COMMENT RESPONSE DOCUMENT (CRD) TO NOTICE OF PROPOSED AMENDMENT (NPA) 2009-08

for amending Decision No. 2003/02/RM of the Executive Director of the Agency of 17 October 2003 on Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance, for Large Aeroplanes (« CS-25 »)

and

for amending the Annex to Decision No 2003/10/RM of the Executive Director of the Agency of 24 October 2003 on Certification Specifications, Including Airworthiness Codes and Acceptable Means of Compliance, for European Technical Standard Orders ("CS-ETSO")

"Activation of ice protection system and update of ETSO C16 for electrically heated pitot and pitot static tubes"

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Explanatory Note

I. General

1. The purpose of the Notice of Proposed Amendment (NPA) 2009-08, dated 31 August 2009 was to propose an amendment to Decision No. 2003/02/RM of the Executive Director of the Agency of 17 October 2003 on Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance, for Large Aeroplanes (« CS-25 »)[1] and an amendment to the Annex to Decision No 2003/10/RM of the Executive Director of the Agency of 24 October 2003 on Certification Specifications, Including Airworthiness Codes and Acceptable Means of Compliance, for European Technical Standard Orders ("CS-ETSO")[2].

II. Consultation

2. The draft Executive Director Decision amending Decision No. 2003/02/RM and Decision No. 2003/10/RM was published on the web site (http://www.easa.europa.eu) on 1 September 2009.

3. By the closing date of 1 October 2009, the European Aviation Safety Agency ("the Agency") had received 14 comments from 9 National Aviation Authorities, professional organisations and private companies.

III. Publication of the CRD

3. All comments received have been acknowledged and incorporated into this Comment Response Document (CRD) with the responses of the Agency.

4. In responding to comments, a standard terminology has been applied to attest the Agency's acceptance of the comment. This terminology is as follows:

- **Accepted** – The comment is agreed by the Agency and any proposed amendment is wholly transferred to the revised text.
- **Partially Accepted** – Either the comment is only agreed in part by the Agency, or the comment is agreed by the Agency but any proposed amendment is partially transferred to the revised text.
- **Noted** – The comment is acknowledged by the Agency but no change to the existing text is considered necessary.
- **Not Accepted** - The comment or proposed amendment is not shared by the Agency

The resulting text highlights the changes as compared to the current rule.

5. The Executive Director Decision will be issued immediately after the publication of this CRD and thus it will not be possible to react to the Agency's responses.

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[1] Executive Director Decision No 2003/2/RM of 17 October 2003, as last amended by Executive Director Decision 2009/010/R of 26 June 2009 (CS-25 Amendment 6).

[2] Executive Director Decision No 2003/10/RM of 24 October 2003, as last amended by Executive Director Decision 2008/012/R of 20 November 2008 (CS-ETSO Amendment 3).

IV. CRD table of comments, responses and resulting text

(General Comments)	-

comment	*1* comment by: *LAMA* The Light Aircraft Manufacturers Association (LAMA) USA is the leader and advocate of the Light Sport Aircraft (LSA) Community in both the USA and Overseas. As the Light Sport industry, (in which the majority of European manufactures enjoy the majority of their sales of these 2-place training and recreational airplanes in the USA) benefits from the ASTM airworthiness standards created by the FAA, interested public persons, and the LSA industry itself, LAMA sees no value or purpose for EASA to pursue complicated airworthiness issues, such as "ice protection systems" for these kind of aircraft. We plead to EASA to come to the same conclusion many other countries in Afica, Asia, Australia, SouthAmerica and China have come to, and for uniformity, for industry self-regulation, we plead for EASA to adopt the ASTM airworthiness standards for light sport aircraft. Respectfully submitted: Larry Burke, Founder and Chair Emeritus Light Aircraft Manufacturers Association
response	Noted. Light aircraft are not concerned by this rulemaking task which addresses CS-25 only, i.e. certification specifications for Large Aeroplanes.

comment	*10* comment by: *Luftfahrt-Bundesamt* The LBA has no comments on NPA 2009-08.
response	Noted.

comment	*15* comment by: *Swiss International Airlines / Bruno Pfister* SWISS International Air Lines has no further comments to this NPA.
response	Noted.

comment	*18* comment by: *Thales Aerospace Division* As proposed by this NPA, THALES Aerospace concurs with the harmonisation of the EASA ETSO-C16 with the existing FAA TSO-C16a. In addition, THALES Aerospace would be ready, upon EASA request, to participate in any regulatory working group relevant to further evolutions of this ETSO.
response	Noted. The Agency appreciates Thales offer to support a future regulatory working group. We envisage cooperating with EUROCAE to set a working group whose objective will be to define a new international standard for pitot probes. Thales could probably join this group.

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comment	*11* comment by: *CAA-NL* CAA-NL fully supports this initiative to improve flight safety with respect to operation in icing conditions.
response	Noted.

A. Explanatory Note - I. General p. 3

comment	*12* comment by: *CAA-NL* Considering the current level of technology, and the expected flight safety improvement, CAA-NL thinks that the burden on (the certification of) the aircraft design is acceptable.
response	Noted.

A. Explanatory Note - V. RIA - 11. Impacts p. 5-6

comment	*13* comment by: *CAA-NL* Considering the current level of technology, and the expected flight safety improvement, CAA-NL thinks that the burden on (the certification of) the aircraft design is acceptable. However, CAA-NL has the following objection. With regard to paragraph 11.a.i. (and with reference to the proposed amendment of CS 25.1419 (g)(3): given the intent of this NPA to increase flight safety, CAA-NL is of the opinion that a repetitive alert to the flight crew to cycle the IPS, still leads to an unnecessary increase of the flight crew workload. Moreover, even if a repetitive alert is presented, there is still no guarantee, especially during high-workload flight phases, that the flight crew will operate the system as certified. CAA-NL is of the opinion that an automated system will be more reliable in its operation and will be non-dependant on flight crew action. Therefore, also considering the current state of technology, CAA-NL is of the opinion that this design option should not be allowed.
response	Not accepted. This third method permits to ensure on-time activation of the airframe IPS by alerting flight crews when the IPS must be cycled. The only remaining workload is the activation of the IPS itself, which is considered reasonable. Moreover, as for any system or equipment, the airframe IPS shall comply with CS 25.1302: “this installed equipment must be shown, individually and in combination with other such equipment, to be designed so that qualified flightcrew members trained in its use can safely perform their tasks associated with its intended function”.

B. DRAFT DECISIONS - I Draft Decision CS-25 - CS 25.143 General p. 9

comment 6 comment by: *AIRBUS*

The paragraphs (j) (1) and (j) (2) should be written as follows:

"(1) The aeroplane is controllable in a pull-up manoeuvre up to 1.5g load factor **or lower load factor if limited by design characteristic of the flight control system**; and
(2) There is not pitch control reversal during a pushover manoeuvre down to 0.5g load factor **or higher load factor achievable by design characteristic of flight control system**."

Reason: Aircraft protection may limit the maximum and minimum achievable load factors.

response Not accepted.
The current CS-25 does not fully take into account fly-by-wire aircraft. This technology is addressed by Special Conditions. The particular issues raised by Airbus will be addressed through update of these Special Conditions.

B. DRAFT DECISIONS - I Draft Decision CS-25 - CS 25.207 Stall warning p. 9-10

comment 3 comment by: *Lockheed Martin Aeronautics*

Current regulations stipulate that the impact on the aircraft handling characteristics and performance must be determined for flight in icing conditions. One area of concern is tail stall. Ice accumulation may induce premature tail stall, causing a sudden change in pitching moment. Wing stall is a much more common threat, but tail stall is less known to pilots. Required pilot actions are roughly opposite. It is unclear in section CS 25.207 whether the stall warning system must identify whether the stall is occurring at the wing, tail or both. This would aid the pilot to determine the required response.

response Not accepted.
CS 25.143 will ensure controllability with ice on the tail, and therefore a tail stall warning is not necessary.

comment 7 comment by: *AIRBUS*

The paragraph 25.207 does not apply as is on aircraft fitted with hard angle of attack protection that prevent the aircraft from stalling. Stall warning is triggered in case of flight control law degradation (i.e. Failure cases). Dedicated Special Conditions apply on Airbus aircraft.

response Not accepted.
The current CS-25 does not fully take into account fly-by-wire aircraft. This technology is addressed by Special Conditions. The particular issues raised by Airbus will be addressed through update of these Special Conditions.

B. DRAFT DECISIONS - I Draft Decision CS-25 - CS 25.1419 Ice protection p. 11

comment	*8* comment by: *AIRBUS* The paragraph (e)(2) should be written as follows: "A definition of visual cues for recognition of ~~the first sign of ice accretion on a specified surface~~ **airframe icing** combined with and advisory ice detection system that alerts the flight crew to activate the airframe ice protection system; or" Reason: The sentence is unclear and may be subject to different interpretations. Airbus recommends that a material guidance is developed in order to interpret this sentence.
response	Not accepted. The objective of CS 25.1419(e)(2) is for flight crews being able to recognize that icing conditions are encountered by using a reliable reference surface which shows ice accretion; this reference surface is chosen by the aircraft manufacturer. In addition, an advisory ice detection system means is required to complement these visual cues information.

comment	*14* comment by: *Austro Control GmbH* Austro Control recommends to change the wording of CS 25.1419 (g)(3) as follows: (3) An primary ice detection system must be provided to alert the flight crew each time the ice protections system must be cycled.
response	Not accepted. The proposed rule requires an ice detection system, which does not necessarily have to be a primary ice detection system. The method of icing detection available in CS 25.1419(e) is also applicable to CS 25.1419(g).

B. DRAFT DECISIONS - II Draft Decision Annex to CS-ETSO p. 13

comment	*9* comment by: *AIRBUS* General comment on proposed ETSO-C16a: Airbus recommends that an industry and airworthiness authority working group is established under the banner of SAE and/or EUROCAE to promptly define ETSO icing requirements in line with the rationale in section 3 below rather than adopting the TSO C16a. Airbus has significant concerns regarding the adoption of the TSO C16a requirements because: • The TSO icing conditions are not sufficiently conservative. Recent Airbus testing has demonstrated that the icing test requirements of the TSO are less conservative than Airbus requirements • The TSO does not require the probes to be tested in ice crystal or mixed phase icing conditions despite probes being sensitive to such icing conditions. • The TSO does not mention the potential installation effects upon the

probe
- The TSO format is very confusing and open to misinterpretation

If EASA decides to rewrite the Air Data Probe ETSO in line with TSO C16a as an interim measure Airbus strongly recommends that a working group is established as soon as possible.

Reason/Justification:

The TSO C16a defines a minimum set of requirements for pitot and pitot static probes. It is recognized that the TSO is not intended to provide adequate justification to qualify the probes nor to certify the installed system. Additional qualification and certification activities are required to achieve this. However the TSO defines only 3 test points and includes icing conditions that are less conservative than the certification icing conditions. No tests in ice crystal conditions are required by the TSO despite the certification guidance material recommending such tests.
As the icing conditions requirements have a fundamental effect upon the design and testing of a pitot probe it is important that the requirements are comprehensive, conservative and clearly written.
Additionally as the TSO is an opportunity to spread best practice Airbus recommends that specific guidance related to two important but perhaps not widely known aspects of probe installation and icing tunnel scaling be included.
In summary Airbus recommends that the TSO content is not adopted due to 4 main areas of concern:

- The TSO icing conditions are not sufficiently conservative
- The TSO does not require the probes to be tested in ice crystal or mixed phase icing conditions
- The TSO does not mention the potential installation effects
- The TSO format is very confusing and open to misinterpretation

Icing Conditions
The certification icing requirements defined in CS 25 Appendix C include liquid water contents, temperatures and droplet diameters in excess of those specified in the TSO. In addition the AMC to CS 25.1419 defines mixed phase and ice crystal conditions. Whilst it is recognized that the TSO tests are not intended as a means of compliance for the certification regulations Airbus believes the ETSO should include icing conditions that are more comprehensive than those defined in the TSO.
There would appear to be little benefit in designing and testing a probe to the TSO requirements if it is necessary to repeat the tests to more conservative conditions to support the aircraft certification.
Pitot and pitot static probes are known to be sensitive to ice crystal and mixed phase conditions and therefore Airbus always tests its probes in these conditions. The AMCs to CS 25.1323 and 25.1325 states:
“Airspeed Indicating System
1 Tests should be conducted to the same standard as recommended for turbine engine air intakes (see AMC 25.1093(b)(1)) unless it can be shown that the items are so designed and located as not to be susceptible to icing conditions. Ice crystal and mixed ice and water cloud will need to be considered where the system is likely to be susceptible to such conditions.
2 However, in conducting these tests due regard should be given to the presence of the aeroplane and its effect on the local concentration of the

	cloud" In addition the AMC to CS 25.1419 paragraph 4 states that an assessment of the vulnerability of pitot heads to ice crystal conditions must be made. Conversely TSO C16a does not require tests to be performed in mixed phase or ice crystal conditions. In Airbus view such an omission is contrary to the objective of setting a minimum level of performance particularly as most aircraft fly in such conditions. Furthermore a probe designed and tested in liquid icing conditions only may require a significant redesign to meet the ice crystal and mixed phase requirements. It should be noted that recent evidence indicates that the ice crystal and mixed phase conditions defined in AMC 25.1419 may not be adequate for pitot and pitot-static probes. **Probe Installation Effects** The TSO requires probes to be tested to the liquid water icing requirements of BS2G135 amendment 1 to asses anti-icing performance and modified ISO 8006 icing conditions for de-icing performance. Test N°2 specifies Max intermittent icing conditions that are considered below JAR25/CS-25 Appendix C requirements. Accounting for installation effects on A330/A340, local LWC at –30°C should be 1.5g/m^3 for maximum intermittent icing (without safety factors). The TSO C16A recommendation is 1.25g/m^3, which therefore does not cover installation effect on Airbus A330/A340. These conditions are free-stream conditions and do not consider the effect of the potential installation effects. Depending on the probe design and aircraft installation these installation effects can lead to the Liquid Water Content (LWC) at the probe location several times greater than the free-stream conditions. The TSO should at least highlight the potential installation affects to applicants. The TSO requires probes to be tested at 0° angle of attack only whereas angles of attack up to 15° are not uncommon in service. Airbus believes that tests at angles of attack up to at least 15° should be included in the ETSO. **Scaling of Icing Conditions During Icing Tunnel Testing** During recent icing tunnel testing it was found that the electrical current drawn by air data probe heaters varied with the mach number of the airstream such that at lower mach numbers the probe current reduced due to a change in the heater element resistance. This effect needs to be considered when scaling icing conditions as for some heater designs increasing the LWC to offset lower attainable icing tunnel speeds and vice versa may not be representative. Airbus recommends that the ETSO highlights this phenomenon. **Format** In order to interpret the icing conditions of TSO C16a the reader must first read the main body of the document which cross refers to the Appendix which in turn refers to ISO 8006 for deicing tests and BS2G135 Amdt 1 for anti-icing tests. In addition the Appendix of TSO C16a modifies the ISO 8006 requirements. The reader must therefore refer to 3 separate documents to define the test conditions. Airbus believes in the interest of clarity the test requirements should be contained in a single document.
response	Partially accepted. The Agency envisages cooperating with EUROCAE to set a working group. This activity should start 1Q2010.

	In the meantime, the Agency considers that a first step has to be done by amending the existing ETSO C16 to use a more recent standard. In the future, this ETSO will be upgraded using the outcome of the working group which will be a new international standard for pitot probe. The Agency appreciates Airbus comments which should be taken into account by the working group.

B. DRAFT DECISIONS - II Draft Decision Annex to CS-ETSO - ETSO-C16a - 3 - Technical Conditions	p. 13-14

comment	*5* comment by: *UK CAA* **Page No:** 14 of 16 Paragraph No: 3.1.3 **Comment:** We do not agree with the statement "***None***". The probe may contain software to compute Air data parameters or to control the electrical power for heating. Some probes today do e.g. Goodrich Smart probe. **Justification:** Some probes today have embedded software. **Proposed Text (if applicable):** See CS-ETSO Subpart A paragraph 2.2
response	Not accepted. This ETSO covers pitot and pitot-static tubes (electrically heated). It doesn't cover associated instruments or software. Refer to SAE standard AS8006, paragraph 3.1 "Function: When installed in accordance with the aircraft manufacturer's instructions, the tube shall sense pitot pressure or pitot and static pressures for transmission to instruments or associated equipment, or both".

V. Resulting text

The text proposed in the NPA is unchanged following the review of comments.