Special Condition SC-VLA.901-02 for CS-VLA Aeroplanes with embedded aft engines and aft propeller

Introductory Note:

The hereby presented Special condition has been classified as an important Special Condition 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.), 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 Certification specifications CS-VLA are applicable for single engine aeroplanes. Conventionally single engine aeroplanes are in tractor configuration, with the propeller and the engine in the front. The case of an embedded engine in the aft fuselage and the propeller also installed in the aft fuselage is not fully addressed by the CS-VLA requirements.

Justification

The configuration where an embedded engine is installed in the aft fuselage and the propeller is also installed in the aft fuselage poses additional hazards that need to be addressed via specific requirements. Considering the above, the following Special condition is proposed:

SPECIAL CONDITION SC-VLA.901-02 is.1

CS-VLA Aeroplanes with embedded aft engines and aft propeller

Fire protection

SC-VLA.901-02-1181

a) The designated fire zone in the engine compartment shall be identified.
b) It must be demonstrated that an engine fire will be contained within the designated fire zone after recognition of a fire occurrence and flammable fluids are turned off.

SC-VLA.901-02-1182 – areas adjacent to the designated fire zone

CS-VLA 1182 apply to components, lines, and fittings installed in the areas adjacent to the fire zone (as defined according to SC-VLA.901-02-1181 a)).

SC-VLA.901-02-1193 – cowling and nacelle

In addition to CS VLA a,b,c,d,e, the following requirement should be added:

f) the aeroplane must be designed so that no fire originating in the engine compartment can enter, either through openings or by burn-through, any other region where it would create additional hazards.

SC-VLA.901-02-1351 – fire protection of electrical equipment

CS-VLA 1351 e) apply to Electrical equipment installed in the areas adjacent to the fire zone (as defined according to SC-VLA.901-02-1181 a)).

SC-VLA.901-02-1203 - Fire detection

a) There must be means that ensures the proper detection of a fire in the engine compartment.
b) Each fire detector system must be constructed and installed to withstand the vibration, inertia and other loads to which it may be subjected in operation.
c) No fire detector may be affected by any oil, water, other fluids, or fumes that might be present.
d) There must be means to allow the crew to check, in flight, the functioning of each fire detector electric circuit.
e) Wiring and other components of each fire detector system in a designated fire zone must be at least fire-resistant.

Loads

SC-VLA.901-02-371 – gyroscopic loads

In addition to the inertial and aerodynamic loads acting on the airframe, the aeroplane shall be designed for the gyroscopic loads resulting, with the propeller at maximum continuous rpm, under the conditions prescribed in CS VLA-351 and CS VLA-423. The gyroscopic loads should be combined with the inertial, aerodynamic loads and trust loads in rational manner.

AMC SC-VLA.901-02-371

In absence of data, the following angular speeds can be considered

i. A yaw velocity of 2·5 radians per second;
ii. A pitch velocity of 1·0 radian per second;

Propeller

SC-VLA.901-02-905 propeller

In addition to CS-VLA 905 a) and b) the following requirements shall be added:

(e) for aeroplanes which obtain also approval for IFR, the following requirement shall be met: all areas of the aeroplane forward of the pusher propeller that are likely to accumulate and shed ice into the propeller disc during any operating condition must be suitably protected to prevent ice formation, or it must be shown that any ice shed into the propeller disc will not create a hazardous condition. (See AMC to SC-VLA.901-02-905 e))

(f) Each pusher propeller must be marked so that the disc is conspicuous under normal daylight ground conditions.

(g) If the engine exhaust gases are discharged into the pusher propeller disc, it must be shown by tests, or analysis supported by tests, that the propeller is capable of continuous safe operation. (See AMC to SC-VLA.901-02-905 g))

(h) All engine cowlings, access doors, and other removable items must be designed to ensure that they will not separate from the aeroplane and contact the pusher propeller.

AMC to SC-VLA.901-02-905 e)

Ice shed from the forward fuselage and the wings may cause significant damage to pusher propellers that are very close to the fuselage and well back from the aeroplane nose. Simlarly, ice shed from the wing may cause significant damage to wind mounted pusher propellers. Account should be taken of these possibilities.

The term ‘during any operating condition’ may require tests also for intentional, or temporary unintentional entry into icing conditions. This may also be shown by analysis or a combination of both.

AMC to SC-VLA.901-02-905 g)

In most pusher propeller installations, the engine exhaust gases pass through the propeller disc. Many factors affect the temperature of these gases when they contact the propellers and propeller tolerance to these gases varies with propeller design and materials.

SC-VLA.901-02-925 ground clearance

In addition to CS-VLA 925, the aeroplane shall be designed such that the propeller will not contact the runway surface when the aeroplane is in the maximum pitch attitude attainable during normal take-off and landings.