Introduction to Airplane Certification

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Agenda

- Introduction
- Certification Basics
- Boeing Certification Processes: An Overview
- FAA Delegation
- Wrap Up
Introduction

• Learning Objectives
  – Gain a basic understanding of the aircraft certification process
  – Gain a basic understanding of how delegation is used in FAA certification
## Helpful Acronyms

<table>
<thead>
<tr>
<th>AC-E</th>
<th>Airplane Certificate - Eligibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>Airworthiness Directive</td>
</tr>
<tr>
<td>AEG</td>
<td>Aircraft Evaluation Group</td>
</tr>
<tr>
<td>AR</td>
<td>Authorized Representative</td>
</tr>
<tr>
<td>ATC</td>
<td>Amended Type Certificate</td>
</tr>
<tr>
<td>C-of-A</td>
<td>Certificate of Airworthiness</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>CS</td>
<td>Certification Specifications</td>
</tr>
<tr>
<td>DAR</td>
<td>Designated Airworthiness Representative</td>
</tr>
<tr>
<td>DAS</td>
<td>Designated Alteration Station</td>
</tr>
<tr>
<td>DER</td>
<td>Designated Engineering Representative</td>
</tr>
<tr>
<td>DMIR</td>
<td>Designated Manufacturing Inspection Representative</td>
</tr>
<tr>
<td>EASA</td>
<td>European Aviation Safety Agency</td>
</tr>
<tr>
<td>FAA</td>
<td>Federal Aviation Administration</td>
</tr>
<tr>
<td>FCAA</td>
<td>Foreign Civil Aviation Authority</td>
</tr>
<tr>
<td>ICA</td>
<td>Instructions for Continued Airworthiness</td>
</tr>
<tr>
<td>JAA</td>
<td>Joint Aviation Authorities</td>
</tr>
<tr>
<td>JAR</td>
<td>Joint Aviation Requirements</td>
</tr>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
</tr>
<tr>
<td>ODA</td>
<td>Organization Designation Authorization</td>
</tr>
<tr>
<td>ODAR</td>
<td>Organizational Designated Airworthiness Representative</td>
</tr>
<tr>
<td>OMT</td>
<td>Organization Management Team</td>
</tr>
<tr>
<td>PC</td>
<td>Production Certificate</td>
</tr>
<tr>
<td>SAW</td>
<td>Safety and Airworthiness</td>
</tr>
<tr>
<td>SPLC</td>
<td>Significant Product Level Change</td>
</tr>
<tr>
<td>STC</td>
<td>Supplemental Type Certificate</td>
</tr>
<tr>
<td>TC</td>
<td>Type Certificate</td>
</tr>
<tr>
<td>TCDS</td>
<td>Type Certification Data Sheet</td>
</tr>
</tbody>
</table>
Certification Basics

- Civil aircraft: requires 4 separate FAA inspection & certification processes to be operated:
  1. Type Certificate
  2. Production Certificate
  3. Airworthiness Certificate
  4. Airline operating certificate

- Additional certification required for subsequent modifications & improvements to the design.
Certification

1. Type Certificate
   Certification of the design

2. Production Certificate
   Certification of manufacturing

3. Airworthiness Certificate
   Certification of a specific aircraft

4. Airline operating certificate
   Certification of the operator
Safety Responsibilities Are Shared

Manufacturers
- Safe airplane design
- Manufactured in conformity

Operators
- Operated safely
- Maintained properly

Government
- Airworthiness standards
- Safe operating environment
Aircraft Certification

- Certification is broken into two main efforts:
  - COMPLIANCE and CONFORMITY. Therefore, there are two main sets of FAA organizations, job titles, acronyms, and forms.
  - Compliance – Ensuring that engineering complies with the CFRs (usually determined by ARs or DERs).
  - Conformity – Ensuring that the parts are built in agreement with the engineering definition. During an official FAA Conformity, this is usually determined by the DAR or ODAR.
Key FAA Organizations

- **Aircraft Certification Office (ACO)**
  - Design approval

- **Manufacturing Inspection District Office (MIDO)**
  - Production Approval
  - Airworthiness Certificate

- **Flight Standards**
  - Operating Certificate
The FAA delegates compliance and conformity

Authorized by law

• Use systems to supplement their own workforce

• Necessary for the FAA to accomplish the entirety of their responsibility
Certification & Continuing Airworthiness Is a Global Activity

Every Country has its own Regulatory Authority

Although many countries rely on FAA regulations through bilateral agreements
Boeing Certification Processes: An Overview
System Engineering Approach

Do we have the right requirement?
Are we building the right airplane?

Do we meet the requirement?
Did we build the airplane right?
Timeline/Schedule

New Type Certification or Amended Type Certification

- **Configuration Definition**
- **Detailed Design & Release**
- **Build**
- **Flight Test**
- **Support**

- **Concept Development**
- **Configuration Definition**
- **Detail Design & Release**
- **Build**
- **Flight Test**
- **Support**

- **Prelim. Type Cert Board**
- **Cert Basis**
- **Issue Papers, CRIs & Special Conditions**
- **Component Test & Analysis Reports**
- **Cert Plans**
- **Final Type Cert Board**
- **Plan Closure**
- **Airplane Test & Analysis Reports**

- **Config Selection**
- **Firm Concept Committed Tech & Processes**
- **Authority to Offer**
- **PDR**
- **Program Launch**
- **Firm Config**
- **CDR**
- **Start Major Assembly**
- **First Flight**
- **AC-E C of A Delivery**

**Time (Months/Years)**

Revised 03-29-2007
New Airplane Model Program:
New Type Certificate (TC) Program

Certification Top Functions

Boeing/FAA/FCAA
Familiarization
Meetings

TC/PC Application

Requirements / Prelim. Design
Verification / Validation
Integration
Engineering
Design

Manufacturing
Boeing/Suppliers

Test
Production

Assembly

Generate, Substantiate, & Find Compliance

New TC/PC Issued

Descriptive Data
Operations & Maintenance

Component / Flight Test
ICA, Manuals

Issue Papers

Develop & Negotiate New Cert Basis
Strategize & Develop, Cert Plans
Close Cert Basis
Accept Cert Plans

Boeing/FAA/FCAA

Regulatory
Boeing
Customer

Substantial Change - New Cert Basis  (14 CFR 21.19, Order 8110.4c)
-Zero Passenger Airplane (Flight Test Airplane without Complete Customer Interior and Options)
## Certification Process

<table>
<thead>
<tr>
<th>Type of Program</th>
<th>Program Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Type Certificate (TC)</td>
<td>up to 5 years</td>
</tr>
<tr>
<td>Amended Type Certificate (ATC)</td>
<td>up to 5 years</td>
</tr>
<tr>
<td>Customer Introduction</td>
<td>Program Decision (4 - 18 months)</td>
</tr>
<tr>
<td>Production Incorporation</td>
<td>Program Decision (nominally 18 months)</td>
</tr>
<tr>
<td>In-Service Airplane Modification / Major Repair</td>
<td>Program Decision (nominally 6 months)</td>
</tr>
</tbody>
</table>

Revised 03-29-2007
787 Case Study
Program Summary

- Apply to FAA for 7E7  March 28, 2003
- Cert basis proposal  Aug 28, 2003
  - 110 Cert plans
- Type Certificate issued Aug 26, 2011
<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Flight</td>
<td>Dec 15, 2009</td>
</tr>
<tr>
<td>Initial Airworthiness</td>
<td>Jan 15, 2010</td>
</tr>
<tr>
<td>Ultimate wing load test</td>
<td>March 2010</td>
</tr>
<tr>
<td>First flight of GE engine</td>
<td>June 16, 2010</td>
</tr>
<tr>
<td>Fatigue testing begins</td>
<td>Sept 2010</td>
</tr>
<tr>
<td>Power system updated</td>
<td>Dec 2010</td>
</tr>
<tr>
<td>Type Certificate</td>
<td>Aug 26, 2011</td>
</tr>
</tbody>
</table>
Flight Test Activity

- Total Flights/Hours
  - ZA001  518 flights  1326 hrs
  - ZA002  316 flights  952 hrs
  - ZA003  164 flight  526 hrs
  - ZA004  303 flights  870 hrs
  - ZA005  328 flights  842 hrs
  - ZA006  152 flights  551 hrs
  - ZA102  389 flights  350 hrs
  Total  1880 flights  5445 hours
Flight Test Activity

- Early testing
  - Initial airworthiness
  - Flutter and stability and control
  - After these tests and issuance of TIA, the FAA will go onboard airplanes
  - TIA – Type Inspection Authorization

- Establish Performance
  - Fuel mileage, S&C, landing, takeoff

- Certification Testing
  - Hot, cold, ice, system performance
FAA and Responsibility for Safety

- Agency that is primarily responsible for the regulation of aviation safety in the U.S.

- FAA Mission
  - Our continuing mission is to provide the safest, most efficient aerospace system in the world.
Continuum of FAA Delegation

Type Certification
(Airplane Programs, Modifications, Service Bulletins, etc.)

Delegation Systems

- None
- Designated Engineering Representative (DER)
- Delegation Option Authorization (DOA)
- Organization Designation Authorization (ODA)
- Certified Design Organization (CDO)

Applicant responsibility for administration increases
FAA interaction & substantiation decreases

Available Today
Boeing 1950s - 2004
BCA 2005
BCA 2008
In Development By FAA
Boeing 2017?

FAA
 Applicant

- Leverage FAA w/applicant resources
- Systematic delegation
- Further enable global alignment
- Further delegation
- Integrate Engineering & Quality
- Certification by process
What is ODA?

- FAA established the ODA program which will address all FAA delegations to organizations.
  - ODAs may use approvals done by suppliers that have an ODA
  - Increased Organizational delegation of functions currently performed by individuals
  - Focus more on organizational performance and less on individuals

- Current delegation programs, including Boeing’s, were phased out in November 2009
FAA Delegation of Compliance

- Boeing has an Organization Designation Authorization (ODA) from the FAA
- Similar in concept to the FAA authorizing DERs to be their designees, the FAA has now authorized Boeing to carry out certain responsibilities on their behalf.
- This includes managing the authorized representatives, finding compliance and conformance and other responsibilities as defined in the Procedures Manual.
Thank You
Questions?

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