Evidence-Based Training

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Background

- EBT is an initiative to improve safety in flying operations
- To further reduce airline accident rate a review of recurrent and type-rating training was necessary
- So far – event based training, … including lessons learned from past accidents/incidents into training sessions, leading to a systematic form of training, - checking off tick boxes
Data research process

- Flight ops and training data from the past 20 years has been reviewed (i.e. LOSA programs, air safety reports, flight data analysis).
- Examination of threats, errors, undesired aircraft states and their relationship to unwanted consequences.
- These findings were compared with current training practices with the outcome, that the current training schema does not factor in the differences of the four aircraft generations in use today.
- One size training does NOT fit all aircraft types.
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
<table>
<thead>
<tr>
<th>Aircraft Generations</th>
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<tbody>
<tr>
<td><strong>Generation 4 Jet</strong></td>
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<tr>
<td><strong>Generation 3 Jet</strong></td>
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<tr>
<td>A310/A300-600, B737-300/400/500, B737-600/700/800 (NG), B757, B767, B747-400, B747-8, B717, BAE 146, MD11, MD80, MD90, F70, F100, Bombardier CRJ Series, Embraer ERJ 135/145</td>
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<tr>
<td><strong>Generation 3 Turboprop</strong></td>
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<tr>
<td>ATR 42-600, ATR 72-600, Bombardier Dash 8 Q Series</td>
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<tr>
<td><strong>Generation 2 Jet</strong></td>
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<tr>
<td>A300 (except A300-600), BAC111, B727, B737-100/200, B747-100/200/300, DC9, DC10, F28, L1011</td>
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<tr>
<td><strong>Generation 2 Turboprop</strong></td>
</tr>
<tr>
<td>ATR 42, ATR 72 (all series except -600), Embraer EMB-120</td>
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<tr>
<td><strong>Generation 1 Jet</strong></td>
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<td>DC8, B707</td>
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EBT was developed with industry over 6 years, under ITQI, and jointly agreed by ICAO, IATA, and IFALPA. **ICAO doc 9995** was published in May 2013.

augmented by IATA ITQI doc ‘**EBT Implementation Guide**’
EBT Source Data

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

- Data from 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)

**LOSA data:**
- Over 9,000 observed flights
- 50+ airlines
- 90 page report from LOSA Archive
- Subsidiary follow up report
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 almost always poorly performed
  - Usually a surprise to the crew
  - Very rarely occurs at (the briefed) missed approach height
Competencies to manage the unforeseen

- Repetitive & foreseeable
  - Evidence
  - What we know

- Unique & unforeseeable
  - No evidence
  - What we don’t know

Operation
System
Environment

Competencies
To manage foreseen and un-foreseen
8 Core Competencies

Application of Procedures
Communication
Flight path management - automation
Flight path management - manual
Leadership & teamwork
Problem solving & decision-making
Situation awareness
Workload management
Competencies & related Knowledge, Skills and Attitudes

⚑ Competency
⚑ Competency Description
⚑ Performance Criteria – observable behavior – Situation Awareness

⚑ Is aware of what the aircraft and its systems are doing
⚑ Is aware of where the aircraft is and what its environment is
⚑ Keeps track of time and fuel
⚑ Is aware of the condition of people involved in the operation including passengers
⚑ Recognizes what is likely to happen, plans and stays ahead of the situation
⚑ Develops “what if” scenarios and plans for contingencies
⚑ Identifies threats to the safety of the aircraft and people, and takes appropriate action
<table>
<thead>
<tr>
<th>Competency</th>
<th>Competency Description</th>
<th>Behavioral indicator</th>
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<tbody>
<tr>
<td>Application of Procedures</td>
<td>Identifies and applies procedures in accordance with published operating instructions and applicable regulations, using the appropriate knowledge.</td>
<td>Identifies the source of operating instructions Follows SOP’s unless a higher degree of safety dictates an appropriate deviation Identifies and follows all operating instructions in a timely manner Correctly operates aircraft systems and associated equipment Complies with applicable regulations. Applies relevant procedural knowledge</td>
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<tr>
<td>Communication</td>
<td>Demonstrates effective oral, non-verbal and written communications, in normal and non-normal situations.</td>
<td>Ensures the recipient is ready and able to receive the information Selects appropriately what, when, how and with whom to communicate Conveys messages clearly, accurately and concisely Confirms that the recipient correctly understands important information Listens actively and demonstrates understanding when receiving information Asks relevant and effective questions Adheres to standard radiotelephone phraseology and procedures Accurately reads and interprets required company and flight documentation Accurately reads, interprets, constructs and responds to datalink messages in English Completes accurate reports as required by operating procedures Correctly interprets non-verbal communication Uses eye contact, body movement and gestures that are consistent with and support verbal messages</td>
</tr>
<tr>
<td>Aircraft Flight Path Management, automation</td>
<td>Controls the aircraft flight path through automation, including appropriate use of flight management system(s) and guidance.</td>
<td>Controls the aircraft using automation with accuracy and smoothness as appropriate to the situation Detects deviations from the desired aircraft trajectory and takes appropriate action Contains the aircraft within the normal flight envelope Manages the flight path to achieve optimum operational performance Maintains the desired flight path during flight using automation whilst managing other tasks and distractions Selects appropriate level and mode of automation in a timely manner considering phase of flight and workload Effectively monitors automation, including engagement and automatic mode transitions</td>
</tr>
<tr>
<td>Aircraft Flight Path Management, manual control</td>
<td>Controls the aircraft flight path through manual flight, including appropriate use of flight management system(s) and flight guidance systems.</td>
<td>Controls the aircraft manually with accuracy and smoothness as appropriate to the situation Detects deviations from the desired aircraft trajectory and takes appropriate action Contains the aircraft within the normal flight envelope Controls the aircraft safely using only the relationship between aircraft attitude, speed and thrust Manages the flight path to achieve optimum operational performance Maintains the desired flight path during manual flight whilst managing other tasks and distractions Selects appropriate level and mode of flight guidance systems in a timely manner considering phase of flight and workload Effectively monitors flight guidance systems including engagement and automatic mode transitions</td>
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<tr>
<td>Leadership and Teamwork</td>
<td>Demonstrates effective leadership and team working.</td>
<td>Understands and agrees with the crew's roles and objectives. Creates an atmosphere of open communication and encourages team participation Uses initiative and gives directions when required Admits mistakes and takes responsibility Anticipates and responds appropriately to other crew members' needs Carries out instructions when directed Communicates relevant concerns and intentions Gives and receives feedback constructively Confidently intervenes when important for safety Demonstrates empathy and shows respect and tolerance for other people Engages others in planning and allocates activities fairly and appropriately according to abilities Addresses and resolves conflicts and disagreements in a constructive manner Projects self-control in all situations</td>
</tr>
<tr>
<td>Problem Solving and Decision Making</td>
<td>Accurately identifies risks and resolves problems. Uses the appropriate decision-making processes.</td>
<td>Seeks accurate and adequate information from appropriate sources Identifies and verifies what and why things have gone wrong Employs proper problem-solving strategies Perserves in working through problems without reducing safety Uses appropriate and timely decision-making processes Sets priorities appropriately Identifies and considers options effectively Monitors, reviews, and adapts decisions as required Identifies and manages risks effectively Improvises when faced with unforeseeable circumstances to achieve the safest outcome</td>
</tr>
<tr>
<td>Situation Awareness</td>
<td>Perceives and comprehends all of the relevant information available and anticipates what could happen that may affect the operation.</td>
<td>Identifies and assesses accurately the state of the aircraft and its systems Identifies and assesses accurately the aircraft's vertical and lateral position, and its anticipated flight path Identifies and assesses accurately the general environment as it may affect the operation Keeps track of time and fuel Maintains awareness of the people involved in or affected by the operation and their capacity to perform as expected Anticipates accurately what could happen, plans and stays ahead of the situation Develops effective contingency plans based upon potential threats Identifies and manages threats to the safety of the aircraft and people Recognizes and effectively responds to indications of reduced situation awareness.</td>
</tr>
<tr>
<td>Workload Management</td>
<td>Manages available resources efficiently to prioritize and perform tasks in a timely manner under all circumstances.</td>
<td>Maintains self-control in all situations Plans, prioritizes and schedules tasks effectively Manages time efficiently when carrying out tasks Offers and accepts assistance, delegates when necessary and asks for help early Reviews, monitors and cross-checks actions conscientiously Verifies that tasks are completed to the expected outcome Manages and recovers from interruptions, distractions, variations and failures effectively</td>
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</tbody>
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EBT - Baseline Program
Relative Importance of contributing factors in fatal accidents
(Source: Civil Aviation Safety Data, 1989-2003)
Deficient Competencies in Gen4 accidents over last 15 years
The problem

- By regulation flight crew training and checking is based on events, which may be highly improbable in modern aeroplanes.

- Training programmes are consequently saturated with items that may not necessarily mitigate the real risks or enhance safety in modern air transport operations.
Mandatory Training Items

- Flight Preparation
- Before take-off checklist
- Engine failure between V1 and V2
- Rejected take-off before reaching V1
- Instrument departure and arrival procedures
- Engine-out Precision Approach to minima
- Non-Precision approach to MDA
- Go-Around 1 engine-out at DA
- Landing critical engine inoperative
Findings for 4th generation aircraft

- Adverse Weather Management
- Automation Management
- Go-Around Management
- Manual Aircraft Control
- Monitoring, cross checking, error detection
- Non – Compliance issues
- Unstable Approach (recognition and management)
## EBT baseline program

<table>
<thead>
<tr>
<th>Gen4 Jet Training Topics</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adverse weather</td>
<td></td>
<td>Adverse wind</td>
<td>ATC</td>
</tr>
<tr>
<td>Automation management</td>
<td></td>
<td>Aircraft system malfunction</td>
<td>Engine failure</td>
</tr>
<tr>
<td>Competencies non-technical (CRM)</td>
<td></td>
<td>Aircraft System management</td>
<td>Fire and smoke management</td>
</tr>
<tr>
<td>Compliance</td>
<td></td>
<td>Approach, visibility close to minimum</td>
<td>Loss of communications</td>
</tr>
<tr>
<td>Error management</td>
<td></td>
<td>Landing</td>
<td>Managing loading, fuel, performance errors</td>
</tr>
<tr>
<td>Go-Around management</td>
<td></td>
<td>Runway or taxiway condition</td>
<td>Navigation</td>
</tr>
<tr>
<td>Manual aircraft control</td>
<td></td>
<td>Surprise</td>
<td>Operations or type specific</td>
</tr>
<tr>
<td>Mismanaged aircraft state</td>
<td></td>
<td>Terrain</td>
<td>Pilot incapacitation</td>
</tr>
<tr>
<td>Monitoring &amp; cross-checking</td>
<td></td>
<td>Workload, distraction, pressure</td>
<td>Traffic</td>
</tr>
<tr>
<td>Unstable approach</td>
<td></td>
<td></td>
<td>Upset recovery</td>
</tr>
<tr>
<td></td>
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<td>Windshear recovery</td>
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Program Implementation

Choice 1

Baseline EBT Programme
- Off the shelf solution
- No analysis or design work by the operator required

Source: EBT Manual Appendices

Choice 2

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

Evidence Validation

Prioritization & Ranking

Scenario Design
Example of recurrent training under EBT

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

2 Maneuvers Training Phase
- Train maneuver skills to proficiency.
- Validate system performance and skill decay

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

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

Conduct
- Sequence of deliberate actions to achieve a prescribed flight path
  - E.g. RTO, EF V1, OEI APP, OEI GA, Em..Descent

- Line orientated flight scenarios
  - One or more predictable or unpredictable threats
EBT Instructor qualities

Manage Safety
Prepare the Training Environment
Manage the Trainee
Conduct Training
Perform assessment
Perform course evaluation
Continuously improve performance

ICAQ Doc 9868 Chapter 6

Patient and has a positive attitude
Shows humility and admits mistakes
Encourages and is honest
Non-judgmental and shows empathy
Supportive, respectful and honest
Good knowledge
Summary

- Examine the evidence
- Learn from the positive
- Measure effectively
- Learn by discovery
- Reinforce Key learning

Resilience
Questions?

Thank you!

http://www.iata.org/whatwedo/ops-infra/itqi/Pages/index.aspx