U.S. Department of Transportation

Federal Aviation Administration

Memorandum

Subject:	INFORMATION: Equivalent Level of Safety Finding for the Airbus A380-800, Project No CP-101	Date:	28 September 05
		Reg Ref:	§ 25.831(g)
From:	Manager, Transport Standards Staff, Propulsion/Mechanical Systems Branch, ANM-112	Reply to Attn of:	Steve Happenny ANM-112
To:	Manager, Transport Standards Staff, International Branch, ANM-116	ELOS Memo #:	CP-101-S-22

Background

Airbus has declared that the A380-800 aircraft will not demonstrate compliance with airworthiness requirement § 25.831(g) that states in part *"(g) The exposure time at any given temperature must not exceed the values shown in the following graph after any improbable failure condition."* The intent of 14 CFR 25.831(g) is to ensure that in the event of airplane ventilation system failures, the temperature and humidity within the airplane shall not exceed values that are hazardous to the occupants.

In the preamble to Amendment 25-87, during the Supersonic Transport (SST) review in the 1960s, it was noted that certain pressurization system failures, whether considered alone or in combination with the use of ram air for emergency pressurization, could lead to cabin temperatures exceeding human tolerance. The FAA therefore concluded that any failure or combination of failures that could lead to temperature exposures that would cause undue discomfort must be shown to be improbable. Minor corrective actions (e.g., selection of alternate equipment or procedures) would be allowed if necessary for probable failures. The FAA also concluded that any failure or combination of failures that could lead to intolerable temperature exposures must be extremely improbable. Major corrective actions (e.g., emergency descent, configuration changes) would be allowed for an improbable failure condition. Temperature limits were incorporated into the special conditions imposed on executive transport airplanes when approved for high altitude operation. The SST and executive transport special conditions contained two graphs that provided the requirements for the probable and improbable cases. In formulating § 25.831(g), the FAA determined that the public interest is served by adopting, per Amendment 25-87, time-temperature limits associated with improbable failure conditions. Section 25.831(g) at Amendment 25-87 does not allow the time of exposure at any given temperature to exceed the values given in the associated graph.

While well intended, Amendment 25-87 incorporated a time-temperature relationship containing a single-point humidity requirement. Manufacturers have found this difficult or impossible to

comply with under the assumption of loss of all conditioned airflow for flight following failure, including descent and landing under all operating environments, especially in warmer and/or humid climates. It should be noted that no mention of the 27 mBar limit appears in Amendment 25-87. It has been speculated that the fixed humidity level of 27 mBar appears to be a reasonable limit for altitude conditions around 10,000 feet. Unfortunately this humidity level is often exceeded at lower altitudes at and near sea level for airport ambient conditions. Thus, this requirement would prohibit the use of outside air to ventilate the aircraft during high humidity conditions above 27 mBar. It is this restriction to any fixed humidity limit that created the need for rulemaking in this section of Part 25.

The FAA formed an Aviation Rulemaking Advisory Committee (ARAC) to review this regulation and recommend any needed changes. ARAC Mechanical Systems Harmonization Working Group (MSHWG) developed a new, performance-based standard to preserve a tolerable environment by limiting the metabolic and environmental heat loads to passengers and crew during exposures to a potential heat stress event. The report was submitted to the FAA in October 2003. Airbus has requested an Equivalent Level of Safety Finding (ELOS) for § 25.831(g) and proposes to use ARAC Recommended Rulemaking to preserve a tolerable environment using a new, performance-based standard. Airbus proposed to use ARAC Recommended Rulemaking from the MSHWG, in accordance with the Transport Airplane Directorate (TAD) Memo 00-113-1034, dated January 4, 2001, which provides guidance on the use of ARAC Recommended Rulemaking not yet formally adopted by the FAA.

Applicable regulation(s)
§ 25.831(g) as proposed by the ARAC MSHWG Report on 25.831(g) per the guidelines established in TAD Memo 00-113-1034, dated January 4, 2001.

Regulation(s) requiring an ELOS
§ 25.831(g)

Description of compensating design features or alternative standards that allow the granting of the ELOS (including design changes, limitations or equipment need for equivalency)

Airbus will show that the A380-800 airplane will meet the full intent of the proposed regulation via the means recommended in the ARAC MSHWG report on 25.831(g). The TAD Memo 00-113-1034, dated January 4, 2001, provides guidance on the use of ARAC Recommended Rulemaking not yet formally adopted by the FAA; the Transport Airplane Directorate believes that it is appropriate to use an equivalent level of safety finding for § 25.831(g).

Explanation of how design features or alternative standards provide an equivalent level of safety to the level of safety intended by the regulation

FAA has stated that all applicants may utilize a thermal analysis based upon computer modeling with validation, or the use of new or historical temperature exposure test data for demonstrating compliance for steady-state and transient conditions as deemed appropriate. FAA will ensure that all applicants who request an equivalent level of safety finding for § 25.831(g) are required to follow the same methodology or equivalent means as noted in the MSHWG report. The pass-fail criteria shall be in accordance with page 10 of the MSHWG report which states, "*For applicable failure events prior to final descent, an acceptable means of compliance (MOC) is*

considered to be a 1 deg C rise, not to exceed 38 deg C body core temperature see page 2 of Reference 3. As discussed in the report this is a conservative criteria for exposure of unacclimatized people working for long periods of time in a hot environment. It is acknowledged that occupants will be able to receive appropriate medical treatment immediately after landing. Therefore, a 38.5 deg C body core temperature limit is acceptable, only for final approach and landing, during any time period not to exceed 20 minutes. 38.5 deg C body core temperature shall not be exceeded or sustained for any amount of time." Therefore, applicants must meet the stated criteria which limits temperature rise in occupants to 38 deg C [100.4 degree F] body core temperature (steady-state) and 38.5 deg C [101.3 degree F] body core temperature (transient condition not to exceed 20 minutes).

FAA approval and documentation of the ELOS

The FAA has approved the aforementioned Equivalent Level of Safety Finding in project issue paper S-22. The FAA, EASA and Airbus concurred that the body core temperature must meet the stated criteria which limits temperature rise in occupants to 38 deg C [100.4 degree F] body core temperature (steady-state) and 38.5 deg C [101.3 degree F] body core temperature (transient condition not to exceed 20 minutes).

This memorandum provides standardized documentation of the ELOS that is non-proprietary and can be made available to the public. The Transport Directorate has assigned a unique ELOS Memorandum number (see front page) to facilitate archiving and retrieval of this ELOS. This ELOS Memorandum number should be listed in the Type Certificate Data Sheet under the Certification Basis section (TC's & ATC's) or in the Limitations and Conditions Section of the STC Certificate. An example of an appropriate statement is provided below.

Equivalent Safety Findings have been made for the following regulation(s):
§ 25.831(g) "Pressurized Cabins" (Documented in TAD ELOS Memo CP-101-S-22)]

Original Signed by Neil D. Schalekamp — *September 28, 2005*

Manager, TSS, Propulsion/Mechanical Systems Branch, ANM-112 — Date

ELOS Originated by: Standards Staff, Mechanical Systems Branch	Project Engineer Stephen M Happenny	Routing Symbol ANM-112