Proposed Special Condition for Certification of Auto-Throttle Function in CS-23 Aircraft - SC-F23.1329-01

Introductory Note

The following Special Condition has been classified as a new Special Condition and as such 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

Current CS-23 does not contain appropriate safety standards for auto-throttle system (ATS) installations, so special conditions are required to establish an acceptable level of safety. CS-25 regulations contain appropriate safety standards for these systems, so the intent for this project is to apply the language in §25.1329 for the auto-throttle, addressing §23.1309 and §23.143 in place of the similar CS-25 regulations referenced in §25.1329.
In addition, proper function of the ATS must be demonstrated according to §23.1301 in a manner acceptable to the administrator, as prior evaluations of the system components included in the existing type design did not include demonstration of proper installed function on the ground or in the air.

Special Condition

CS-23 at this time does not sufficiently address auto-throttle technology and safety concerns. Therefore, special conditions must be developed and applied to this project to ensure an acceptable level of safety has been obtained. For approval to use the ATS during flight, CS-23 airplane must demonstrate compliance to the intent of the requirements of §25.1329, applying the appropriate CS-23 references to § 23.1309 (to include performing FHA/SSA to determine the appropriate/applicable Software and Airborne Electronic Hardware assurance levels) and §23.143 and the following special conditions:

a) Quick disengagement controls for the auto-thrust functions must be provided for each pilot. The auto-thrust quick disengagement controls must be located on the thrust control levers. Quick disengagement controls must be readily accessible to each pilot while operating the thrust control levers.

b) The effects of a failure of the system to disengage the auto-thrust functions when manually commanded by the pilot must be assessed in accordance with the specifications of CS 23.1309.

c) Engagement or switching of the flight guidance system, a mode, or a sensor must not produce a transient response affecting the control or flight path of the aeroplane any greater than a minor transient.

d) Under normal conditions, the disengagement of any automatic control functions of a flight guidance system must not produce a transient response affecting the control or flight path of the aeroplane any greater than a minor transient.

e) Under rare-normal or non-normal conditions, the disengagement of any automatic control functions of a flight guidance system must not produce a transient response affecting the control or flight path of the aeroplane any greater than a significant transient.

f) The function and direction of motion of each command reference control (e.g., heading select, vertical speed) must be readily apparent or plainly indicated on, or adjacent to, each control if necessary to prevent inappropriate use or confusion.

g) Under any condition of flight appropriate to its use, the flight guidance system must not:
   - produce unacceptable loads on the aeroplane, or
   - create hazardous deviations in the flight path.

   This applies to both fault-free operation and in the event of a malfunction, and assumes that the pilot begins corrective action within a reasonable period of time.

h) When the flight guidance system is in use, a means must be provided to avoid excursions beyond an acceptable margin from the speed range of the normal flight envelope. If the aircraft experiences an excursion outside this range, the flight guidance system must not provide guidance or control to an unsafe speed.

i) The flight guidance system functions, controls, indications, and alerts must be designed to minimise flight crew errors and confusion concerning the behaviour and operation of the flight guidance system. Means must be provided to indicate the current mode of operation, including any armed modes, transitions, and reversions. Selector switch position is not an acceptable means of indication. The controls and indications must be grouped and presented in a logical and consistent manner. The indications must be visible to each pilot under all expected lighting conditions.

j) Following disengagement of the auto-thrust function, a caution (visual and auditory) must be provided to each pilot.

k) During auto-thrust operation, it must be possible for the flight crew to move the thrust levers without requiring excessive force. The auto-thrust response to flight crew override must not create an unsafe condition.

l) For purposes of this section, a transient is a disturbance in the control or flight path of the airplane that is not consistent with response to flight crew inputs or environmental conditions.
   1. A minor transient would not significantly reduce safety margins and would involve flight crew actions that are well within their capabilities. A minor transient may involve a slight increase in flight crew workload or some physical discomfort to passengers or cabin crew.
   2. A significant transient may lead to a significant reduction in safety margins, an increase in flight crew workload, discomfort to the flight crew,

or physical distress to the passengers or cabin crew, possibly including non-fatal injuries. Significant transients do not require, in order to remain within or recover to the normal flight envelope, any of the following:

i. Exceptional piloting skill, alertness, or strength.
ii. Forces applied by the pilot which are greater than those specified in CS-23.143(c).
iii. Accelerations or attitudes in the airplane that might result in further hazard to secured or non-secured occupants.

The applicant must also functionally demonstrate independence between the left and right ATS installation to prove they cannot have a single point failure that is not extremely improbable that inadvertently leads to a loss of thrust, or to substantial uncommanded thrust changes and transients, in both engines simultaneously.