



## TERMS OF REFERENCE

<b>Task Nr:</b>	25.058
<b>Issue:</b>	1
<b>Date:</b>	9 July 2010
<b>Regulatory reference:</b>	CS-25 <sup>1</sup>
<b>Reference documents:</b>	ARAC IPHWG task 2 report revision A dated 19 December 2005, and IPHWG phase IV report and recommendations <sup>2</sup>

**1. Subject:** Large Aeroplane Certification Specifications in Supercooled Large Drop, Mixed phase, and Ice Crystal Icing Conditions

**2. Problem/Statement of issue and justification; reason for regulatory evolution (regulatory tasks):**

**Background**

31 October 1994, near Roselawn, Indiana-USA, an accident involving an ATR 72 occurred in icing conditions believed to include freezing drizzle drops. The accident investigation led to the conclusion that freezing drizzle conditions created a ridge of ice on the wings' upper surface aft of the de-icing boots and forward of the ailerons. It was further concluded that the ridge of ice resulted in an uncommanded roll of the aeroplane. The atmospheric condition (freezing drizzle) that may have contributed to the accident is outside the CS-25 Appendix C icing envelope that is used for certification of Large Aeroplanes.

Another atmospheric icing condition which aeroplanes may experience and that is outside of the Appendix C icing envelope is freezing rain.

These kinds of icing conditions constitute an icing environment known as Supercooled Large Drops (SLDs).

Following the ATR 72 accident, the NTSB published safety recommendations to upgrade aeroplanes icing conditions specifications, and therefore an Aviation Rulemaking Advisory Committee (ARAC) was tasked in December 1997, through its Ice Protection Harmonization Working Group (IPHWG), to conduct the following studies:

- Define an icing environment that includes SLDs;
- Consider the need to define a mixed phase icing environment (supercooled liquid and ice crystals);
- Devise requirements to assess the ability of aircraft to either safely operate without

<sup>1</sup> 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»). Decision as last amended by Decision No. 2009/017/R of the Executive Director of the Agency of 11 December 2009 («CS-25/Amendment 8»).

<sup>2</sup> This material can be found on the FAA website under the Aviation Rulemaking Advisory Committee section of the Regulations & Policies chapter. The following link can also be used: [http://www.faa.gov/regulations\\_policies/rulemaking/committees/arac/media/tae/TAE\\_IP\\_T2.pdf](http://www.faa.gov/regulations_policies/rulemaking/committees/arac/media/tae/TAE_IP_T2.pdf)

restrictions in these conditions or safely operate until it can exit these conditions;

- Study the effects icing requirement changes could have on FAR/JAR 25.773, 25.1323, and 25.1325.

The ARAC was also tasked to consider the need for a regulation on ice protection for angle of attack probes.

The IPHWG task 2 report on "Supercooled Large Droplet Rulemaking" revision A was released 19 December 2005 to FAA.

Additional recommendations were provided by the IPHWG following an ARAC 'Phase IV' review by the working group, which was requested due to the immature state of large drop icing simulation and compliance methods (SLD engineering tools) at the time of the task 2 report submittal. This latter report included "Interim Guidance Materials" reflective of the state of the art, and was accepted by the FAA on 14 August 2009. Additional US and European industry inputs were also recently provided to the FAA relative to proposed means of compliance for systems aspects.

Note: In terms of rulemaking action justification, the ARAC report also refers to documented cases of over 100 ice crystal and mixed phase engine power loss events, with six occurrences of multi-engine flameouts, during the period of 1988 through 2003. There is also a history of incidents where temporary loss of or misleading airspeed indications occurred in icing conditions; this can happen when encountering high concentrations of ice crystals which may affect Pitot probes.

#### **Interim actions**

Following the ATR 72 accident in 1994, measures were taken to minimise the potential hazard associated with certain aeroplanes operating in severe icing conditions.

Several Airworthiness Directives (AD) have been issued to require certain aeroplanes to exit severe icing conditions when visual cues indicate that these conditions exceed the capabilities of the ice protection equipment.

JAA issued interim policy INT/POL/25/11 "Severe Icing Conditions" and FAA produced a generic issue paper "Roll control in Supercooled Large Droplet conditions". These policies have been applied to certify new aeroplanes equipped with unpowered axis controls and pneumatic de-icing boots. EASA also uses Special Conditions for new certification projects based on JAA INT/POL/25/11. The intent is to ensure protection against loss of control by providing for means of detection and exiting from freezing drizzle and freezing rain conditions. However, they are not intended to certify an aeroplane for unrestricted flight in Supercooled Large Drops or any other conditions which are outside of the Appendix C icing envelope.

#### **Rulemaking action**

It is needed to improve the existing regulation to ensure safe operation of aeroplanes in freezing drizzle, freezing rain, mixed phase and ice crystal conditions. The ARAC report material and recommendations mentioned above, as well as any recent relevant industry inputs, should be considered when developing the rulemaking options.

### **3. Objective:**

Upgrade the existing CS-25 certification specifications to ensure that Large Aeroplanes safely operate in icing conditions including Supercooled Large Drop (freezing drizzle, freezing rain), mixed phase and ice crystal.

### **4. Specific tasks and interface issues (Deliverables):**

- 1) Review and analyse the ARAC report.
- 2) Prepare a CS-25 amendment which will:
  - provide an extended icing environment which will include SLD (freezing rain,

freezing drizzle);

- review aeroplane performance and handling qualities requirements when operating in this icing environment;
- provide specifications for protection of engine installation and aeroplane equipments against mixed phase and ice crystal;
- include Guidance Material and Acceptable Means of Compliance as required and, considering the state of the art of SLD engineering tools, determine whether the identification of interim method(s) of compliance (MOC) may be appropriate for some aspects."

3) Liaise and cooperate with FAA in order to promote harmonisation.

4) Coordinate with rulemaking task E.009 that will deal with engine certification aspects, in order to ensure consistency between the CS-25 specifications for ice protection of the engine installation and the CS-E specifications for engine ice protection.

**5. Working Methods** (in addition to the applicable Agency procedures):

Agency

Note: The Agency envisages to publish one NPA dealing with the CS-25 rule proposal (Book 1) and a separate NPA thereafter dealing with the corresponding guidance material and acceptable means of compliance (Book 2). The first CS-25 rule NPA will be connected with the NPA for task E.009 which will be prepared in parallel.

**6. Time scale, milestones:**

NPA: 2010/Q4

CS-25 Decision: 2012/Q2