Special Condition

10 Minutes OEI Take-off Thrust at High Ambient Temperature rating

Approval of Turbofan Engine "10 Minutes OEI Take-off Thrust at High Ambient Temperature" rating

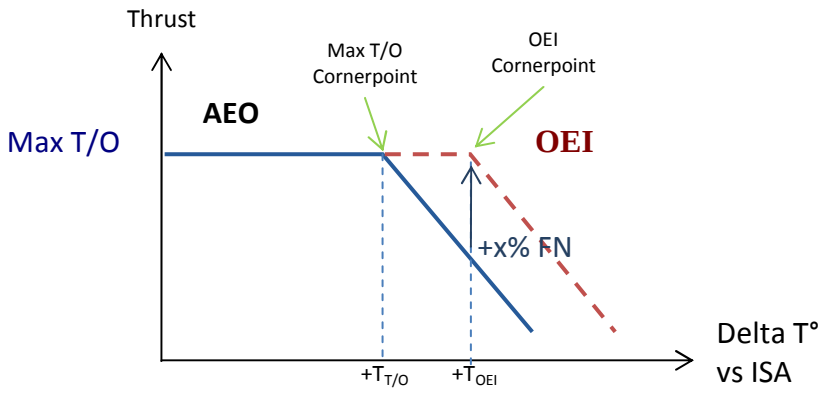
This Special Condition is raised to support the approval of an additional rating for turbofan engines. This rating ensures the availability of increased engine thrust above Max Take Off corner point, to allow an aircraft to continue the Take-off following one engine inoperative after reaching V1 under High Ambient TO temperature conditions.
This rating is not currently defined in CS-E 40.

Introductory note:

The hereby proposed Special Condition shall be subject to public consultation, in accordance with EASA Management Board decision 02/04 dated 30 March 2004, 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."

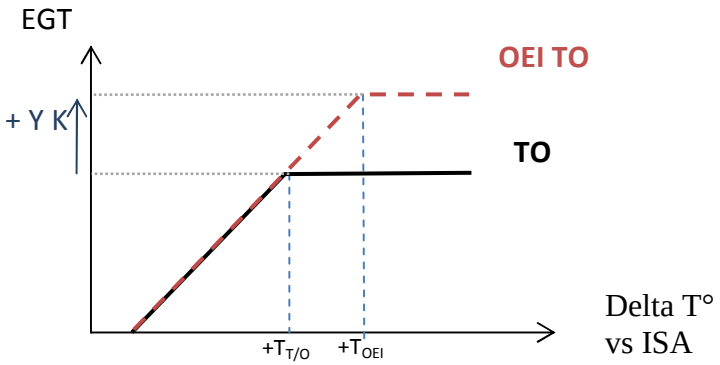
Statement of Issue:

This Special Condition defines the additional requirements for the certification of a "10 Minutes OEI Take-off Thrust at High Ambient Temperature" rating for a multi turbofan engine application. It introduces an alleviated thrust corner point for an engine in OEI aircraft configuration, compared to Max Take-Off rating corner point (corner point modification in order to maintain Max Take-off Thrust at higher ambient temperature). This rating is intended to be used for a cumulated usage of 10 minutes.
EC No 1702/2003 paragraph 21A.16B has to be addressed as the related airworthiness code does not contain adequate or appropriate safety standards for the product,
At least the following requirements are affected: CS-E 25, CS-E 40, CS-E 60, CS-E 515 and CS-E 740.



AEO: All Engines Operative = Max Take-off Thrust rating per CS-E 40(a)
OEI: One Engine Inoperative

This thrust increase at high ambient temperature leads to increase the EGT temperature and declare a dedicated Max EGT for that rating.



A cumulated usage of 10 minutes e of the OEI rating will require a subsequent mandatory engine servicing.

Discussion:

CS-E provides requirements for a number of engine ratings. “Take-off” and “Maximum Continuous” ratings (referred to as “Standard ratings”) are listed in CS-E 40(a); “Other ratings” are listed in CS-E 40(b). In particular, CS-E 40(b)(2) lists One Engine Inoperative (OEI) ratings, applicable to Turbine Engines for Multi-Engine Aeroplanes. The requirements and associated usage limitations and conditions for these OEI ratings are clearly described in CS-Definitions and CS-E.

Endurance Tests

The applicant shall propose and justify additional running time at or above this requested rating, including continuous 10 minute periods, in order to cover the Endurance Test safety objectives for the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating.

Pilot alert

Provision for means must be available to alert the pilot when the engine is at the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating, when the event begins, and when the 10 minutes cumulative usage has been consumed.

Engine deterioration

It must be ensured that the engine deterioration in service will not exceed its acceptable limits, which are either those assumed for declaring the engine Time Between Overhaul (TBO), or any other “on-condition” limits defined in the engine Instructions for Continued Airworthiness (ICA). For this, means must be provided, which may consist of a manual increment log, or automatic counting through the Engine Control Unit (ECU) of the time spent at the “10 Minutes OEI Take-off Thrust at High Ambient Temperature ” rating.

EASA Position:

The Certification Basis for the Silvercrest engine model in addition to the applicable airworthiness code is amended by this Special Condition as follows:

- CS-E 25 Instructions for Continued Airworthiness:
  - Operating limitations and the cumulated usage of 10 minutes limitation associated with use of the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating must be specified in the Instructions for Continued Airworthiness (ICA) and will be included in the Type Certificate Data Sheet (TCDS).
  - It must be demonstrated that the use of the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating in service will not result in engine deterioration in excess of that assumed for the engine TBO (if one is declared) or in exceeding any other “on-condition” limit defined in the engine ICA.
  - Mandatory maintenance has to be performed following a cumulated usage of 10 minutes of the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating in service. Related tasks will be defined in the ICA.

- If monitoring is to be performed by the pilot this must be specified in the instructions for installing and operating the engine.

- CS-E 40 Ratings
  - In addition to the ratings already listed in CS-E 40, a new “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating is created and defined as follows:
  - “Rated 10 Minutes OEI Take-off Thrust at High Ambient Temperature” means the approved engine thrust, developed under specified altitudes and temperatures within the operating limitations established for the engine, for continuation of flight operation after failure or shutdown of one engine in multi-engine aircraft during takeoff operation, limited in use of periods no longer than 10 minutes each in any one flight and followed by mandatory inspection when the cumulative usage of that rating exceeds 10 minutes.

- CS-E 60 Provision for Instruments
  - Engines having “10 Minutes OEI Take-off Thrust at High Ambient Temperature ” rating must have means or provision for means, which cannot be reset in flight, to alert the pilot when the engine is at the “10 Minutes OEI Take-off Thrust at High Ambient Temperature ” rating, when the event begins, and when the cumulative usage of that rating exceed 10 minutes.

- CS-E 515 Engine Critical Parts
  - A representative usage of the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” rating must be included in the Engine Flight Cycle used for the establishment of the Approved Life of the Engine Critical Parts.

- CS-E 740 Endurance Tests
  - The following modifications of the test schedules required by CS-E 740(c) have been established as an acceptable means to demonstrate the capability of the engine in regard to this additional rating. This acceptable means is based on those associated with 30 Second and 2 Minutes OEI Power ratings, while the subject rating will be used only during Take-off.
    - During the time allocated for Take-off thrust required by CS-E 740, a minimum of 20 minutes consisting of 2 periods of 10 minutes must be run at the “10 Minutes OEI Take-off Thrust at High Ambient Temperature” and associated operating limitations. These 2 periods of 10 minutes of test are covering the usage of this OEI rating which is limited to cumulate a total use of 10 minutes only.
    - The modified test periods must be adequately distributed throughout the endurance testing. In any case the modification of the CS-E 740

test sequences (order and schedules) must be proposed by the applicant and accepted by the Agency.

- Compliance with CS-E 740(h) must be demonstrated..

Any further CS-E paragraphs have to be considered by the applicant for the new rating as/if applicable.

Any other method proposed by the applicant shall be justified and will be subject to the acceptance of the Agency.