Proposed Special Condition for the OEI High Ambient Take-Off Temperature rating

Applicable to Turbofan Engine for the approval of an additional rating.

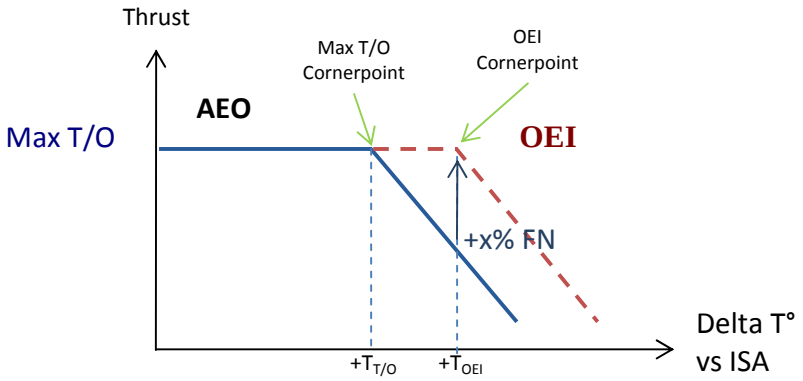
This rating, ensuring availability of increased engine thrust above Max Take Off corner point, allows the aircraft to continue the Take-off after one engine has failed after reaching V1 under High Ambient TO temperature conditions.
This rating is not currently defined in CS-E 40.
The related airworthiness code does not contain adequate or appropriate safety standards for the product, EC No 1702/2003 paragraph 21A.16B has to be addressed.

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."

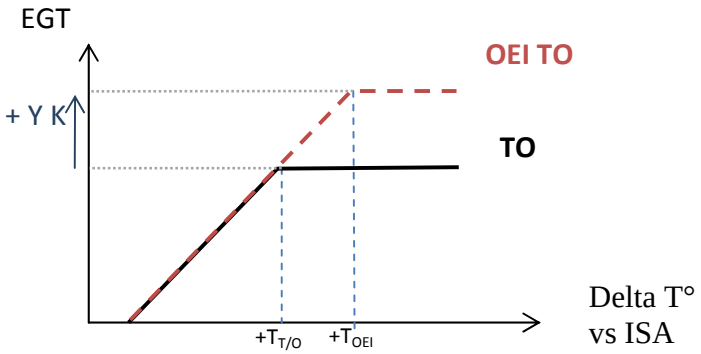
Statement of Issue:

This Special Condition for a twin engine application defines the requirements for certification of a "OEI High Ambient Take-Off Temperature" rating for a turbofan engine, which 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).



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.



Every single usage of the OEI rating will be followed by an adequate engine servicing within a maximum cumulated usage of 10 minutes. Any other maintenance action has to be agreed by the Authority.
In accordance with Part 21A.16B, as there are no CS-E requirements covering such rating, a Special Condition is necessary. The following requirements are affected: CS-E 20, CS-E 25, CS-E 40, CS-E 60, CS-E 515 and CS-E 740.

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 20, CS-E 25, CS-E 40, CS-E 60 and CS-E 740.

Endurance Tests

In order to cover the Endurance Test safety objectives for the “OEI High Ambient Take-Off Temperature” rating, the Applicant shall propose and justify additional running time at or above this additional rating, including continuous 10 minute periods.

Pilot alert

Provision for means must be available to alert the pilot when the “OEI High Ambient Take-Off Temperature Rating” rating is used, would it be required at aircraft level.

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 occurrences of use of the “OEI High Ambient Take-Off Temperature” rating.

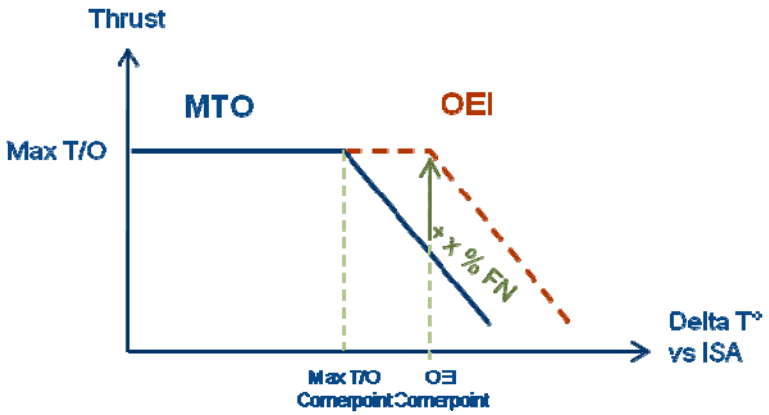
EASA Position:

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 20 Engine Configuration and Interfaces & CS-E 25 Instructions for Continued Airworthiness:
  - Operating limitations and cumulated time limitation associated with use of the “OEI High Ambient Take-Off 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 “OEI High Ambient Take-Off 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.
  - If dedicated inspections are to be performed following usage of the “OEI High Ambient Take-Off Temperature” rating in service, they 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 “OEI High Ambient Take-Off Temperature” rating is created and defined as follows:
  - “OEI High Ambient Take-Off Temperature” rating means the thrust, developed in standard atmosphere at sea level or specified altitude, limited in use:
    - For periods of not more than 10 minutes each at rotors rotation speeds and gas temperature established for this rating.
    - When an engine fails during take-off phase in order to provide additional thrust at high ambient temperature (above Max Take-Off rating corner point).



- CS-E 60 Provision for Instruments
  - The engine must have provision for means to alert the pilot when the 10 minutes allowable continuous time spent at the “OEI High Ambient Take-Off Temperature” rating has expired, would it be required at aircraft level.
  - If monitoring is to be performed by the pilot this must be specified in the instructions for installing and operating the engine.

- CS-E 515 Engine Critical Parts
  - A representative usage of the “OEI High Ambient Take-Off 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.
    - During the time at Take-off power required by CS-E 740, a minimum of 20 minutes consisting of 2 periods of 10 minutes must be run at the “OEI High Ambient Take-Off Temperature” thrust level and associated operating limitations. 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.
    - If, for compliance with the above requirement, credit is sought for time accrued during other parts of the test (e.g. for time at OEI rating), it must be shown that these sequences were run with operating limitations equal to or higher than the “OEI High Ambient Take-Off Temperature” rating operating limitations.
- Even though specific maintenance action can be expected following the use of the “OEI High Ambient Take-Off Temperature” rating, compliance with CS-E 740(h) will be demonstrated.

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