Flight Crew Procedure Development and Modification

Overview

- Flight Deck Design Support of Procedures
- FAA/JAA Pilot Coordination
- Crew Procedures and Checklists Development and Validation
- Maintenance of Procedures and Checklists
- Additional Support to Operators
- Flight Crew Training Manual Evolution
Flight Deck Design Support of Procedures

- Flight Deck Design Team
- Pilot design review meetings
- EICAS message audits
- Nomenclature Standardization Review Board
- Customer meetings
  - Formal reviews
  - Simulator sessions
  - Individual and group reviews
FAA/JAA Pilot Coordination

• For new and variant airplanes:
  – Establish schedules for training initial cadres of Boeing, FAA, JAA pilots
  – Develop training program “footprints”
  – Determine validation and training required in the Engineering Simulator
  – Support lesson profile development
  – Determine training levels (A, B, C, D, E) for variant airplanes
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Crew Procedures and Checklists
Development and Validation

• Establish operational philosophy
• Develop preliminary procedures
• Coordinate Engineering and pilot reviews
• Validate
• Training program “hands-on” experience
• Maintain procedures/checklists
• Customer support
Key Elements of Boeing Flight Deck Design Philosophy

Flight deck design philosophy leads to the operational philosophy of the procedures and checklists

• Apply automation as a tool to aid, not replace, the pilot

• Address fundamental human strengths, limitations, and individual differences—for both normal and non-normal operations

• Use new technologies and functional capabilities only when:
  – They result in clear and distinct operational or efficiency advantages, and
  – There is no adverse effect on the human-machine interface
Key Elements of Boeing Flight Deck Design Philosophy (Cont’d)

Flight deck design philosophy leads to the operational philosophy of the procedures and checklists

- The pilot is the final authority for the operation of the airplane
- Both crew members are ultimately responsible for the safe conduct of the flight
- Flight crew tasks, in order of priority, are: safety, passenger comfort, and efficiency
- Design for crew operations based on pilots’ past training and operational experience
- Design systems to be error-tolerant
- The hierarchy of design alternatives is: simplicity, redundancy, and automation
Crew Procedures Validation Process

Key Questions

• Why are the procedures validated?
• Who uses crew procedures?
• How are the procedures developed?
• How are the procedures validated?
• When are procedures validated?
• Who validates procedures and where?
Why Are Procedures Validated?

• Procedures are validated to assure:
  – The procedure steps work with the airplane systems as built
  – Indications to the crew consistently lead to correct crew action
  – The procedures accommodate certification requirements
**Who Uses Crew Procedures?**

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<tr>
<th>System Design Engineers and DERs</th>
<th>Flight Training/Flight Publications</th>
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<tr>
<td>• Failure Modes and Effects Analysis and Fault Hazard Assessment</td>
<td>• Part 121 training program</td>
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<td>• Detailed test procedures</td>
<td>• 7X7 Ops Manual and Flight Crew Training Manual</td>
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<th>Certification Authorities</th>
<th>Flight Test</th>
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<td>• FAR 25.1585 operating procedure (Airplane Flight Manual and Summary Cert Document)</td>
<td>• Airplane flight test engineers and pilots</td>
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<td>• FAR 25.1523 minimum flight crew (workload)</td>
<td>• Engineering simulator evaluation</td>
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<td>• System design validation</td>
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How Are Procedures Developed?

- **Flight Deck Crew Operations Group**
  - System design engineers and DERs
  - Previous Boeing airplane procedures
  - Electronic checklist & EFB design compatibility
  - Engineering testing
  - Flight testing
  - Customer procedures

- **Flight Technical**
  - Boeing engineering and training pilots
  - Customer airlines
  - Boeing engineering and training pilots
  - Previous Boeing airplane procedures

- **7X7 Operations Manual**
  - (includes procedures and checklists)
  - Airplane Flight Manual
How Are Procedures Validated?

Systems Integration Lab

Engineering Simulators

Selected subset

Airplane

Selected subset

Selected subset

Flight Controls Test Rig

All normal and non-normal procedures (including AFM procedures)

7X7 Procedures and Checklists
**When Are Procedures Validated?**

**Objective:** Validate all procedures prior to flight test

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**Legend:**
- Del: Delivery
- Cab avail: Cab available
- CAB 1: CAB 1 electronic and paper review
- CAB 2: CAB 2
- 1000 cycle: 1000 cycle
- 1st fit: 1st fit
- Prelim: Preliminary
- OPS man: OPS man
- 1st draft procedure: 1st draft procedure
- Drifting 2: Drifting 2 - info release
- Drifting 3: Drifting 3 - Engineering approval
- CAB 2: CAB 2
-选定了的程序
- 飞行控制，液气，以及其他选定了的程序
- 程序由飞行员和监管者选定
Training Program Experience

• Boeing and Regulatory Agency students give feedback to procedure developers

• Flight Training Instructors and initial customer students give feedback to procedure developers

• Procedures refined and simplified
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• **Maintenance of Procedures and Checklists**
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Maintenance of Procedures and Checklists

• Main Sources of Procedure Changes
  – Airline/Operator Input
  – Boeing Engineering
  – Boeing Flight Test
  – Engine Manufacturers
  – Flight Training
  – Incidents or Accidents
  – Commonality Reviews
Maintenance of Procedures and Checklists

- Changes via the “Procedure Change Process” (CS-3)
  - Procedures Manager normally Initiates
- Technical Review Board
  - Engineering
  - Publications Group
  - Flight Test Pilots
  - Training Department
- Flight Operations Review Board (FORB)
  - Management Approval
Maintenance of Procedures and Checklists

Results of procedure changes:

• New or modified procedure incorporated in next scheduled Operations Manual Revision

• “If the FORB determines an unacceptable delay would be imposed by waiting for the scheduled revision period, an Operations Manual Bulletin will be considered.”
Operations Manual Bulletin

• Authorized only to:
  – Address safety-related procedural changes
  – To match the delivery of airplanes with unique configuration features not previously covered in the Operations Manual
Operations Manual Bulletin

• Requirement Normally Identified by:
  – Airplane Certification
  – Engineering Model Chief Pilot
  – Flight Deck
  – Flight Operations Engineering
  – Flight Technical Publications
  – Regulatory Agencies
  – Training, Technical & Standards

• Target Flow Time:
  – 5 to 10 Days
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Additional Support to Operators

- Respond to procedural questions
- Regulatory Support
- Technical reviews of customer unique procedures
No Technical Objection

• An NTO is offered, upon request, to a Customer’s Procedure if:
  – Technically Accurate
  – Same in effect as the Boeing Procedure
  – No significant compromise to Safety
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Flight Crew Training Manual (FCTM) Evolution

• Provides amplification of Ops Manual procedures and training information

• Customer feedback resulted in “Phase of Flight” format

• Added two new Sections:
  Maneuvers
  Non-Normal Operations

• Moving toward greater commonality/standardization
Boeing Training, Technical & Standards

Summary

• To minimize the effort required by each airline’s flight technical group, Flight Training, Technical & Standards is involved from the beginning of each program in:

  – Flight deck design development
  – Flight training program development
  – Flight Crew procedures and checklists development and validation
  – Flight Crew Training Manual development and validation
Questions?