

SUBJECT : **Equivalent Safety Finding to CS25.1143(c)**

REQUIREMENTS incl. Amdt. : **CS 25.1143(c) at Amendment 13**

ASSOCIATED IM/AMC¹ : Yes ☐ / No ☒

ADVISORY MATERIAL : **AMC 25.1143(c)**

INTRODUCTORY NOTE:

The following Equivalent Safety Finding has been classified as important 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."

IDENTIFICATION OF ISSUE:


Flight testing in icing conditions has shown that the Pratt & Whitney PW814GA / PW815GA engines on the Gulfstream GVII-G500 and GVII-G600 airplanes are susceptible to wear of the abradable area of the fan case during certain icing encounters, and that this wear may exceed Engine Maintenance Manual (EMM) limits.

The possibility of abradable rub is amplified when the engines are operating at or near their fan resonance speed. To address this, Gulfstream updated the electronic engine control (EEC) software on the GVII-G500 aircraft to raise the engine idle above the fan resonance speed when operating in icing conditions in a clean configuration (i.e., landing gear retracted), and will now provide an additional update to introduce a new "No Dwell Zone" (NDZ) logic when the aircraft transitions to the landing configuration (i.e., landing gear extended).

The NDZ feature is designed to prevent steady-state engine operation in the low pressure (LP or N1) rotor resonance zone, such that if the commanded N1 (as a function of thrust lever angle) is within this zone, each engine will be controlled to either the upper or lower boundary of the zone rather than being allowed to dwell at or near the resonance speed.

To preserve a positive and immediate thrust response at the aircraft level, the left and right engines use slightly different NDZ logic. When the commanded N1 (as a function of thrust lever angle) is within the resonance range, in lieu of either engine being allowed to dwell at or near the resonance speed, the right engine will be held at or above the NDZ upper boundary (and the left will be held at or below the NDZ lower boundary, as required to achieve the total net commanded thrust.

¹ In case of SC, the associated Interpretative Material and/or Acceptable Means of Compliance may be published for awareness only and they are not subject to public consultation.

 European Union Aviation Safety Agency	<p align="center">Equivalent Safety Finding</p> <p align="center">Engine controls in icing conditions</p>	Doc. No. : E-37 Issue : 2 Date : 02 August 2019 Proposed <input type="checkbox"/> Final <input checked="" type="checkbox"/> Deadline for comments: 31 July 2019
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EASA position is; Gulfstream must show that the incorporation of the NDZ logic is equivalent safe to the intent of the CS 25.1143(c), which requires that:

“each power and thrust control must provide a positive and immediately responsive means of controlling its engine.”

The intent of the requirement is directed at the prevention of inadvertent operation of engine controls.

Considering all the above as well as the result from the comments received during the consultation period, the following ESF is proposed. The comments are published in the corresponding Comment Response document.

Compensating Factors for the Equivalent Safety to CS 25.1143(c), Amendment 13

The equivalent safety must be shown by considering the following as compensating means:

1. The proposed design must be validated as required by component, ground, and/or flight testing, and must include a thorough safety analysis to show compliance with CS25.901(c) and CS25.1309.
In order to show compliance with CS25.1143(c), Gulfstream must demonstrate that the engine thrust control is positive and immediately responsive and predictable, and that the presence of the NDZ does not create any nuisance or additional workload to the flight crew.
2. It must be shown that there are no failure conditions of the NDZ logic that would prevent continued safe flight and landing in complying with the requirements of CS 25.901(c) and CS 25.1309.
3. It must be shown that any trim conditions requiring a N1 within the NDZ would not introduce any Airplane Pilot Coupling (APC) susceptibility”.
4. By means of tests, it must be shown that the controllability of the aircraft in lateral, directional and longitudinal stability is not objectionably affected under both steady state and worst case transient thrust conditions with the NDZ logic activated.
5. Information must be provided in the flight crew manuals raising the awareness on the behaviour of the engine instruments when operated in the NDZ.

For those reasons, EASA accepts the equivalent safety finding to the **CS25.1143(c) at amendment 13**.

Abbreviations

APC Airplane Pilot Coupling
NDZ No Dwell Zone

