



Regulatory Engagement

2018 CFR Regulatory Conference

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November 26, 2018

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Engaging with Authorities Pre-Application, through Certification & beyond

Aerospace Recommended Practice (ARP) 4754 Implementation

- **Bombardier / TCCA meetings held on**
 - **October 22, 2008**
 - Understanding TCCA Draft Cert Memo introduced as Certification Discussion Item (CDI)
 - Bombardier Preliminary Plan to address ARP4754 for CSeries (now A220) Systems
 - Partial gap analysis between Bombardier Engineering System (BES) and ARP4754
 - TCCA recommendations
 - **December 18, 2008**
 - ARP4754/BES gap assessment
 - Outline of Bombardier proposed Development Plan
 - Overview of the Aircraft Safety Assessment (ASA) database (Reqmts Mgmt)
 - TCCA recommendations and concerns
 - **February 26, 2009**
 - Bombardier Core Engineering leading ARP4754 activities for CSeries
 - Bombardier Plan to align with ARP4754 for CSeries
 - **May 14, 2009**
 - BA CSeries Proposed ARP4754 Development Plan
- **Bombardier / EASA / TCCA meeting held on**
 - **March 2 and 3, 2009**
- **Monthly Meeting with TCCA thereafter till application Dec 2009**

In Excess of 60 Joint Meetings Held Prior to Type Certification

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Application for Type Certification
Dec 2009

Type Certification
Dec 2015

Continuous Monthly Meeting with Transport Canada for Process implementation, Validation, Verification with Suppliers

Issue Paper M-01
ESF 25.1309

Issue Paper M-03
ESF 25.1309

TCCA Validation & Verification Audit at BA and Suppliers

Final Type Board

Per-Application

Phase I
Establish Cert Basis

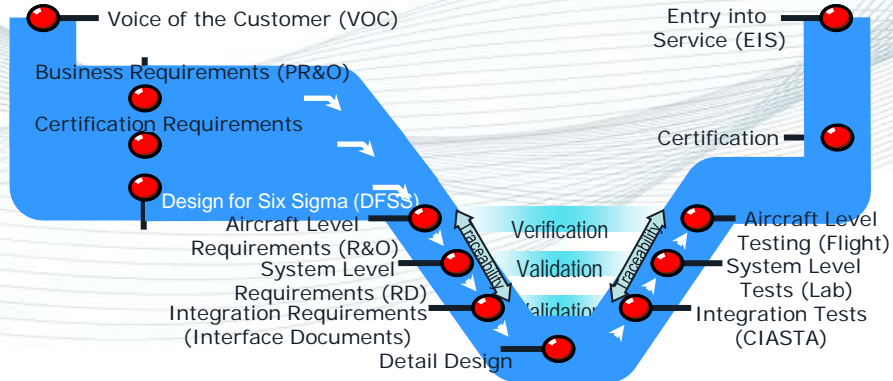
Phase II
Agree on MOC & LOI

Phase III
Compliance Demonstration

Phase IV
Certification

Certification Discussion Item

Understanding and implementing the process, gap analysis



Engaging with Authorities Pre-Application, through Certification & beyond

Active Control Technology (ACT) Program (Fly-By-Wire)



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Engaging with Authorities Pre-Application, through Certification & beyond

Active Control Technology (ACT) Program (Fly-By-Wire)

- **Program Started 1996 - Ended 2004**
- **Prime Objectives**
 - To develop a FBW philosophy
 - To define and validate flight control laws design requirements
 - To develop technical expertise in control law design and sidestick technology
 - To develop tools and methods to implement FBW Control Laws (CLAWS)
- **Feb 2000** - ACT First Flight
- **Nov 2003** - TCCA FBW Workshop – BA invited to a TCCA Certification Workshop to present overview of ACT flight control laws and testing.
- **Feb 2004** - Demonstrated ACT to guest pilots – Included BFTC pilots and 2 TCCA pilots and 2 TCCA FTEs. Exercise included simulator (REFS) testing and flights on the ACT demonstrator
- **ACT Testing included:**
 - Over 800 hours of REFS testing
 - Over 100 hours Aircraft Complete Integration Lab (ACIL) testing
 - Flight Tests were performed using a modified Challenger test aircraft
 - Total of 125 flights and 230 flight hours were completed

The early engagement of TCCA in the ACT program through briefings and hands on experience, provided TCCA with the opportunity to begin considering the TCCA certification requirements as the prime certification authority.

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Active Control Technology (ACT) Program (Fly-By-Wire)

Discussions with TCCA on FBW Certification

- 2004 – Started formal meetings with TCCA to define FBW Certification requirements and the required Special Conditions
 - SCA 2012-06 Sidestick Controllers
 - SCA 2013-02 Flight Control Systems
 - SCA 2013-12 Flight Envelope Protection: General Limiting Requirements; Normal Load Factor (g) Protection; High Speed Protection; Pitch Attitude Limiting; Bank Angle Limiting; Roll Rate Limiting; Manoeuvre Load Alleviation; Horizontal Stabilizer Stall Protection
- Several meetings and telecoms where held with TCCA
- Example of Architectural changes – Discussions with TCCA on the need/type of “ultimate “ backup to the FBW system, in addition to the Normal Mode (NM) and Direct Mode (DM) command paths, resulted in the introduction of an Alternate Flight Control Unit (AFCU).
 - The introduction of an AFCU influenced the overall FBW system architecture and design.
 - TCCA mechanical systems were involved in the development of the overall system design requirements.

When developing new technology, early discussions with the certification authorities is critical to avoid “over design” or last minute design changes