PACDEFF 2015

Pilot Monitoring Workshop

What does the evidence say?

Pat Murray
Scope

- Background & History
- What the OEMs say
- Monitoring research
- Recent initiatives
- Practicalities
- Q & A
Flightpath (Trend) Monitoring?
Colgan 3407
Asia Pacific Leads Future Pilot Demand

New Pilots by Region (2015-2034)

- Asia Pacific: 226,000
- Europe: 95,000
- North America: 95,000
- Middle East: 60,000
- Latin America: 47,000
- CIS: 17,000
- Africa: 18,000

World Total: 558,000

Boeing 2015
Background – single pilot
“Pilot’s Helper”
Copilot
Full task – sharing PF/PNF/PM
“...Task sharing, effective cross-check and backup should be practised in all phases of ground and flight operation, in normal operation or in abnormal / emergency conditions...”
– The Pilot Flying (PF) must focus on flying the aircraft by controlling and/or monitoring the pitch attitude, bank angle, airspeed, thrust, sideslip, heading etc. to capture and maintain the desired vertical and lateral flight path.

– The Pilot Not Flying (PNF) must assist the Pilot Flying (PF) by **actively monitoring all flight parameters** and actively directing the attention of the PF to any excessive deviation.

(Airbus Safety Library)
Airbus

Preparing the aircraft commander for the 21st century - RAeS Conference (2013)

Pilots are becoming ‘lazy, just watching’ warned keynote speaker Captain Jacques Drappier.
Boeing

– Captain Philip Adrian, 737/737 MAX Chief Technical Pilot / 
Chief Pilot Regulatory Affairs...

– ...he asked whether we were making pilot monitoring ‘too 
complicated’, saying essentially: “The goal of the PM is to 
stop the pilot flying from killing the crew and passengers 
and damaging the aircraft.”

– He also stressed that proper monitoring habits: “Should be 
created and maintained in normal flight,” not just in non-
normal situations.
Peer reviewed research (not much)!


Sarter et al (2007)

– “...Given the complexity of the flight deck interface, we believe that effective knowledge-driven monitoring is critical for effective flight operations; even more important than data-driven monitoring...”

– “...These data suggest that pilots have insufficient knowledge of automation behavior to anticipate important automation state changes...”

– “...Training to improve pilot mental models and to improve monitoring strategies needs to be developed until flight deck interface improvements can be established in the fleet...”

“...While it is true that humans are not naturally good monitors, we firmly believe that crew monitoring performance can be significantly improved through policy changes, training and by pilots following an active monitoring concept.... We would appreciate comments to refine the program...”

- Developing well thought out SOPs
- Training monitoring skills
- Practising monitoring skills

- FAA AC 120-51D (2001), “Crew Resource Management” has scant reference to monitoring....wording in this document be strengthened to showcase the importance of monitoring and describe how monitoring performance can be improved.
“...to ensure the highest levels of safety, each flight crewmember must carefully monitor the aircraft’s flight path and systems and actively cross-check the actions of other crewmembers. Effective monitoring and cross-checking can be the last line of defense that prevents an accident...”
Structured / Unstructured Monitoring
Self Monitoring?
Outcome Monitoring?
How good is your monitoring?

- Boeing 737- 800 fully serviceable
- ILS approach - BNE R/W 19
- Flap 40 – Vref 134 / Vapp 139
- ILS Minima 220ft
- Wind calm
- Cloud fluctuating around minima (100 ft actual)
- Vis 8Km
• What was the lowest altitude?

• Pitch attitude on go around?

• Lowest speed / stall margin on go around?

• Was there a hard / soft EGPWS warning?
• What was the lowest altitude?

• Pitch attitude on go around?

• Lowest speed / stall margin on go around?

• Was there a hard / soft EGPWS warning?
Evidence – Based Training (EBT)

- Training Criticality
- Pilot Survey
- Training Data AQP/ATQP
- Accidents/Incidents
- Flight Data
- LOSA

1962-2010 n >3,000
2 reports n >9,000
n > 1,000
n > 2,000,000
## LOSA data

### Most Frequent SOP Cross-Verification Errors and Their Outcomes

<table>
<thead>
<tr>
<th>SOP Cross-Verification Error</th>
<th>% of all SOP Cross-Verification Errors</th>
<th>% of these errors leading to Added Error or UAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Omitted flight mode verification</td>
<td>20%</td>
<td>4%</td>
</tr>
<tr>
<td>2. Failure to cross-verify MCP/FCU/altitude alert setting</td>
<td>18%</td>
<td>14%</td>
</tr>
<tr>
<td>3. Failure to cross-verify FMC/FMGC entries</td>
<td>16%</td>
<td>14%</td>
</tr>
<tr>
<td>4. Failure to cross-verify documentation/paperwork/takeoff figures/calculations</td>
<td>9%</td>
<td>7%</td>
</tr>
</tbody>
</table>
Evidence Based Training (EBT) Project

**Objective**
- Conduct Manoeuvres Training
  - Train manoeuvre skills to proficiency
e.g. RTO, Engine-out manoeuvre, and Go Arounds (AEO &OEI)

**Conduct**
- Line Orientated Evaluation
- Scenario Based Training
  - Develop resilience by exposure in a learning environment
- Line orientated training

**Evaluation**
- Assess competence
- Identify training needs
- Line Orientated Evaluation
- Evidence Based Training (EBT) Project
Recent initiatives

• UKCAA (2013/02) “Monitoring matters”

- The observation and interpretation of the flight path data, configuration status, automation modes and on-board systems appropriate to the phase of flight.

- It involves a cognitive comparison against the expected values, modes and procedures. It also includes observation of the other crew member and timely intervention in the event of deviation.

(http://www.caa.co.uk/default.aspx?catid=2575)
What hampers effective monitoring?
Griffith Aerospace Safety Centre

Monitoring Lapse

- Complacency
- Limited Attention Resource
- Lack of knowledge
- Boredom
- Poor SA
- Distraction
- Attention-tunnelling
- Low arousal Level
- Disorientation

Human Performance Shaping Factors

Physiological
- Circadian Rhythms
- Vigilance
- Lack of sleep
- Sleep inertia
- Visual illusions
- Comfort

Psychological
- Confidence
- Trust
- Anxiety
- Cognitive dissonance
- Cognitive bias
- Emotional stress
- Cultural inhibition

Personal
- Experience
- Knowledge
- Competency
- Attitude
- Workload
- Motivation
- Fitness
A319 Entering the hold
Recent initiatives

• Effective Monitoring Initiative” (USA)
• “Areas of vulnerability” concept
Recent initiatives
Some local research

• Model for Assessing Pilot Performance
  Tim Mavin

• Pathological Behaviours in Pilots During Unexpected Critical Events: The Effect of Startle, Freeze and Denial on Situation Outcome
  Wayne Martin

• Patterns of Threat & Error Management in Regional Airlines
  Pat Murray
Discussion / Questions?
Thanks for your attention

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