Proposed Equivalent Safety Finding on CS 25.867(a) :Wing Leading Edge Slats

Applicable to Boeing 737-7 / -8 / -9

Introductory Note:

The hereby presented Equivalent Safety Finding has been classified as an important Equivalent Safety Finding and as such shall be subject to public consultation, in accordance with EASA Management Board decision 12/2007 dated 11 September 2007, Article 3 (2.) of which states:

"*2. Deviations from the applicable airworthiness codes, environmental protection certification specifications and/or acceptable means of compliance with Part 21, as well as important special conditions and equivalent safety findings, shall be submitted to the panel of experts and be subject to a public consultation of at least 3 weeks, except if they have been previously agreed and published in the Official Publication of the Agency. The final decision shall be published in the Official Publication of the Agency.*"

Statement of Issue:

The 737 -7/-8/-9, ("MAX") type design change includes the replacement of the CFM56-7B engine installation used on the 737-700/800/900ER with the CFM LEAP-1B engine. The Leap-1B engine installation and nacelle is of similar design, placement and dimensions as the CFM56 installation.
The trailing edge of the wing leading edge slats (qty 2) are located on the upper outboard side of each engine within the 1 nacelle diameter defined area and are a metallic honeycomb bonded sandwich construction.

Per CS 25.867(a), surfaces to the rear of the nacelle, within one nacelle diameter of the nacelle centerline are required to be constructed of materials at least equivalent in resistance to fire as aluminium alloy in appropriate design dimensions. Aluminium sheet parts are fire resistant by definition per CS Definitions 'Fire Resistant'. All other surfaces within the zone are required to be fire resistant by test in accordance with AC 20-135 and ISO 2685, or by similarity to previously accepted certification test data.

A recent engineering test demonstrated that the test panel representative of the trailing edge of the wing leading edge slat would not pass the required fire test prescribed in AC 20-135 and ISO 2685. Extensive redesign of the trailing edge of the wing leading edge slat would be required to meet the 5 minute, 2000°F fire test requirement. This redesign would add unnecessary weight, cost and drag to the wing aerodynamic surface, which is unchanged from the 737NG design. New tooling would also be required for the new wing leading edge slat structure.

Boeing intends to show an equivalent level of safety for the trailing edge of the wing leading edge slat for 25.867(a).

Boeing 737-7 / -8 / -9 – Equivalent Safety Finding to CS 25.867(a) : wing leading edge slat – E-24/MAX

Design description:

All of the surrounding slat and underlying wing surfaces adjacent to the trailing edge of the wing leading edge slat will be shown to be fire resistant. There will be no exposed wing compartments, or surfaces under the slat trailing edge wedge that will not be at least fire resistant in construction. This is accomplished with:

1. Removal of the trailing edge of the wing leading edge slat will expose fire resistant surfaces. The wing surface directly under the slat trailing edge wedge which consists of composite

fiberglass honeycomb construction, will be shown fire resistant by similarity to previously approved certification test data.

2. Bulb seals underneath the slat trailing edge wedge, which run spanwise along the leading edge and forward along the slat closing out the wing leading edge compartment, will be shown fire resistant by test (test conducted per AC20-135 and ISO 2685).
3. The wing leading edge nose skin adjacent to the slat trailing edge wedge is composed of a gage aluminum layer, which is fire resistant by definition.

Justification:

The compensating factors given through the Design description section provide an equivalent level of safety to the level of safety intended by the regulation:

1. Removal (or burn through) of the trailing edge of the wing leading edge slat would result in exposed fire resistant surfaces. The fiberglass structure and the seals underneath the slat trailing edge wedge will be shown fire resistant so that if a fire breaches the slat trailing edge wedge (primary surface), the wing structure and systems within the wing leading edge compartment are still protected.
2. There are no exposed systems under the slat trailing edge wedge.
3. If the trailing edge of the wing leading edge slat is partially or entirely removed, the effect on airplane performance and handling will not create an additional hazard.

Safety Equivalency Demonstration:

The 737-8 design is equivalently safe to that intended by CS 25.867(a) based on the following compensating features:

1. All surrounding surfaces and underlying surfaces are fire resistant.
2. There are no exposed systems under the trailing edge of the wing leading edge slat.
3. If the slat trailing edge wedge is compromised during an in-flight fire, the impact to airplane performance characteristics will not create an additional hazard to the airplane.