EASA
European Union Aviation Safety Agency

Cologne, 10-11 December 2019

AMC VTOL Flight Control Systems (FCS)

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Introduction – AMC VTOL FCS

- → Due to the unique characteristics of VTOL aircraft, all flight controls known today are FbW* with complex closed-loop control laws.
- → Also, for the Enhanced category (and Basic category 7-9 passengers), the safety objective at aircraft level is ‘no single failure, E.I. and FDAL A’ which is consistent with the safety objectives for CS-25/29 FbW* products.
- → For highly critical & complex flight controls, EASA therefore draws on our past Fly-by-Wire experience.
- → As VTOLs are functionally closer to rotorcraft than to aeroplanes and we did recent work on a FbW* rotorcraft together with FAA, we started from the CS-29 generic FbW* CRIs.

(*) FbW = Fly-by-Wire.

Scope – AMC VTOL FCS

- This is a first issue and a first part (AMC-VTOL-FbW**-01)**. Additional FbW guidance may be needed (e.g. -02, -03), but today we put all our efforts into this -01 document.
- Fly-by-Wire only. We do not envisage today traditional/ conventional/ simple flight control systems on VTOL aircraft.
- Several panel 4 subjects <u>not covered</u> by this AMC-VTOL-FbW-01:
  - Ground manoeuvring (e.g. landing gear, steering and braking),
  - Doors,
  - Handling Qualities,
  - Certification credit for simulators and rig testing
  - Interaction between Systems and Structure,
  - The total engine failure or total electrical failure case (to be defined in another AMC).

Content – AMC VTOL FCS

- AMC-VTOL-FCS will provide:
  - Definitions.
  - A recognition of significant parts of the ASTM flight control standard F3232-F3232M-17 (recognised by AMC-23 Amdt 5) linked to Fly-by-Wire implementation.
  - Additional guidance material to address the Fly-by-Wire-specificities

Requirements – AMC VTOL FCS

- Provides AMC material for the following SC-VTOL requirements:
  - VTOL.2300 Flight control systems
  - VTOL.2135 Controllability
  - VTOL.2145 Flying qualities
  - VTOL.2425 Lift/thrust system operational characteristics
  - VTOL.2435 Lift/thrust installation support systems
  - VTOL.2500 General requirements on systems and equipment function
  - VTOL.2510 Equipment, systems, and installations
  - VTOL.2615 Flight, navigation, and lift/thrust system instruments

Topics Covered – AMC VTOL FCS (1/2)

- Pre-flight check
  - To ensure the full control authority is available prior to flight
- Control margin awareness
  - So the crew know whether they are approaching any limit
- Flight crew awareness of the modes of operation
  - So the crew know whether handling or operational characteristics have changed
- Flight envelope protection
  - To ensure structural and operational limits are not exceeded
- Flight control and critical displays at all attitudes
  - To ensure flight information and control is available during all manoeuvres.

Topics Covered – AMC VTOL FCS (2/2)

- → Control Signal Integrity
  - → Defines malfunctions and causes of perturbations to FC signals
- → Validation of Electronic Flight Control Laws (FCL)
  - → Formalisation of validation process
- → Flight Control Jams
  - → Prevention, alleviation and management of jams
- → Consideration of Common Mode Failures and Errors in FC Functions
  - → Analysis methodology and design precautions to be taken
- → Addressing hidden failures
  - → Handling of hidden failures in the safety analysis

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Thank you
Any further question?

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