management.
• Just Policy and culpability
• Reporting System including confidential system
• New Error Investigation Training and Practices
Non Technical Skills Training – Awareness Proceeds Behavioural Change - Proactive

Human Performance
- Stress Awareness
- Drug & Alcohol Awareness
- Vision
- General Health
- Motivation

Human Factors
- Fatigue Awareness & Management
- Communication
- Teamwork
- Co-Workers
- Distraction
- Workload/Multi-tasking
- Noise
- Confusing Maintenance
- Data
- Climatic Conditions
- Complex Systems
- Unavailable or Inaccurate procedures
- Awareness
- Memory
- Lighting
- Perception
- Supervision
- Concentration
- Hearing
- Complacency

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Investigating Links

People and Procedures

People and Machines

People and People

People and Environment

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Moving from Reactive to Proactive
QANTAS Engineering

The Beginning
2005 → 2007 (Reactive)

Enhanced Programs
2007 → 2014 (Proactive)
The Story so Far – QANTAS Engineering

No Programs | The Beginning | Enhanced Programs
---|---|---

- **2004**: No Programs
- **2005-2007**: The Beginning
- **2008-2012**: Enhanced Programs

- **Risk**
  - High
  - Medium
  - Low Risk
  - Very Low

- **Reporting**

Paper Based Reported Occurrences

- **Online Based Reported Occurrence**
The Story so Far – QANTAS Engineering

Reporting has stabilized (2.3 reports per person per year)

Risk Level has now plateaued
Maintenance Risk Plateau

Level of Risk

[Bar chart showing the count of nature of report from 2007 to 2015, with a trend line indicating a decrease in risk levels over time.]
The Challenge

Moving from Reactive to Proactive and Predictive – QANTAS Engineering

The Beginning

2005 → 2007
(Reactive)

Enhanced Programs

2007 → 2014
(Proactive)

2015 → (Predictive)
The Challenge - Moving to Predictive

What are the elements required?
Moving to Predictive Requires Data
Event Reporting

- Easy to Use (online)
- Employees given time to report
- Employees allowed to report
- Provide employees feedback on reporting
- Risk rate reports
- Prioritise
- Ensure Just Culture policy is used
Data Sharing Partnerships

- Airlines & Manufacturers
- Regulators & Other Industry
- World Data
Existing Database

- Safety Investigations
- Maintenance Error Investigations
- Audits
- Other relevant database information

Existing Data
What is the Data Trying to Say

**MEDA Investigation Data Base**

- **Installation Error**: 174 (42%)
- **FOD Error**: 27 (6%)
- **A/C / Equip Damage Error**: 50 (12%)
- **Airworthiness Control Error**: 61 (14%)
- **Other Maint Error**: 26 (6%)
- **FVT/Test/Inspec Error**: 55 (13%)
- **Repair Error**: 8 (2%)
- **Servicing Error**: 21 (5%)
What is the Data Trying to Say

- MEDA Codes
- Investigations
- Data base

<table>
<thead>
<tr>
<th>Cause</th>
<th>Number of Causes</th>
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</thead>
<tbody>
<tr>
<td>A.4. Inadequate (Info)</td>
<td>111</td>
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<tr>
<td>K. Other Issues</td>
<td>68</td>
</tr>
<tr>
<td>A.8. Information not used (Info)</td>
<td>67</td>
</tr>
<tr>
<td>H.7. Work Process/Procedure</td>
<td>65</td>
</tr>
<tr>
<td>F.6. Complacency</td>
<td>62</td>
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<tr>
<td>F.3. Time constraints</td>
<td>56</td>
</tr>
<tr>
<td>F.8. Workplace distractions/interrupts</td>
<td>48</td>
</tr>
<tr>
<td>J.2. Between Engineers (Communication)</td>
<td>42</td>
</tr>
<tr>
<td>F.9. Memory lapse (Forgot)</td>
<td>41</td>
</tr>
</tbody>
</table>

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Bow Tie Methodology

**THREAT**
- The thing we want to do or use
- Need to maintain control over this as it is potentially dangerous

**HAZARD**
- Direct potential to cause a “Top Event”, which may release/ change the desired state of the hazard

**TOP EVENT**
- The point where control is lost
- This event does not actually cause the damage (the “consequence” does)

**CONSEQUENCE**
- Has potential to cause damage or harm (but is not the actual loss or damage)

**LOSS / DAMAGE**
- Loss/damage to People, Environment, Assets/Value, Reputation, etc

**ESCALATION FACTOR**
- Potential to defeat or reduce effectiveness of control

**Recovery Measure**
- • Loss/damage to People, Environment, Assets/Value, Reputation, etc

**Qantas Engineering**
Bow Ties can shift along the causal chain

- The focal point (Top Event) is a choice (it is not fixed)
- Find a natural starting point (ie, normal vs out of control)
- Start at the macro level and - drill down (zoom in / out) - slide along the sequence of events (point in time)
Risk Assessments & Risk Modelling

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Risk Assessment & Modelling
Risk Assessments & Risk Modelling
Observations, Surveillance, & Gut Feel

Audits
- Self Audits
- Cross Port Audits
- Surveillance Programs
- Maintenance LOSA Program

Observations and Surveillance
- Internal & External Audit Results
- Focus Groups

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Moving to Predictive Requires Data

- Audits
- Observations & Surveillance
- Risk Assessment & Modelling
- Existing Data
- Event Reporting
- Airlines & Manufacturers
- Regulators & Other Industry
- World Data
Review data to build a Profile

- Build a Profile
- Assess the risk
- Where required apply a Change Management Plan
- Mitigate using Hierarchy of Risk Control
- Review and adjust
- Stay the course
Mitigate Using Hierarchy of Risk Controls

Risk Assess

More desirable

• Eliminate
• Substitute
• Engineer
• Administration
• Personal protective equipment

Less desirable
Predictive Mitigation Example – A330

- A330 Nose Landing Gear Full Service
- Error Prone Task
- Reports and Investigations show complexity in task leading to possible incorrect servicing.
- Training package now imbedded within the task.
- At the time of the task, engineers attend training specifically for the task.
- Task briefing on job prior to commencing
Predictive Mitigation Example – A330

A330 NLG Shock Absorber

- The Airbus A330 Nose Landing Gear (NLG) has an oleo-pneumatic shock absorber.

Tooling and Equipment

- Locally developed combined P1 and P2 gauge kit (Digital)
Conclusion – Just Policy

Just Policy

- Must have a Just Policy and Procedure
- Consistently applied across all activities
- Consistently applied across the whole company
- Actions based on behaviours not the outcomes
Event Reporting

- Easy to report
- Give people time to report
- Risk assess and prioritise
- Provide feedback to reporter
Event Investigation

• Prioritise Investigations

• Trained & Skilled Investigators

• Consistency across investigations

• Recommendations that provide higher level controls (Risk Control Hierarchy)

• Greater analysis of event data for continuous improvement
Leadership & Management Commitment

- Out of the book & into action
- Providing clear vision on safety & what safety looks like
- Providing financial commitment
- Applying transparent change management
- Challenge own behaviours, systems, and procedures
Predictive Safety and Error Management

The Challenge

- Better Analysis of data from:
  - Reporting
  - Partnership Data sharing
  - World wide industry
  - Existing data
  - Risk Assessment & Error Modelling
  - Observations & Surveillance
  - Audit data
The Challenge

- Becoming more Proactive and even predictive:
  - Error Prone Tasks
  - Error Prone Situations
- Provide Mitigation Strategies:
  - At the time we need them
  - Build redundancy into maintenance functions
  - Driving Human Factors out of the classroom
- Risk Management Hierarchy into mitigation strategies
Thank you Andy.