



Federal Aviation Administration

Memorandum

Date: March 28, 2013

To: Manager, Military Certification Office, ACE-100M

From: Manager, Transport Airplane Directorate, ANM-100

Prepared by: Frank Mokry, ACE-100M

Subject: INFORMATION: Equivalent Level of Safety (ELOS) Finding for
Vibration/Buffeting Compliance Criteria on Airbus Model A340-300 Series
Aircraft, FAA Project Number ST0251MC-T

Memo No: ST0251MC-T-F-1

Reg. Ref: § 25.251(b)

This memorandum informs the certificate management aircraft certification office of an evaluation made by the Transport Airplane Directorate (TAD) on the establishment of an equivalent level of safety (ELOS) finding for the Airbus Model A340-300 series of aircraft.

Background

The means of demonstrating compliance with Title 14, Code of Federal Regulations 25.251(b) is cited in the rule (“each part of the airplane must be demonstrated in flight to be free from excessive vibration under any appropriate speed and power conditions up to V_{DF}/M_{DF} ”). Therefore, a flight demonstration out to V_{DF}/M_{DF} is required to demonstrate compliance with the rule. When external modifications are made to an existing type design, compliance with § 25.251(b) must be addressed.

FedEx has proposed an equivalent level of safety with § 25.251(b) by means other than flight testing up to V_{DF}/M_{DF} , that the installation would not cause excessive vibration under any appropriate speed and power conditions up to V_{DF}/M_{DF} .

Applicable regulation(s)

§ 25.251(b)

Regulation(s) requiring an ELOS finding

§ 25.251(b)

Description of compensating design features or alternative Methods of Compliance (MoC) which allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

The compensating factors that provide an equivalent level of safety for § 25.251(b) not complied with are as follows:

FedEx will use the following procedure to show that original aircraft type design § 25.251(b) compliance demonstration remains valid for the case of multiple external flush mounted installations to the Airbus Model A340-300 series aircraft:

1. The Navier Stokes based software for this project, CFD++, which has been accepted by the FAA on previous projects as a valued tool for computational fluid dynamics (CFD) use, is capable of accurately assessing whether a shock is present, including its strength and location, and the area of separated flow. The design and location of the modifications installed on the Airbus Model A340-300 is expected to have results with acceptable downstream flow field conditions at local mach numbers.
2. A Navier-Stokes CFD model will be developed for the Airbus Model A340-300 installations. The Airbus Model A340-300 CFD model fidelity, grid size, and spacing associated with the CFD analysis matches that of the previous FedEx validated model. Calculations will be made for flight conditions V_{MO}/M_{MO} and V_D/M_D . It will be shown that shock locations, strengths and downstream total pressure loss for the Airbus Model A340-300 will be in acceptable ranges.
3. Actual flight testing out to V_{mo}/M_{mo} shall be performed on the Airbus Model A340-300 aircraft installation as a means to further demonstrate non-impact to original § 25.251(b) certification predicted by the analysis accomplished in item 2 above.
4. Provided that above conditions 1 thru 3 are shown, it will be concluded that this installation on the Airbus Model A340-300 does not invalidate the original Airbus Model A340-300 § 25.251(b) compliance demonstration for this model.

Explanation of how design features or alternative Methods of Compliance (MoC) provide an equivalent level of safety to the level of safety intended by the regulation

FedEx's position that for well designed modifications (not extensive from a complete aircraft perspective) strategically placed in regions having minimal downstream flow field impact, such modifications may not pose a significant impact to overall aircraft aerodynamics or vibration characteristics. In such a situation, the original aircraft type certification § 25.251(b) compliance demonstration should remain valid.

Given these factors and the criticality/risks of performing high speed tests, and that the Airbus Model A340-300 fairing installations are shown to be in compliance and the above conditions 1 thru 4 in the previous section are shown, it will be shown that installations on the Airbus Model A340-300 provides an equivalent level of safety to the requirements of § 25.251(b).

FAA approval and documentation of the ELOS finding

The FAA has approved the aforementioned ELOS finding in project issue paper F-1. This memorandum provides standardized documentation of the ELOS finding that is non-proprietary and can be made available to the public. The TAD has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Limitations and Conditions section of the STC. An example of an appropriate statement is provided below.

Equivalent Level of Safety Findings have been made for the following regulation(s):

§ 25.251(b) Vibration and buffeting (documented in TAD ELOS Memo ST0251MC-T-F-1)

Original signed by

Paul Siegmund

3/28/13

Transport Airplane Directorate,
Aircraft Certification Service

Date

ELOS Originated by MCO	Frank Mokry	ACE-100M
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