EUROPEAN AVIATION SAFETY AGENCY
AGENCE EUROPÉENNE DE LA SÉCURITÉ AÉRIENNE
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Concept for Certification of non ETSO avionics for VLA

VFR day and night

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Foreword

- The scope of this presentation is limited to CS - VLA VFR DAY / NIGHT;
- The aspects of equipment qualification (VLA 1309) will be covered;
- The type of avionic that will be considered is EFIS (PFD/MFD);
- It is not a guideline, but a collection of useful inputs and highlights based on the experience on some (few) real projects; It is not the only way;

- What this presentation will not cover:
  - Certification of non ETSO avionics for LSA (Cert. memo is under preparation);
  - Other aspects of VFR night certification for VLA (powerplant, flight, etc.).

Summary

- Required / approved (part 21)
- Certification basis;
- Approach for certification VFR DAY / NIGHT

Approved/Required? **Part 21**

21.A.305 Approval of parts and appliances

In all cases **where the approval** of a part or appliance **is** explicitly **required** by Union law or Agency measures, **the part** or appliance **shall comply with** the applicable **ETSO** or with the **specifications** recognised as **equivalent** by the Agency in the particular case.

Approved/Required: Interpretation

Every equipment

- that is required to be "**approved**" by the CS (ex: wheels, tires, etc.) or,

- **providing essential function**; **???**

must show to have an **adequate level of qualification:**

- It must be either approved (**ETSO** or TSO if agreed by EASA), or

- **certified at A/C level**; **???**

Approved/Required? **example**

CS-VLA 1303 Flight and navigation instruments

The following **are required** flight and navigational instruments:

(a) An airspeed indicator;

(b) An altimeter;

(c) A magnetic direction indicator.

Required to be approved?	**Provide essential function?**
NO	**YES**

Certification basis

- **Relevant requirements** for equipment qualification:

- VFR day:
  - CS VLA 1301, CS VLA 1309, CS VLA 1321;

- VFR night:
  - As above +
  - Special condition for VFR night.

Certification basis VLA – VFR DAY / night

CS-VLA 1301 Function and installation	Special condition VFR night
Each item of installed equipment must – (a) Be of a kind and design appropriate to its intended function; (b) Be labelled as to its identification, function, or operating limitations, or any applicable combination of these factors; (c) Be installed according to limitations specified for that equipment; and (d) Function properly when installed.	not changed

Approach for Equipment qualification

VFR DAY / NIGHT

(ref. CS VLA.1301)

All equipment must properly work in the operating environment:

- They must be calibrated;
- Appropriate to the function and to the operating environment;
- Properly labelled;
- MOC 2, 5 and 6 are considered acceptable (engineering assessment + ground and flight tests);
- The configuration of the equipment must be under the control of the TCH;

Certification basis VLA – VFR DAY/NIGHT

CS-VLA 1309 **Equipment, systems,** **and** **Installations**	**Special condition VFR night**
The equipment, systems, and installations must be designed to minimise hazards to the aeroplane in the event of a probable malfunction or failure.	For night VFR operations, **the installations of complex systems may require an assessment as required by CS 23.1309 b.**

Approach for Equipment qualification

VFR DAY

(ref. CS VLA.1309)

- **CS VLA.1309**
  - The req. is **extensively reduced** with respect to 23.1309;
  - An **assessment of the hazards to be minimised** in event of malfunction is acceptable, **with use of engineering judgment**;
  - **Engineering judgment:**
    - [illegible]
    - [illegible]
    - [illegible]

Important:

While "Engineering judgment" provides some relief from activities normally associated with demonstrations of compliance to the requirements, it emphasizes the importance of, and reliance on, individual competencies.

Approach for Equipment qualification

VFR NIGHT

According to **SC for VFR night** the **23.1309 (b)** *"..may be required for complex systems"*. This implies:

- **FHA at A/C level** (AC 23.1309 **can** be used as guidance);
- Identification of the criticality of the **functions (essential?),**
- Identification of the **instrument that display** the function;
- **Establishment of the Adequate level of certification**; **???**

Approach for Equipment qualification

VFR NIGHT

Depending on the **criticality** of the displayed function, **as identified with the FHA**:

- For criticality higher than minor:
  - **Software** qualification as per **AC 23.1309**;
  - **RTCA DO 160** is the standard for **environmental testing**;
  - **HIRF** must be accounted for;
  - **Lightning**, direct & indirect effects: **not applicable**;
  - Performance of the **functions** must be checked against the corresponding **ETSO;**

AC 23.1309 is not a must!! and leaves room for interpretation (for small A/C). **Alternatives can be proposed.**

Certification basis VLA – VFR DAY/NIGHT

CS-VLA 1321 Arrangement and visibility	**Special condition VFR night**
Each flight, navigation, and powerplant instrument must be clearly arranged and plainly visible to each pilot.	For night VFR operations, the following arrangement of instruments is acceptable: (a) For each aeroplane **the flight instruments required by CS-VLA 1303 and**, as applicable, **by the Operating Rules <u>should</u> be grouped** on the instrument panel **and centred** as nearly as practicable about the vertical plane of the pilot's forward vision. In addition…. **(T-Basic);**

Approach for Equipment qualification

VFR DAY / NIGHT

(ref. CS VLA.1321)

- For VFR DAY
  - HF Assessment of the cockpit

- For VFR night
  - T-basic layout **should** be used, **but**;
    - **An alternative layout** could be accepted when supported by proper Human factor assessment;
    - **The instruments required** by 1303 and operational rules need to be in the **main field of view of the pilot**;

Assessment of the hazards to the crew/passenger

VFR DAY / NIGHT

- **An assessment of the possible hazards** (flame, smoke, sharp edges, etc.) **to the crew/passenger**, that could be produced by the equipment, is necessary;
  - **No** specific **standard** is set for this;
  - Assessment of the installation by the applicant, with use of **engineering judgment**, is acceptable.

Summary

- Use of non-ETSO EFIS is possible with both VFR-Day and VFR-Night.
  - But it is not for free!!!
  - Special Condition applies for VFR-Night

- Use of Non-ETSO EFIS has compliance implications, namely:
  - Qualification at A/C level is necessary;
  - The reference to assess the performance is the corresponding ETSO standard;
  - Some factors can reduce the level of qualification needed; **but**
  - The burden on the applicant is much higher both during IAW and CAW

Some factors

- The equipment could have its own qualification (some functions could be ETSO'd);
- **Use of Analog instrument** as primary source of information can reduce the level of qualification of the corresponding non-ETSO'd EFIS;
- It must be clear to the pilot which instruments provide the primary information (SC VLA 1321 is met);
- Failures and misleading information are assessed, and mitigated with limitations, placards and emergency procedures. **HF evaluation is very important**;

but

..but

- **The burden on the TCH is higher** both during certification and during the life of the A/C;
- **Engineering judgment is not always an easy way**. Specific competencies in the area of Systems and safety assessment are necessary;
- The **equipment configuration** must be **under control** of the TCH;
- **The DOA and POA** aspects must be timely accounted for. The **Authorities** must be timely and **appropriately involved** of the;
- From this point of view, **the support** that can be provided **by the equipment manufacturer can** play an important role to **help its certification at A/C level**.

Non ETSO'd EFIS for Situational awareness

Is the pilot really looking at the Analog instruments???

it may be true, **but**

- The installation of the non ETSO avionic is done in a controlled environment (TCH):
  - Effects of failures and HF aspects are properly assessed;
  - Approved Analog instruments are in the primary FOV;
  - The equipment is qualified at A/C level;
  - Limitations, placards and emergency procedures are in place;
  - The TCH is responsible for the installation and the CAW;

QUESTIONS?