Evidence Based Training
.....a walk through the data

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Scope

- The core concepts and elements of EBT
- Sources of evidence
- Some examples of results
- The way ahead
Fatal accidents per million departures

2nd generation: 2nd jet generation

3rd generation: Glass-cockpit
Nav display
FMS

4th generation: FBW
Flight Envelope
Protection

4Q 2011

All aircraft
EBT Project Objective

Develop a new paradigm for competency based training and evaluation of airline pilots based on evidence

Phase 1
Recurrent

- ICAO Doc 9868 PANS-TRG
- ICAO Doc 9995 Manual of EBT
- EBT Implementation Guide
- Data Report for EBT

Phase 2
Type Rating

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Sources of data

- LOSA reports
- Flight Data Analysis studies
- Accident/Incident analyses
- Studies on AQP/ATQP Airline results
- Skill Decay & Skill Retention Studies
- Flight deck Automation studies
- STEADES
- Airbus Special FDA Reports
- Pilot Survey
CONVERGENCE

Scientific Reports
Pilot Surveys
Training Data AQP/ATQP
Accidents/Incidents
Flight Data

n ≈ 1,000
n ≈ 3,000
N ≈ 3,000,000
n > 9,000

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Methods of analysis

Flight data

- Over 3 million flights over multiple aircraft types over multiple airlines over several regions
- Use of standardized event set
- Analyzed for event frequency rate and clusters (drill down)
Methods of analysis

LOSA data

- Over 8,000 observed flights
- 40+ airlines
- Major 60 page report from LOSA Archive
- Subsidiary follow up report
Methods of Analysis

Pilot Training Survey – Boeing and Airbus

- Questionnaire created and analyzed by EBT Data subgroup
- Examples later
Methods of Analysis

Results from the individual analyses are:

- Distilled into singular declarative sentences
- Entered in Findings database
- Linked to:
  - Study Objectives
  - Phases of Flight
  - Data Sources
  - Topics discussed in the Conclusion
  - Context and Comments surrounding findings
Methods of Analysis

Findings data base enables:

- Managing **multiple results** from different sources
- Separation of data streams
- Context of results
- Convergence of data
- View clear **support of conclusions**
- Traceability from conclusion back to source data
LOSA:

- 4% of all approaches were unstable
- 97% of unstable approaches are continued to landing
  - 10% result in abnormal landings
- Only 3% of unstable approaches lead to a Go-Around
- When a GA occurs – it is almost always poorly performed
  - Usually a surprise to the crew
  - Very rarely occurs at (the briefed) missed approach height.
Flight data study:

- Over 1 million flights
- 3.5% of approaches are unstable
- Only 1.4% of them lead to a Go-Around
- (0.31% of stable approaches lead to a Go-Around)
Airline – safety data

Causes of Go-Arounds

- Unstable Approaches – 29%
- Flight Management – 17%
- WX – 19%
- ATC – 10%
- Traffic – 8%
- Cabin – 5%
- Airport – 5%
- EGPWS/GPWS – 4%

46%
Airline – safety data

Distribution of GAs by initiation altitude (N=333)
LOSA

➢ 28% of flights have an Automation error
Reports on flight deck automation

Some examples of pilot survey feedback:

- Automation - most important change last 30 years.
- Automation should be trained gradually - in blocks
- Scenario (‘event’) based training should be used
- Pilots should be taught “why” not just “what”
Cross-linking findings from several sources:

- Important links between Automation and Monitoring and Cross-Checking [LOSA]

- Link between Skill Decay and automation [Skill Decay report, >2 million sim sessions]
  - There is more skill decay for cognitive tasks compared to physical tasks
Pilot training survey (2010-2011)

- Aim: Pilot perspectives on training issues and effectiveness
- Delivered via the IFALPA website
- N=966
After the type rating course, you felt “comfortable” operating the FMS…

17% acquired comfort after completion of their initial operating experience (IOE)

36% acquired comfort after 3 months of operation

22% acquired comfort after 6 to 12 months of operation
Areas where FMS training can be improved:

1. Automation surprises
2. Hands on use in the operational situation
3. Transitions between modes
4. Basic knowledge of the system
5. Programming

Operational

- Programming
- Basic knowledge of the system
- Automation surprises
- Transitioning between operational ...
- Hands on use in the operational s ...
- Using the Keypad, Navigation, Men ...
- Other

Functional
In the last 6 months did you encounter an operational situation that you were not trained sufficiently

20% reported yes
% of accidents & incidents with each factor - Last 15 years

Factors in each Generation per 1M TOs, Last 15Y, except Gen1 70s-90s

Gen1
Gen2
Gen3
Gen4

Adverse Weather/Ice
MisA/CState
CRM
Systemal
Ground manoeuvring
Compliance
Poor Visibility
Fire
EngFail

% distribution of factors in each Generation, Last 15Y, except 70s-90s for Gen1
Generation 4 “A List” (alphabetical order)

- Adverse Weather Management
- Automation Management
- Go-Around Management
- Manual Aircraft Control
- Monitoring, cross checking, error detection
- Non – Compliance issues
- Unstable Approach (recognition and management)
Relative risk per factor – Gen 3

- Syst mal
- Adverse Weather/Ice
- Compliance
- Poor Visibility
- Fire
- Mis-Sys
- Ground manoeuvring
- Terrain
- Crosswind
- ATC
- Workload Distraction Pressure
- Ground equipment
- Def-Proc's
- Upset
- Eng Fail

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## Generation 2 vs Generation 4
### Training Priorities

<table>
<thead>
<tr>
<th>Gen 2</th>
<th>Gen 4</th>
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<tbody>
<tr>
<td>Adverse Wx (Poor Vis)</td>
<td>Adverse Wx (Crosswind)</td>
</tr>
<tr>
<td>System malfunction</td>
<td>Compliance</td>
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<tr>
<td>Eng Failure</td>
<td>Flight-path Monitoring</td>
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<tr>
<td>Fire</td>
<td>Mismanaged Systems</td>
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<td></td>
<td>Runway/Taxi Management</td>
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</table>
Typical Recurrent EBT Module

**Evaluation Phase**
- Assess competence
- Identify training needs
- Validate training system performance

**Manoeuvres Training Phase**
- Train maneuver skills to proficiency.
- Validate system performance and skill decay.

**Scenario Based Training Phase**
- Manage the critical threats according to evidence
- Improve competency to manage foreseen & unforeseen threats

**Objective**

**Conduct**
- Line orientated
- One or more occurrence
- Assessment of one or more Competency Elements

**Manoeuvres Training Phase**
- Sequence of deliberate actions to achieve a prescribed flight path
  - E.g. RTO, EF V1, OEI APP, OEI GA, Emer. Descent

**Scenario Based Training Phase**
- Line orientated flight scenarios
- One or more predictable or unpredictable threats

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EBT Program Implementation

Baseline EBT Programme

• Off the shelf solution
• No analysis or design work by the operator required

Source: EBT Manual Appendices

Enhanced EBT Programme

• Data collection
• Aircraft type analysis
• Risk and training analysis
• Guidance development
• Program definition

Developed by the operator according the principles laid down in the EBT manual
EBT Status

ICAO Doc 9868 PANS-TRG
ICAO Doc 9995 Manual of EBT
EBT Implementation Guide

Applicability 3rd May 2013
Published July 2013

EBT Data Report
FAA Endorsement
EASA Rulemaking task 2014
CAAC CCAR 121 R4 requirement

To be published Sept 2013
EBT Implementation
EBT Progress
Total System Approach

- MPL Ab-Initio Program
- Evidence Based Type Rating Program
- DE Pilot selection
- Evidence Based Recurrent Training Program
- Validation of system improvements
- Output system training data
- Continual program development
- Operations Data: FOQA; LOSA; ASR
- Global Data: EBT; LOSA; OEM events;
- Determination of remediation in training, feedback to training system
Thank you for your attention

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