This document was created to make public selected Special Conditions, Equivalent Safety Findings, Deviations, Elect to Comply and Reversions that are part of the applicable Certification Basis as recorded in TCDS EASA.A.064 and particular Interpretative Material:

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Revision 17	Addition of CRI E-65
Revision 18	Addition of CRI E-3003
Revision 19	Review of SC E-34, Addition of SC D-24, SC D-27, ESF B-17, ESF D-31, ESF F-125
Revision 20	Update of D-08 Add D-25, FCD-MULTI-01, F-MULTI-04, D-21, D-24, D-25, D-28, D-33, D35, F-5001, S-76-1 Removal of E-3002 as it is an IM Extension of SC E-01 to A319, keeping the E-1005 (having same title) specific to A320.
Revision 21	Addition of F-37 Replacement of SC F-2 by SC F-8 (F-2 being the reference of the CRI calling the SC F-8) Addition of EtC A-4008
Revision 22	F-37 header corrected from ESF to SC
Revision 23	Update of SC B-04 to add the applicability to A321-xxxNY Addition of SC B-201, SC B-203, SC B-207, SC C-03, SC D-32, SC E-67, ESF B-216, ESF E-68, ESF F-38, ESF G-228 released for the A321-253NY project Removal G-1006 (due to related clarification in TCDS issue 54)

SPECIAL CONDITION	A-1: Interaction of systems and structure
APPLICABILITY:	A318, A319, A321
REQUIREMENTS:	JAR 25.305, 25.629
ADVISORY MATERIAL:	---

BACKGROUND

The aircraft is equipped with systems which directly, or as a result of failure or malfunction, affect structural performance.

SPECIAL CONDITION

Add: 25.302 Interaction of systems and structures.

For an aeroplane equipped with systems which directly, or as a result of a failure or malfunction, affect structural performance, the *ininfluence* of these systems and their failure conditions must be accounted for in showing compliance with the requirements of Subpart C and D. (See ACJ 25.302).

Replace: 25.305(f) (pre-NPA 25 BCD-236 text) by the following text:

Unless shown to be extremely improbable, the aeroplane must be designed to withstand any additional load resulting from any failure, malfunction or adverse condition in the flight control system. These loads must be treated in accordance with § 25.302.

Replace: 25.629(d)(9) (pre-NPA 25BCD-236 text) with the following text:

Any damage, failure or malfunction considered under §§ 25.671, 25.672, and 25.1309. However, any failure or malfunction of a control system where the displacement of the movables is actively controlled by a system reacting to the relative motion of the aeroplane, or part of the aeroplane, must be addressed in accordance with ACJ 25.302 §4.

Replace: 25.629(d)(10) (pre-NPA 25 BCD-236 text) with the following text:

Any other combination of failures, malfunctions, or adverse conditions not shown to be extremely improbable. Combinations of structural damage and system failures which have an effect on the aeroelastic stability of the aeroplane should be addressed in accordance with ACJ 25.302 §4.1.2(vi).

SPECIAL CONDITION	**A-2: Stalling speeds for structural design**
APPLICABILITY:	A318, A319, A321
REQUIREMENTS:	JAR 25.333, 25.335, 25.479, 25.481, 25.729
ADVISORY MATERIAL:	---

BACKGROUND

The flight control system is equipped with a stall protection function which automatically controls elevator motion as the aeroplane approaches the stalling speed. The inclusion of this function influences the results of the conventional stalling manoeuver which is used in the definition of the minimum stalling speed. This, in turn, affects the values of the structural design speeds which are linked to V_S. To ensure that the conventional levels of design speed are used in the structural justification, new interpretations of some JAR paragraphs are needed.

SPECIAL CONDITION

For structural design purposes, the stalling speed has been redefined in the following paragraphs:

- JAR 25.333: use .94 V_{S1g} in lieu of V_{S1} in manoeuvring envelope.
- JAR25.335: use .94 V_{S1g} in lieu of V_{S1} and V_{S0}
- JAR25.335(c) & (d): use .94 V_{S1g} in lieu of V_{S1} and V_{S0}
- JAR25.335(e): use .94 V_{S1g} in lieu of V_{S1} and V_{S0}
- JAR 25.479(a): use .94 V_{S1g} in lieu of V_{S0}
- JAR25.481(a)(1): use .94 V_{S1g} in lieu of V_{S1} and V_{S0}
- JAR 25.729(a)(1)(ii): use .94 V_{S1g} in lieu of V_{S1} and V_S.

SPECIAL CONDITION	A-2.1.1: Load Alleviation System Influence on Structure (loads, aeroelastic, static and fatigue design)
APPLICABILITY:	TC: A320
REQUIREMENTS:	LAF - Certification criteria
ADVISORY MATERIAL:	---

BACKGROUND

For A/C with LAS there was a need for special interpretation of existing requirements. In some cases, special principles had to be defined to cover the particular characteristics of such systems.

The reference document proposed these LAS-Principles together with methods of demonstration due to non-availability of written requirements for A/C with LAS.

SPECIAL CONDITION

A design basis for aircraft with LAF has been established. This is in line with JAR 25.1309 failure philosophy.
AA agrees with the principles with which Airbus propose to show compliance except for criteria relative to dispatch in known failure condition which are discussed in a separate CRI.
In showing compliance with these and other principles which may need to be applied, the equivalent safety objective to conventional A/C will be considered to be met.

SPECIAL CONDITION	**A-2.2.2: Fly By Wire (FBW) Influence on Design Manoeuvre Requirements**
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	Design Manoeuvre Interpretation for A/C with FBW
ADVISORY MATERIAL:	---

BACKGROUND

The existing requirements for design manoeuvre need a special interpretation in cases where relevant system control laws are implemented.

SPECIAL CONDITION

Airbus will show compliance to agreed design conditions for which FBW manoeuvres are more severe that the required design.

SPECIAL CONDITION	A-2.2.3: FBW - Influence of High Speed Protection on Determination of V_D
APPLICABILITY:	A320 (kept for A319/A321)
REQUIREMENTS:	JAR 25.335 b(1), b(2)
ADVISORY MATERIAL:	N/A

BACKGROUND

The introduction of a high speed protection raises the problem of application of the manoeuvre defined in the JAR 21.335(b) 1 in view to determine V_D.

The principle of the high speed protection consists in establishing simultaneously, when the aircraft speed exceeds a determined speed (given by the setting of the system):
- an order in view to pull up,
- a reduction of the pilot authority in pull down.

These associated actions cannot allow to maintain the 7,5 ° slope during 20 seconds.

Failure of the high speed protection has to be considered.

SPECIAL CONDITION

A complete set of means of compliance with JAR 25.335 b) 1) and b) 2) covering both HSP operative and inoperative states is given, in which the same criteria are applied for the whole range of altitudes.

Delete the UK NV for JAR 25.335 b (2) and associated ACJ 25.335 b (2) and replace them by the basic JAR 25.335 b (2) with the interpretative material and means of compliance.

SPECIAL CONDITION	A-3.6.1: High Lift Devices
APPLICABILITY:	TC: A320
REQUIREMENTS:	JAR 25.345 (c), (e)
ADVISORY MATERIAL:	GIFAS Proposal for NPA

BACKGROUND

The existing requirement has to be cleaned up because it is confusing and therefore implies the danger of misinterpretations. Definitions of the used terms are needed as:

- en route
- procedure flight
- approach etc.

Second draft of GIFAS proposed NPA which was accepted by AA in the JAR Structure Study Group (meeting 25-26-27 September 84) will be adopted.

SPECIAL CONDITION

Second Draft of GIFAS Proposed NPA

Paragraph affected:
- JAR 25.335 – design airspeeds
- JAR 25.345 – high lift devices

Proposal:

- JAR 25.335 (g): delete completely
- JAR 25.345 (c): add at the end: (see ACJ 25.345(c))
- JAR 25.345 (e): delete completely
- ACJ 25.345 (c): interpretative material

1) En route conditions, as applied to the use of high lift devices, are meant to include flight segments other than take-off, approach and landing.

The following flight phases are to be considered as en route conditions:

- holding in designated areas outside of the terminal area of the airport of destination,

- flight with flaps extended from top of descent.

The following flight phases are to be considered as approach conditions:

- portion of the flight corresponding to standard arrival routes preceding the interception of the final approach path,

- holding at relatively low altitude close to the airport of destination.

2) To apply JAR 25.341 gust conditions to JAR 25.345 (c) speeds V_{FB}, V_{FC} and V_{FD} may be determined for the flap positions selected in en route conditions. An applicant may elect not to comply with the V_{FB} gust conditions if the airplane can be cleaned up for severe turbulence. If the latter solution is adopted, this shall be in accordance with procedures defined in the Airplane Flight Manual.

3) The manoeuvre of 25.345 (c) (1) is to be considered as a balanced condition.

Justification:

- With the above interpretative material (extracted from two letters of FAA to JAR structures group dated 01-04-82 and 17-09-82) there is no problem in interpreting FAA rules.

- The concept of introduction design conditions "procedure flight conditions" in between "en route" conditions and "approach, take-off and landing" conditions is of little practical value, as in the design of the airplanes we know the critical loading cases for leading edge devices are clean or "en route conditions", and the critical loading cases for flaps are landing conditions.

Hence we consider that there is no good reason anymore to deviate from the basic FAA text.
(And the proposed ACJ may possibly ease the deletion of JAR 25.345 UK national variant).

SPECIAL CONDITION	**A-4.3.1 SC A-4.3: Discrete Tuned Gust (D.T.G.) 25.341 (d) + Vertical**
APPLICABILITY:	TC: A320-111, -211, -231, -212, WV 001-006
REQUIREMENTS:	JAR 25.341 (d)
ADVISORY MATERIAL:	N/A

BACKGROUND

The existing British National Variation at basic TC date needed some further detailed interpretation to be used for vertical gust calculations.

SPECIAL CONDITION A.4.3

For vertical gust use the following TUNING-LAW:

The H 1/3 law has to be chosen that way that it meets:

- 90 % Ude (V_C, V_B, V_D) at 75 ft gust length;

- beyond that, 90 % Ude = const. has to be used.

- 100 ft gust length as the lower value for 90 % Ude.

SPECIAL CONDITION	**A-4.3.2 SC A-4.3: Discrete Tuned Gust (D.T.G.) 25.351 + NV (GB) – Lateral**
APPLICABILITY:	TC: A320-111, -211, -231, -212, WV 001-006
REQUIREMENTS:	JAR 25.351
ADVISORY MATERIAL:	N/A

BACKGROUND

The existing British National Variation needs some further detailed interpretations to be used for lateral gust calculation, which has to be different from vertical gust which was found unnecessarily severe based on accidents due to lateral gusts.

SPECIAL CONDITION A.4.3

For lateral gust use the following TUNING-LAW:

The H 1/3 law has to be chosen that way that it meets:

- 90 % Ude (V_C, V_B, V_D) at 100 ft gust length.

- beyond that, 90 % Ude = const. has to be used.

SPECIAL CONDITION	**A-4.4: Loads on High lift devices - Checked Manoeuvre**
APPLICABILITY:	Post TC: A320
REQUIREMENTS:	JAR 25.345 (a)(3) and (C)(3) UK National Variant
ADVISORY MATERIAL:	…

BACKGROUND

This National Variant requires a checked manoeuvre to be considered in configuration with high lift devices extended.

SPECIAL CONDITION

Based on past experience from a safety point of view, the design manoeuvre condition under configuration with high lift devices extended need to take in to account the following JAR 25.345 (a)(3) and (C)(3).

SPECIAL CONDITION	**A-4.5: Braked Roll Conditions – Dynamic Braking**
APPLICABILITY:	A319/A320/A321 (further variants certificated after Aug 10 1998 (and for A319 weight variant 002 and following, superseded by JAR 25.943(d) at Change 14 (CRI A7)).
REQUIREMENTS:	JAR 25.493 (d) UK National Variant
ADVISORY MATERIAL:	N/A

BACKGROUND

The UK National Variant required to take into consideration the dynamic braking case in addition to 25.493 braked roll conditions basic text.

SPECIAL CONDITION

AA considers this NV is not in conflict with basic JAR 25. This NV is required by CAA.

AI applies this requirement.

SPECIAL CONDITION	**A-4.6: Speed Control Devices**
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.373 UK National Variant
ADVISORY MATERIAL:	N/A

BACKGROUND

Cross references in JAR 25.373 NV (UK) is not understood.

SPECIAL CONDITION

Cross reference is wrong in the NV and should be read JAR 25.335(f).

NV was found not significant for the A320 because the speed control devices usage is unrestricted within the flight envelope. The UK NV is accepted for inclusion into the A320 common basis.

ELECT TO COMPLY	A-7: Braked Roll Conditions
APPLICABILITY:	Post-TC: A319/A320/A321
REQUIREMENTS:	JAR 25.493(d) at Change 14
ADVISORY MATERIAL:	N/A

BACKGROUND

JAR 25 at Change 13 Introduced paragraph 25.493(d) for dynamic braking. Due consideration must be given to the loads arising from a sudden increase of vertical dynamic reaction at the nose gear as a result of sudden application of maximum main gear braking effort.

JAR 25 at Change 13 paragraph 25.493(d) for dynamic braking is technically equivalent to A320 HC A4.5, as far as the nose gear vertical reaction is concerned. However there is no longer combination with drag load.

In addition to the proposed certification basis defined in the certification programme related to the project J1W002 (A319 weight variant 002; modification number 27112), and for any further A320 family variant, Airbus Industrie elect to comply with JAR 25.493(d) at Change 14 plus amendment 25/96/1.

ELECT TO COMPLY

JAA Position: JAA agree with Airbus statement regarding the technical content of the new paragraph JAR 25.493(d) compared with A320 Harmonisation Condition HC A4.5.

In addition:

- paragraph 25.493(d), considered alone, addresses in itself the certification issue and,

- JAR 25 at Change 14 plus amendment 25/96/1 is the latest applicable requirement.

The Airbus Elect to Comply is acceptable to JAA. For A319 weight variant 002 certification, and for any further variant certification on the A320 family, the HC A4.5 is superseded by JAR 25.493(d) at Change 14.

ELECT TO COMPLY	**A-2006: Discrete gust requirements – deletion of Load Alleviation Function**
APPLICABILITY:	Post-TC: A319/A320/A321
REQUIREMENTS:	JAR 25.341 (a) at Change 14 NPA 25C-205
ADVISORY MATERIAL:	N/A

BACKGROUND

For the first A320 models, in order to get better design commonality within the A319/A320/A321 fleet, Airbus Industrie has applied for certification of the major change titled 'Flight Controls - deletion of LAF features from A320'.

Reminder: the LAF was introduced in the A320 type design in order to alleviate the discrete gust loads (see §341(a)). Then, for the A320 derivatives (from weight variant 007 and for A321 & A319), the harmonised gust requirements from NPA 25C-205 have been used.

ELECT TO COMPLY

Airbus Industrie elects to comply with the new discrete gust requirements of JAR Change 14 as amended by NPA 25C-282.

ELECT TO COMPLY	**A-4008: Emergency landing conditions**
APPLICABILITY:	Post-TC: A319 corporate jet use
REQUIREMENTS:	JAR 25.561(c) change 14
ADVISORY MATERIAL:	N/A

BACKGROUND

The review of applicable requirements and compliance to be shown for the A319 with up to 6 auxiliary fuel centre tanks (ACTs) lead to consider paragraph JAR 21,561(c) at change 14 relevant for system and equipment in that area due to the installation of ACTs in the forward cargo hold.

JAR 25.561(c) is specific to JARs. It requires that the attachments be designed to withstand 1.33 times the loads of JAR 25.561(b)3.

Quote:
[…] Equipment, cargo in the passenger compartment and other large masses must be positioned so that if they break loose they will unlikely to: […] penetrate fuel tanks or lines or cause fire of explosion hazard by damage to adjacent systems; […] If the local attachments *(i.e. according to NPA 25C-120 introduced in Change 13: those parts of the attachment which may be subject to degradation through wear and tear)* for these items are subject to severe tear and wear, these attachments should be designed to withstand 1.33 times the specified loads. […]
Unquote

ELECT TO COMPLY

For the A319 Corporate Jet use certification, Airbus Industrie elect to comply with JAR 25.561(c) at the latest published Change, i.e. at Change 14 (same wording as in Change 13).

SPECIAL CONDITION	**A-5001: Engine failure Loads**
APPLICABILITY:	TC: A318-121/122
REQUIREMENTS:	JAR 25.361
ADVISORY MATERIAL:	N/A

BACKGROUND

The initial airworthiness standards contained in FAR 25 require that turbine engine mounts and supporting structure must he designed to withstand "...a limit engine torque load imposed by sudden engine stoppage due to malfunction or structural failure (such as compressor jamming)." This was first made a specific requirement for U.S. transport category aeroplanes in 1957 by Civil Air Regulation (CAR) 4b.216 (a)(4). This same requirement is contained in JAR 25.361(b), except that this subparagraph also addresses auxiliary power unit (APU) installations.

The size, configuration, and failure modes of jet engines have changed considerably since FAR/JAR 25.361(b) was first adopted.

Relative to the engine configurations that existed when the rule was first developed, these later generations of jet engines are sufficiently different and novel to justify amending the regulations to ensure that adequate design standards are available for the mounts and the structure supporting these newer engines. Therefore, in order to maintain the level of safety intended by JAR 25.361(b), it is considered that a more comprehensive criterion is necessary one that considers all load components when designing to address engine failure events.

Studies made by the engine and the airframe manufacturers have shown that large turbofan engines exhibit two distinct classes of sudden deceleration events:
- transient deceleration conditions involving rapid slowing of the rotating system
- engine failures that result in extensive engine damage and permanent loss of thrust –producing capability

Accordingly, an amendment of JAR 25.361 and a new JAR 25.362 and with ACJ 25.362 addressing engine failure loads, which would distinguish between design criteria for the more common failure events (first type of event) and design criteria for those rare events resulting from structural failures (second type of event).

SPECIAL CONDITION

1. Amend JAR 25.361 to read as follows:

JAR 25.361 Engine and auxiliary power unit torque

(a) Each engine mount and its supporting structure must be designed for the effects of:

(1) a limit engine torque corresponding to takeoff power and propeller speed acting simultaneously with 75 percent of the limit loads from flight condition A of JAR 25.333(b);
(2) a limit torque corresponding to the maximum continuous power and propeller speed, acting simultaneously with the limit loads from flight condition A of JAR 25.333(b); and:
(3) for turbopropeller installations, in addition to the conditions specified in subparagraphs (a){l) and (a)(2), a limit engine torque corresponding to takeoff power and propeller speed, multiplied by a factor accounting for propeller control system malfunction, including quick feathering, acting simultaneously with 1g level flight loads. In the absence of a rational analysis, a factor of 1.6 must be used.

(b) The limit engine torque to be considered under subparagraph (a) must be obtained by multiplying mean torque for the specified power and speed by a factor of:
(4) 1.25 for turbopropeller installations;
(5) 1.33 for reciprocating engines.

(c) For turbine engine installations, the engine mounts, pylons, and adjacent supporting airframe structure must be designed to withstand 1g level night loads acting simultaneously with the maximum limit torque loads imposed by each of the following:
(6) sudden engine deceleration due to a malfunction which could result in a temporary loss of power or thrust; and
(7) the maximum acceleration of the engine.

(d) For auxiliary power unit installations, the power unit mounts and adjacent supporting airframe structure must be designed to withstand 1g level flight loads acting simultaneously with the maximum limit torque loads imposed by each of the following:
(8) sudden auxiliary power unit deceleration due to malfunction or structural failure; and
(9) the maximum acceleration of the power unit.

2. Add a new JAR 25.362 to read as follows:

JAR 25.362 Engine failure loads

(e) For engine supporting structure, an ultimate loading condition must be considered that combines 1g flight loads with the transient dynamic loads resulting from:
(10) the loss of any fan, compressor, or turbine blade; and

(11) separately, where applicable to a specific engine design, any other engine structural failure that results in higher loads.

(f) The ultimate loads developed from the conditions specified in paragraph (a) are to be:
(1) multiplied by a factor of 1.0 when applied to engine mounts and pylons; and
(2) multiplied by a factor of 1.25 when applied to adjacent supporting airframe structure.

SPECIAL CONDITION	**A-5003: Design Dive Speed VD**
APPLICABILITY:	TC: A318 Post-TC: A319/A320/A321 with mod 160500/160023
REQUIREMENTS:	JAR 25.335 (b)(1) and (b)(2)
ADVISORY MATERIAL:	ACJ 25.335 (b)(2)

BACKGROUND

The A318 is equipped with a high speed protection system which limits nose down pilot authority at speeds above V_C/M_C. The requirement of JAR 25.335 (b)(1) must therefore be adapted.

For basic A320, Interpretative Material A-2.2.3 was issued to address the case of overspeed protection failure, in addition to ACJ 25.335(b)(2) - Design Diving Speed. This addition should be applicable also to A318.

Regarding applicability of ACJ 25.335 (b)(2), Airbus elects to apply the harmonised material for atmospheric variations aspects, i.e. revised vertical gust shear compared to current ACJ 25.335.

NOTE: This Special Condition is applicable also for A319/A320/A321 aircraft equipped with modification 160500 or 160023 (Sharklets).

SPECIAL CONDITION

Modify JAR 25.335(b) to read:

(b) Design Dive speed, V_D. V_D must be selected so that V_C/M_C is not greater than 0.8 V_D/M_D, or so that the minimum speed margin between V_C/M_C and V_D/M_D is the greater of the following values:

(1) The speed increase above V_C/M_C resulting from the following manoeuvres:

(i) From an initial condition of stabilised flight at V_C/M_C, the aeroplane is upset so as to take up a new flight path 7.5° below the initial path. Control application, up to full authority, is made to try and maintain this new flight path. Twenty seconds after initiating the upset manual recovery is made at a load factor of 1.5 g (0.5 g acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral. The speed increase occurring in this manoeuvre may be calculated, if reliable or conservative aerodynamic data is used. Power as specified in JAR 25.175 (b)(1)(iv) is assumed until recovery is made, at which time power reduction and the use of pilot controlled drag devices may be assumed.

(ii) From a speed below V_C/M_C, with power to maintain stabilised level flight at this speed the aeroplane is upset so as to accelerate through V_C/M_C at a flight path 15° below the initial path (or at the steepest nose down attitude that the system will permit with full control authority if less than 15°).

Note: pilots controls may be in neutral position after reaching V_C/M_C and before recovery is initiated.

Recovery may be initiated 3 seconds after operation of high speed, attitude or other alerting system by application of a load factors of 1.5 g (0.5 g acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral. Power may be reduced simultaneously.

All other means of decelerating the aeroplane, the use of which is authorised up to the highest speed reached in the manoeuvre, may be used. The interval between successive pilot actions must not be less than one second.

(2) The minimum speed margin must be enough to provide for atmospheric variations (such as horizontal gusts, and penetration of jet streams and cold fronts) and for instruments errors and airframe production variations. These factors may be considered on a probability basis. However, the margin at altitude where M_C is limited by compressibility effects may not be less than .05 M.

DEVIATION	**ACNS-B-GEN-01: Removal of DM89 Monitoring message from the required CPDLC downlink messages list**
APPLICABILITY:	Post TC: A318/319/320/321
REQUIREMENTS:	CS ACNS-B
ADVISORY MATERIAL:	-

BACKGROUND

The purpose of this CRI is to address an installation that does not include the message DM89 MONITORING [unitname] [frequency] within the message set that can be downlinked. CS ACNS.B.DLS.B1.075 CPDLC Downlink Messages, requires DM89 message as part of the required ATN B1 message set. Additionally, this deviation requires to consider as well CS CNS.A.GEN.001 Applicability requirement.

CS-ACNS Subpart B Section 2 contains the applicable requirements and Acceptable means of compliance for Data link installations interoperable with ATN B1 data link, supporting the European Data link regulation (EC) No 29/2009. CS ACNS.A.GEN.001 indicates that "compliance with the appropriate section of these Certification Specifications ensures compliance with the following European regulations: … (d) Commission Regulation (EC) No 29/2009 of 16 January 2009 laying down requirements on data link services for the Single European Sky; …". By deviating from CS ACNS.B.DLS.B1.075, compliance with Commission Regulation (EC) No 29/2009 may be affected.

CS-ACNS Subpart B Section 2 requires that airborne ATN B1 Data link installations are compliant with certain paragraphs of EUROCAE ED-120, related to Safety and Performances, and EUROCAE ED-110B, related to Interoperability.

For the proposed installation, the ATN B1 capability is proposed through the ATN B2 Backward Compatibility with ATN B1 capability, as defined in the EUROCAE ED-231A (Interoperability requirements standard for Baseline 2 ATS data communications, ATN B1 accommodation (ATN Baseline 1 – Baseline 2 Interop standard)). This standard ED-231A defines the backward compatibility interoperability requirements on air and ground systems in order to support the required services when talking to ATN B1 ground and air implementations.

However, the lack of implementation of DM89 leads to partial lack of support of some ATC Communications Management (ACM) services, where it may be required:

- transfers from T-ATSU to R-ATSU both ATSUs using CPDLC;
- transfers from T-ATSU not using CPDLC to R-ATSU using CPDLC;
- transfers and/or change of frequency with no change in the established CPDLC, both sectors using CPDLC;
- transfers from T-sector not using CPDLC (OFF) to R-sector using CPDLC (ON), with no change in the established CPDLC;

DEVIATION

Considering that:

- DM89 is not operationally used in European implementation of ATN B1 Data link services, as none of EU ANSP's use MONITOR concept under their standard operating methods
- ICAO has removed DM89 from the CPDLC Message set or identified as not operationally required
- International experts' community considers that silent transfer using DM89 message is not adequate; basic assumption of maintaining radio voice communications for intervention may be jeopardized in the absence of voice contact when entering a sector managed by the receiving ATSU.

It is proposed a deviation to CS ACNS.B.DLS.B1.075 requirement by not including DM89 MONITORING [unit name] [frequency] in the downlink message set installed.

Original CS-ACNS requirement	Proposed deviation to CS ACNS.B.DLS.B1.075
CS ACNS.B.DLS.B1.075 CPDLC Downlink Messages The data link system is capable of preparing and send the following downlink message elements: … DM89 MONITORING [unitname] [frequency]	This installation is not capable to generate and downlink DM89 MONITORING message. ~~DM89 MONITORING [unitname] [frequency]~~

As a consequence, since removal of DM89 does not allow to fully support the ACM operating methods referred in ED-120 Sections 5.1.1.1.1 to 5.1.1.1.7, which are required by Commission Regulation (EC) No 29/2009, compliance with CS ACNS.A.GEN.001 Applicability may not be assured.

Taking into account the previous justifications, EASA considers acceptable that airborne installations where DM89 is not implemented in CPDLC message set can still be interoperable with European ATN B1 ground ATC centres. Aircraft installations without DM89 implemented should include the following limitation in AFM:

> Aircraft CPDLC installation complies with CS-ACNS Subpart B Section 2, except that the aircraft system is unable to generate DM89 MONITORING

No additional mitigation means are foreseen as "Monitor" concept is not operationally used in European implementation of ATN B1 Data link services.

SPECIAL CONDITION	**B-01: SA New Engine Option (NEO) Stalling and Scheduled Operating**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.21, 25.103, 25.143 (h), 25.145, 25.201, 25.203, 25.207, 25.1323
ADVISORY MATERIAL:	---

BACKGROUND

The SA NEO is equipped with a low speed protection system providing a protection against stall that cannot be overridden by the pilot.
The requirements of CS 25 must therefore be adapted to consider this function.

SPECIAL CONDITION

1 – Definitions

This Special Condition addresses novel features and uses terminology that does not appear in CS 25.

The following definitions shall apply:

- High incidence protection system : A system that operates directly and automatically on the aeroplane's flying controls to limit the maximum angle of attack that can be attained to a value below that at which an aerodynamic stall would occur.
- Alpha-floor system : A system that automatically increases thrust on the operating engines when angle of attack increases through a particular value
- Alpha-limit : The maximum angle of attack at which the aeroplane stabilises with the high incidence protection system operating and the longitudinal control held on its aft stop
- Vmin : The minimum steady flight speed in the aeroplane configuration under consideration with the high incidence protection system operating. See section 3 of this Special Condition.
- Vmin1g : Vmin corrected to 1g conditions. See section 3 of this Special Condition. It is the minimum calibrated airspeed at which the aeroplane can develop a lift force normal to the flight path and equal to its weight when at an angle of attack not greater than that determined for Vmin.

2 - Capability and Reliability of the Hiqh Incidence Protection System

Those paragraphs of CS 25 quoted in reference may be amended in accordance with this Special Condition provided that acceptable capability and reliability of the high incidence protection system can be established by flight test, simulation, and analysis as appropriate. The capability and reliability required are as follows:
1- It shall not be possible during pilot induced manoeuvres to encounter a stall and handling characteristics shall be acceptable, as required by section 5 of this Special Condition.
2- The aeroplane shall be protected against stalling due to the effects of wind-shears and gusts at low speeds as required by section 6 of this Special Condition.

3- The ability of the high incidence protection system to accommodate any reduction in stalling incidence must be verified in icing conditions
4- The high incidence protection system must be provided in each abnormal configuration of the high lift devices that is likely to be used in flight following system failures
5- The reliability of the system and the effects of failures must be acceptable in accordance with CS 25.1309.

3 - Minimum Steady Flight Speed and Reference Stall Speed

Delete existing CS-25.103 and replace as follows:

CS 25.103 : Minimum steady flight speed and Reference stall speed

(a) The minimum steady flight speed, Vmin, is the final stabilised calibrated airspeed obtained when the aeroplane is decelerated until the longitudinal control is on its stop in such a way that the entry rate does not exceed 1 knot per second.
(b) The minimum steady flight speed, Vmin, must be determined with:
(1) The high incidence protection system operating normally.
(2**)** Idle thrust and alpha-floor system inhibited;
(3) All combinations of flaps setting and, landing gear position for which Vmin is required to be determined;
(4) The weight used when Vsr is being used as a factor to determine compliance with a required performance standard;
(5) The most unfavourable centre of gravity allowable; and
(6) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim
system.
(c) The one-g minimum steady flight speed, Vmin1g, is the minimum calibrated airspeed at which the aeroplane can develop a lift force (normal to the flight path) equal to its weight, whilst at an angle of attack not greater than that at which the minimum steady flight speed of sub-paragraph (a) was determined.
(d) The reference stall speed, Vsr, is a calibrated airspeed defined by the applicant. Vsr may not be less than a 1-g stall speed. VSR is expressed as:

$$V_{SR} \geq \frac{V_{CL_{MAX}}}{\sqrt{n_{ZW}}}$$

where
VCLMAX = Calibrated airspeed obtained when the load factor corrected lift coefficient $\left(\frac{n_{ZW}W}{qS}\right)$ is first a maximum during the manoeuvre prescribed in sub-paragraph (f) of this paragraph.
nZW = Load factor normal to the flight path at VCLMAX
W = Airplane gross weight;
S = Aerodynamic reference wing area; and
q = Dynamic pressure.
(e) VCLMAX is determined with:
(1) Engines idling, or, if that resultant thrust causes an appreciable decrease in stall speed, not more than zero thrust at the stall speed;

(2) The aeroplane in other respects (such as flaps and landing gear) in the condition existing in the test or performance standard in which Vsr is being used;
(3) The weight used when Vsr is being used as a factor to determine compliance with a required performance standard;
(4) The centre of gravity position that results in the highest value of reference stall speed;
(5) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system, but not less than 1.13 Vsr and not greater than 1.3 Vsr;
(6) Alpha-floor system inhibited; and
(7) The High Incidence Protection System adjusted, at the option of the applicant, to allow higher incidence than is possible with the normal production system.

(f) Starting from the stabilised trim condition, apply the longitudinal control to decelerate the aeroplane so that the speed reduction does not exceed one knot per second.

4 - Stall Warning

Delete existing CS 25.207 and replace as follows:

4.1 Normal operation

If the conditions of paragraph 2 are satisfied, equivalent safety to the intent of CS 25.207, Stall Warning, shall be considered to have been met without provision of an additional, unique warning device.

4.2 High Incidence Protection System Failure

Following failures of the high incidence protection system, not shown to be extremely improbable, such that the capability of the system no longer satisfies items 1, 2 and 3 of paragraph 2, stall warning must be provided in accordance with CS 25.207(a), (b) and (f)

5 - Handling Characteristics at High Incidence

Delete existing CS 25.201, replace as follows:

5.1 High Incidence Handling Demonstrations

CS 25.201 : High incidence handling demonstration

(a) Manoeuvres to the limit of the longitudinal control, in the nose up sense, must be demonstrated in straight flight and in 30° banked turns with:
(1) The high incidence protection system operating normally.
(2) Initial power conditions of:
I: Power off
II: The power necessary to maintain level flight at 1.5 Vsr1, where Vsr1 is the reference stall speed with flaps in approach position, the landing gear retracted and maximum landing weight.
(3) Alpha-floor system operating normally unless more severe conditions are achieved with inhibited alpha floor.
(4) Flaps, landing gear and deceleration devices in any likely combination of positions

(5) Representative weights within the range for which certification is requested; and
(6) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

(b) The following procedures must be used to show compliance with 25.203, as amended by this special condition:

(1) Starting at a speed sufficiently above the minimum steady flight speed to ensure that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction does not exceed one knot per second until the control reaches the stop
(2) The longitudinal control must be maintained at the stop until the aeroplane has reached a stabilised flight condition and must then be recovered by normal recovery techniques.
(3) The requirements for turning flight manoeuvre demonstrations must also be met with accelerated rates of entry to the incidence limit, up to the maximum rate achievable.

5.2 Characteristics in High Incidence Manoeuvres

Delete existing 25.203 and the associated AMC, Replace as follows:

CS 25.203: Characteristics in High Incidence

(a) Throughout manoeuvres with a rate of deceleration of not more than 1 knot per second, both in straight flight and in 30° banked turns, the aeroplane's characteristics shall be as follows:

(1) There shall not be any abnormal nose-up pitching.
(2) There shall not be any uncommanded nose-down pitching, which would be indicative of stall. However reasonable attitude changes associated with stabilising the incidence at Alpha limit as the longitudinal control reaches the stop would be acceptable.
(3) There shall not be any uncommanded lateral or directional motion and the pilot must retain good lateral and directional control, by conventional use of the controls, throughout the manoeuvre.
(4) The aeroplane must not exhibit buffeting of a magnitude and severity that would act as a deterrent from completing the manoeuvre specified in § 5.1.(a).

(b) In manoeuvres with increased rates of deceleration some degradation of characteristics is acceptable, associated with a transient excursion beyond the stabilised Alpha-limit. However the aeroplane must not exhibit dangerous characteristics or characteristics that would deter the pilot from holding the longitudinal control on the stop for a period of time appropriate to the manoeuvre.
(c) It must always be possible to reduce incidence by conventional use of the controls.
(d) The rate at which the aeroplane can be manoeuvred from trim speeds associated with scheduled operating speeds such as V2 and Vref up to Alpha-limit shall not be unduly damped or be significantly slower than can be achieved on conventionally controlled transport aeroplanes.

5.3 Characteristics up to maximum lift angle of attack

Manoeuvres with a rate of deceleration of not more than 1 knot per second up to the angle of attack at which VCLMAX was obtained as defined in paragraph 3 must be demonstrated in straight flight and in 30° banked turns with:

(1) The high incidence protection deactivated or adjusted, at the option of the applicant, to allow higher incidence than is possible with the normal production system.
(2) Alpha floor system inhibited
(3) Engines idling
(4) Flaps and landing gear in any likely combination of positions
(5) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

During such manoeuvres, the aeroplane must not exhibit dangerous characteristics; it must always be possible to reduce angle of attack by conventional use of the controls.

6 - Atmospheric Disturbances

Operation of the high incidence protection system must not adversely affect aircraft control during expected levels of atmospheric disturbances, nor impede the application of recovery procedures in case of wind-shear.

7 - Alpha floor

The Alpha-floor setting must be such that the aircraft can be flown at normal landing operational speeds and manoeuvred up to bank angles consistent with the flight phase without triggering Alpha-floor.
In addition there must be no alpha-floor triggering unless appropriate when the aircraft is flown in usual operational manoeuvres and in turbulence.

8 – Proof of compliance

Add the following paragraph 25.21 (b):

(b) The flying qualities will be evaluated at the most unfavourable CG position.

9 – Change CS 25.145 (a), CS 25.145 (b) (6) and CS 25.1323(d) as follows:

CS 25.145 (a) Vmin in lieu of "stall identification"
CS 25.145 (b) (6) Vmin in lieu of Vsw
CS 25.1323 (d) "From 1.23 Vsr to Vmin" in lieu of "1.23 Vsr to stall warning speed" and "speeds below Vmin" in lieu of "speeds below stall warning"

SPECIAL CONDITION	**B-03: SA New Engine Option (NEO) Motion and Effect of Cockpit Control**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.143, JAR 25.777
ADVISORY MATERIAL:	N/A

BACKGROUND

The SA NEO, like the SA CEO (conventional engine option), is equipped with a side stick control system. As such the requirements of CS 25.143 and JAR25.777 are adapted for side stick controls.

SPECIAL CONDITION

1) Add to paragraph JAR 25.777 (b):
Pitch and roll control force and displacement sensitivity shall be compatible, so that normal inputs on one control axis will not cause significant unintentional inputs on the other.

2) Introduce new paragraph CS 25.143 (j):
Pilot strength.
In lieu of the "strength of pilots" limits shown in CS 25.143 (c) for pitch and roll, and in lieu of specific pitch force requirement of CS 25.145 (b) and CS 25.175 (d), it must be shown that the temporary and maximum prolonged force levels for the side stick controllers are suitable for all expected operating conditions and configurations, whether normal or non-normal.

3) Introduce new paragraph CS 25.143 (k) :
Pilot control.
It must be shown by flight tests that turbulence does not produce unsuitable pilot-in-the loop control problems when considering precision path control/tasks.

4) Introduce new paragraph CS 25.143 (l) :
When a flight case exists where, without being commanded by the crew, control surfaces are coming so close to their limits that return to normal flight condition and (or) continuing of safe flight needs a specific crew action, a suitable flight control position annunciation shall be provided to the crew, unless other existing indications are found adequate or sufficient to prompt that action.

SPECIAL CONDITION	B-04: SA New Engine Option (NEO) Static Directional, Lateral and Longitudinal Stability and Low energy awareness
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN/A321-2XXNY
REQUIREMENTS:	CS 25.171, CS 25.173, CS 25.175, CS 25.177
ADVISORY MATERIAL:	N/A

BACKGROUND

The SA NEO, like the SA CEO (conventional engine option) family, is equipped with an electronic flight control system. As such the regulations linked to lateral directional stability, longitudinal stability and low energy awareness are adapted.

For SA NEO this SC:
- Proposes a unique SC for longitudinal, lateral, directional stability and low energy awareness,
- Updates the SC in accordance with CS 25 Amdt 11 (requirement CS25.177 evolution NPA 25B-333 and NPA 2009-12),
- Completes the low energy awareness interpretative material.

1) Lateral-directional Stability
The SA NEO has a flight control design feature within the normal operational envelope in which side stick deflection in the roll axis commands roll rate. As a result:
- static lateral stability as defined in CS 25.177(b) by the tendency to raise the low wing in a sideslip with the aileron controls free will be neutral.
- the stick force in the roll axis will be zero (neutral stability) during the straight, steady sideslip flight manoeuvre of CS 25.177(c), and will not be "substantially proportional to the angle of sideslip" as required by the rule.

In addition, compared to JAR25.177(c) at change 11, CS 25 Amdt 11 introduces:
- a modification in CS25.177 (c) and its interpretative material: addressing the domain of sideslip angles appropriate to the operation of the aeroplane, and
- a new separate paragraph CS25.177 (d) and its interpretative material : addressing the domain of sideslip angles greater than those prescribed in (c), and up to the angle at which full rudder control is used.

SPECIAL CONDITION

1) Replace CS 25.171 by the following:
"The aircraft must be shown to have suitable lateral, directional and longitudinal stability in any condition normally encountered in service, including the effects of atmospheric disturbances. The aircraft, fitted with flight control laws presenting neutral static longitudinal stability significantly below the normal operating speeds, must provide adequate awareness to the pilot of a low energy state.
2) Remove CS 25.173
3) Remove CS 25.175
4) Remove CS 25.177 (b)

5) Replace CS 25.177 (c) by the following:
(c) In straight, steady, sideslips over the range of sideslip angles appropriate to the operation of the aeroplane, the rudder control movements and forces must be substantially proportional to the angle of sideslip in a stable sense. The factor of proportionality must lie between limits found necessary for safe operation. The range of sideslip angles evaluated must include those sideslip angles resulting from the lesser of:

(1) one-half of the available rudder control input; and
(2) a rudder control force of 801 N (180 lbf).

This requirement must be met for the configurations and speeds specified in subparagraph (a) of CS 25.171. (See AMC 25.177(c).)

SPECIAL CONDITION	**B-07: SA New Engine Option (NEO) Flight Envelope Protection**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.143
ADVISORY MATERIAL:	N/A

BACKGROUND

Like the SA CEO (conventional engine option), SA NEO has flight envelope protections (high and low speed, angle of attack, bank angle) implemented in the Electrical Flight Control System (EFCS).
For SA NEO, in the frame of CPR assessment, paragraph 25.143 is applicable at CS25 Amdt 2.

SPECIAL CONDITION

Add a new paragraph CS 25.143 (h).

Normal operation:

1) Onset characteristics of each envelope protection feature must be smooth, appropriate to the phase of flight and type of manoeuvre and not in conflict with the ability of the pilot to satisfactorily change aeroplane flight path, or attitude as needed.

2) Limit values of protected flight parameters must be compatible with:
   a) aeroplane structural limits,
   b) required safe and controllable manoeuvring of the aeroplane and
   c) margin to critical conditions.

   Unsafe flight characteristics/conditions must not result from:
   - dynamic manoeuvring,
   - airframe and system tolerances (both manufacturing and in-service), and
   - non-steady atmospheric conditions, in any appropriate combination and phase of flight, if this manoeuvring can produce a limited flight parameter beyond the nominal design limit value.
   Note : Reference may be made to FAA Advisory Circular AC 120-41 for guidance on atmospheric conditions.

3) The aeroplane must respond to intentional dynamic manoeuvring within a suitable range of the parameter limit. Dynamic characteristics such as damping and overshoot must also be appropriate for the flight manoeuvre and limit parameter concerned.

4) When simultaneous envelope limiting is engaged, adverse coupling or adverse priority must not result.

Failure states:
EFCS (including sensor) failures must not result in a condition where a parameter is limited to such a reduced value that safe and controllable manoeuvring is no longer available. The crew must be alerted by suitable means if any change in envelope limiting or manoeuvrability is produced by single or multiple failures of the EFCS not shown to be extremely improbable.

SPECIAL CONDITION	**B-08 : SA New Engine Option (NEO) Normal Load Factor Limiting System**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.143
ADVISORY MATERIAL:	N/A

BACKGROUND

Like the SA CEO (conventional engine option), SA NEO has a normal load factor limiting feature implemented in the flight control laws within the whole flight domain, which limits the load factor capability within the structural load factor range defined by CS 25.333.
For SA NEO Type Certification, the following Special Condition is proposed to replace the existing SC F-8 as currently applicable for the SA CEO with Sharklets.
For SA NEO, in the frame of CPR assessment, paragraph 25.143 is applicable at CS25 Amdt 2.

SPECIAL CONDITION

Add a new paragraph CS 25.143 (i) to read as follows:

CS 25.143 General

(i) In the absence of other limiting factors:
- 1) The positive limiting load factor must not be less than:
  - a) 2.5 g for the EFCS normal state with high lift devices retracted.
  - b) 2.0 g for the EFCS normal state with the high lift devices extended.

2) The negative limiting load factor must be equal to or more negative than:
- a) minus 1.0 g for the EFCS normal state with high lift devices retracted.
- b) 0 g for the EFCS normal state with high lift devices extended.

SPECIAL CONDITION	B-12 : Soft Go Around
APPLICABILITY:	Post-TC: SA NEO
REQUIREMENTS:	CS 25.101(g) and (h), 25.119, 25.121(d), 25.1001, 25.1301, 25.1309, 25.1581, 25.1587(b)(3)(ii).
ADVISORY MATERIAL:	CRI B-11, AMC 25.1581 (d) (13), (15) & (16)

BACKGROUND

The A320 is to be equipped with a new thrust setting "Soft Go Around (Soft GA)" which is available after GA initiation.

According to CS 25.1587 (b)(3)(ii), the climb gradient in the approach configuration must be established in the Airplane Flight Manual in Performance section:

In CS25.1587, it has been implicitly assumed that the all-engines-operating go-around climb gradient would be higher than or equal to the one-engine-inoperative go-around climb gradient, and that publishing the latter in the Airplane Flight Manual would therefore be sufficient.

The new "Soft GA" thrust setting, potentially leading to lower climb performance with all engines operating than with one engine inoperative, invalidates this assumption and is therefore a novel and unusual design

The new "Soft GA" thrust setting procedure which requires two successive actions and which induces two different thrust setting procedures, is therefore considered as a novel and unusual design feature as defined in Part 21.A.16B, and it necessitates a Special Condition to be raised

SPECIAL CONDITION

1) CS 25.1587(b)(3)(ii) shall be amended as follows:

25.1587 Performance information
(b) …
(3) …
(ii) Climb in the approach configuration
Published approach climb performance shall represent the lower of
a. the performance obtained with GA thrust and one engine inoperative
b. the performance obtained with "Soft GA" thrust and all engines operating
OR
When "Soft GA" thrust setting is used and resulting climb gradient is lower than the climb gradient that would be obtained with GA thrust and one engine inoperative, there shall be a clear and unmistakable means to alert the flight crew of this situation.

2) An appropriate alert is required if the total aircraft thrust in the conditions OEI and throttle in MCT/FLX position are less than the total aircraft thrust obtained in OEI and throttle in TOGA position
For the particular case where an engine failure happens either immediately before or immediately after the G/A initiation with aircraft in landing configuration (LG extended), it should be shown at the landing in critical climb condition, by test or calculation that a safe go-around can be made at decision height with

- the critical engine inoperative
- a configuration and speed initially for landing and then in accordance with the goaround procedures, using actual time delays and, except for movements of the primary flying controls, not less than one second between successive crew actions.
- the power available with the thrust levers initially in the MCT/FLX position
- the landing gear selection to up being made after a steady positive rate of climb is achieved.

Alternatively, if a safe go-around can only be performed with an immediate crew action resetting the Thrust levers to TOGA position, a warning alert is required to prevent an unsafe condition.

The reset of the engine power/thrust setting must be demonstrated as acceptable in terms of pilot detection and required actions in high workload environment.

SPECIAL CONDITION	**B-14: Design dive speed**
APPLICABILITY:	TC / Post TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.335 [b(1)], JAR 25.335 [b(2)] at Ch 15
ADVISORY MATERIAL:	ACJ 25.335 [b(2)]

BACKGROUND

For A319-17xN/-15xN and A319NEO CJ models, in the frame of the Change Product Rule process, it became apparent that an improvement in the wording of the existing Special Condition (SC) A-5003 was needed in order to clarify the details of the upset manoeuvre for the definition of the design dive speed VD. It aims at covering the intent of NPA 2011-09, incorporated in CS25 Amdt 13, based on the discussions on comment §74 of CRD 2011-09, dated 16 Nov 2012.

The Certification Review Item (CRI) A-5003 was originally developed at the time of the A318 model type certification and then progressively extended to all the members of the Single Aisle family. Since then, Airbus introduced no design change of the flight controls and of the high speed protection system that would invalidate the assumptions for which the SC A-5003 was developed.

The scope of the present CRI is therefore to:

- replace the CRI A-5003 for the Airbus A319-17xN/-15xN and A319NEO CJ models / design change;
- introduce the new wording amending JAR 25.335 [b(1)(i)];
- Coherently present the same remaining information originally introduced in the Special Condition and Interpretative Material sections of the CRI A-5003.

SPECIAL CONDITION

The JAR 25.335(b) shall be amended as follows:

(b) Design Dive speed, VD. VD must be selected so that VC/MC is not greater than 0.8 VD/MD, or so that the minimum speed margin between VC/MC and VD/MD is the greater of the following values:

(1) The speed increase above VC/MC resulting from the following manoeuvres:

(i) From an initial condition of stabilized flight at VC/MC, the airplane is upset so as to take up a new flight path 7.5° below the initial path. The control input to initiate the maneuver must be an immediate application of sufficient stick to achieve a reduction of at least 0.5 g load factor before stabilizing at the 7.5° or full forward stick if 0.5 g cannot be achieved. Control application, up to full authority, is then made to try and maintain this new flight path. Twenty seconds after initiating the upset manual recovery is made at a load factor of 1.5 g (0.5 g acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral.

The speed increase occurring in this maneuver may be calculated, if reliable or conservative aerodynamic data is used. Power as specified in JAR 25.175 [b(1)(iv)] is assumed until recovery is made, at which time power reduction and the use of pilot controlled drag devices may be assumed.

(ii) From a speed below VC/MC, with power to maintain stabilized level flight at this speed the aeroplane is upset so as to accelerate through VC/MC at a flight path 15° below the initial path (or at the steepest nose down attitude that the system will permit with full control authority if less than 15°).

NOTE: Pilots controls may be in neutral position after reaching VC/MC and before recovery is initiated. Recovery may be initiated 3 seconds after operation of high speed, attitude or other alerting system by application of a load factors of 1.5 g (0.5 g acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral. Power may be reduced simultaneously.

All other means of decelerating the aeroplane, the use of which is authorized up to the highest speed reached in the manoeuvre, may be used. The interval between successive pilot actions must not be less than one second.

(2) The minimum speed margin must be enough to provide for atmospheric variations (such as horizontal gusts, and penetration of jet streams and cold fronts) and for instruments errors and airframe production variations. These factors may be considered on a probability basis. However, the margin at altitude where MC is limited by compressibility effects may not be less than .05 M.

EQUIVALENT SAFETY FINDING	B-17: Vibration/buffeting compliance criteria for large external antenna installation
APPLICABILITY:	A318/A319/A320/A321 all models
REQUIREMENTS:	CS 25.251(b) at amendment 11
ADVISORY MATERIAL:	-

IDENTIFICATION OF ISSUE:

The applicant proposes the installation of a GoGo HBCS Ku-Band large antenna on the upper rear section of the fuselage (section 17 between frames 58 and 63) of the A321neo aircraft. A radome is installed as aerodynamic interface to cover the antenna mounted on the adapter base plate.
For design changes installing a large antenna, compliance must be shown to CS 25.251(b), which states that each part of the airplane must be demonstrated in flight to be free from excessive vibration under any appropriate speed and power conditions up to VDF/MDF.
EASA has determined that if it can be shown by an acceptable method that the original compliance finding for this rule remains valid (i.e., no vibration/buffet issues exist due to the change), an equivalent level of safety has been shown.

Equivalent Safety Finding

Unless it can be shown that the modification would not affect the original compliance demonstration to 25.251(b), the applicant must show compliance with CS 25.251 either by flight test up to VDF/MDF, or by using the means of compliance proposed which are considered to provide an equivalent level of safety to flight testing up to VDF/MDF. To evaluate whether the modification could affect the original compliance finding or to extrapolate findings beyond VMO/MMO, the applicant may propose to use any suitable combination of the following:

- Similarity to EASA approved designs:
  - Aircraft Design speeds are identical
  - Airplane hosting the antennas is from the same family (Single Aisle) and has the same diameter of fuselage, as well as Installation location
  - Antenna is installed on aft fuselage
- CFD analysis:
  - CFD mastered: best practices validated against wind tunnel and flight tests
  - Reliable CFD results: CFD computations on a fully accurate geometry using validated best practices at relevant flight conditions
  - No risk of vibrations within the operational range: antenna free of shocks and flow detachment up to MMO
  - Negligible vibrations at the borders of the flight envelope: vibrations caused by the flow detachment at VD/MD are one order of magnitude smaller than the usual vibrations at VD/MD

SPECIAL CONDITION	B-201: Stalling and Scheduled Operating Speeds
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.21 at amdt 23 (except 25.21(g) not applicable), 25.103 at amdt 23 (except 25.103(b) at amdt 2), 25.143(h) at amdt 23, 25.145 at amdt 23, 25.201 at amdt 23, 25.203 at amdt 23, 25.207 at amdt 2, CS25.1323 at amdt 23
ADVISORY MATERIAL:	N/A

BACKGROUND

In this Special Condition, A321-200NY and its commercial name A321neo XLR are used synonymously.
The A321neo XLR is a derivative of A321neo.

The A321neo XLR, like the A321neo and ceo, A330, A340 and A380 is equipped with a low speed protection system providing a protection against stall that cannot be overridden by the pilot.

The requirements of CS 25 must therefore be adapted to consider this stall protection function.
For A321neo XLR, the SC B-201 replaces SC B-01 in order to:

- Update the requirement references to CS 25 Amdt 23,
- Account for Flight in Icing reversion request,
- Introduce some evolutions of this Special Condition requirements agreed for recent Airbus certification programmes

Note: Differences with SC B-01 are highlighted by grey color.

SPECIAL CONDITION

0. Foreword

In the following paragraphs, "In icing conditions" means with the ice accretions (relevant for the flight phase) as defined in CS-25 amendment 23 appendix C.

1. Definitions

This Special Condition addresses novel features and uses terminology that does not appear in CS 25.

The following definitions shall apply:

- High Angle of Attack Limiting Function:	A system that operates directly and automatically on the aeroplane's flying controls to limit the maximum angle of attack that can be attained to a value below that at which an aerodynamic stall would occur.
- Alpha-floor system:	A system that automatically increases thrust on the operating engines when angle of attack increases through a particular value (see IM B-201 paragraph 2).
- Alpha-limit:	The maximum angle of attack at which the aeroplane stabilises with the High Angle of Attack Limiting Function operating and the longitudinal control held on its aft stop (see IM B-201 paragraph 2).
- Vmin:	The minimum steady flight speed in the aeroplane configuration under consideration with High Angle of Attack Limiting Function operating. See section 3 of this Special Condition.
- Vmin1g:	Vmin corrected to 1g conditions. See section 3 of this Special Condition. It is the minimum calibrated airspeed at which the aeroplane can develop a lift force normal to the flight path and equal to its weight when at an angle of attack not greater than that determined for Vmin.

2. Capability and Reliability of the High Angle of Attack Limiting Function

Those paragraphs of CS 25 quoted in reference may be amended in accordance with this Special Condition provided that acceptable capability and reliability of the High Angle of Attack Limiting Function can be established by flight test, simulation, and analysis as appropriate. The capability and reliability required are as follows:

1) It shall not be possible during pilot induced manoeuvres to encounter a stall and handling characteristics shall be acceptable, as required by section 5 of this Special Condition.
2) The aeroplane shall be protected against stalling due to the effects of wind-shears and gusts at low speeds as required by section 6 of this Special Condition.
3) The ability of the High Angle of Attack Limiting Function to accommodate any reduction in stalling incidence must be verified in icing conditions.
4) The High Angle of Attack Limiting Function must be provided in each abnormal configuration of the high lift devices that is likely to be used in flight following system failures.
5) The reliability of the system and the effects of failures must be acceptable in accordance with CS 25.1309.

3. Minimum Steady Flight Speed and 1g Stall Speed Reference Stall Speed

Delete existing CS 25.103 and replace as follows:

CS 25.103: Minimum steady flight speed and Reference stall speed

(a) The minimum steady flight speed, Vmin, is the final stabilised calibrated airspeed obtained when the aeroplane is decelerated until the longitudinal control is on its stop in such a way that the entry rate does not exceed 1 knot per second. (See Interpretative Material IM B-201, paragraph 3)

(b) The minimum steady flight speed, Vmin, must be determined in icing and non-icing conditions with:

1) The High Angle of Attack Limiting Function operating normally;

2) Idle thrust and alpha-floor system inhibited;

3) All combinations of flaps setting and landing gear position for which Vmin is required to be determined;

4) The weight used when V_{SR} is being used as a factor to determine compliance with a required performance standard;

5) The most unfavourable centre of gravity allowable; and

6) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

(c) The one-g minimum steady flight speed, Vmin1g, is the minimum calibrated airspeed at which the aeroplane can develop a lift force (normal to the flight path) equal to its weight, whilst at an angle of attack not greater than that at which the minimum steady flight speed of sub-paragraph (a) was determined. It must be determined in icing and non-icing conditions.

(d) The reference stall speed, V_{SR}, is a calibrated airspeed defined by the applicant. VSR may not be less than a 1-g stall speed. V_{SR} must be determined in non-icing conditions and is expressed as:

$$V_{SR} \geq \frac{V_{CL_{MAX}}}{\sqrt{n_{zw}}}$$

Where

V_{CLMAX} = Calibrated airspeed obtained when the load factor corrected lift coefficient (n_{zw} W / qS) is first a maximum during the manoeuver prescribed in sub-paragraph (f) of this paragraph;

n_{zw} = Load factor normal to the flight path at V_{CLMAX};

W = Airplane gross weight;

S = Aerodynamic reference wing area; and

q = Dynamic pressure.

(e) V_{CLMAX} is determined in non-icing conditions with:

1) Engines idling, or, if that resultant thrust causes an appreciable decrease in stall speed, not more than zero thrust at the stall speed;
2) The aeroplane in other respects (such as flaps and landing gear) in the condition existing in the test or performance standard in which V_{SR} is being used;
3) The weight used when V_{SR} is being used as a factor to determine compliance with a required performance standard;
4) The centre of gravity position that results in the highest value of reference stall speed;
5) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system, but not less than 1.13 V_{SR} and not greater than 1.3 V_{SR};
6) Alpha-floor system inhibited; and
7) The High Angle of Attack Limiting Function adjusted, at the option of the applicant, to allow higher incidence than is possible with the normal production system.

(f) Starting from the stabilised trim condition, apply the longitudinal control to decelerate the aeroplane so that the speed reduction does not exceed 1 knot per second.

4. Stall Warning

Delete existing CS 25.207 and replace as follows:

4.1 Normal operation

If the conditions of paragraph 2 are satisfied, equivalent safety to the intent of CS 25.207, Stall Warning, shall be considered to have been met without provision of an additional, unique warning device.

4.2 Failures cases

In non-icing conditions, following failures of the High Angle of Attack Limiting Function, not shown to be extremely improbable, such that the capability of the system no longer satisfies items 1), 2) and 3) of paragraph 2, stall warning must be provided in accordance with CS 25.207(a), (b) and (f) (See Interpretative Material IM B-201 paragraph 5).

When flying in icing conditions after a failure leading to the loss of the high incidence protection system, safety margin not less than 3% or 3 kt between stall warning and stall must be maintained.

5. Handling Characteristics at High Incidence

Delete existing CS 25.201 and replace as follows:

5.1 High Incidence Handling Demonstrations

CS 25.201: High incidence handling demonstration in icing and non-icing conditions

(a) Manoeuvres to the limit of the longitudinal control, in the nose up sense, must be demonstrated in straight flight and in 30° banked turns with:

1) The High Angle of Attack Limiting Function operating normally.

2) Initial power conditions of :

I. Power off

II. The power necessary to maintain level flight at 1.5 V_{SR1}, where V_{SR1} is the reference stall speed with flaps in approach position, the landing gear retracted and maximum landing weight.(see Interpretative Material IM B-201 paragraph 6).

3) Alpha-floor system operating normally unless more severe conditions are achieved with inhibited alpha-floor.

4) Flaps, landing gear and deceleration devices in any likely combination of positions (see Interpretative Material IM B-201 paragraph 7).

5) Representative weights within the range for which certification is requested; and

6) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

(b) The following procedures must be used to show compliance in non-icing and icing conditions:

1) Starting at a speed sufficiently above the minimum steady flight speed to ensure that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction does not exceed 1 knot per second until the control reaches the stop (see Interpretative Material IM B-201 paragraph 3).

2) The longitudinal control must be maintained at the stop until the aeroplane has reached a stabilised flight condition and must then be recovered by normal recovery techniques.

3) Manoeuvres with increased deceleration rates

i. In non-icing conditions, the requirements must also be met with accelerated rates of entry to the incidence limit, up to the maximum rate achievable.

ii. In icing conditions, with the anti-ice system working normally, the requirements must also be met with increased rates of entry to the incidence limit up to 2kt/s.

4) Manoeuvers with ice accretion prior to operation of the normal anti-ice system

With the ice accretion prior to operation of the normal anti-ice system, the requirement must also be met in deceleration at 1kt/s up to FBS (with and without alpha floor operating).

5.2 Characteristics in High Incidence Manoeuvres

Delete existing CS 25.203 and the associated AMC. Replace as follows:
CS 25.203: Characteristics in High Incidence
(see Interpretative Material IM B-201 paragraph 8)
In icing and non-icing conditions

(a) Throughout manoeuvres with a rate of deceleration of not more than 1 knot per second, both in straight flight and in 30° banked turns, the aeroplane's characteristics shall be as follows:

1) There shall not be any abnormal nose-up pitching.

2) There shall not be any uncommanded nose-down pitching, which would be indicative of stall. However reasonable attitude changes associated with stabilising the incidence at Alpha limit as the longitudinal control reaches the stop would be acceptable. (See Interpretative Material IM B-201 paragraph 8.3)

3) There shall not be any uncommanded lateral or directional motion and the pilot must retain good lateral and directional control, by conventional use of the controls, throughout the manoeuvre.

4) i. In non-icing conditions, the aeroplane must not exhibit buffeting of a magnitude and severity that would act as a deterrent from completing the manoeuvre specified in § 5.1. (a).

ii. In icing-conditions, the aeroplane may exhibit buffeting of a stronger magnitude and severity than in non-icing conditions, provided the aeroplane is demonstrated free from excessive vibration and buffeting over the range of speeds adequate for normal operation.

(b) In manoeuvres with increased rates of deceleration some degradation of characteristics is acceptable, associated with a transient excursion beyond the stabilised Alpha-limit. However the aeroplane must not exhibit dangerous characteristics or characteristics that would deter the pilot from holding the longitudinal control on the stop for a period of time appropriate to the manoeuvre.

(c) It must always be possible to reduce incidence by conventional use of the controls.

(d) The rate at which the aeroplane can be manoeuvred from trim speeds associated with scheduled operating speeds such as V_2 and V_{ref} up to Alpha-limit shall not be unduly damped or be significantly slower than can be achieved on conventionally controlled transport aeroplanes.

5.3 Characteristics up to V_{CLMAX}

Manoeuvres with a rate of deceleration of not more than 1 knot per second up to the angle of attack at which V_{CLMAX} was obtained as defined in paragraph 3 must be demonstrated in straight flight and in 30° banked turns with:

1) The High Angle of Attack Limiting Function deactivated or adjusted, at the option of the applicant, to allow higher incidence than is possible with the normal production system,

2) Alpha-floor system inhibited,

3) Engines idling,

4) Flaps and landing gear in any likely combination of positions,

5) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

During such manoeuvres, the aeroplane must not exhibit dangerous characteristics; it must always be possible to reduce angle of attack by conventional use of the controls.
The pilot must retain good lateral and directional control, by conventional use of the controls, throughout the manoeuvre.

6. Atmospheric Disturbances

Operation of the High Angle of Attack Limiting Function must not adversely affect aircraft control during expected levels of atmospheric disturbances, nor impede the application of recovery procedures in case of wind-shear. This shall be demonstrated in non-icing conditions only and shall allow to draw conclusion for icing conditions without further demonstration (see Interpretative Material IM B-201 paragraph 9).

7. Speed references associated with other requirements

Change as follows:

1) CS 25.145 (a): Vmin in lieu of “stall identification”
2) CS 25.145 (b): Vmin in lieu of Vsw
3) CS 25.1323 (d): "From 1.23 V_{SR} to Vmin" in lieu of "1.23 V_{SR} to stall warning speed" and "speeds below Vmin" in lieu of "speeds below stall warning".

8. Alpha-floor

In icing and non-icing conditions, the Alpha-floor setting must be such that the aircraft can be flown at normal landing operational speeds and manoeuvred up to bank angles consistent with the flight phase without triggering Alpha-floor.
In addition, there must be no Alpha-floor triggering, unless appropriate when the aircraft is flown in usual operational manoeuvres and in turbulence.

9. Proof of compliance

Add the following paragraph 25.21 (b):

(b) The flying qualities will be evaluated at the most unfavourable CG position.

SPECIAL CONDITION	**B-203: Electronic Flight Control System (EFCS) Control Surface Awareness**
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.143 at Amdt. 23
ADVISORY MATERIAL:	N/A

BACKGROUND

In this Special Condition, A321-200NY and its commercial name A321neo XLR are used synonymous.
The A321neo XLR is a derivative of A321neo.

Like A321neo, A321neo XLR is equipped with Electronic Flight Control System (EFCS) with the side stick controllers. A special condition SC SAneo B-03- Motion and Effect of Cockpit Controls has been developed for SAneo.

The applicable certification requirements of the A321neo XLR aircraft are the CS 25 amendment 23.
The side stick control system certification requirements have been introduced at CS 25 Amendment 13 through CS 25.143 (k) and CS 25.777 (i), but the control surface awareness requirements have not been included at that time. The SC SAneo B-03 Motion and Effect of Cockpit Controls is therefore partially captured by the CS 25 requirements.

As per Part 21.A.16 (a) (1), it is proposed to address the control surface awareness requirement defined in the SAneo Special Condition B-03 in a dedicated A321neo XLR Special Condition.

SPECIAL CONDITION

Introduce a new paragraph CS 25.143 (m);

When a flight case exists where, without being commanded by the crew, control surfaces are coming so close to their limits that return to normal flight condition and (or) continuing of safe flight needs a specific crew action, a suitable flight control position annunciation shall be provided to the crew, unless other existing indications are found adequate or sufficient to prompt that action.

SPECIAL CONDITION	B-207: Flight Envelope Protections
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.143 at Amdt. 23
ADVISORY MATERIAL:	N/A

BACKGROUND

In this Special Condition, A321-200NY and its commercial name A321neo XLR are used synonymous.
The A321neo XLR is a derivative of A321neo.

Like the SAneo, A321neo XLR has flight envelope protections (high and low speed, angle of attack, bank angle) implemented in the Electrical Flight Control System (EFCS).

For A321neo XLR, in the frame of CPR assessment, paragraph 25.143 is applicable at CS25 Amdt 23, except that 25.143(c), (i), (j) are not applicable.

SPECIAL CONDITION

Add a new paragraph CS 25.143(n):

<u>Normal operation:</u>

1) Onset characteristics of each envelope protection feature must be smooth, appropriate to the phase of flight and type of manoeuvre and not in conflict with the ability of the pilot to satisfactorily change aeroplane flight path, or attitude as needed.

2) Limit values of protected flight parameters must be compatible with:
   a) aeroplane structural limits,
   b) required safe and controllable manoeuvring of the aeroplane, and
   c) margin to critical conditions.

Unsafe flight characteristics/conditions must not result from: - dynamic manoeuvring, - airframe and system tolerances (both manufacturing and in-service), and - non-steady atmospheric conditions, in any appropriate combination and phase of flight, if this manoeuvring can produce a limited flight parameter beyond the nominal design limit value.
Note: Reference may be made to FAA Advisory Circular AC 120-41 for guidance on atmospheric conditions.

3) The aeroplane must respond to intentional dynamic manoeuvring within a suitable range of the parameter limit. Dynamic characteristics such as damping and overshoot must also be appropriate for the flight manoeuvre and limit parameter concerned.

4) When simultaneous envelope limiting is engaged, adverse coupling or adverse priority must not result.

Failure states:

EFCS (including sensor) failures must not result in a condition where a parameter is limited to such a reduced value that safe and controllable manoeuvring is no longer available. The crew must be alerted by suitable means if any change in envelope limiting or manoeuvrability is produced by single or multiple failures of the EFCS not shown to be extremely improbable.

Equivalent Safety Finding	B-216: Normal Load Factor Limiting System
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.143(l) at Amdt. 23
ADVISORY MATERIAL:	N/A

BACKGROUND

In this ESF, A321-200NY and its commercial name A321neo XLR are used synonymous.

The A321neo XLR is a derivative of A321neo.

Like the SAneo, A321neo XLR has a normal load factor limiting feature implemented in the flight control laws. A special condition SC B-08 Normal Load Factor Limiting System has been developed in the frame of SAneo Certification to address this design feature.

For A321neo XLR, following CPR assessment, CS 25 paragraph 25.143(l) is applicable at Amdt. 23.

This requirement was introduced at CS 25 amendment 13 to deal with Electronic Flight Control Systems (EFCS) which embody a normal load factor limiting system. This requirement has later been discussed, for aircraft equipped with flight envelope protections, within Flight Test Harmonization Working Group (FTHWG) Phase 2 and the result is reflected in Report Rev A Topic 1 Phase 2 dated April 2017.

For recent certifications, following the Change Product Rule process, CS 25.143 (l) was not applicable.

For A321neo XLR, in order to cover the intent of CS 25.143(l), it is proposed to replace the existing SAneo Special Condition B-08 by this new ESF B-216 and to follow FTHWG recommendations.

EQUIVALENT SAFETY FINDING TO CS 25.143(l) AMDT 23

The following compensating factors must be demonstrated to provide an equivalent level of safety:

1) Positive Load Factors. Unless positive maneuver capability is limited by airframe characteristics (e.g. wing lift, deterrent buffet, or pitch control power), or by other protection functions that serve specific flight characteristics design purposes (e.g., high-angle-of-attack protection or pitch attitude protection), the positive load factor command limit with EFCS functioning in its normal mode and the airplane in its normal trim state for the flight condition must not be less than:
    - 2.5 g with the high-lift devices retracted, and
    - 2.0 g with the high-lift devices extended.

   A reduced positive limiting load factor that decreases gradually from 2.5 g at Vmo/Mmo to 2.25 g at Vd/Md has been considered acceptable on aircraft with negative pitch attitude protection and highspeed protection, provided it does not hinder overspeed recovery (CS 25.335(b)(1)).

2) Negative Load Factors. Unless negative maneuver capability is limited by airframe characteristics (e.g. wing lift, deterrent buffet, or pitch control power), or by other protection functions that serve specific flight characteristics design purposes (e.g., high speed protection, low-angle-of-attack protection or pitch attitude protection), the negative limiting load factor command with the EFCS functioning in its normal mode must be equal to or more negative than:

    - -1.0 g with the high-lift devices retracted; or
    - 0 g with the high-lift devices extended.

   Maximum negative load factor command may be further limited by flight control system characteristics or flight envelope protections, provided that:

    - pitch down responsiveness is satisfactory, and
    - from trimmed level flight, 0 g can be commanded or a satisfactory trajectory change is readily achievable at operational speeds.

   It has also been considered acceptable for the control law to initially restrict the negative load factor to approximately 0 g with high-lift devices retracted to reduce the risk of inadvertent brief negative-g maneuvers, with the load factor limit increasing gradually to approximately - 1.0 g within a reasonable time.

SPECIAL CONDITION	C-03: Installation of Integral Rear Centre Tank – Crashworthiness Conditions
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.561, CS 25.562, CS 25.721, CS 25.963, CS 25.994 (Amdt 23)
ADVISORY MATERIAL:	FAA AC 25-8

BACKGROUND

EASA received an application for a major change to type design on a large aeroplane.

1) The design change introduces a conformal fuselage structural fuel tank to the aeroplane, also called rear centre tank (RCT) located behind the main landing gear wheel bay, in the lower section of the fuselage, partially replacing the aft cargo compartment.

   The experience gathered with large aeroplanes carrying more than 19 passengers, equipped with classical wing fuel tanks (including centre wing fuel tanks) and auxiliary tanks located in cargo compartments, is generally considered satisfactory in terms of protection of the cabin occupants against crash events.

   However, the integration of an RCT located below the cabin floor, because of its design and location, is considered as an unusual design feature relative to design practices on which CS-25 certification specifications are based. Therefore, in application of point 21.B.75 of Part 21, EASA identified the need to prescribe special detailed technical specifications (named Special Conditions) to ensure adequate occupants protection against the risks of external fire and burnthrough, fuel vapour ignition and fuel tank explosion as well to ensure crashworthiness of this fuel tank so that no fuel is released in sufficient quantities so to start a serious fire in an otherwise survivable crash event.

   The protection against external fire burnthrough and fuel vapour ignition and fuel tank explosion are addressed through dedicated Special Condition

   The present Special Condition addresses the RCT crashworthiness.

2) CS 25 at amendment 23, that is applicable to the RCT major change to type design project, includes specifications that address the risk of fuel spillage due to crash event. However, those specifications limit the risk to crash conditions specified in CS 25.721(b):
   - CS 25.963(d)(4) : Fuel tanks must, so far as it is practicable, be designed, located and installed so that no fuel is released in or near the fuselage or near the engines in quantities sufficient to start a serious fire in otherwise survivable emergency landing conditions. For each fuel tank and surrounding airframe structure, the effects of crushing and scraping actions with the ground should not cause the spillage of enough fuel, or generate temperatures that would constitute a fire hazard under the conditions specified in CS 25.721(b).

- CS 25.994: Fuel system components in an engine nacelle or in the fuselage must be protected from damage which could result in spillage of enough fuel to constitute a fire hazard as a result of a wheels-up landing on a paved runway under each of the conditions prescribed in CS 25.721(b).
- CS 25.721(b): The aeroplane must be designed to avoid any rupture leading to the spillage of enough fuel to constitute a fire hazard as a result of a wheels-up landing on a paved runway, under the following minor crash landing conditions:
  (1) Impact at 1.52 m/s (5 fps) vertical velocity, with the aeroplane under control, at Maximum Design Landing Weight,
    i. with the landing gear fully retracted and, as separate conditions,
    ii. with any other combination of landing gear legs not extended.
  (2) Sliding on the ground, with -
    i. the landing gear fully retracted and with up to a 20° yaw angle and, as separate conditions,
    ii. any other combination of landing gear legs not extended and with 0° yaw angle.

The existing CS-25 emergency landing conditions need to be complemented, considering the unusual design, location and installation aspects of the RCT.

The sole existing guidance addressing the protection of fuel tank in fuselage is the FAA AC 25-8. It provides design considerations and precautions in fuel tank installation, but it is mainly focussing upon auxiliary fuel tanks located within the fuselage pressure shell, that do not share any boundary with the fuselage skin. It also points out that survivable crashes have occurred beyond the existing defined emergency landing conditions.

There is a need to define a Special Condition to specify under which crash conditions, in addition to the conditions defined by CS-25 Amdt. 23, the unusual design of the RCT should prevent fuel spillage in sufficient quantities to start a serious fire in an otherwise survivable crash event. There is also the need to define the means of how to demonstrate compliance with this Special Condition.

Considering all the above, the following Special Condition is determined to complement CS-25 Amdt. 23 certification specifications:

SPECIAL CONDITION

The conformal fuselage fuel tank must, so far as it is practicable, be designed, located and installed so that no fuel is released in or near the fuselage or near the engines in quantities sufficient to start a serious fire in otherwise survivable crash conditions beyond the emergency landing conditions specified in CS 25.963(d)(4) (that cross-refers to CS 25.721). The conditions must include consideration of off runway events and loss of landing gear and engines due to contact with obstacles.

Definition

A conformal fuselage structural fuel tank is a structural fuselage fuel tank, which shares some boundaries with the fuselage skin.

SPECIAL CONDITION	CCD-01: Operational Suitability Data – Cabin Crew Data
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	Commission Regulation (EU) 748/2012 as amended by Commission Regulation (EU) 69/2014 Annex I to Commission Regulation (EU) 748/2012
ADVISORY MATERIAL:	---

Having regard of the applicable JAR-OPS 1/EU-OPS 1 requirements and in accordance with "Part 3-Procedure Document for Joint Operational Evaluation Board (JOEB)-Cabin Crew, at various amendments", which governed the (J)OEB CC evaluations, the following aircraft type specific elements that would impact normal and/or emergency operations for cabin crew were compared and assessed, in order to fulfil the purpose of the evaluations:

- aircraft configuration
  - number of aisles
  - number of passenger decks

- doors and exits
  - exit arming/disarming
  - direction of movement of the operating handle
  - direction of exit opening
  - power assist mechanism

Note: In accordance with JAR-OPS 1.1030/EU-OPS 1.1030 and later on with ORO.CC.250, self-help exits, for example Type III and Type IV exits, need not to be included in the determination of new type or variant.

- assisting evacuation means

- aircraft systems for cabin crew duties
  - emergency lighting system
  - smoke detection system
  - built-in fire extinguishing system
  - drop-down oxygen system
  - communication and public address system
  - control and indication panels

Using the above categories as criteria, detailed Operator Differences Tables (ODRs) - the Airbus equivalent for Aircraft Differences Tables (ADTs) - were provided by Airbus, in order to highlight the exiting differences between the A320 as the "base" aircraft and the A318, the A319, the A321 as the "candidate" aircraft within the comparisons.

The ODRs also include recommended levels of cabin crew training associated to the levels of complexity of the identified differences between the base and the candidate aircraft.

The outcome of the A320 aircraft family (J) OEB CC evaluations confirmed that for cabin crew, the A318, the A319, the A321, are variants of the A320 (as per JAR-OPS 1.1030; and later on, in accordance with EU-OPS 1.1030 and ORO.CC.250). As such, cabin crew differences training would be required when transferring from one aircraft to another, in order to ensure compliance at the operator level, with JAR-OPS 1.1010, and later on, with EU OPS 1.1010 and ORO.CC130.

As contained in the ODRs, Levels of training varying from Level 1 to Level 3, were identified as adequate in order to cover the design differences identified between the "base" and the "candidate" aircraft.
Difference Levels

The following is an excerpt from Chapter 4 – Difference Levels for Training and Checking of the EASA OEB Handbook, Part III - Draft Procedures Document for Cabin Crew Subgroup, version 5 of 04 Sept.2007, and defines the different levels of training.

Difference level	Training	Checking
1	Self-Instruction (Written information)	Not applicable
2	Aided Instruction (CBT, Video.)	Applicable as required
3	Hands-on Training (Training Device, or Aircraft)	Applicable

Level 1: Applicable to aircraft with differences that can be adequately addressed through self-instruction. Level 1 training represents a knowledge requirement such that, once appropriate information is provided, understanding and compliance can be assumed to take place. Compliance with Level 1 training is typically achieved by methods such as issuance of operating manual page revisions, dissemination of cabin crew operating bulletins or differences hand-outs to describe minor differences between aircraft.

Level 2: Applicable to aircraft with systems or procedural differences that can be adequately addressed through aided instruction. At Level 2, aided instruction is appropriate to ensure crew understanding, emphasise issues, provide a standardised method of presentation of material, or to aid retention of material following training. Level 2 aided instruction typically employs such means as slide/tape presentations, computer based training (CBT), stand-up lectures or videotapes.

Level 3: Applicable to aircraft with differences that can only be addressed through use of devices capable of system training (i.e. hands-on training). Training devices are required to supplement instruction to ensure attainment or retention of crew skills and abilities to accomplish the more complex tasks, usually related to operation of particular aircraft systems. Typical training devices for Level 3 would include emergency evacuation procedures trainers, fire and smoke trainers, cabin crew panel trainers etc. When dedicated trainers are not available, Level 3 would require hands-on training using the aircraft.

In addition to the transfer of the A320 OEB CC Report to the A320 Cabin Crew Operational Suitability Data - Data compliance documentation, and in response to the Commission Regulation No 69/2014, Airbus and EASA have agreed on the Airbus proposed division of the Operational Suitability Data in mandatory data (M) and non-mandatory data (AMC = Acceptable Means of Compliance), as highlighted in the compliance documentation.
As per the Commission Regulation (EU) No 69/2014, Article 7a, para.3, the elements identified in accordance with the JAA/EASA procedures (described above), shall be included in the relevant type-certificate and shall be deemed to constitute the A320 aircraft family cabin crew operational suitability data, approved in accordance with this CRI.

EQUIVALENT SAFETY FINDING	D-01: Over-performing Type I exit
APPLICABILITY:	Post-TC: A320
REQUIREMENTS:	CS 25.807(g)
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus has requested an increase of the Maximum Passenger Seating Capacity (MPSC) of the A320 aircraft models from the current value of 180, by increasing the credit of seats permitted for the forward and aft floor levels exits.

The A320 has been Type Certified in February 1988, with a MPSC of 179 in accordance with JAR/FAR 25.807(c)(1). The JAA already agreed to increase the MPSC to 180 through Equivalent Safety Finding E-2107 based on data analysis.

The change is classified as Major Significant and in the frame of this change, one of the affected requirements according to the Change Product Rule assessment (CPR) is CS 25.807(g) at Amdt 13.

The CS25.807(g) at Amdt 13 requires that:
"Type and number required. The maximum number of passenger seats permitted depends on the type and number of exits installed on each side of the fuselage. Except as further restricted in subparagraphs (g)(1) through (g)(9) of this paragraph, the maximum number of passenger seats permitted for each exit of a specific type installed on each side of the fuselage is as follows:

Type A 110
Type B 75
Type C 55
Type I 45
Type II 40
Type III 35
Type IV 9
[…]"

In order to achieve a higher MPSC the applicant has requested an Equivalent Safety Finding to increase the credit of seats permitted for the forward and aft floor levels exits to 65 (today the forward and aft floor levels exits are certified as oversized Type I according to E-2107 and equivalent from a performance point of view to Type C).

EQUIVALENT SAFETY FINDING

The equivalence justification below details the means and provisions (i.e. the compensating factors) the applicant intends to use to demonstrate that an equivalent level of safety, compared with the currently required exit performance, will be reached or exceeded for the desired increase in number of seats permitted for the floor level exits.

Design proposal

- The design features characterizing the new over-performing Type I exit are:
  - a door size of 32"x73" (unobstructed opening)
  - an escape slide
    - with a usable sliding width of more than 80"
    - capable of staggered use
    - strong enlarged sliding surface boundaries
    - good illumination of the sliding surface
    - beam strength as per the values identified in ETSO C-69c

Justification proposal

- For the purpose of demonstrating the individual and overall increased evacuation performance the applicant will conduct:
  - comparative testing on a mock-up, with naïve test subjects, to demonstrate that the evacuation performance of their new over-performing Type I floor level exit sufficiently exceeds the performance of a Type C emergency exit (capable of evacuating 55 passengers). The chosen baseline exit dimensions for this comparative testing have been chosen by the applicant as 30"x60";
  - additional testing and analysis to demonstrate that the requirements of CS25.803(c), including the safety margins described in the associate guidance material, will still be met at aircraft level under the new mandatory configuration for an increased MPSC, through the following means:
    - partial evacuation testing on an operationally representative aircraft configured with the minimum door access path width (20");
    - total cabin evacuation analysis based on the original A320 full scale evacuation demonstration and the newly generated data from this partial evacuation testing with the following assumptions:
      - use of slide-ready times as measured during previous compatibility testing
      - average egress rate as determined in the partial evacuation tests.

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The above compensating factors are accepted by EASA as providing an equivalent safety to the CS 25.807(g) provided that the following additional conditions are demonstrated by the applicant:

- The applicant should demonstrate through comparative testing with statistically significant results that the non-standard exit configuration provides a proportionate increase in evacuation performance over the Type C performance standard to justify the required increase of maximum number of passenger seats permitted for each of the floor level exit pair (i.e. 65 vs 55), achieved under a conservative approach .

- The applicant should demonstrate through an acceptable number of partial evacuation tests or a full scale evacuation demonstration, under the conditions set in CS25 appendix J, that the new configuration will increase the evacuation performance of the oversized Type I (performing equivalently to a Type C) emergency exits to an extent that the evacuation performance at aircraft level, considering the new desired MPSC, will meet the requirements of CS25.803(c) including the safety margins described in the associated guidance material.
- Should an increase of the dimensions of the emergency exit access area (i.e. passageway, access space, etc.) above the minimum values be needed to demonstrate the desired evacuation performance, such new dimensions will constitute a limitation of the design of the new over-performing Type I emergency exit.
- Should the tests demonstrate an evacuation performance which would lead to a passenger credit above 65, the credit of the new over-performing Type I emergency exit will be in any case limited to 65.
- The maximum passenger seat credit for the remaining emergency exits (i.e. over-wing exits) will be determined by the outcomes of the CPR analysis applicable to the proposed design.
- The other criteria defining a Type C exit remain unchanged and are met (CS25.807(g)(8), 25.810(a)(1)(ii), 25.813(a), 25.813(b)(3) and 25.813(b)(4)).
- Additional testing and/or analysis to demonstrate that an equivalent level of safety is maintained in foreseeable evacuation scenarios.

EQUIVALENT SAFETY FINDING	**D-02: Over-performing Type I exit**
APPLICABILITY:	Post-TC: A321
REQUIREMENTS:	CS 25.807(g)
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus has requested an increase of the Maximum Passenger Seating Capacity (MPSC) of the A321 aircraft models from the current value of 220, by increasing the credit of seats permitted for the forward and aft floor levels exits.

The A321 has been Type Certified in December 1993, with a MPSC of 220 in accordance with Special Condition SC E3 as defined in CRI E-3001.

The change is classified as Major Significant and in the frame of this change, one of the affected requirements according to the Change Product Rule assessment (CPR) is CS 25.807(g) at Amdt 15.

The CS25.807(g) at Amdt 15 requires that:

"Type and number required. The maximum number of passenger seats permitted depends on the type and number of exits installed on each side of the fuselage. Except as further restricted in subparagraphs (g)(1) through (g)(9) of this paragraph, the maximum number of passenger seats permitted for each exit of a specific type installed on each side of the fuselage is as follows:

Type A	110
Type B	75
Type C	55
Type I	45
Type II	40
Type III	35
Type IV	9

[…]"

In order to achieve a higher MPSC the applicant has requested an Equivalent Safety Finding to increase the credit of seats permitted for the forward and aft floor levels exits to 65 (today the forward and aft floor levels exits are certified as oversized Type I according to SC E3 as defined in CRI E-3001 and equivalent from a performance point of view to Type C).

EQUIVALENT SAFETY FINDING

The equivalence justification below details the means and provisions (i.e. the compensating factors) the applicant intends to use to demonstrate that an equivalent level of safety, compared with the currently required exit performance, will be reached or exceeded for the desired increase in number of seats permitted for the floor level exits.

Design/Analysis proposal

- The design features characterizing the new over-performing Type I exit are:
    - a door size of 32"x73" (unobstructed opening)
    - an escape slide
        - with a usable sliding width of more than 80"
        - capable of staggered use
        - strong enlarged sliding surface boundaries
        - good illumination of the sliding surface
        - beam strength as per the values identified in ETSO C-69c

- For the purpose of demonstrating the individual and overall increased evacuation performance the applicant will conduct:
    - comparative testing on a mock-up, with naïve test subjects, to demonstrate that the evacuation performance of their new over-performing Type I floor level exit sufficiently exceeds the performance of a Type C emergency exit (capable of evacuating 55 passengers). The chosen baseline exit dimensions for this comparative testing have been chosen by the applicant as 30"x60";
    - additional testing and analysis to demonstrate that the requirements of CS25.803(c), including the safety margins described in the associate guidance material, will still be met at aircraft level under the new mandatory configuration for an increased MPSC, through the following means:
        - partial evacuation testing on an operationally representative aircraft configured with the minimum door access path width (20");
        - total cabin evacuation analysis based on the original A321 evacuation analysis and the newly generated data from this partial evacuation testing with the following assumptions:
            - use of slide-ready times as measured during previous compatibility testing
            - average egress rate as determined in the partial evacuation tests.

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The above compensating factors are accepted by EASA as providing an equivalent safety to the CS 25.807(g) provided that the following additional conditions are demonstrated by the applicant:

- The applicant should demonstrate through comparative testing with statistically significant results that the non-standard exit configuration provides a proportionate increase in evacuation performance over the Type C performance standard to justify the required increase of maximum number of passenger seats permitted for each of the floor level exit pair (i.e. 65 vs 55), achieved under a conservative approach.

- The applicant should demonstrate through an acceptable number of partial evacuation tests or a full scale evacuation demonstration, under the conditions set in CS25 appendix J, that the new configuration will increase the evacuation performance of the oversized Type I (performing equivalently to a Type C) emergency exits to an extent that the evacuation performance at aircraft level, considering the new desired MPSC, will meet the requirements of CS25.803(c) including the safety margins described in the associated guidance material.
- Should an increase of the dimensions of the emergency exit access area (i.e. passageway, access space, etc.) above the minimum values be needed to demonstrate the desired evacuation performance, such new dimensions will constitute a limitation of the design of the new over-performing Type I emergency exit.
- Should the tests demonstrate an evacuation performance which would lead to a passenger credit above 65, the credit of the new over-performing Type I emergency exit will be in any case limited to 65.
- The maximum passenger seat credit for the remaining emergency exits (i.e. over-wing exits/floor level exits) will be determined by the outcomes of the CPR analysis applicable to the proposed design.
- The other criteria defining a Type C exit remain unchanged and are met (CS25.807(g)(8), 25.810(a)(1)(ii), 25.813(a), 25.813(b)(3) and 25.813(b)(4)).
- Additional testing and/or analysis to demonstrate that an equivalent level of safety is maintained in foreseeable evacuation scenarios.

EQUIVALENT SAFETY FINDING	**D-03: Over-performing Type I exit**
APPLICABILITY:	Post-TC: A319
REQUIREMENTS:	CS 25.807(g)
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus has requested an increase of the Maximum Passenger Seating Capacity (MPSC) of the A319 aircraft models from the current value of 145, by increasing the credit of seats permitted for the forward and aft floor levels exits.

The A319 has been Type Certified in April 1996, with a MPSC of 145 in accordance with an ESF as defined in CRI E-4001.

The change is classified as Major Significant and in the frame of this change, one of the affected requirements according to the Change Product Rule assessment (CPR) is CS 25.807(g) at Amdt 15.

The CS25.807(g) at Amdt 15 requires that:

"Type and number required. The maximum number of passenger seats permitted depends on the type and number of exits installed on each side of the fuselage. Except as further restricted in subparagraphs (g)(1) through (g)(9) of this paragraph, the maximum number of passenger seats permitted for each exit of a specific type installed on each side of the fuselage is as follows:

Type A	110
Type B	75
Type C	55
Type I	45
Type II	40
Type III	35
Type IV	9

[…]"

In order to achieve a higher MPSC the applicant has requested an Equivalent Safety Finding to increase the credit of seats permitted for the forward and aft floor levels exits to 65 (today the forward and aft floor levels exits are certified as oversized Type I according to CRI E-4001 ESF and equivalent from a performance point of view to Type C).

EQUIVALENT SAFETY FINDING

The equivalence justification below details the means and provisions (i.e. the compensating factors) the applicant intends to use to demonstrate that an equivalent level of safety, compared with the currently required exit performance, will be reached or exceeded for the desired increase in number of seats permitted for the floor level exits.

Design/Analysis proposal

- The design features characterizing the new over-performing Type I exit are:
  - a door size of 32”x73” (unobstructed opening)
  - an escape slide
    - with a usable sliding width of more than 80”
    - capable of staggered use
    - strong enlarged sliding surface boundaries
    - good illumination of the sliding surface
    - beam strength as per the values identified in ETSO C-69c

- For the purpose of demonstrating the individual and overall increased evacuation performance the applicant will conduct:
  - comparative testing on a mock-up, with naïve test subjects, to demonstrate that the evacuation performance of their new over-performing Type I floor level exit sufficiently exceeds the performance of a Type C emergency exit (capable of evacuating 55 passengers). The chosen baseline exit dimensions for this comparative testing have been chosen by the applicant as 30”x60”;
  - additional testing and analysis to demonstrate that the requirements of CS25.803(c), including the safety margins described in the associate guidance material, will still be met at aircraft level under the new mandatory configuration for an increased MPSC, through the following means:
    - partial evacuation testing on an operationally representative aircraft configured with the minimum door access path width (20”);
    - total cabin evacuation analysis based on the original A319 evacuation analysis and the newly generated data from this partial evacuation testing with the following assumptions:
      - use of slide-ready times as measured during previous compatibility testing
      - average egress rate as determined in the partial evacuation tests.

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The above compensating factors are accepted by EASA as providing an equivalent safety to the CS 25.807(g) provided that the following additional conditions are demonstrated by the applicant:

- The applicant should demonstrate through comparative testing with statistically significant results that the non-standard exit configuration provides a proportionate increase in evacuation performance over the Type C performance standard to justify the required increase of maximum number of passenger seats permitted for each of the floor level exit pair (i.e. 65 vs 55), achieved under a conservative approach .

- The applicant should demonstrate through an acceptable number of partial evacuation tests or a full scale evacuation demonstration, under the conditions set in CS25 appendix J, that the new configuration will increase the evacuation performance of the oversized Type I (performing equivalently to a Type C) emergency exits to an extent that the evacuation performance at aircraft level, considering the new desired MPSC, will meet the requirements of CS25.803(c) including the safety margins described in the associated guidance material.
- Should an increase of the dimensions of the emergency exit access area (i.e. passageway, access space, etc.) above the minimum values be needed to demonstrate the desired evacuation performance, such new dimensions will constitute a limitation of the design of the new over-performing Type I emergency exit.
- Should the tests demonstrate an evacuation performance which would lead to a passenger credit above 65, the credit of the new over-performing Type I emergency exit will be in any case limited to 65.
- The maximum passenger seat credit for the remaining emergency exits (i.e. over-wing exits) will be determined by the outcomes of the CPR analysis applicable to the proposed design.
- The other criteria defining a Type C exit remain unchanged and are met (CS25.807(g)(8), 25.810(a)(1)(ii), 25.813(a), 25.813(b)(3) and 25.813(b)(4)).
- Additional testing and/or analysis to demonstrate that an equivalent level of safety is maintained in foreseeable evacuation scenarios.

SPECIAL CONDITION	D-08: Installation of Personal Electronic Device charging stowage for CC use
APPLICABILITY:	Post TC: A319/A320/A321
REQUIREMENTS:	JAR 25.1301
ADVISORY MATERIAL:	CM ES-001

BACKGROUND:

Airbus is proposing the installation of a Personal Electronic Device (PED in this context are all battery powered devices from mobile telephone up to including laptop computer) stowage and charging provision(s) for a single PED unit for cabin crew use into the entrance/cabin crew working area of A320 family aircraft. Recent experience with lithium batteries, that are the main power supplies to PED, has shown that there is an increased fire risk associated to the charging of such batteries.

PED and their power supply (a common power supply are lithium-ion batteries) are carry on board items with an unknown technical status. EASA has recognized that charging of lithium-ion batteries may lead to higher battery temperatures that can lead to a technical defect of the battery and start a battery fire. To ensure that PED stowage and charging provisions in the aircraft cabin will not create an unacceptable safety hazard, EASA is introducing additional requirements for stowage and charging provision(s) for a single PED.

Special Condition

1. Each PED stowage or charging station must be designed to prevent the propagation of a fire starting from a PED to adjacent compartments.
2. It must be demonstrated that a fire originating from a PED stowed in a PED stowage or charging station is detected and extinguished before it can propagate to other PEDs or it can create any hazard smoke, toxic gases, explosions, etc.) to cabin occupants.
3. Each stowage or charging station must be limited to the maximum battery capacity or to the specific PED that will be allowed inside.
4. A manual or automatic shutdown of the electrical power supply must be provided and usable in case of smoke or fire detection at the PED stowage or charging station.

EQUIVALENT SAFETY FINDING	D-09: Over-performing Type I exit
APPLICABILITY:	A321-251NX / -252NX / -253NX / -271NX / -272NX
REQUIREMENTS:	CS 25.807(g) at Amdt 15
ADVISORY MATERIAL:	---

Design / Analysis proposal

The design features characterizing the new over-performing Type I exit are:
- a door size of 32”x73” (unobstructed opening)
- an escape slide
  - with a usable sliding width of more than 80”
  - capable of staggered use
  - strong enlarged sliding surface boundaries
  - good illumination of the sliding surface
  - beam strength as per the values identified in ETSO C-69c

For the purpose of demonstrating the individual and overall increased evacuation performance the applicant shall present the data resulting from conducting:
- comparative testing on a mock-up, with naïve test subjects, to demonstrate that the evacuation performance of their new over-performing Type I floor level exit sufficiently exceeds the performance of a Type C emergency exit (capable of evacuating 55 passengers). The chosen baseline exit dimensions for this comparative testing have been chosen by the applicant as 30”x60”;
- additional testing and analysis to demonstrate that the requirements of CS 25.803(c), including the safety margins described in the associate guidance material, will still be met at aircraft level under the new mandatory configuration for an increased MPSC, through the following means:
  - partial evacuation testing on an operationally representative aircraft configured with the minimum door access path width (20”);
  - total cabin evacuation analysis based on the original A320 full scale evacuation demonstration and the newly generated data from this partial evacuation testing with the following assumptions:
    - use of slide-ready times as measured during previous compatibility testing
    - average egress rate as determined in the partial evacuation tests.
- additional testing and/or analysis to demonstrate that an equivalent level of safety is maintained in foreseeable evacuation scenarios.

Conditions for acceptance of the ESF

- The applicant should demonstrate through comparative testing with statistically significant results that the non-standard exit configuration provides a proportionate increase in evacuation performance over the Type C performance standard to justify the required increase of maximum number of passenger seats permitted for each of the floor level exit pair (i.e. 65 vs 55), achieved under a conservative approach .

- The applicant should demonstrate through an acceptable number of partial evacuation tests or a full scale evacuation demonstration, under the conditions set in CS 25 appendix J, that the new configuration will increase the evacuation performance of the oversized Type I (performing equivalently to a Type C) emergency exits to an extent that the evacuation performance at aircraft level, considering the new desired MPSC, will meet the requirements of CS25.803(c) including the safety margins described in the associated guidance material.
- Should an increase of the dimensions of the emergency exit access area (i.e. passageway, access space, etc.) above the minimum values be needed to demonstrate the desired evacuation performance, such new dimensions will constitute a limitation of the design of the new over-performing Type I emergency exit.
- Should the tests demonstrate an evacuation performance which would lead to a passenger credit above 65, the credit of the new over-performing Type I emergency exit will be in any case limited to 65.
- The maximum passenger seat credit for the remaining emergency exits (i.e. over-wing exits / floor level exits) will be determined by the outcomes of the CPR analysis applicable to the proposed design.
- The other criteria defining a Type C exit remain unchanged and are met (CS 25.807(g)(8), 25.810(a)(1)(ii), 25.813(a), 25.813(b)(3) and 25.813(b)(4)).

EQUIVALENT SAFETY FINDING	D-11: Over wing Type III exit interior arrangement
APPLICABILITY:	A321-251NX / -252NX / -253NX / -271NX / -272NX
REQUIREMENTS:	CS 25.813[c(2)(i)] and CS25.813[c(4)(i)] at Amdt 15
ADVISORY MATERIAL:	AMC 25.813; AC 25-17A

Design / Analysis proposal

- The design features characterizing the over wing Type III exit interior arrangement are:
    - an outward opening ADH Type III exit
    - vertical direction (z-axis)
        - a provided exit opening size of 20″x41″ (unobstructed opening) being 5″ higher than the minimum requirements (20″x36″)
        - a required opening that can be inscribed within the provided opening in accordance with CS 25.807(c). However, to ensure the minimum required opening is unobstructed in accordance with CS 25.813[c(4)], and the step down distance is in accordance with CS 25.807[a(3)] and CS 25.807[b], the base of the inscribed required opening has to be positioned 2″ above the sill of the actual provided opening
        - an outboard seat cushion with compression characteristics in excess of 2″ encroachment in the projected provided opening of the exit up to a maximum of 4″
    - horizontal direction (x-axis) (applicable only to forward exit of a dual exit configuration)
        - the relative position of the two Type III exits and the maximum overlap of the required passageway with the clear opening of the forward exit to 6″ limits the seat row installation between the exits for the forward exit when both exits are active
        - the required passageway width is only 6″ (instead of 10″) within the required projected opening width of the exit. This leads to an offset between the centreline of the exit and the centreline of the passageway of 10,5″

Conditions for the acceptance of the ESF

The following conditions apply to all Type III exit arrangements foreseen.

- The applicant shall demonstrate by test that the door operation is not affected by the interior arrangement, especially by the positioning of the seat relative to the exit's operating handle and by the encroaching seat cushion
- The applicant shall demonstrate by test that the seat cushion of any seat adjacent to the Type III exit(s) is easily compressible when a force of 170 lbs is applied over 40 square-inches (Criteria per guidance provided by AC 25-17A)
- The design and arrangement of all seats bordering and facing an access passageway to a Type III exit, both with and without the bottom cushion in place, must be free from any gap, which might entrap a foot or other part of a person standing or kneeling on the seat or moving on to along the seat row and to resist to evacuees' stepping on the seat.

- The seats shall be compliant to CS 25.562 at Amdt 15 (with the exception of subparagraph [c(5)] and [c(6)]).

The following conditions apply to the forward exit of a dual Type III exit arrangement only.

- The maximum offset of 10,5” between the centreline of the exit and the centreline of the passageway shall not be exceeded.
- The applicant shall demonstrate by test that the exit operation and the evacuation related performance (evacuation flow rate) of an interior arrangement with 6” of the required passageway being within the required opening of the exit is at a comparable level to the configuration required by CS25.813[c(2)(i)].

Any single Type III exit or the aft exit of a dual Type III exit arrangement shall comply with the requirements of the CS 25.813[c(2)(i)] at Amdt 15.

EQUIVALENT SAFETY FINDING	**D-12: Single Cabin Attendant Seat at door 3**
APPLICABILITY:	TC: A321-27xNX / -25xNX
REQUIREMENTS:	CS 25.785(h[1]) Chg 11
ADVISORY MATERIAL:	AC 25-17A, AC 25.785-1B

BACKGROUND

Airbus proposes for the A321neo ACF interior arrangements with a single Cabin Attendant Seat (CAS) on one side of the fuselage at door 3 similar to currently certified A321 legacy aircraft, (CRI E-3003) to further increase the flexibility for customer layout definition.

The single CAS located on the side of the fuselage is judged to be remote from the exit on the opposite side of the cabin, further than the distance of the three seat rows (as per AC 25.785-1B).

EQUIVALENT SAFETY FINDING

Airbus requested an Equivalent Safety Finding to propose a single cabin attendant seat at door 3.

EASA agreed that the test performed on A321 legacy aircraft to demonstrate that there were no significant difficulties for the cabin attendant to reach the usable exit side before the first passengers when coming from the attendant seat located outboard at the opposite side of the fuselage.

Evidence is required in terms of the ability of a cabin attendant to reach the far exit before any passenger, so that he/she can effectively open the exit and manage the passenger flow onto the slide against any resulting passenger crowding at this exit. Such evidence shall cover all the foreseen combinations of passageways and exit's types/deratings.

The outcome of the testing shall be reflected in the evacuation analysis and the positioning of the CAS shall take into account the direct view requirement.

The ability of the outboard seated cabin attendant to reach the opposite exit shall be covered by the cabin crew training program.

EQUIVALENT SAFETY FINDING	**D-13: Over-performing Type III exit(s)**
APPLICABILITY:	A321-251NX / -252NX / -253NX / -271NX / -272NX
REQUIREMENTS:	CS25.807[g(1)], CS25.807[g(7)] at Amdt 15
ADVISORY MATERIAL:	---

Design / Analysis proposal

- The design features characterizing the new over-performing Type III exit are:
  - an exit opening size of 20”x41” (unobstructed opening) being 5” higher than the minimum requirements
  - a door
    - fully compliant to CS 25.813[c(6)] at Amdt 15
    - which actuation is power assisted
    - with an opening time significantly less than what prescribed by CS 25.809[b(2)] at Amdt 15 (i.e.: 10 seconds)
    - with a mechanism for immediate activation of the slide
  - an escape route (regardless of the number of the exits)
    - with a dual lane feature
    - with a width in excess of the requirements prescribed by CS 25.810[c(1)] at Amdt 15
    - with an over wing illumination level in excess of the requirements prescribed by CS 25.812[g(1)(i)] and CS 25.812[g(1)(ii)] at Amdt 15

- For the purpose of demonstrating the individual and overall increased evacuation performance the applicant will conduct:
  - door operations test to substantiate the enhanced door readiness time
  - tests to demonstrate the compatibility between the door opening time and the slide availability
  - testing and/or analysis based on test to compare the evacuation performance of the standard Type III exit as defined by the regulation at Amdt 15 and the proposed design
  - partial evacuation test
    - for the single OWE configuration
    - for the dual OWE configuration (could be combined with the D#3 partial evacuation testing)
    - on an operationally representative aircraft configured with the minimum exit access path width in accordance with CS 25.813[c(2)(i)] and CS 25.813[c(2)(ii)]
- The outcomes of the above testing shall be combined and analysed to demonstrate the desired increased rating

Conditions for the acceptance of the ESF

The applicant should demonstrate the following conditions:

- The applicant should demonstrate through testing, with statistically significant results, that the OWE exit configuration provides a proportionate increase in evacuation

performance over the standard Type III defined by the following requirements at Amdt 15:
    - CS 25.807[a(3)] – geometry
    - CS 25.809[b(2)] – opening time
    - CS 25.813[c(6)] – automatic disposal
    - CS 25.813[c(2)(i)] – access to the exit

to justify the desired increase of maximum number of passenger seats permitted for each of the OWE pair (i.e. more than 35 for single OWE and more than 65 for dual OWE configuration), achieved under a conservative approach.

- The applicant should demonstrate through an acceptable number of partial evacuation tests or a full scale evacuation demonstration, under the conditions set in CS 25 Appendix J, that the new configuration will increase the evacuation performance of the Type III emergency exits to an extent that the evacuation performance at aircraft level, considering the new desired MPSC, will meet the requirements of CS25.803(c) including the safety margins described in the associated guidance material.
- Any increase of the dimensions of the emergency exit access area (i.e. passageway, access space, main aisle, etc.) above the minimum values required by the regulations to demonstrate the desired evacuation performance will constitute a limitation of the design of the new over-performing Type III emergency exit.
- For the single OWE configuration, should the tests demonstrate an evacuation performance which would lead to a passenger credit above 39, the credit of the new over-performing Type III emergency exit will be in any case limited to 39.
- For the dual OWE configuration, should the tests demonstrate an evacuation performance which would lead to a passenger credit above 73, the credit of the new over-performing Type III emergency exit will be in any case limited to 73.

EQUIVALENT SAFETY FINDING	**D-14: De-rating of Door #3 to 45 or 35 passenger**
APPLICABILITY:	A321-251NX / -252NX / -253NX / -271NX / -272NX
REQUIREMENTS:	CS 25.807(c)(g), 25.813(c) at Amdt 15, JAR 25.785(h) at Ch 11
ADVISORY MATERIAL:	---

De-rating of Door 3 to 45 passengers

Each exit (LH/RH) must be provided with:

1. An unobstructed 51 cm / 20 inches wide passageway from the longitudinal aisle to the exit[1].
2. A passageway width within the minimum required width of an exit defined by CS 25.807(a)(1)
3. Fixed seat backs and restricted recline and break-over for all seats bounding the passageways to the exits.
4. Outboard seat armrest not encroaching into the required clear opening of the exit defined by CS 25.807(a)(1).
5. The exit pair must be provided with one Cabin Attendant Seat. At each exit, LH and RH, one assist space of appropriate dimensions shall be provided. Each new configuration of Cabin Attendant Seat and assist space shall be certified.
6. The Cabin Attendant Seat is to be marked to ensure that it is occupied by a Cabin Crew Member during take-off and landing.
7. The exit design and operating mechanism including associated markings and placards and the emergency escape slide configuration must remain unchanged compared to the basic Type C exit arrangement. Means minimizing the likelihood of inadvertent operation of the door handle must be provided.

De-rating of Door 3 to 35 passengers

Each exit (LH/RH) must be provided with:

1. An unobstructed 33 cm / 13 inches passageway from the longitudinal aisle to the exit
2. A passageway width within the minimum required width of an exit defined by CS 25.807(a)(3).
3. Fixed seat backs and restricted recline and break-over for all seats bounding the passageways to the exits
4. Outboard seat armrest not encroaching into the required clear opening of the exit defined by CS 25.807(a)(3).
5. The exit pair will be provided with one Cabin Attendant Seat and an associated assist space of appropriate dimensions. Each new configuration of Cabin Attendant Seat and assist space shall be certified.
6. The Cabin Attendant Seat is to be marked to ensure that it is occupied by a Cabin Crew Member during take-off and landing.

[1] CRI D-10 (MoC) "Canted passageway to door 3" must not be applied when the exit is de-rated to 45 passengers.

7. The exit design and operating mechanism including associated markings and placards and the emergency escape slide configuration remain unchanged compared to the basic Type C exit arrangement. Means minimizing the likelihood of inadvertent operation of the door handle must be provided.

SPECIAL CONDITION	D-15: Pilot Control Mode TaxiBot Operations
APPLICABILITY:	Post TC: A318/A319/A320/A321
REQUIREMENTS:	CS 25.302, 25.745(d) & 25.1309
ADVISORY MATERIAL:	n/a

BACKGROUND:

The TaxiBot tractor is qualified as a towbarless towing tractor for operations in driver control mode. The subject change is to allow pilot-controlled towbarless towing of the Airbus SA aircraft throughout the taxi phase with the TaxiBot tractor.

The pilot controls the steering inputs, executed by the TaxiBot tractor, and normal (non-emergency) braking is achieved via the aircraft yellow braking system.

JAR 25X745(d) states that "the design of the attachment for towing the aeroplane on the ground must be such as to preclude damage to the steering system".

JAR 25.1309 states:
"(a)… systems used for non-essential services need only comply so far as is necessary to ensure that the installations are neither a source of danger in themselves nor liable to prejudice the proper functioning of any essential service."
And:
"(b) The aeroplane systems and associated components, considered separately and in relation to other systems, must be designed so that (see ACJ's Nos. 1 and 3 to JAR 25.1309) —
(1) The occurrence of any failure condition [which would prevent the continued safe flight and] landing of the aeroplane is extremely improbable, and
(2) The occurrence of any other failure condition which would reduce the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions is improbable."

The intent of the above is considered to ensure the aircraft design is such that any means to be used for ground manoeuvring of the aircraft with knowledge and/or approval of the constructor should not have the capability to cause damage to the NLG or the nose wheel steering (NWS) function.

The towbarless towing CRI D-0332-001 addresses the need to preclude damage to the steering system in the event that loads induced approach the capability of the design to withstand the loads during pushback operations with 'Towbarless Towing'.
This CRI (D-15) extends this need to preclude damage or at least provide an equivalent level of protection to the complete NLG (including the steering system) throughout TaxiBot operations as that which is available from the more conventional towbar towing and taxi arrangements.

If, due to specific nose landing gear constraints, such means (to preclude damage) cannot be defined, or are considered not to be practicable, the constructor may define such alternative means in order to provide the flight crew with an unmistakable warning, during taxi, if damage to the steering system, braking system or NLG structure may have occurred during TaxiBot operations. Such means may be considered as providing equivalent safety to devices which preclude damage to the steering system, braking system and NLG structure.

Additionally, impact of towbarless TaxiBot operations and its failures on aircraft & NLG loads should be assessed.

JAR 25 does not contain adequate safety standard for such operations. In accordance with Part 21A.16B(a)(1), EASA considers that a special condition is needed to address towbarless TaxiBot operations.

For Airbus SA, the Special Condition and the Acceptable Means of Compliance to this CRI, as per towbarless towing CRI D-0332-001 at issue 3, remain applicable for 25X745.

The principle used for AMC 25.745 (specifically in AMC 25.745(d) 2. (d3)) can also be applied to 25.1309 such that it extends from nose-wheel steering specifically to the complete NLG (system and structure).

Additionally, towbarless TaxiBot operations and TaxiBot failures may impact aircraft loads, in particular the NLG loads. As a result EASA proposes to extend the applicability of this CRI on towbarless TaxiBot operations to current CS 25.302 & Appendix K.

Special Condition

Replace the entire text of the current paragraph JAR 25X745(d) with the following:

CS 25.745 Nose-wheel steering
(d) The nose-wheel steering system, towing attachment(s), and associated elements must be designed or protected by appropriate means such that during ground manoeuvring operations effected by means independent of the aeroplane:
(1) Damage affecting the safe operation of the nose-wheel steering system is precluded, or

(2) A flight crew alert is provided, if damage may have occurred before the start of taxiing or during taxi (see AMC 25.1322).

(See AMC 25.745(d))

SPECIAL CONDITION	D-19: Incorporation of Inertia Locking Device in Dynamic Seats
APPLICABILITY:	Post TC: A318/319/320/321
REQUIREMENTS:	CS 25.562
ADVISORY MATERIAL:	-

BACKGROUND

Airbus is allowing the incorporation of an inertia locking device (ILD) in some passenger seats on the Single Aisle family aircraft models as a means to achieve compliance with particular aspects of CS 25.562. In general, seats designed and tested to show compliance have, up until now, relied on either basic seat structure or in some cases, particular 'passive' energy absorbing features. The inertia locking device constitutes the first known application in commercial aerospace of an 'active' seat moving device to help achieve compliance, i.e. a system which mechanically deploys during the impact event. This is considered a novel design feature and one for which a special condition is needed to address requirements applicable to this feature in a seat.

Special Condition

1) Level of Protection Provided by Inertia Locking Device(s) (ILD)
The ILD is a mechanically deploying feature of a seat with a fore/aft tracking system. The ILD will self-activate only in the event of a predetermined aircraft loading condition such as that occurring during crash or emergency landing. The ILD will interlock the seat tracking mechanism so as to prevent excessive seat forward translation. EASA considers that a minimum level of protection should be provided if the device does not deploy. It must be demonstrated by test that the seat and attachments, when subject to the emergency landing dynamic conditions specified in CS 25.562 and with the ILD not deploying, do not suffer structural failure that could result in:

- separation of the seat from the aircraft floor,
- separation of any part of the seat that could form a hazard to the seat occupant or any other aircraft occupant,
- failure of the occupant restraint or any other condition that could result in the occupant separating from the seat. However, failure of the occupant restraint may occur where it can be demonstrated that the seat occupant cannot form a hazard to any other aircraft occupant. This would normally only be agreed by the Agency on the basis of physical separation of the seat from other seats in the aircraft, for example in a mini-suite type arrangement.

2) Protection Provided Below and Above the ILD Actuation Condition
The normal means of satisfying the structural and occupant protection requirements of JAR 25.562 result in a non-quantified but nominally predictable progressive structural deformation and/or reduction of injury severity for impact conditions less than the maximum specified by the rule. A seat using the ILD technology however involves a step change in protection for impacts below and above that at which the ILD activates and deploys to its 'retention' position.

This could result in the effects of the impact, for example structural deformation and occupant injury criteria, being higher at an intermediate impact condition than that resulting from the maximum.
It is acceptable for these effects to have such non-linear or step change characteristics provided that they do not exceed the allowable maximum at any condition at which the ILD does or does not deploy, up to the maximum severity pulse specified by the requirements. Tests must be performed to demonstrate this taking into account any necessary tolerances for deployment.

3) Intermediate Pulse Shape
The existing ideal triangular maximum severity pulse is defined in FAA AC 25.562.1B. EASA considers that for the evaluation and testing of less severe pulses, a similar triangular pulse should be used with acceleration, rise time, and velocity change scaled accordingly.

4) Protection over a range of crash pulse vectors
The device will be tested at the EASA 25.562 specified crash pulse vectors of 14g at 30 degrees to the vertical and 16g at the horizontal. In addition it shall be shown that the device will also operate at a range of crash pulse vectors between those specified.

5) Protection during Secondary Impacts
The design of the ILD shall be such that if there is more than one impact, for the final impact that is above the severity at which the device is intended to deploy, the maximum protection of the device must be provided.

6) Protection of Occupants other than 50th Percentile
The ILD shall not affect compliance of the seat and installation with CS 25 requirements, or those of this Special Condition, with respect to protecting the specified range of occupant sizes.

7) It must be shown that any inadvertent operation of the device, for example during extreme flight manoeuvres, does not affect the performance of the seat during a subsequent emergency landing.

8) The installation of the ILD on the seat shall be physically protected from any contamination likely to occur during operation, e.g. drink, food etc. The installation should also be protected against other foreign object ingress.

9) The effects of wear and criticality of manufacturing tolerances should be considered with respect to reliability and adverse effect on operation of the ILD. In addition other possible effects that may render the device inoperative must be taken into account such as aging/drying of lubricants and corrosion.

10) The design, installation and operation of the ILD shall be such that it is possible, by maintenance action, to check the functioning, i.e. movement, of the device in-situ.

11) A method of functional checking and a maintenance check interval should be established (if applicable).

12) If there is a need to include any means to release an inadvertently operated device (i.e. that has engaged in a non-crash condition where the seat could otherwise remain in-situ on the aircraft), this function shall not introduce additional hidden failures.

EQUIVALENT SAFETY FINDING	D-21: Over-Wing Exit Interior Arrangement
APPLICABILITY:	Post TC: A321 ACF
REQUIREMENTS:	CS C25.0813(c)(2)
ADVISORY MATERIAL:	-

BACKGROUND

The proposed Airbus A321-27xNX/-25xNX cabin layout is made of 76 seats that are electrically actuated and that can be driven to full flat (bed) position.

The cabin exits arrangement includes the activation of one pair of oversized Type III automatic opening doors over the wing, in order to ensure compliance with the CS 25.807(f)(4) "60ft rule".

When a seat located in the vicinity of the Type III exits is actuated towards the bed position, this creates an obstruction of the passageway resulting in a non–compliance to CS 25.813(c)(2) at Amdt 15. Nevertheless, when the seat is in Taxi, Take-Off and Landing (TTOL) position, the seat installation is in compliance with CS 25.813(c)(2) with no obstruction of the required passageway to the over-wing exit.

EQUIVALENT SAFETY FINDING

An equivalent level of safety finding ot he affected regulation can be demonstrated via the criteria detailed here below:
Design / Analysis proposal:

- The seats will be installed at the over-wing exit in full respect of the ESF D-11 "Over wing Type III exit interior arrangement".
- The seat installation will be in accordance with CS25.813(c)(2) when the seat is in Taxi, Take-Off and Landing (TTOL) position.
- At least 25.4 cm (10 inches) of the required passageway width will be within the projected opening width of the exit and a 13" wide passageway will be maintained in TTOL.
- The seat configuration at the Type III over wing exit will always ensure that the base of the exit can be used as a step, regardless if the seat is in TTOL or in bed position.
- The seat at the over-wing exit will be electrically actuated. A feature will be installed allowing the cabin crew to deactivate the seat from the cabin attendant position. This deactivation can easily be performed before preparing the cabin for TTOL.
- Information of the flight phase and the status of a switch on the Flight Attendant Panel (FAP) will be routed to the seat. The logic will be the following:
    - • The status of this switch as well as the "landing gear extended" and the "flaps in TTOL positon" information will be routed to the seat.
    - • The switch, when engaged, powers the Portable Electronic Devices (PED) outlets units of the seats and allows full functionality of the seat actuation system. When this switch is disengaged power is removed from the PED outlets units and the seat actuation system is restricted such that only the "TTOL" switch of the seat actuation system is powered. Then, in any position of the

seat, the seat can only be driven back to TTOL position, or, when in TTOL position, the seat cannot be driven out of that position.
  - • The same logic automatically applies if either the landing gear is extended or the flaps are set to their TTOL position.
- Forward and aft floor level exits will be equipped with either wide slides or slide/rafts as per A321-27xNX/-25xNX type certificate.
- The seats will have a mechanical override to bring them in the TTOL position in case of power loss. This mechanical override is not easily accessible to the passenger.
- The A321-27xNX/-25xNX is equipped with Type III over-wing automatic opening exits. These exits are top-hinged and open to the outside such that any interference with interior design is excluded.

Procedure implementation:

- A limitation will be included in the "Cabin Instructions and Limitations List" (CIL), and referenced in the Airplane Flight Manual (AFM), mandating the Cabin Crew (CC) to disengage the seat power prior to the cabin preparation for TTOL to ensure the seats cannot be driven out of their TTOL position.
- The CC will check that all seats are in their TTOL position as per the normal cabin procedure.
- For the proposed MPSC of 76, the minimum required CC would be 2 based on the operational requirement. A limitation will be included in the "Cabin Instructions and Limitations List" (CIL), and referenced in the Airplane Flight Manual (AFM), that the Minimum Cabin Crew is 3. The additional CC will be mandated to have the dedicated duty to disengage the seat power before checking the seating configuration at the Type III over-wing exit when the cabin is prepared for TTOL. If needed, this CC will also perform the manual override to bring the seats in the over-wing exit row to the TTOL position.

Applicant Safety Equivalency Demonstration:

- According to CRI D-17, the theoretical maximum seating capacity in the door configuration C65-III-C65 is 165 (allocating a rating of 35 to the Type III over-wing exit). The actual proposed seating capacity of 76 is a reduction by a factor of more than 2 of the theoretical maximum.
- The configuration of both the forward and the aft floor level exits is in accordance with CRI D-09 "Increase of seats' credit for oversized Type I (qualified to Type C) floor level exits", granting a rating of 65 passenger. For the proposed MPSC of 76, the evacuation performance will be demonstrated by a combination of analysis and testing with substantial margins, in compliance to 25.803(c), without taking any credit of the evacuation performance of the single Type III over-wing exit.
  - - Irrespective of the status of the seats at the exit row (TTOL position, full flat bed position, or any position in between) it will be ensured that there is an unobstructed Type III exit opening as required by 25.807(a)(3) available, and useable for evacuation, such that compliance to CS25.807(f)(4) ("60 feet rule") is always maintained.

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SPECIAL CONDITION	D-24: Installation of Airbags in the backrest of seats
APPLICABILITY:	Post TC: AIRBUS A318/A319/A320/A321 All models
REQUIREMENTS:	CS 25.562 Amdt. 15, JAR 25.785 Change 11
ADVISORY MATERIAL:	AC 25-17A Change 1, AC 25.562-1B,

BACKGROUND

In order to show to compliance with CS 25.562(c)(5) Amdt. 15, Airbus is proposing the application of airbags that are mounted into the back of a passenger seat as a means to reduce the potential for head injury in the event of an accident.
A seat back mounted airbag is defined as an inflatable restraint system mounted on the back of passenger seats that may move with the passenger seat backrest under dynamic conditions. The seat back mounted airbag deploys from the backrest of the seat in front between the passenger and the backrest of the seat in front.
Seatback mounted airbags are an unusual design feature in the passenger seat environment that is not specifically addressed in CS 25. Therefore, special conditions and related guidance material are needed to address the installation of such systems on large aeroplanes.

SPECIAL CONDITION

1) HIC Characteristic
The existing means of controlling Front Row Head Injury Criterion (HIC) result in an unquantified but usually predictable progressive reduction of injury severity for impact conditions less than the maximum specified by the rule. Airbag technology however involves a step change on protection for impacts below and above that at which the airbag device deploys. This could result in the HIC being higher at an intermediate impact condition than that resulting from the maximum.
It is acceptable for HIC to have such a non-linear or step change characteristic provided that the value does not exceed 1000 at any condition at which the seatback mounted airbag does or does not deploy, up to the maximum severity pulse specified by the requirements. Tests must be performed to demonstrate this taking into account any necessary tolerances for deployment.

2) Intermediate Pulse Shape
The existing ideal triangular maximum severity pulse is defined in FAA AC 25.562-1B. EASA considers that for the evaluation and testing of less severe pulses, a similar triangular pulse shall be used with acceleration, rise time, and velocity change scaled accordingly.

3) Protection During Secondary Impacts
EASA acknowledges that the seatback mounted airbag will not provide protection during secondary impacts after actuation. However, evidence must be provided that the post deployment features of the installation shall not result in an unacceptable injury hazard. This must include consideration of the deflation characteristics in addition to physical effects. As a minimum, a qualitative assessment shall be provided.
Furthermore, the case where a small impact is followed by a large impact must be addressed. If the minimum deceleration severity at which the airbag is set to deploy is unnecessarily low,

the airbag's protection may be lost by the time the second larger impact occurs. It must be substantiated that the trigger point for airbag deployment has been chosen to maximize the probability of the protection being available when needed.

4) Protection of Occupants other than 50th Percentile
The existing policy is to consider other percentile occupants on a judgmental basis only i.e. not using direct testing of injury criteria but evidence from head paths etc. to determine likely areas of impact.
The same philosophy may be used for seatback mounted airbags in that test results for other size occupants need not be submitted. However, sufficient evidence must be provided that other size occupants are protected.
A range of stature from a two-year-old child to a ninety-five percentile male must be considered.
In addition, the following situations must be taken into account:

- The seat occupant is holding an infant, including the case where a supplemental loop infant restraint is used:
- The seat occupant is a child in a child restraint device.
- The seat occupant is a pregnant woman

5) Airbag Deployment
Evaluation of the deployment of the airbag must take into account the possible movement of the seatback the airbag is mounted to during the crash pulse. This movement of the seatback and the associated seat may change depending on the load conditions of the front seat (occupied or not, changing number of occupants on the front seat).
Compliance with the CS 25.562(c)(5) shall be demonstrated with the seat in front occupied and unoccupied.

6) Occupants Adopting the Brace Position
The seatback mounted airbag shall not, in itself, form a hazard to any occupant in a brace position including any position in between the brace position and upright position during deployment.

7) The gas generator shall not release hazardous quantities of gas or particulate matter into the cabin.

8) The probability of inadvertent deployment must be shown to be acceptably low. The seated occupant must not be seriously injured as a result of the seatback mounted airbag deployment. Inadvertent deployment must not cause a hazard to the aircraft or cause injury to anyone who may be positioned close to the seatback mounted airbag (e.g. seated in an adjacent seat or standing adjacent to the airbag installation or the subject seat). Cases where the inadvertently deploying seatback mounted airbag is near a seated occupant or an empty seat must be considered. The above must be demonstrated or the probability of the inadvertent deployment must be demonstrated to be in accordance with the severity of the failure.

9) It must be demonstrated that the seatback mounted airbag when deployed does not impair access to the seatbelt or harness release means, and does not hinder evacuation, including consideration of adjacent seat places and the aisle.

10) There must be a means for a crewmember to verify the integrity of the seatback mounted airbag activation system prior to each flight, or the integrity of the seatback mounted airbag activation system must be demonstrated to reliably operate between inspection intervals.

11) It must be demonstrated that the seatback mounted airbag is not susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground maneuvers likely to be experienced in service.

12) The equipment must meet the requirements of CS 25.1316 with associated guidance material AMC 20-136 for indirect effects of lightning. Electro static discharge must also be considered.

13) The equipment must meet the requirements for CS 25.1317 with associated guidance material of AMC 20-158 with an additional minimum RF test for the threat from passenger electronic devices of 15 Watts radiated power.

14) The seatback mounted airbag mechanisms and controls must be protected from external contamination.

15) The seatback mounted airbag installation must be protected from the effects of fire such that no hazard to occupants may result.

16) The seatback mounted airbag must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly or adjacent seats considering that unoccupied seats may have active seatback mounted airbag.

17) The seatback mounted airbag must function properly after loss of normal aircraft electrical power and after a transverse separation in the fuselage at the most critical location. A separation at the location of the airbag does not have to be considered.

18) It is accepted that a material suitable for the inflatable airbag that will meet the usually acceptable flammability standard for a textile, i.e. the 12 second vertical test of CS 25 Appendix F, Part 1, Paragraph (b)(4), is currently not available.
In recognition of the overall safety benefit of seatback mounted airbags, and in lieu of this standard, it is acceptable for the material of inflatable bag to have an average burn rate of no greater than 2.5 inches/minute when tested using the horizontal flammability test of CS25 Appendix F, part I, paragraph (b)(5).

19) If lithium-ion non-rechargeable batteries are used to power the inflatable restraint, the batteries must be RTCA DO-227 and Underwriters Laboratory (UL) compliant. The use of rechargeable lithium-ion batteries may require additional special conditions.

20) Seatback mounted airbag systems should not introduce additional hazards in respect to occupant safety when compared to certified systems.

21) In case seatback mounted airbag systems are installed in or close to passenger evacuation routes (other than for the passenger seat the airbag is mounted for) a possible impact on emergency evacuation (e.g. hanging in the aisle, building a potential trip hazard, etc.) should be evaluated.

22) The airbag, once deployed, must not adversely affect the emergency lighting system (i.e. block escape path lighting to the extent that the light(s) no longer meet their intended function).

23) Neck Injury Criteria: The installation of the structure mounted airbag must protect the occupant from experiencing serious neck injury. The assessment of neck injury must be conducted with the airbag activated unless there is reason to also consider that the neck injury potential would be higher below the airbag activation threshold. If so, additional tests may be required.
The following neck injury criteria listed in the FMVSS 571.208 using the FAA Hybrid III ATD can be adopted.

a) The neck loads and moments during the entire impact event are limited as follows:
The Nij must be below 1.0, where Nij =Fz/Fzc + My/Myc, and Nij intercepts limited to:
Fzc = 694 kg (1530 Ib) for tension
Fzc = 628,2 kg (1385 Ib) for compression
Myc = 310,5 Nm (229 Ib·ft) in flexion
Myc = 135,6 Nm (100 Ib·ft) in extension

b) In addition, peak FZ must be below 425 kg (937 Ib) in tension and 407,8 kg (899 Ib) in compression.

c) Available biomechanics texts, citing relevant research literature *, indicate that there is a high risk of injury for head rotation over 114 degrees. To account for the degree of uncertainty in determining the rotation angle from observation of test video, rotation of the head about its vertical axis relative to the torso is limited to 105 degrees in either direction from forward-facing.

d) Impact of the neck with any surface could cause serious neck injury from concentrated loading and is not allowed.

* *"Accidental Injury, Biomechanics and Prevention", Third Edition 2015, N. Yoganandan, A. Nahum, J. Melvin editors, Chapter 11"Neck Injury Biomechanics", R Nightingale, B. Myers, N. Yoganandan, Section 11.4.3 "Torsion".*
In that section, 114 degrees is cited from a study by Myers as the "rotation required to produce injury in the
cadaver". The injury cited is "atlantoaxial dislocation" which is an AIS-3 (Serious) injury.

SPECIAL CONDITION	**D-25: Installation of structure mounted airbag**
APPLICABILITY:	Post TC: A320 Family
REQUIREMENTS:	CS 25.1316 at Amendment 15 JAR 25.785 at Change 11. CRI SE14 (SC S76-1 – Protection from the effect of HIRF) CRI E-31 elect to comply with CS 25.562
ADVISORY MATERIAL:	AMC 20-136

BACKGROUND

In order to show compliance with CS 25.562(c)(5), Airbus is proposing the installation of structure mounted airbags as a means to reduce the potential for head injury in the event of an accident.

A structure mounted airbag is an inflatable restraint system which is mounted on interior structure and works similarly to an automotive airbag (supplemental restraint system). In an emergency landing, the structure mounted airbag deploys, mitigating the risk of serious injuries caused by head impact on the surrounding structure.

Structure-mounted airbags are a design feature that is not specifically addressed in CS-25. Therefore, special conditions and related guidance material are needed to address the installation of such systems on large aeroplanes.

It must also be noted that inflatable lap belts on passenger seats are a design features that are not addressed by the present CRI. However, EASA has issued dedicated special conditions (ref. A320 CRI E34).

Special Condition

1) HIC Characteristic
The existing means of controlling Front Row Head Injury Criterion (HIC) result in an unquantified but normally predictable progressive reduction of injury severity for impact conditions less than the maximum specified by the rule. Airbag technology however involves a step change on protection for impacts below and above that at which the airbag device deploys. This could result in the HIC being higher at an intermediate impact condition than that resulting from the maximum.

It is acceptable for HIC to have such a non-linear or step change characteristic provided that the value does not exceed 1000 at any condition at which the airbag does or does not deploy, up to the maximum severity pulse specified by the requirements. Tests must be performed to demonstrate this taking into account any necessary tolerances for deployment.

2) Intermediate Pulse Shape
The existing ideal triangular maximum severity pulse is defined in FAA AC 25.562-1B. EASA considers that for the evaluation and testing of less severe pulses, a similar triangular pulse shall be used with acceleration, rise time, and velocity change scaled accordingly.

3) Protection During Secondary Impacts
EASA acknowledges that the structure mounted airbag will not provide protection during secondary impacts after actuation. However, evidence must be provided that the post-deployment features of the installation shall not result in an unacceptable injury hazard. This must include consideration of the deflation characteristics in addition to physical effects. As a minimum, a qualitative assessment shall be provided.
Furthermore, the case where a small impact is followed by a large impact must be addressed. In such a case if the minimum deceleration severity at which the airbag is set to deploy is unnecessarily low, the bag's protection may be lost by the time the second larger impact occurs. It must be substantiated that the trigger point for airbag deployment has been chosen to maximize the probability of the protection being available when needed.

4) Protection of Occupants other than 50th Percentile
The existing policy is to consider other percentile occupants on a judgmental basis only i.e. not using direct testing of injury criteria but evidence from head paths etc. to determine likely areas of impact.

The same philosophy may be used for structure mounted airbags in that test results for other size occupants need not be submitted. However, sufficient evidence must be provided that other size occupants are protected.
A range of stature from a two-year-old child to a ninety-five percentile male must be considered.

In addition the following situations must be taken into account:

- The seat occupant is holding an infant, including the case where a supplemental loop infant restraint is used:
- The seat occupant is a child in a child restraint device.
- The seat occupant is a pregnant woman

5) Occupants Adopting the Brace Position
There is no requirement for protection to be assessed or measured for seat occupants in any other position or configuration than seated alone upright, as specified in FAA AC 25.562-1B. However, it must be shown that the structure mounted airbag does not, in itself, form a hazard to any occupant in a brace position or a person in between the brace position and upright position during deployment.

6) It must be shown that the gas generator does not release hazardous quantities of gas or particulate matter into the cabin.

7) Airbag Deployment
Evaluation of the deployment of the airbag must take into account the deflection or deformation of the installation during the crash pulse. If installed in a monument used for stowage, this should include the possible range of loading conditions. The effects of any loads imposed by the airbag deployment on the positioning of the airbag should also be included in the evaluation.

The HIC test may be performed with the airbag deploying from a rigid test fixture provided that the above factors and the occupant size considerations in paragraph 4) are taken into account. A rational analysis supported by static deployment tests would be acceptable.

8) The probability of inadvertent deployment must be shown to be acceptably low and in accordance with the severity of the failure condition resulting. The seated occupant must not be seriously injured as a result of the structure mounted airbag deployment. Inadvertent deployment must not cause a hazard to the aircraft or cause injury to anyone who may be positioned close to the structure mounted airbag (e.g. seated in an adjacent seat or standing adjacent to the airbag installation or the subject seat). Cases where the inadvertently deploying structure mounted airbag is near a seated occupant or an empty seat must be considered.

9) It must be demonstrated that the structure mounted airbag when deployed does not impair access to the seatbelt or harness release means, and does not hinder evacuation, including consideration of adjacent seat places and the aisle.

10) There must be a means for a crewmember to verify the integrity of the structure mounted airbag activation system prior to each flight, or the integrity of the structure mounted airbag activation system must be demonstrated to reliably operate between inspection intervals.

11) It must be shown that the structure mounted airbag is not susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground manoeuvres likely to be experienced in service.

12) The equipment must meet the requirements of CS 25.1316 with associated guidance material (AMC 20-136) for indirect effects of lightning. Electro static discharge must also be considered.

13) The equipment must meet the requirements for HIRF (AMC 20-158) with an additional minimum RF test as per the applicable category of RTCA DO-160 Section 20.

14) The structure mounted airbag mechanisms and controls must be protected from external contamination associated with that which could occur on or around passenger seating.

15) The structure mounted airbag installation must be protected from the effects of fire such that no hazard to occupants will result.

16) The structure mounted airbag must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly or adjacent seats considering that unoccupied seats may have active structure mounted airbag.

17) The structure mounted airbag must function properly after loss of normal aircraft electrical power and after a transverse separation in the fuselage at the most critical location. A separation at the location of the airbag does not have to be considered.

18) It is accepted that a material suitable for the inflatable bag that will meet the normally accepted flammability standard for a textile, i.e. the 12 second vertical test of CS-25 Appendix F, Part 1, Paragraph (b)(4), is not currently available.
In recognition of the overall safety benefit given by the installation of structure mounted airbags, and in lieu of this standard, it is acceptable for the material of inflatable bag to have

an average burn rate of no greater than 2.5 inches/minute when tested using the horizontal flammability test of CS25 Appendix F, part I, paragraph (b)(5).

19) If lithium-ion non-rechargeable batteries are used to power the inflatable restraint, the batteries must be DO-227 and TSO 142A compliant. However, if rechargeable lithium-ion batteries are used, additional special conditions may apply.

20) Structure mounted airbag systems should not introduce additional hazards in respect to occupant safety when compared to certified systems.
21) In case structure mounted airbag systems are installed in or close to passenger evacuation routes (other than for the passenger seat the airbag is mounted for) a possible impact on emergency evacuation (e.g. hanging in the aisle, building a potential trip hazard, etc.) should be evaluated.

22) The airbag, once deployed, must not adversely affect the emergency lighting system (i.e. block escape path lighting to the extent that the light(s) no longer meet their intended function).

23) Neck Injury Criteria: The installation of the structure mounted airbag must protect the occupant from experiencing serious neck injury. The assessment of neck injury must be conducted with the airbag activated unless there is reason to also consider that the neck injury potential would be higher below the airbag activation threshold. If so, additional tests may be required.
EASA finds that it is reasonable to adopt the neck injury criteria recently proposed by the FAA listed in the FMVSS 571.208 using the FAA Hybrid III ATD.

a) The neck loads and moments during the entire impact event are limited as follows: The Nij must be below 1.0, where Nij =Fz/Fzc + My/Myc, and Nij intercepts limited to:

Fzc = 1530 Ib for tension
Fzc = 1385 Ib for compression
Myc = 229 Ib·ft in flexion
Myc = 100 Ib·ft in extension

b) In addition, peak FZ must be below 937 Ib in tension and 899 Ib in compression.

c) Available biomechanics texts, citing relevant research literature*, indicate that there is a high risk of injury for head rotation over 114 degrees. To account for the degree of uncertainty in determining the rotation angle from observation of test video, rotation of the head about its vertical axis relative to the torso is limited to 105 degrees in either direction from forward-facing.

d) Impact of the neck with any surface could cause serious neck injury from concentrated loading and is not allowed.

* *"Accidental Injury, Biomechanics and Prevention", Third Edition 2015, N. Yoganandan, A. Nahum,*

J. Melvin editors, Chapter 11"Neck Injury Biomechanics", R Nightingale, B. Myers, N. Yoganandan,
Section 11.4.3 "Torsion".

In that section, 114 degrees is cited from a study by Myers as the "rotation required to produce injury in the cadaver". The injury cited is "atlantoaxial dislocation" which is an AIS-3 (Serious) injury.

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SPECIAL CONDITION	D-27: Installation of Three Point Restraint & Pretensioner System
APPLICABILITY:	Post TC: A320 Family
REQUIREMENTS:	CS 25.1316 at Amendment 15 JAR 25.785 at Change 11. CRI SE14 (SC S76-1 – Protection from the effect of HIRF) CRI E-31 elect to comply with CS 25.562
ADVISORY MATERIAL:	AMC 20-136

BACKGROUND

In order to demonstrate compliance with CS 25.562, Airbus is proposing the installation of shoulder harnesses with pretensioners on seats as a means to reduce the potential for occupant injury in the event of an accident. The pretensioner works similarly to an automotive pretensioner, except that the pretensioner acts on the shoulder harness only and not to the lap belt.

The Schroth 3-Point Restraint with Pre-tensioner system is a self-contained restraint system specifically designed to improve occupant protection from serious injuries during a survivable crash. The system is installed as part of the seat assembly and is activated by a Mechanical Crash Sensor Unit (MCSU) mounted on the rigid seat structure.

The belt is attached to the seat structure via three anchor points. Two of the three anchor points hold two lugs of the belt to the seat shackle. The third anchor point holds the automatic belt retractor, which is located on the seat back.

The Mechanical Crash Sensor Unit (MCSU) activating the pre-tensioning feature is lithium battery powered and completely independent without any interface to aircraft wiring.

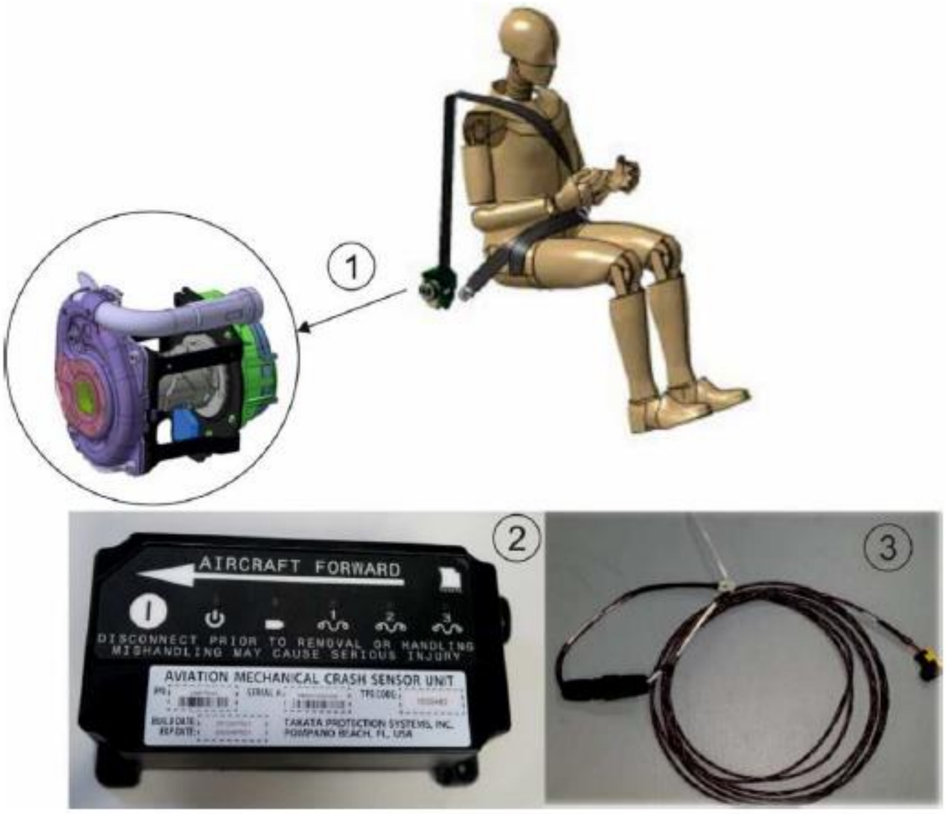
The 3-point diagonal restraint system with inertia reel pre-tensioner consists of three (3) top level components:

(1) Restraint System including inertia reel equipped with pre-tensioner
(2) MCSU
(3) Cable Harness

The pre-tensioner is activated by a crash detection unit (MCSU, item 2 in the figure reported below) in case of a high deceleration of the aircraft in forward direction. Before and after activation, the pretensioner does not affect the function of the inertia reel.
Activation of the pre-tensioner function is done electrically by igniting a micro gas generator that accelerates a piston. The piston pushes metal balls through a pipe and a ball wheel is set into counter-clockwise rotation. A clutch engages the ball wheel to the spool pot such that it is set into rotation and the harness slack is removed. The piston passes an exhaust hole that reliefs the driving gas pressure.

The above sequence happens before the occupant starts to move due to inertia forces. When the occupant starts forward displacement the inertia reel locks due to the activation of the standard webbing sensitivity feature and increase in load will disengage the clutch. This stops the pre-tensioning function.

The electrical pre-tensioner activation function is testable via a switch on the MCSU.



Special Condition

1. HIC Characteristic
The existing means of controlling Front Row Head Injury Criterion (HIC) result in an unquantified but normally predictable progressive reduction of injury severity for impact conditions less than the maximum specified by the rule. Pretensioner technology however involves a step change on protection for impacts below and above that at which the device deploys. This could result in the HIC being higher at an intermediate impact condition than that resulting from the maximum.

It is acceptable for HIC to have such a non-linear or step change characteristic provided that the value does not exceed 1000 at any condition at which the pretensioner does or does not deploy, up to the maximum severity pulse specified by the requirements. Tests shall be performed to demonstrate this, taking into account any necessary tolerances for deployment.

2. Intermediate Pulse Shape
The existing ideal triangular maximum severity pulse is defined in FAA AC 25.562-1B. For the evaluation and testing of less severe pulses, a similar triangular pulse shall be used with acceleration, rise time, and velocity change scaled accordingly.

3. Protection During Secondary Impacts
The pretensioner might not provide protection during secondary impacts after actuation. Therefore, the case where a small impact is followed by a large impact shall be addressed. In such a case if the minimum deceleration severity at which the pretensioner is set to deploy is unnecessarily low, the protection offered by the pretensioner may be lost by the time the second larger impact occurs. It shall be substantiated that the trigger point for the activation of the pre-tensioner has been chosen to maximize the probability of the protection being available when needed.

4. Protection of Occupants other than 50th Percentile
A range of stature from a two-year-old child to a ninety-five percentile male shall be considered. In addition no hazard shall be introduced by the pre-tensioner due to the following seating configurations:

- The seat occupant is holding an infant, including the case where a supplemental loop infant restraint is used:
- The seat occupant is a child in a child restraint device.
- The seat occupant is a pregnant woman

5. Occupants Adopting the Brace Position
There is no requirement for protection to be assessed or measured for seat occupants in any other position or configuration than seated alone upright, as specified in FAA AC 25.562-1B. In addition it shall be shown that there is no adverse effect on PAX adapting the traditional brace position if the pre-tensioner is activated.

6. The probability of inadvertent actuation shall be shown to be acceptably low. The seated occupant must not be seriously injured as a result of the actuation. Inadvertent activation must not cause a hazard to the aircraft or cause injury to anyone who may be positioned close to the retractor or belt (e.g. seated in an adjacent seat or standing adjacent to the seat).

7. There shall be a means for a crewmember to verify the availability of pre-tensioner function prior to each flight, or the probability of failure of the pre-tensioner function shall be demonstrated to be acceptably low between inspection intervals. It shall be demonstrated that an acceptable level of performance of the pre-tensioner is maintained between inspection intervals.

8. It shall be shown that the system is not susceptible to inadvertent actuation as a result of wear and tear, or inertial loads resulting from in-flight or ground manoeuvres likely to be experienced in service

9. It shall be ensured by design that any incorrect orientation (twisting) of the belt does not compromise the pre-tensioning protection function.

10. The equipment shall meet the requirements for HIRF and Indirect Effect of Lightning with additional tests as per the applicable category of sections 20 and 22 of RTCA DO-160G.

11. The mechanisms and controls shall be protected from external contamination associated with that which could occur on or around passenger seating.

12. The pre-tensioner system shall not induce a hazard to the occupants in case of fire.

13. The system shall function properly after loss of normal aircraft electrical power and after a transverse separation in the fuselage at the most critical location. A separation at the location of the system does not have to be considered.

SPECIAL CONDITION	D-28: Installation of oblique seats
APPLICABILITY:	A319/A320/A321 including ACF
REQUIREMENTS:	CS 25.562, 25.785(d) at Amendment 15
ADVISORY MATERIAL:	SAE AS6316

IDENTIFICATION OF ISSUE:

The intent of § 25.562 has been to improve the level of safety provided to occupants of passenger and cabin attendant seats installed on large aeroplanes. Since most seating on large aeroplanes is forwardfacing, the pass/fail criteria developed in § 25.562 focused primarily on these seats. With respect to seats other than forward-facing, the performance measures of CS 25.562(c) have proved to adequately address the injury criteria for occupants of aft-facing seats but not for occupants of side-facing seats, i.e. seats that make more than an 18o angle with the vertical plane containing the aeroplane centreline, as defined in CS 25.785(d).
In 2009 EASA certified for the first time the installation on A330 aeroplanes of side-facing seats not directly compliant with JAR 25.785(c). The occupants of the side-facing seats in question were not protected from head injury by a safety belt and an energy absorbing rest that would support the arms, shoulders, head and spine, or by a safety belt and shoulder harness that would prevent the head from contacting any injurious object. The certification approach was based on an Equivalent Safety Finding achieved mainly through the installation of inflatable restraint systems. The details of the ESF approach were initially documented in EASA A330 CRI E-27 and were subsequently consolidated in EASA A330 CRI E-134, which limited the ESF applicability to seats installed at 30 degrees or less with respect to the aircraft longitudinal axis.

For the same type of seat installation on A350 aeroplanes EASA issued ESF CRI D-30.

More recently EASA has been extensively involved in the development of SAE AS6316 which sets new occupant injury criteria for the certification of the installation of oblique seats on large aeroplanes. In the context of AS6316, occupant facing direction is defined as follows:
- Forward facing seats - Seats installed into the aircraft where the occupant facing direction is at 0 +/- 18° relative to the aircraft longitudinal axis.
- Aft facing seats - Seats installed into the aircraft where the occupant facing direction is at 180° +/- 18° relative to the aircraft longitudinal axis.
- Side facing seats - Seats installed into the aircraft where the occupant facing direction is at 90° relative to the aircraft longitudinal axis.
- Oblique facing seats - Seats installed into the aircraft where the occupant angle relative to the aircraft longitudinal axis is other than those described above.

For oblique seats installation, EASA has determined that in order to provide a level of safety that is equivalent to that afforded to occupants of forward and aft-facing seating, the applicant must meet the additional occupant injury criteria and installation/testing guidelines defined by the special condition contained in the Appendix A to this CRI, which are derived from SAE AS6316. This SAE Aerospace Standard (AS), which was officially released on 28th June 2017, documents a common understanding of terms, compliance issues, and occupant injury criteria to facilitate the design and certification of oblique facing passenger seat installations.

The proposed special condition applies to seats with an occupant facing direction greater than 18° and no greater than 45° relative to the aircraft longitudinal axis. Seats installed at angles greater than 30° relative to the aircraft longitudinal axis must have an energy absorbing rest or shoulder harness and must satisfy the special condition.

Special Condition: Installation of Oblique Seats

The special condition applies to seats with an occupant facing direction greater than 18° and no greater than 45° relative to the aircraft longitudinal axis.
Seats installed at angles greater than 30° relative to the aircraft longitudinal axis must have an energy absorbing rest or shoulder harness and must satisfy the special condition.
The installation of oblique seats must comply with the additional performance standards outlined in Section 10 of SAE AS6316 (Performance Standards for Oblique Facing Passenger Seats in Transport Aircraft), dated 28 June 2017, which is reported below.

10. ADDITIONAL PERFORMANCE STANDARDS FOR OBLIQUE FACING SEATS

This section provides standards and information not provided in AS8049C necessary to run and evaluate
dynamic tests on oblique facing seats. The test set ups and orientations are exactly as described in AS8049C. Test 1 is commonly referred to as the vertical test and is defined in AS8049C, Section 5.3.1.1.
Test 2 is commonly referred to as the horizontal test and is defined in AS8049C, Sections 5.3.1.2 and
5.3.1.3. Information relevant to the conducting of both these tests is contained throughout AS8049C,
Section 5.3. 10.1 Test 1 - Structural and Occupant Injury Evaluation (AS8049C, Section 5.3.1.1)

10.1.1 Occupant Simulation

For Test 1, an ATD representing a 50th percentile male as defined in 49 CFR Part 572, Subpart B, or an equivalent shall be used to simulate each occupant. See AS8049 5.3.2 for further information on ATDs and equivalency standards.

10.1.2 Contactable Items

Items contactable by the occupant shall be included in the test, replaced with a part shown to create a conservative test condition, or excluded based upon a rational analysis. Any replaced or excluded part shall be documented together with a rational analysis substantiating the action.
Items that do not influence the test such as trim, placards, wires, finishes, etc., may be omitted from the test article.

10.1.3 Occupant Injury Criteria

The injury criteria listed in AS8049C are applicable to this test.

10.2 Test 2 - Structural Evaluation (AS8049C, Sections 5.3.1.2 and 5.3.1.3)

10.2.1 Occupant Simulation

For Test 2 (structural evaluation), an ATD representing a 50th percentile male as defined in 49 CFR Part 572, Subpart B, or an equivalent shall be used to simulate each occupant. See AS8049 5.3.2 for further information on ATDs and equivalency standards.

10.2.2 Contactable Items

Items contactable by the occupant shall be included in the test, replaced with a part shown to create a conservative test condition, or excluded based upon a rational analysis. Any replaced or excluded part shall be documented together with a rational analysis substantiating the action.
Items that do not influence the test such as trim, placards, wires, finishes, etc., may be omitted from the test article.

10.2.3 Selection of Test Conditions

AS8049C Section 5.3.6 provides requirements applicable to all structural evaluation tests. In addition, due to the lack of seat symmetry about the load direction, both yaw directions (+/-10°), relative to the aircraft longitudinal axis, shall be tested to show structural integrity of the seat system, unless previous testing and/or rational analysis can demonstrate that a single yaw direction encompasses all critical structural aspects of the seat and its attachments.

10.2.4 Combining Structural and Occupant Injury Tests

Combining the structural evaluation test(s) with the occupant injury test(s) is not recommended. If the applicant decides to combine the tests, the additional set up to ensure the ATD contacts the supporting structure at the correct contact point to collect the necessary occupant injury criteria shall be documented. This document provides no guidance or recommendations on this topic.

10.3 Test 2 - Occupant Injury Evaluation (AS8049C, Section 5.3.1.2)

10.3.1 Occupant Simulation

For Test 2 (occupant injury evaluation), an FAA Hybrid III ATD shall be used. A floor under the ATD’s feet shall be used.

10.3.2 Contactable Items and Occupant Injury Assessments

Items contactable by the occupant shall be included in the test, replaced with a part shown to create a conservative test condition, or excluded based upon a rational analysis. Any replaced or excluded part shall be documented together with a rational analysis substantiating the action.
Damage or failure of these items shall be assessed to ensure that valid results have been obtained and that no sharp edges, injurious protrusions or egress impediments have been produced.
The aircraft fittings, or track, need not be representative. Any bracing or reinforcement of items included in the test shall be documented and shown to create a conservative test condition.
Items that do not influence the test such as trim, placards, wires, finishes, etc., may be omitted from the test article.

10.3.3 Selection of Test Conditions

AS8049C, Section 5.3.6 and Table 2 in this document provide the requirements for all occupant injury evaluation tests. Data from previous tests, simulation, or rational analysis shall

be used to determine the critical case(s). When determining the critical case(s) all yaw angles within the +/-10° range must be considered. Multiple tests may be necessary to examine all injury criteria.
Tests that only evaluate injury criteria do not require floor deformation.

10.3.4 Occupant Injury Criteria

Table 2 – Occupant injury criteria

Body Part	**Injury Criterion**
Head	(1) HIC ≤ 1000 (AS8049C, Section 5.3.9.4) in the event of head contact with seats, or other structure (including airbags), ① or (2) HIC 15 ≤ 700 (49 CFR 571.208) in the event of head contact with an airbag only ② ①Following a test, calculate HIC. If this value is ≤1000, the test is successful. If HIC is >1000, and contact is made with the seat or other structure, regardless of airbag usage, the test has failed. ②Use of HIC 15 is permitted as an alternate to HIC if the ATD head only contacts an airbag and makes no head contact with the seat or other structure. ATD head contact with the seat or other structure, through the airbag, or contact subsequent to contact with the airbag requires the use of HIC. HIC 15 is not applicable if head contact has occurred. The following evaluations of the test data should be used to determine if head contact has occurred: a. A review of the dynamic test videos and evaluation of the ATD head path movement, head contact, and head reaction at contact should be made. There should be a noticeable change in the head movement at the time of contact. b. A review and evaluation of the ATD head acceleration plots (x, y, z, and resultant) should be made. The resultant ATD head acceleration plot during the time period in which the critical HIC calculation was made should show an abrupt change in the head acceleration.
Neck	Nij (49 CFR 571.208) (1) Nij shall be below 1.0, where Nij = Fz/Fzc + My/Myc, and Nij critical values: (a) Fzc = 1530 pounds (6805 N) tension (b) Fzc = 1385 pounds (6160 N) compression (c) Myc = 229 foot-pounds (310 Nm) in flexion (d) Myc = 100 foot-pounds (136 Nm) in extension (2) Peak Fz shall be below 937 pounds (4168 N) in tension and 899 pounds (3999 N) in compression. (3) Rotation of the head about its vertical axis relative to the torso is limited to 105° in either direction from forward-facing. (4) Concentrated loading on the neck is unacceptable during any phase of the test and the neck shall not carrying any load between the ATD and the seat system. Incidental contact of the neck, such as a sliding motion against a flat surface, or a headrest, during rebound may be acceptable. (Visual evidence and load data shall be collected during the test to show that neck contact is not load carrying.)
Shoulder	(1) Where upper torso straps are used, tension loads in individual straps shall not exceed 1750 pounds (7784 N). If dual straps are used for restraining the upper torso, the total strap tension loads shall not exceed 2000 pounds (8896 N). (2) The upper torso restraint straps (where installed) shall remain on the ATD's shoulder during the impact.
Thorax	Significant contact between the thorax and seat system structure is not permitted during initial impact, except for intentional contact with an airbag or shoulder restraint.

Body Part	Injury Criterion
	For example, contact with a corner or protrusion would be significant contact and be unacceptable. Sliding along a smooth wall is not significant contact and could be acceptable, provided all other injury criteria are met. Rebound contact that produces an x direction acceleration exceeding 20g for more than 3ms is not permitted.
Abdomen	Significant contact between the abdomen and seat structure is not permitted except for intentional contact with an airbag or seat cushion.
Spine	1) The lumbar spine force (Fz) shall not exceed 1200 pounds (5338 N) tension and 1500 pounds (6673 N) compression. (2) Spine forces and moments shall be recorded using a six axis load cell and shall be reported. This data is collected for knowledge gathering. There are no pass/fail criteria associated with this data except as noted above for Fz.
Pelvis	(1) The pelvic restraint shall remain on the ATD's pelvis during the impact and rebound phases of the test. Provided that the pelvic restraint remains on the ATD's pelvis, trapping of the belt between the ATD leg and the pelvis is acceptable. (2) The load-bearing portion of the bottom of the ATD pelvis must not translate beyond the edges of its seat's bottom seat-cushion supporting structure.
Femur	(1) Where leg contact with seats or other structure occurs, the axial compressive load in each femur shall not exceed 2250 pounds (10008 N). (2) Axial rotation of the upper leg shall be limited to 35° in the strike direction from the nominal seated position. Evaluation during rebound is not biofidelic and need not be considered.
All	Contact between the head, pelvis, torso, or shoulder area of one ATD with the adjacent-seated ATD's head, pelvis, torso, or shoulder area is not allowed. Contact during rebound is allowed.

10.4 Restraint Systems

10.4.1 General Design

The design and installation of restraint systems shall prevent unbuckling or detachment due to applied inertial forces or impact of the hands/arms of the occupant during Tests 1 and 2.

10.4.2 Airbags

Airbag systems include inflatable restraints and structure mounted airbags.

For seats with airbag systems, it shall be shown that the system will deploy and provide protection under emergency conditions where it is necessary to prevent serious injury. The system shall provide a consistent approach to injury protection throughout the range of occupant, two year old child to 95th percentile male, whether it is designed to manage injury parameters (HIC, Nij, Neck Rotation, etc.) or occupant motion. The system shall be included in each of the certification tests as it would be installed in the airplane. If airbag systems influence the test results, they shall be active during the test.

Airbag systems may also be used to control occupant motion. The intended function of the airbag system shall be demonstrated during each applicable test.

Oblique seating systems including airbags shall be shown to meet the occupant injury criteria of Table 2 throughout the entire range of yaw that encompasses the installation angle +/-10° relative to the aircraft longitudinal axis.

Other considerations for airbag systems are outside the scope of this document.

10.5 Other Considerations

10.5.1 Recording of Shoulder Harness Loads

If a shoulder belt incorporating an airbag is used, care shall be taken when placing the webbing load cell to ensure that an accurate measurement is made and that the load cell does not affect the performance of the airbag.

10.5.2 ATD Placement

As an alternative to AS8049C, Section 5.3.8.3(b) through (e), the following procedure has been found to be adequate from previous experience for placing the ATD in a consistent manner for Test 2 and to determine the nominal (1g) seated position for Test 1:

1. Lower the ATD vertically into the seat while simultaneously (see Figure 3 for illustration):
   a. Aligning the midsagittal plane (a vertical plane through the midline of the body; dividing the body into right and left halves) with the middle of the seat place.
   b. Applying a horizontal x-axis direction (in the ATD coordinate system) force of approximately 20 pounds (89N) to the torso at the intersection of the midsagittal plane and lower sternum of the HII or FAA HIII at the midsagittal plane, to compress the seat back cushion.
   c. Keeping the upper legs as horizontal as possible by supporting them just behind the knees, or using an equivalent procedure.

2. Once all lifting devices have been removed from the ATD:
   a. Rock the ATD slightly to settle it in the seat.
   b. Separate the knees by about 100 mm (4 inches).
   c. Position the HII or FAA HIII hands on top of its upper legs.
   d. Position the feet such that the centerlines of the lower legs are approximately parallel to a lateral vertical plane (in the aircraft coordinate system).

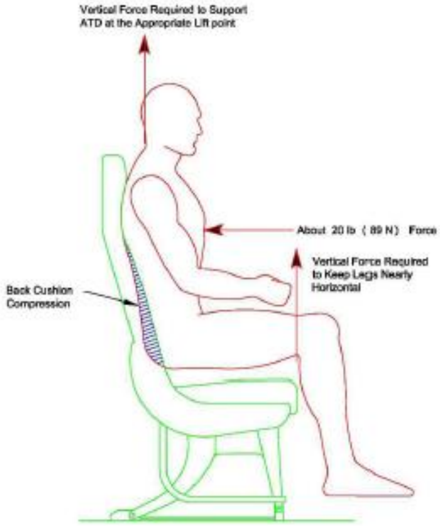


FIGURE 3 - ATD Placement

EQUIVALENT SAFETY FINDING	**D-31: Application of reduced Intrusion Loads in certain areas of the flight deck boundaries**
APPLICABILITY:	Post TC: A318/A319/A320/A321 All models
REQUIREMENTS:	CS 25.795(a)(1) at Amendment 22
ADVISORY MATERIAL:	AMC 25.795(a) / AC 25.795-1A

BACKGROUND:

The certification basis of the new Airspace cabin for the Airbus Single Aisle programme includes the requirements of CS 25.795(a)(1) at Amendment 22.
In that respect the flight deck door as well as the boundaries that are separating the flight deck compartment from the area occupied by passengers shall be designed to withstand the impact of 300 Joules defined in sub-paragraph (a)(1).
On the Airbus Single Aisle aircraft, depending on the aircraft customized layout, various configurations are defined for the boundaries: lavatories and galleys (transversal or longitudinal).
For each of the foreseeable configurations, Airbus is of the opinion that the impact energy of 300J required by 25.795(a) (1) is in certain cases beyond the loads that could effectively be applied from an attempt at forcible intrusion.
For these special cases, Airbus would like to propose alternative load values that will ensure a level of safety equivalent to the one mandated by the regulatory requirement of 25.795(a)(1).

Equivalent safety finding

Tests were performed with semi-kick boxers in a monument mock up environment to determine the level of energy and forcible intrusion loads that can realistically and physically be applied to these boundaries.
Based on this data, all expected configurations on single aisle are evaluated and for each of them a realistic level of energy is determined. Dedicated certification documents are proposed to summarize the results of the investigations performed on the single aisle expected configurations and substantiate the foreseeable intrusion loads these various configurations have to withstand.

SPECIAL CONDITION	D-32: Passenger protection from external fire
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.856(b) at Amendment 23
ADVISORY MATERIAL:	AMC 25.856 / FAA AC 25.856-2A

BACKGROUND

EASA received an application for a major change to type design on a large aeroplane. The design change includes the following features that require a Special Condition to be raised by EASA.

1) An integral (structural) rear centre tank (RCT) located behind the wheel bay is introduced to the aeroplane in the lower section of the fuselage, partially replacing the aft cargo compartment.

   The RCT creates a 'cold feet' effect for the passengers located above it, and insulation panels will have to be installed between the RCT and the cabin floor for comfort reasons. As per CS 25.856(b), these panels will have to be compliant with the burnthrough specifications. The aircraft manufacturer studied this strategy and concluded that, for the proposed design, compliance with CS 25.856(b) is technically not feasible due to the following reasons:

   a) It is not possible to install insulation panels between the RCT and the cabin floor that would be compliant with the installation requirements as expressed in FAA AC 25.856 2A, due to the lack of space.
   b) Burnthrough protection of the cabin floor would leave the decompression panels located on each side of the fuselage unprotected, as they cannot be blocked by any insulation panels. The total area of discontinuities above the RCT in terms of burnthrough protection would be around 10 %.
   c) Due to the Fire, Explosion and Smoke Risk Assessment (FESRA) conclusions around the RCT, a certain level of ventilation must always be ensured, and any attempt to install burnthrough-compliant material would jeopardize this ventilation.

2) The integration of a fuselage integral fuel tank located behind the wheel bay, under the passenger cabin, brings additional risks (explosion, penetration by fire, vapor migration, etc) if it is exposed to an external fire. While the other risks are addressed separately, this Special Condition intend to address the risk of penetration by fire only.

   Even though paragraph 25.856(b) focuses on the insulation material, the intent of the rule is to provide enough time for the occupants to evacuate the aircraft in case of an external pool fire. An integral fuselage fuel tank exposed to an external fire, if not adequately protected, may not provide enough time for the passengers to safely evacuate the aircraft.

   From a fuel tank fire protection perspective, aluminium alloys are indeed recognised to have fire resistant properties, when of a thickness that is appropriate to the function to be performed. This minimum thickness is, unfortunately, not specified. Moreover, from a fuselage burnthrough point of view, it is also acknowledged that an aluminium skin provides very limited protection, hence the fire protection function is mainly provided by the insulation material.

Considering all the above, the following Special Condition is determined:

SPECIAL CONDITION

In order to protect the cabin occupants from an external pool fire, the lower half of the fuselage, in the longitudinal location of the rear centre tank, shall be resistant to fire penetration.

SPECIAL CONDITION	D-33: Cabin Attendant Seat (CAS) on movable part
APPLICABILITY:	Post TC: A319/A320/A321 All models
REQUIREMENTS:	JAR 25.561, 25.783(j) at Change 11 CS 25.562, 25.1301, 25.1309 at Amendment 15
ADVISORY MATERIAL:	FAA AC25-17A

Identification of Issue

On the Single Aisle fleet, Airbus intends to install a Cabin Attendant Seat (CAS) that can be occupied during all phases of flight, including taxi take-off and landing, on the hinged door of a lavatory. Two traditional methods exist to install CAS in an aircraft layout, they are either mounted to the aircraft floor structure or to monument walls (e.g. lavatories, partitions), that means to non-moveable structural elements fixed to the aircraft structure. With the CAS mounted to the moveable door blade of the lavatory module, there is an unusual design feature that has to ensure normal operation of the lavatory module as well as safe operation of the CAS when it is occupied by a crewmember. The proposed design is also introducing a frequent use of the door and the locking mechanism that will ensure compliance with the emergency landing dynamic conditions and the associated loads. Therefore, the mechanism should be designed to cover adequately the frequent use. In addition, the applicant should introduce the appropriate maintenance procedure and schedule. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for such design. Special conditions are required for the certification of a CAS mounted to a hinged, moveable lavatory door, to supplement the JAR 25 requirements at Change 11 and the CS 25 requirements at Amendment

Special Condition

Cabin attendant seat mounted on a movable part of an interior monument

1. The proposed installation of a cabin crew seat that can be occupied during all phases of flight on a movable part of an interior monument (e.g. a hinged door) must be capable to carry flight, ground, pressurization (decompression) and emergency landing condition loads in accordance with JAR/CS1 25.301, 25.365, 25.561, 25.562, including the special factors of CS 25.619 (e.g. fitting factors). As part of these applicable load conditions, the seat attachment to the movable part, the movable part and its attachments to the interior monument, must be capable of carrying the emergency landing condition loads in accordance with JAR/CS 25.561 and JAR/CS 25.562 as these parts are considered to be components of the seat system.

2. The design must ensure that the seat can only be used if the movable part of a cabin interior monument is securely locked in the closed position. If the cabin crew must ensure the closing of the movable part of a cabin interior monument before using the seat, this must become part of the Cabin Crew Training programme. Additional instruction placards may be used to support the cabin crew in the use of the seat. The monument design must ensure that the crew seat can only be used with all necessary locks engaged to carry the emergency landing loads as well as flight and ground loads. When applying these loads, the effect of deformation of the cabin interior monument as

well as the movable part to which the seat is attached to, needs to be considered, to prevent any unlocking.

3. In case the movable part of an interior monument is a lavatory door, a) the applicant should investigate and address the additional risk of cabin crew seat not being available during flight when needed in case the seat cannot be used when the lavatory is occupied, and b) the applicant should investigate and address the additional risk of a passenger being trapped inside the lavatory in accordance with JAR/CS 25.783(j)2 .

4. Potential deterioration of moving parts due to wear and tear (JAR/CS 25.561 (c) (2)) needs to be addressed accordingly. Therefore, in addition to the application of the 1.33 wear and tear factor the mechanism should be cycle tested according to the use case of the movable part of the interior monument. In addition, appropriate Instructions for Continued Airworthiness shall be defined.

SPECIAL CONDITION	D-35: Airbelt without HIC requirement
APPLICABILITY:	A318/A319/A320/A321 All models
REQUIREMENTS:	CS 25.785(b), CS25.1301(a)
ADVISORY MATERIAL:	-

Identification of Issue

To show compliance with CS 25.562 (c) (5) at Amendment 15, or at previous CS-25 Amendments, Airbus has used inflatable restraint systems on certain seat part numbers. An inflatable restraint system works similarly to an automotive airbag (supplemental restraint system), except that the airbag is integrated within the lap belt of the restraint system and inflates away from the seated occupant. The inflatable lap belt is designed to limit occupant forward excursion if an accident occurs. This will reduce the potential for head injury, thereby reducing the Head Injury Criterion (HIC) measurement required by CS 25.562(c)(5). While airbags are now standard in the automotive industry, the use of an inflatable lap belts on passenger seats of large transport aeroplane is a design feature that is not specifically addressed in CS-25. Therefore, special conditions and related interpretative material have been issued to ensure that the installation of such systems provides an adequate level of safety to the occupant of large aeroplanes. The EASA certification basis of the Airbus Single Aisle family doesn't include 25.562(c)(5) and in case of the installation of seats equipped with inflatable lap belts, adequate criteria addressing all the safety issues associated with this equipment need to be defined.

Special Condition: Installation of inflatable restraint systems

1) Reserved

2) Reserved

3) Reserved

4) Reserved

5) Occupants adopting the brace position There is no requirement for protection to be assessed or measured for seat occupants in any other position or configuration than seated alone upright, as specified in FAA AC 25.562-1B. However, it must be shown that the inflatable lap belt does not, in itself, form a hazard to any occupant in a brace position or a person in between the brace position and upright position during deployment.

6) It must be shown that the gas generator does not release hazardous quantities of gas or particulate matter into the cabin.

7) It must be ensured by design that the inflatable lap belt cannot be used in the incorrect orientation (twisted) such that improper deployment would result.

8) The probability of inadvertent deployment must be shown to be acceptably low. The seated occupant must not be seriously injured as a result of the inflatable label

deployment, including when loosely attached. Inadvertent deployment must not cause a hazard to the aircraft or cause injury to anyone who may be positioned close to the inflatable lap belt (e.g. seated in an adjacent seat or standing adjacent to the seat). Cases where the inadvertently deploying inflatable lap belt is buckled or unbuckled around a seated occupant and where it is buckled or unbuckled in an empty seat must be considered.

9) It must be demonstrated that the inflatable restraint belt when deployed does not impair access to the seatbelt or harness release means, and does not hinder evacuation, including consideration of adjacent seat places and the aisle.

10) There must be a means for a crewmember to verify the integrity of the inflatable lap belt activation system prior to each flight, or the integrity of the inflatable lap belt activation system must be demonstrated to reliably operate between inspection intervals.

11) It must be shown that the inflatable lap belt is not susceptible to inadvertent deployment because of wear and tear, or inertial loads resulting from in-flight or ground manoeuvres likely to be experienced in service.

12) The equipment must meet the requirements of CS 25.1316 with associated guidance material. Electrostatic discharge must also be considered.

13) The equipment must meet the requirements for HIRF with an additional minimum RF test as per the applicable category of RTCA DO-160 Section 20.

14) The inflatable lap belt mechanisms and controls must be protected from external contamination associated with that which could occur on or around passenger seating.

15) The inflatable lap belt installation must be protected from the effects of fire such that no hazard to occupants will result.

16) Reserved.

17) Reserved.

18) It is accepted that a material suitable for the inflatable bag that will meet the normally accepted flammability standard for a textile, i.e. the 12 second vertical test of CS-25 Appendix F, Part 1, Paragraph (b)(4), is not currently available. In recognition of the overall safety benefit of inflatable lap belts, and in lieu of this standard, it is acceptable for the material of inflatable bag to have an average burn rate of no greater than 2.5 inches/minute when tested using the horizontal flammability test of CS-25 Appendix F, part I, paragraph (b)(5).

ELECT TO COMPLY	**D-GEN-AIRBUS-01: Halon free hand-held fire extinguisher (HAFEX)**
APPLICABILITY:	Post TC: AIRBUS A300/A310/A318/A319/A320/A321/A330/A340/A380 All models
REQUIREMENTS:	CS 25.851(a) and (c) amdt. 17
ADVISORY MATERIAL:	AMC 25.851 (a)(2) and (c)(3) amdt. 17

IDENTIFICATION OF ISSUE

Airbus intends to install Halon free hand-held fire extinguishers on all programs to meet customer requests and to comply with the ICAO annex 6 forward fit dates.

Airbus elects to comply with CS 25.851 (a) at amdt. 17 for the equipment installation and qualification of the Halon Alternative Fire Extinguisher (HAFEX).

The previous CS 25 amendments ask to install Halon hand-held fire extinguisher.

ELECT TO COMPLY

Airbus elects to comply with CS 25.851 (a) and (c) at amdt. 17

SPECIAL CONDITION	**D-0306-000: Application of heat release and smoke density requirements to seat materials**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.853(a-1) at Change 13; JAR 25.853(c) at Change 14; CS 25 25.853(d); Appendix F Part IV and V
ADVISORY MATERIAL:	AMC 25.853

1. Except as provided in paragraph 3 of these special conditions, compliance with CS25, Appendix F, parts IV and V, heat release and smoke emission, is required for seats that incorporate non- traditional, large, non-metallic panels that may either be a single component or multiple components in a concentrated area in their design.

2. The applicant may designate up to and including 0.139 m² (1.5 square feet) of non-traditional, non-metallic panel material per seat place that does not have to comply with special condition Number 1, above. A triple seat assembly may have a total of 0.418 m² (4.5 square feet) excluded on any portion of the assembly (e.g., outboard seat place 0.093 m² (1 square foot), middle 0.093 m² (1 square foot), and inboard 0.231 m² (2.5 square feet)).

3. Seats do not have to meet the test requirements of CS25, Appendix F, parts IV and V, when installed in compartments that are not otherwise required to meet these requirements. Examples include:

   a. Airplanes with passenger capacities of 19 or less and

   b. Airplanes exempted from smoke and heat release requirements.

4. Only airplanes associated with new seat certification programs applied for after the effective date of these special conditions will be affected by the requirements in these special conditions. This Special Condition is not applicable to:

   a. the existing airplane fleet and follow-on deliveries of airplanes with previously certified interiors

   b. For minor layout changes and major layout changes of already certified versions that:
      - does not affect seat design;
      - does not introduce changes to seat design that affect panels that could be defined as "non- traditional, large, non-metallic panels".

SPECIAL CONDITION	D-0322-001: Installation of suite type seating
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.785 (h)(2), JAR 25.813 (e)
ADVISORY MATERIAL:	FAA AC 25-17

BACKGROUND

The design of the of "Mini suites" usually incorporates "doors/ partitions" to provide privacy for the occupants.

This can potentially constitute an obstacle for the occupant to evacuate, and impede the vision of certain areas of the cabin by a cabin attendant:

JAR 25.813(e) requires that "No door may be installed in any partition between passengers compartment".

25.785(h)(2) requires that "each seat located in the passenger compartment and designated for the use during takeoff and landing by a cabin crewmember required by the operating rules must be: to the extent possible, without compromising proximity to a required floor level emergency exit, located to provide a direct view of the cabin area for which the cabin crewmember is responsible"

The installation of mini-suites may be in deviation to the 2 above requirements. The CRI D-0322-001 provides the additional conditions that must be considered to ensure a level of safety equivalent to the "standard" seat installations.

1. Only single occupancy of the Mini-suite is allowed during taxi, take-off and landing.
2. The mini-suite entrance must only provide access to the specific mini-suite.
3. Mini-suites must not provide the required egress path for any passenger other than for its single occupant.
4. Installation of the mini-suites must not introduce any additional obstructions or diversions to evacuating passengers, even from other parts of the cabin.
5. The design of the doors and surrounding "furniture" above the cabin floor in the aisle must be such that each passenger's actions and demeanour can be readily observed by cabin crew members with stature as low as the 5th percentile female.
6. The mini-suite door(s) must be open during taxi, take-off and landing.
7. A hold open retention mechanism for mini-suite doors must be provided and must hold the doors open under CS 25.561(b) emergency landing conditions.
8. There must be a secondary, backup hold open retention mechanism for the mini-suite doors that can be used to "lock" the doors in the open position if there is an electrical or

mechanical failure of the primary retention mechanism. The secondary retention mechanism must hold the doors open under CS 25.561(b) emergency landing conditions.

9. There must be a means to readily check that all mini-suite doors are fully open and in the latched condition.

10. There must be means to prevent the seated mini-suite occupant from operating the doors and thus ensure that the doors remain open during the TTOL phases of the flight.

11. Appropriate placards, or other equivalent means, must be provided to ensure the mini-suite occupants know that the doors must be in the open position for taxi, take-off and landing.

12. Operating instruction materials necessary to provide adequate compliance with SC 5, 9 and 10, considering also the number of individual mini-suites, shall be discussed and agreed with EASA and shall be provided to the operator for incorporation into their cabin crew training programs and associated operational manuals. This may affect the minimum acceptable number of cabin crew required to operate the aeroplane.

13. In the TTOL configuration, the mini-suite must provide an unobstructed access to the main aisle having a width of at least 30 cm (12 inches) at a height lower than 64 cm (25 inches) from the floor, and of at least 38 cm (15 inches) at a height of 64 cm (25 inches) and more from the floor. A narrower width not less than 23 cm (9 inches) at a height below 64 cm (25 inches) from the floor may be approved when substantiated by tests found necessary by the Agency.

14. In addition, the mini-suite must have an Emergency Passage Feature (EPF) to allow for evacuation of the mini-suite occupant in the event a door closes and becomes jammed during an emergency landing. The EPF must provide a free aperture for passage into the aisle consistent with SC 13 or meeting the requirements of CS 25.807 applicable to a Type IV size emergency exit.
If the EPF consists of frangible and/or removable elements they must be easily broken/removed by the occupant of the mini-suite when a door becomes jammed.
If an EPF consists of dual independent sliding doors opening in opposite directions, the remaining unobstructed access width with one door in the fully closed position must be consistent with SC 13 or meet the requirements of CS 25.807 applicable to a Type IV size emergency exit.
The occupant of the mini-suite must be made aware of the EPF and its way of operation.
In no case shall the occupant using the EPF have to rely on another occupant to assist in passage.

15. The height of the mini suite walls and doors must be such that a 95th percentile male can fit between them and the aeroplane interior furnishing.

16. No mechanism to latch the door(s) in the closed position shall be provided.

17. The mini-suite door(s) must be openable from the inside or outside with 25 pounds force or less regardless of power failure conditions.

18. If the mini-suite doors are electrically powered, in the event of loss of power to the mini-suite with the door(s) open, the door(s) must remain latched in the open position.

19. The mini-suites installation must not encroach into any required main aisle, or passage ways.

20. No mini-suite door may impede main aisle egress path in the open, closed or translating position.

21. The mini-suite doors must remain easily openable, even with a crowded aisle.

22. The seat of the Cabin Crew responsible for a suite area must be located to provide a direct view of the egress path from each mini-suite and of each main aisle adjacent to the minisuites.

EQUIVALENT SAFETY FINDING	D-0329-001: Forward facing seats with more than 18° to aircraft centreline
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.785(c)
ADVISORY MATERIAL:	---

For the installation of seats making an angle of 29° with the aircraft longitudinal axis, dynamic developmental tests have shown that for this installation the test dummy upper torso behaves like in a forward facing impact. This is supported by the design of the seat surroundings, which allows a free forward alignment of the test dummy upper torso during the impact.

As for typical forward facing seating there is no obstruction on the seat occupied or surroundings that neither creates a risk to the occupant nor imposes to the upper dummy body any severe side twisting effect during the impact.

Only the shape of the monument or seat in front rather than the seat angle itself may generate a certain dummy side movement and/or twisting. This is comparable to observation made on forward facing seat arrangements, where the shape of the seat or monument in front of the seat introduces body twisting effects.

The development tests show that the seat design allows the ATD upper torso to align with the deceleration vector, thus it can be concluded that the application of energy absorbing rests for arms, shoulders, head and spine as per CS25.785(c) is not required.

Therefore, Airbus consider that based on the development test conclusions and a qualitative assessment of the videos, an equivalent level of safety of occupant protection to the part of JAR 25.785(d) requiring an "Energy absorbing rest for the upper body parts or a shoulder harness", can be demonstrated by applying the test conditions of 25.562(b).

The design of the seat and the surrounding items must carefully chosen to maximise the ability of the occupant to align with the deceleration vector during the impact.

The installation of an airbag-belt system may be required if the occupant does not realign as much as expected (considering an acceptable forward facing seat under the provisions of JAR 25.785(d)) or if testing shows that the airbag (that is part of the seat design) plays a significant role in maintaining acceptable protection.

Defined ATD internal force and moment measurements, in addition to those required by JAR 25.562 (c), are necessary for comparative purposes. These can be taken during dynamic testing and compared with values from tests of a seat installed at less than 18 degrees to the aircraft centreline. It should be noted that this approach cannot at present involve consideration of absolute values as research data do not exist to back this up. Rather, this will involve a check that the values observed are of comparable magnitude and range and will provide confidence that the mitigating factors are achieving the desired outcome.

The CRI is expanded to all Single Aisle models, when seats are installed with an angle between 18° and 29° to the aircraft centreline provided the following conditions are observed:

1. To consider the specificities of the certification basis of the Single Aisle family: depending on the aircraft model, seats must comply with:
    a) the emergency landing conditions of JAR25.561 or
    b) the emergency landing dynamic conditions of JAR 25.562, except (c)(5)(6), or
    c) the full emergency landing dynamic conditions of JAR 25.562 if CRI E-31 is applied (optional).

2. Due to the fact that research data do not exist to back up "internal force and moment values ",in any landing conditions occupant injury protection must be similar to a forward facing seat installation; therefore the seat and the surrounding furniture must be deeply investigated. e.g. the armrests which could be within the occupant trajectory must be fully stored for Taxi Take off & Landing and must remain stored during the impact. No interaction is allowed between forward armrest and seated occupant. The video analysis recorded during dynamic testing is an acceptable means to ensure the required level of safety under emergency dynamic landing conditions.

3. The free alignment of the occupants to the resulting deceleration vector must always be provided under any landing condition.
    a) Considering emergency landing conditions only, same level of safety is expected if there is no seat or surrounding structure blocking the free alignment of the occupants.

    b) The three standard cameras of the dynamic seat testing (respectively installed on the left, right and top of the test rig), are recording the ATD motion throughout the entire partial/dynamic event.

4. The recorded videos are a means for the visual verification for free alignment under emergency partial/dynamic landing conditions. In addition the head injury criterion must be below HIC1000 for emergency dynamic landing conditions.

5. The installation of an airbag-belt system may be required if the occupant does not realign as much as expected (considering an acceptable forward facing seat under the provisions of JAR 25.785(d)) or if testing shows that the airbag (that is part of the seat design) plays a significant role in maintaining acceptable protection.

6. For aircraft where compliance with the emergency landing conditions for seat JAR 25.562 is not required, the head strike radius of 35 inch measured from the seat reference point to interior installations as defined in AC 25-785-1B must be defined from the SRP at the centreline between the lap-belt attachment point of that seat parallel to the centreline of the aircraft. The head strike radius must be unobstructed for the width of the seat provided down to the height of the seat cushion.

7. The installation of oblique seats is restricted to areas excluding access to Type III emergency exits. If oblique seat form the boundary in front of a Type III access the access path shall be 20 inches wide.

8. If an airbag system is required, either belt mounted or wall mounted, to meet the criteria of JAR 25.562(c)(5) HIC 1000 the conditions defined in CRI E-31 must be complied with.

SPECIAL CONDITION	**D-0332-001: Towbarless Towing**
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	JAR 25X745(d), JAR 25.1309, JAR 25.1322
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus Single Aisle aeroplanes are today operated with "towbarless" towing vehicles. This CRI is raised to record the activities performed by Airbus for this type of operation and to confirm that those comply with the current requirements from EASA.

JAR 25X745(d) states that *"the design of the attachment for towing the aeroplane on the ground must be such as to preclude damage to the steering system".* This requirement originated at a time when the ground handling arrangements for aeroplanes typically included a towing attachment on the nose landing gear assembly, and was drafted in a form which took account of the towing methods in use at that time. The intent of this requirement was to ensure that aeroplanes are designed such that any means to be used for ground manoeuvring of the aeroplane with the knowledge and/or approval of the constructor should not have the capability to cause damage to the steering system.

The design of the nose landing gear incorporates means to preclude damage to the steering system in the event that loads induced in the steering system by conventional towbar towing activities approach the capability of the design to withstand the loads. Airbus SA aeroplanes are today operated with other methods of towing the aeroplane, typically referred to as "Towbarless Towing", which utilize means which do not connect to the aeroplane nose landing gear via the protection device installed to ensure compliance with the Requirement.
Consequently, as "towbarless" towing devices are known to be used for ground manoeuvring of the aeroplane, some means must be provided within the design of the aeroplane that will give, at the very least, an equivalent level of protection to the steering system as that which is available from the more conventional towbar towing arrangements.
If, due to specific nose landing gear constraints, such means cannot be defined, or are considered not to be practicable, the constructor may define such alternative means in order to provide the flight crew with an unmistakable warning, prior to the start of taxiing, if damage to the steering system may have occurred during ground manoeuvring activities. Such means may be considered as providing equivalent safety to devices which preclude damage to the steering system.

JAR 25 does not contain adequate safety standard for such operations. In accordance with Part 21A.16B(a)(1), the EASA team considers that a special condition is needed to address towbarless towing operations.

SPECIAL CONDITION

Replace the entire text of the current paragraph JAR 25X745(d) with the following:

CS 25.745 Nose-wheel steering

(d) The nose-wheel steering system, towing attachment(s), and associated elements must be designed or protected by appropriate means such that during ground manoeuvring operations effected by means independent of the aeroplane:

(1) Damage affecting the safe operation of the nose-wheel steering system is precluded, or

(2) A flight crew alert is provided, before the start of taxiing, if damage may have occurred (see JAR 25.1322).

SPECIAL CONDITION	E-01: Resistance to fire terminology
APPLICABILITY:	A321, A319
REQUIREMENTS:	JAR 1, 25.853, 25.863, 25.867
ADVISORY MATERIAL:	ACJ 25.1181

1) Amend JAR 25.853 (d) to read:

(d) Each disposal receptacle for towels, paper or waste must be fully enclosed and constructed of materials adequate in resistance to fire such that any fire likely to occur in it under normal use will be contained. The ability of the disposal receptacle to contain those fires under all probable conditions of wear, misalignment, and ventilation expected in service must be demonstrated by test. A placard containing the legible words: "No Cigarette Disposal" must be located on or near each disposal receptacle door.

2) Amend JAR 25.863(b)(4) to read:

(4) Means available for controlling or extinguishing a fire, such as stopping flow of fluids, shutting down equipment, fire containment or use of extinguishing agents.

3) Amend JAR 25.867(a) to read:

(3) Surfaces to the rear of the nacelles, within one nacelle diameter of the nacelle centreline, must be constructed of materials at least equivalent in resistance to fire as aluminium alloy in dimensions appropriate for the purpose for which they are used.

SPECIAL CONDITION	**E-10: High altitude airport operations (up to 14,100 ft)**
APPLICABILITY:	A319 / A320 / A321
REQUIREMENTS:	JAR 25.841(a), (b)(6), JAR 25.1447(c)(1) at Change 11
ADVISORY MATERIAL:	N/A

Landing and take-off modes.

1- The normal or high altitude modes for take-off and landing must be clearly indicated to the flight crew.

Pressurisation system.

2- In high altitude mode and for operation over 25,000 feet, the excessive warning altitude setting must be such that corrective actions can be taken in time to ensure that cabin pressure altitude cannot exceed 15,000 feet "in the event of any reasonably probable failure" of the pressurisation system.

3- Under all other conditions, § 25.841(a) & (b)(6) requirements apply. The pressurisation system must perform identically to that found on the standard airplane. In particular, the flight crew retains the capability to control the pressurisation system manually in the event of a system failure.

Oxygen system.

4- In high altitude mode, in lieu of compliance with § 25.1447(c)(1) and considering the ACJ 25.1447(c)(1), passengers dispensing units must be automatically presented before the cabin pressure altitude exceeds 16,000 feet. At any time, the flight crew must retain the capability of deploying the masks, using the manual control in the cockpit.

5- Under all other conditions, the passenger oxygen system must perform identically to that found on the standard airplane. § 25.1447(c)(1) applies.

Procedures.

6- Appropriate procedures must be introduced in the Airplane Flight Manual.

7- The applicant must assess the consequences for the aeroplane and its occupants of the flight crew not applying the correct procedures (i.e. landing at high altitude airport in normal mode or at a normal altitude airport in high altitude modes).

8- Procedures must be such that the high altitude mode is set for the shortest time possible in order to have a minimum change in protections. Except when the aeroplane is landing at, or departing from, a high altitude airport, the cabin follows the normal profile.

EQUIVALENT SAFETY FINDING	**E-12: Reinforced security cockpit door**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.305(b), 307(a), 365, 771, 772, 789(a) 809, 831, 853(a), 1301, 1309 at change 11, JAR 21.21(c)
ADVISORY MATERIAL:	N/A

The new cockpit door design shall meet all existing applicable JAR 25 requirements, including, but not limited to: JAR 25.305(b), 307(a), 365, 771, 772, 789(a), 809, 831, 853(a), 1301, 1309.

The use of electrical latches released by a pressure sensor signal to meet rapid decompression requirements is an unusual design feature, and particular attention should be paid to ensure that compliance to JAR 25.365 is not compromised by this new design feature.

Failure of a decompression mechanism to function when needed could result in a catastrophic failure. Therefore, and in accordance with 25.1309, a quantitative system safety assessment should be produced to justify the system architecture, and to show that its reliability and failure mode effects and probabilities are acceptable.

The JAA team will check the compliance of the proposed design against the following requirements introduced by FAR 25 amendment 106:

Section 25.772 is amended by revising the introductory language and paragraph (a) and by adding a new paragraph (c) to read as follows:

Sec. 25.772 Pilot compartment doors.

For an airplane that has a lockable door installed between the pilot compartment and the passenger compartment:
(a) For airplanes with a maximum passenger seating configuration of more than 20 seats, the emergency exit configuration must be designed so that neither crewmembers nor passengers require use of the flightdeck door in order to reach the emergency exits provided for them; and
* * * * *
(c) There must be an emergency means to enable a flight attendant to enter the pilot compartment in the event that the flightcrew becomes incapacitated.

3. Part 25 is amended by adding a new Sec. 25.795 to read as follows:

Sec. 25.795 Security considerations.

(a) Protection of flightdeck. If a flightdeck door is required by operating rules, the door installation must be designed to:

(1) Resist forcible intrusion by unauthorized persons and be capable of withstanding impacts of 300 Joules (221.3 foot-pounds) at the critical locations on the door, as well as a 250 pound (1113 Newtons) constant tensile load on the knob or handle, and

(2) Resist penetration by small arms fire and fragmentation devices to a level equivalent to level IIIa of the National Institute of Justice Standard (NIJ) 0101.04.

(b) [Reserved]

Revised 25.772 and new 25.795 are acceptable to the JAA as an equivalent safety finding to existing JAR 25.772 paragraph, in accordance with JAR 21.21(c)(2).

FAA AC 25.795-1 (Flight deck intrusion resistance) and AC 25.795-2 (flight deck penetration resistance) provide acceptable means for demonstrating compliance to 25.795. Any deviation to the test set-up proposed by the AC should be identified in the relevant test plans, which will be submitted to the JAA team for review.

In addition, the FAA memorandum published on November 6, 2001 and revised on March 22, 2002, on « certification of strengthened flight deck doors on transport category airplanes » provides additional useful guidance for showing compliance to 25.795 and other applicable JAR 25 paragraphs.

In order to show that the modified cockpit door can fulfil its intended function in normal and emergency (failure case and hijacking situation) conditions, the applicant should present to the JAA certification team the foreseen minimum sequence of events from which operational procedures associated to this new door design can be developed.

Foreseen MMEL relief cases should be presented to the JAA certification team. The JAA requires that the level of safety intended by basic airworthiness requirements related to rapid decompression and emergency evacuation be maintained under MMEL conditions. In the event of a system failure that would result in a door unlocking, the door should maintain at least the ability to be closed in flight. The applicant should propose operational and or design measures to reduce exposure to the risk of an unauthorized cockpit intrusion in such a case.

SPECIAL CONDITION	E-13: Installation of Inflatable Restraints
APPLICABILITY:	Post-TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.785(c)(e)
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus installed, as an optional, inflatable lap belts on passenger seats on A318, A319, A320 and A321 airplanes as an additional means to reduce the potential for head injury in the event of an accident. The configurations are in compliance with JAR 25.785(c)(e) and this modification is requested as an alternative customer option. Inflatable lap belts are considered a novel and unusual design feature on passenger seats and therefore, in addition to the requirements of JAR 25, a special condition and guidance material is needed to address requirements particularly applicable to installation of those systems in an airplane.

The inflatable lap belt works similarly to an automotive airbag (supplemental restraint system), except that the airbag is integrated with the lap belt of the restraint system. For installation of inflatable lap belts on A318, A319, A320 and A321 a/c adequate criteria to address the specific issues raised concerning seats with inflatable lap belts are laid down in CRI E-13 and Special Condition E-13.

SPECIAL CONDITION

1) Test criteria

It is acceptable for the compliance to JAR 25.785(c)(e) that the inflatable lap belt does or does not deploy since it is required by the A318, A319, A320, A321 TC basis to have either:

• a free head strike radius of 35 inches between the seat reference point (SRP) and any fixed installation higher than 18 inches from cabin floor;

• or to have for row to row seat installations a flush surface of the seatback with round edges and no protruding installations.

Any other installation would have to be adequately padded and delethalised (ref. FAA AC 25-17).

However, to assess the proper function and integrity of a seat including the inflatable lap belt system, a single seat row test as per Airbus specification no. 2520 M1F 0005 00 has to be performed.

2) Intermediate Pulse Shape

The existing ideal triangular maximum severity pulse is defined in FAA AC 25.562.1. The JAA considers that for the evaluation and testing of less severe pulses, a similar triangular pulse should be used with acceleration, rise time, and velocity change scaled accordingly.

3) Protection during Secondary Impacts

The JAA acknowledges that the inflatable lap belt will not provide protection during secondary impacts after actuation. However, evidence must be provided that the post-deployment features of the installation shall not result in an unacceptable injury hazard. This must include consideration of the deflation characteristics in addition to physical effects. As a minimum, a qualitative assessment shall be provided.

Furthermore, the case where a small impact is followed by a large impact must be addressed. In such a case if the minimum deceleration severity at which the airbag is set to deploy is unnecessarily low, the bag's protection may be lost by the time the second larger impact occurs. It must be substantiated that the trigger point for airbag deployment has been chosen to maximise the probability of the protection being available when needed.

4) Protection of Occupants other than 50th Percentile

The existing policy is to consider other percentile occupants on a judgmental basis only i.e. not using direct testing of inquiry criteria but evidence from head paths etc. to determine likely areas of impact.

The same philosophy may be used for inflatable lap belts in that test results for other size occupants need not be submitted. However, sufficient evidence must be provided that other size occupants are protected.

A range of stature from a two year old child to a ninety-five percentile male must be considered. In addition the following situations must be taken into account:

The seat occupant is holding an infant, including the case where a supplemental loop infant restraint is used

The seat occupant is a child in a child restraint device.

The seat occupant is a pregnant woman.

5) Occupants Adopting the Brace Position

There is no requirement for protection to be assessed or measured for set occupants in any other position or configuration than seated alone upright as specified in FAA AC 25.562-1A (dated 19 January 1996). However, it must be shown that the inflatable lap belt does not, in itself, form a hazard to any occupant in a brace position during deployment.

6) It must be shown that the gas generator does not release hazardous quantities of gas or particulate matter into the cabin.

7) It must be ensured by design that the inflatable lap belt cannot be used in the incorrect orientation (twisted) such that improper deployment would result.

8) The probability of inadvertent deployment must be shown to be acceptably low. The seated occupant must not be seriously injured as a result of the inflatable lap belt deployment, including when loosely attached.

Inadvertent deployment must not cause a hazard to the aircraft or cause injury to anyone who may be positioned close to the inflatable lap belt (e.g. seated in an adjacent seat or standing adjacent to the seat). Cases where the inadvertently deploying inflatable lap belt is buckled or unbuckled around a seated occupant and where it is buckled or unbuckled in an empty seat must be considered.

9) It must be demonstrated that the inflatable lap belt when deployed does not impair access to the buckle, and does not hinder evacuation, including consideration of adjacent seat places and the aisle.

10) There must be a means for a crewmember to verify the integrity of the inflatable lap belt activation system prior to each flight, or the integrity of the inflatable lap belt activation system must be demonstrated to reliably operate between inspection intervals.

11) It must be shown that the inflatable lap belt is not susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground manoeuvres likely to be experienced in service.

12) The equipment must meet the requirements for indirect effects of lightning.

Electrostatic discharge must also be considered.

13) The equipment must meet the requirements for HIRF with an additional minimum RF test for the threat from passenger electronic devices of 15 Watts radiated power.

14) The inflatable lap belt mechanisms and controls must be protected from external contamination associated with that which could occur on or around passenger seating.

15) The inflatable lap belt installation must be protected from the effects of fire such that no hazard to occupants will result.

16) The inflatable lap belt must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly or adjacent seats considering that unoccupied seats may have active inflatable lap belts, which may be buckled or unbuckled.

17) Each inflatable lap belt must function properly following any separation in the fuselage.

EQUIVALENT SAFETY FINDING	E-14: Photo-luminescent EXIT sign for Movable Class Divider
APPLICABILITY:	A318 / A319 / A320 / A321 all models
REQUIREMENTS:	JAR 25.812(b)(1)(ii)
ADVISORY MATERIAL:	-

BACKGROUND

Movable Class Dividers (MCD) are optionally installed in the cabin of the A320 family. Their locations were restricted to the areas of the cabin where the MCD could not obscure the fore and aft vision of the electrical emergency exit locators required by JAR 25.811(d)(1): any passenger could recognize the location of each emergency exit from a distance equal to the width of the cabin, as required by JAR 25.811(b) and (d).

In order to have additional flexibility, the operators are willing to extend the range of the MCD locations to the areas which were until now prohibited. Therefore an indication exit sign on the centre beam of the MCD meeting the requirements of JAR 25.811(d)(3) is proposed to be installed.

The fore and aft vision to the electrical emergency exit locators by any passenger will then be given, as mandated by JAR 25.811(d)(1). This exit indication sign is required to meet the performance required by JAR 25.812(b)(1)(ii) and JAR 25.812(i).

The supplemental exit sign proposed by Airbus is a photo-luminescent sign. Available current technical solutions for such photo-luminescent signs deviate from JAR 25.812(b)(1)(ii) requiring a white background.

The supplemental photo-luminescent exit sign proposed by Airbus does not meet the 400 micro- lamberts initial requirements of JAR 25.812(b)(1)(ii) when tested according to the guidance of AC25.812-2.

EQUIVALENT SAFETY FINDING

Colour:

The exit sign background has a yellowish green colour, instead of white as required by JAR 25.812(b)(1)(ii). Nevertheless, the human eyes sensitivity is maximum with a yellowish green colour sign, in daylight conditions.

The yellowish green background of the sign is therefore not decreasing the legibility of the sign, in comparison to a sign having a white background.

Brightness :

1. The photo-luminescent exit sign proposed by Airbus has an initial brightness of 400 micro lamberts (1273mcd/m^2), after a charging time of 20 minutes at 500 lux. However, after the 8 or 16 hours discharging time of the 2 worst case test scenarios of AC 25.812-2 , the brightness of the emergency exit sign is below the mandated 400 micro lamberts (1273mcd/m^2).

* "initial brightness" is considered as the brightness of the sign measured 1 second after switching off all cabin lights.

2. The AC 25.812-2 provides guidance to evaluate photo-luminescent floor path marking systems, and does not specifically address isolated photo-luminescent exit signs. Nevertheless, the photo- luminescent exit sign mounted on the MCD has been evaluated according to the 2 worst case test scenarios of AC 25.812-2. The tests carried out have shown that the photo-luminescent emergency exit sign on the MCD is easily legible by any passenger and provides guidance to the emergency exit.

3. On Airbus A320 family aircraft the probability of the test scenarios according to AC 25.812-2 are extremely remote to in-service operations:

3.1. The first flight of the day occurs after a night with a dark cabin (window blinds closed) and a 30 minutes boarding time at 10% cabin illumination. The following criteria has to be kept in mind:

- The boarding is generally performed with a normal100% cabin illumination (700-800 lux).
- Even with a reduced cabin illumination (e.g. 500 lux) the signs would fully be charged within 20min.

3.2. The maximum overnight flight scenario occurs after 8 hours darkness.

- The maximum flight duration for a single aisle aircraft generally does not exceed 8 hours (exception is made for the aircraft equipped with additional center tanks). Most of the flights are shorter, and the cabin is very rarely in complete darkness

The exit sign is charged by means of the cabin illumination.

4. In emergency situation, the electrical emergency lighting system is powered "ON" and provides a level of illumination making anyhow the photo-luminescent exit sign easily legible.

5. The areas where the MCD obscures the electrical exit locator are very limited because it depends on the height and the position of the person moving about the aisle: So far the range where visibility to the electrical exit locator is partially or fully obscured for a person moving towards the next exit is limited. This range varies from 0,5% to 30% of the total cabin length and affects especially the 95 % male population for few MCD locations.

The 30% occurs for a 95% male positioned so far from the MCD, that this passenger will first identify the electrical emergency exit locator installed overhead the other emergency exit.

In any case, the passenger(s) affected will have the information of the next emergency exit through the photo-luminescent installed on the MCD and the flow of passengers will automatically guide them to the closest emergency exit.

Conclusion:

Even if the initial brightness as required per JAR 25.812 (b)(1)(ii) is not reached when using the test criteria out of AC25.812-2, the intent of the rule is fulfilled and that the proposed supplemental photo-luminescent exit sign provides an equivalent level of safety.

EQUIVALENT SAFETY FINDING	**E-16: Emergency Exit Markings Reflectance**
APPLICABILITY:	A318 / A319 / A320 / A321 all models
REQUIREMENTS:	JAR 25.811(f) Change 11
ADVISORY MATERIAL:	N/A

BACKGROUND

Each emergency exit that is required to be operable from the outside, and its means of opening, must be marked on the outside of the aeroplane. In addition, the following apply:

(1) The outside marking for each passenger emergency exit in the side of the fuselage must include a 2-inch coloured band outlining the exit.

(2) Each outside marking including the band, must have colour contrast to be readily distinguishable from the surrounding fuselage surface. The contrast must be such that if the reflectance of the darker colour is 15% or less, the reflectance of the lighter colour must be at least 45%.

'Reflectance' is the ratio of the luminous flux reflected by a body to the luminous flux it receives. When the reflectance of the darker colour is greater than 15%, at least a 30% difference between its reflectance and the reflectance of the lighter colour must be provided.

In some rare cases amongst the numerous associations of two contrasted colours, Airbus may face a non-compliance with the required reflectance value imposed by the above recalled JAR 25.811(f).

In the case of one particular operator, Airbus has identified this kind of deviation with the association of black and grey colour for the emergency exit door marking, affecting only the instructions specified to open the door, while the door surrounding does comply with the requirement, being painted in white colour.
Indeed, given that the black colour is at 0.5% (thus less than the 15% threshold condition which requires the 45% value for the contrasted colour) and that the grey colour at 38.2% only for the reflectance, the association of both these colours does not meet the §25.811(f) requirements. Nevertheless, the absolute value of the grey colour is not so far from the imposed 45%, keeping the intent and spirit of the requirement.

However, such colour association is only affecting the external marking of the doors, which is used to give guidance for their opening in case of emergency from outside. In the event of accident at dark night conditions, the first intent of the ground assistance would be to find the way to the doors, which is facilitated by the door surrounding band painted in white colour (whose reflectance is 88%) and therefore well contrasted with the grey background (difference of 49.8% well above the required 30%). Then, at a close distance of the door handle, the indication marking could be better readable, even with the black/grey contrast.

EQUIVALENT SAFETY FINDING

The design of the handle and its operation is simple and obvious. The movement required to open the door is indicated by an arrow dearly identifiable. The door surrounding band contrast is well above the requirement of 25.811(f). The reflectance of the grey colour is at 38.2% which is below the required value of 45% however, it is accepted that the outside marking has a colour contrast which is readily distinguishable from the surrounding fuselage surface.

EQUIVALENT SAFETY FINDING	**E-18: Improved flammability standards for thermal / acoustic insulation materials (flame propagation)**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.853(b) at change 11 & 13; JAR 25.853(a) at change 14; JAR 25.855(d) at change 14; FAR 25.856(a) at amendment 111
ADVISORY MATERIAL:	N/A

Thermal / acoustic insulation materials accepted as compliant with FAR 25.856(a) will provide a level of safety at least as high as that provided by those accepted as compliant with JAR 25.853(b) at change 11 & 13, JAR 25.853(a) at change 14, and JAR 25.855(d) at change 14.

Since A318/A319/A320/A321 airplanes do not have amendment 111 in their certification basis, compliance with JAR 25.853 and JAR 25.855 is still required. However, once compliance with FAR 25.856(a) has been shown, it is not necessary to test in accordance with JAR 25.853(b) at change 11 and 13, JAR 25.853(a) at change 14, and JAR 25.855(d) at change 14, and these requirements can be substantiated based on equivalent safety.

SPECIAL CONDITION	E-21: External probes - Qualification in Icing Conditions New UTAS Pitot Probes
APPLICABILITY:	Post TC: A318/A319/A320/A321
REQUIREMENTS:	CS 25.1309, CS 25.1323(h), CS 25.1323(i), CS 25.1325(b), CS 25.1419, CS 25.1529
ADVISORY MATERIAL:	ETSO C16a AMC 25.1323(h), AMC 25.1323(i), AMC 25.1325(b), AMC 25.1093(b)(1), AMC 25.1419

The purpose of this CRI is to define the requirements for qualification in icing conditions of new UTAS Pitot probes for the A320 aircraft family

Current level of requirements and recommendations

Icing conditions related contamination of Flight Instrument External Probes is currently regulated through requirement CS 25.1323(h) and CS 25.1323 (i) for airspeed indicating system and CS 25.1325(b) for static pressure system.

CS 25 Appendix C defines maximum icing conditions within stratiform (continuous) and cumuliform (intermittent) clouds upon which approval of airplane operations in icing conditions is based. Considering clouds containing only supercooled liquid droplet characteristics, Appendix C provides relationship between mean effective drop diameters, liquid water content and temperature, of the droplets as well as the definition of the icing cloud envelope in terms of horizontal and vertical extent, and altitude w.r.t. temperature.

This Appendix C has been in use since 1964 for selecting values of icing-related cloud variables for the design of in-flight ice protection systems for aircraft. However, glaciated conditions (icing conditions totally composed of ice crystals without supercooled liquid water) and mixed phase icing conditions (condition containing both supercooled liquid water and ice crystals) are not included in the current Appendix C of CS 25.

It should also be noted that compliance to the ETSO qualification standard for electrically heated Pitot and Pitot-static tubes (ETSO-C16a) and for stall warning instruments (ETSOC54) is not sufficient in itself in demonstrating compliance to the installation requirements of CS 25.1309(a), 25.1323, 25.1325, 25.1326 and 25.1419.
The ETSO C16a specifies freestream conditions and do not consider 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 being several times greater than the free-stream conditions.

In summary, CS 25 Appendix C conditions and ETSO C16a / ETSO C54 do not include mixed phase and ice crystal icing conditions and the operating rules do not prohibit operations in such environment.

In consideration of the above requirement limitations, EASA, through the use of the CS advisory materials, has extended the icing conditions of CS 25 Appendix C to include mixed phase and ice crystal conditions

Moreover, in order to provide further guidance in certification projects, EASA has regularly raised Interpretative Material Certification Review Items (CRI) on the subject of "Icing of Probes", which included consideration of rain, mixed phase and ice crystal conditions.

Finally, there are no specific icing regulations for angle of attack probes, or other angle of attack sensors. CS 25.1309 has been used to address icing of angle of attack probes under some conditions. Section 25.1309 requires that equipment perform its intended function under all foreseeable operating conditions. Thus, compliance with CS 25.1309 has been used to assess whether the angle of attack systems function properly in the icing conditions for which the aircraft is certificated. Those certifications only include the icing conditions in Appendix C.

Evidence of inadequate level of requirement

EASA has constantly and consistently updated the certification conditions related to icing conditions in order to take into account in-service feedback or updated knowledge from research activities. However, a significant number of in service events are still being reported in relation to Pitot probes operation in icing conditions. Even though most of the incident reports involved airspeed fluctuation while in severe atmospheric conditions, temporary loss of airspeed indications has also been experienced.

Analysis of the available atmospheric conditions at the time of the incidents showed icing conditions at an unusually high altitude and at a very low temperature. It is therefore likely that some of these incidents were due to the presence of ice crystals in the atmosphere. These conditions are outside the environment of CS 25 Appendix C and even outside the extended conditions specified by EASA in guidance material and CRIs . Pitot tubes are mounted such that they typically are high efficiency collectors of ice crystals. Encountering high concentrations of ice crystals can lead to the blockage of Pitot probes as the energy required to melt the ice crystals can exceed Appendix C icing conditions design requirements.

A number of events of malfunctioning and/or damage to temperature probes have also been reported and attributed to severe adverse environment encounters.

Even recent qualification done against higher standards, as defined by EASA CRI, covering a wider range of icing conditions (e.g. supercooled droplets and/or crystals) and heavy rain seem to be prone to malfunctioning after icing encounters at high altitude.

Regarding the ice crystal and mixed phase icing conditions, past updates of the CRI took into account the Aviation Rulemaking Advisory Committee's (ARAC) Ice Protection

Harmonization Working Group (IPHWG) recommendations as stated in a report titled "Tasks 5 & 6 Working Group Report," dated October 2006. However, available information from in-service experience show that events may occur at higher altitude and lower temperature than those specified in the IPHWG report or the existing EASA AMC to CS 25.1419.
The ARAC joint Engine and Power Plant Installation Harmonization Working Groups, hereafter referred to as EHWG, also drafted proposed rules addressing FAA 14 CFR Part 25 aircraft turbofan engine installation icing and propeller requirements and Part 33 turbofan engine icing requirements. Included in the EHWG draft rules is a proposed Appendix D to FAA 14 CFR Part 33 defining high ice water content environments in mixed phase and glaciated conditions. The proposed Appendix D to 14 CFR Part 33 has been developed using the history of engine ice

crystal in-service events, theoretical models of the atmosphere and atmospheric flight test results (McNaughton FTs). It is intended to be a more representative characterisation of the icing conditions that lead to engine events and, based on the recent evidence, appear to cause Pitot probe icing issues

All available data pertaining to the actual environmental conditions and installation effects, as well as the data gathered during recent research activities, shall be taken into consideration for the qualification of new Flight Instrument External Probes including, but not necessarily limited to Pitot and Pitot-static probes, alpha vanes, side slip vanes and temperature probes, in order to achieve 25.1309(a)(1) compliance. This position is supported by the actual in service experience.

The Agency understands that there is a need for more extensive and accurate meteorological data to characterize these environments, however it is considered that the proposed Appendix P of the CS 25 as published in the NPA 2011-03 is the most appropriate and accurate information available for the time being

For all applications (new TC, CPR, STC, post-TC) received after 31-01-2010, the Agency policy is to consider high altitude extreme atmospheric conditions in the certification basis. Accordingly, the intent of this Special Condition is to introduce revised environmental conditions for the pitot qualification, taking into account:

- heavy rain conditions ,
- severe icing environment (CS-25 Appendix C super cooled liquid water, mixed phase ice and ice crystals)

CS 25.1323(i) is therefore replaced by a new specification to incorporate the mixed phase and ice crystal conditions as specified in the proposed Appendix D to 14 CFR part 33.

In accordance with IR 21, § 21A.16B, it is the Agency position that the related airworthiness code does not contain adequate or appropriate safety standards regarding the Airbus modification 157391 “NAVIGATION - SENSOR POWER SUPPLY AND SWITCHING - Install UTAS Pitot probes for new environmental conditions” which introduces a new air data pitot probe part number from UTAS supplier, on Single Aisle family aircraft.

ELECT TO COMPLY	E-28: Improved flammability standards for thermal / acoustic insulation materials
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	14 CFR Part 25.856(b) amendment 111
ADVISORY MATERIAL:	N/A

BACKGROUND

The FAA has adopted upgraded flammability standards for thermal and acoustic insulation materials used in transport category airplanes. These standards include new flammability tests and criteria that address flame propagation (FAR 25.856(a)) and the entry of an external fire into the airplane, or burn through (FAR 25.856(b)).

FAR 25.856(a) is applicable to Airbus aircraft manufactured on and after September 2005 through operational requirements of FAR 121.312.

FAR 25.856(b) is applicable to Airbus aircraft manufactured on and after September 2009 through operational requirements of FAR 121.312.

The intent of these requirements is to enhance safety by reducing the incidence and the severity of cabin fires, particularly those in inaccessible areas where thermal and acoustical insulation materials are installed, and by providing additional time for evacuation by delaying the entry of post-crash fires into the cabin.

The EASA intends to publish similar requirements by amending CS-25 with new paragraphs 25.856(a) 25.856(b). This rulemaking activity (EASA task 25.006) is expected to follow the FAA texts as already adopted in FAR Part 25 Amendment 111. The EASA rulemaking for this has been on hold for some time because of the problems reported by the industry with the Park burner mandated by Appendix F Part VII (flame penetration), which was not providing appropriate means for reliable and repetitive certification tests. These problems have been resolved with the FAA to such extent that EASA rulemaking can be progressed; it is therefore understood that the technical content of the EASA CS-25 will be identical to the FAR 25.856.

With respect to the operational requirement, the JAA task NPA 26-17 is part of the JAA Rulemaking program for 2007/08, which has formally been presented to the JAAC. The task was to start 3rd quarter 2007 with a draft JAA NPA prepared by the Agency in co-operation with the JAA CSSG and based on their original JAA text (itself based on the FAR text) so that it could be presented to OST in January 2008 for their approval with the JAA NPA publication. The rulemaking is planned to be completed end 2008/beginning 2009 by a JAAC decision. While the FAA gave 2 years after the date of applicability of the rule to comply with FAR 25.856(a), and 6 years for the flame penetration, the EASA compliance periods however could be proposed shorter in the NPA. Nevertheless, there is currently no clear indication regarding the timeframe EASA will enforce.

Flame propagation (FAR 25.856(a) and Appendix F Part VI):

Airbus has already adopted the flame propagation requirements of FAR 25.856(a) and Appendix F Part VI as a flammability standard. The thermal/acoustic insulation materials that are installed on all Airbus aircraft manufactured after September 2005 comply with the flame propagation requirements. (Ref: CRI E-18).

Flame penetration requirements (FAR 25.856(b) and Appendix F Part VII):

The upgrade of the aircraft in compliance with FAR 25.856(b) requirements has a large design impact on the aircraft, and it is a burden for Airbus to handle two flammability standards (one for the insulation materials that are installed on aircraft operated under FAR 121, and one for the other operators).

Similar to the flame propagation requirements of FAR 25.856(a) and Appendix F Part VI, and in the current absence of EASA equivalent rule, Airbus has voluntarily elected to comply with the requirements of FAR 25.856(b) and Appendix VII, as published in the Final Rule Docket No. FAA -2000-7909 and Final Rule Docket No. FAA-2006-24277, for all Airbus aircraft manufactured* on and after September 2, 2009. This includes also the FAA published interpretative materials (AC25.856-2 at issue 1 and subsequent).

Note: The requirements of FAR 25.856(b) complement the requirements of FAR 25.856(a). This means that insulation materials that must be tested according to FAR 25.856(b) must also be tested according to FAR 25.856(a).

* Date of Manufacture: the date on which inspection records show that an airplane is in a condition for safe flight. This is not necessarily the date on which the airplane is in conformity with the approved type design or the date, on which a Certificate of Airworthiness is issued, since some items not relevant to safe flight, such as passenger seats, may not be installed at that time. It could be earlier, but would not be later than the date on which the first flight of the airplane occurs [definition coming from NPRM dated Sept.20th, 2000_FAA docket FAA-2000-7909 Notice No.00-09].

The FAA has adopted upgraded flammability standards for thermal and acoustic insulation materials used in transport category airplanes (FAR 25.856). These standards are applicable to Airbus aircraft through the FAA operational requirements of FAR 121.312.

- The first part of the rule (FAR 25.856(a) - Flame propagation requirements, and Appendix F Part VI) is already implemented on all Single Aisle manufactured since September 2005.

- The second part of the rule (FAR 25.856(b) - Flame penetration requirements, and Appendix F Part VII) will be applicable to Single Aisle manufactured after September 2, 2009.

In order to reduce the production burden associated to the handling of two different standards (one of FAR 121operators / one for other operators), Airbus will proceed with the upgrade according to FAR 25.856(b) of the whole fleet. The starting point for the modification is determined to match the first FAR 121 operator needs. The serial introduction of the FAR 25.856(b) will be done in two times:

- ST4/ST3 in June 2009

- ST2/ST1 in July 2009

Currently, the EASA does not have equivalent rule. Therefore, Airbus voluntary elects to comply with the FAR 25.856(b) and Appendix VII, as published in the Final Rule Docket No. FAA -2000- 7909 and Final Rule Docket No. FAA-2006-24277. This includes also the FAA published interpretative materials (AC 25.856-2 at issue 1 and subsequent).

ELECT TO COMPLY

Airbus Elects to Comply with 14 CFR Part 25.856 (b) at Amendment 111 - Thermal/Acoustic insulation materials.

(b) For airplanes with a passenger capacity of 20 or greater, thermal/acoustic insulation materials (including the means of fastening the materials to the fuselage) installed in the lower half of the airplane fuselage must meet the flame penetration resistance test requirements of part VII of Appendix F to this part, or other approved equivalent test requirements. This requirement does not apply to thermal/acoustic insulation installations that the FAA finds would not contribute to fire penetration resistance

ELECT TO COMPLY	E-31: Improved Seats in Air Carrier Transport Category Airplanes
APPLICABILITY:	Post-TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.561; JAR/CS 25.562
ADVISORY MATERIAL:	N/A

BACKGROUND

The European Type Certification basis for Airbus A319/A320/A321 aeroplanes is based on JAR 25 at Change 11, which is prior the introduction of JAR 25.562. The Airbus A318 aeroplane was certificated ta JAR 25 at Change 11, with portions of JAR 25 at Change 14 and Change 15 being added, excluding the provisions of JAR 25.562(c)(5)(6) for passenger and cabin crew seats.

In 2005, the FAA introduced a new operational rule- "FAR 121.311 Amdt 315- "Improved Seats in Air Carrier Transport category Airplanes". This requires both cabin attendant and passenger seats to meet the dynamic test aspects of §25.562 on aircraft manufactured after October 27, 2009.

Thus, after 27th October 2009 applicable aeroplanes must comply with the above outlined requirements for operations in accordance with FAR Part 121.

Although Airbus already provides seats on FAR Part 121 aircraft that are capable of meeting the dynamic testing structural criteria of §25.562 Airbus was so far not required to demonstrate compliance to §25.562(c)(5)(6) for the passenger and cabin crew seats, ie. "including HIC" on the Single Aisle aeroplanes. Furthermore, for EU registered aeroplanes, this standard has never been introduced on A319/A320/A321 and only partly on A318.

In order to demonstrate compliance with the FAR Part 121 requirements and also ta enable European or Foreign operators to request a fully §25.562 compliant layout, either to add a value to their aircraft or ta comply with their specific operational rules, Airbus requested the certification of the Cabin Attendant Seat and passenger seats in accordance with CS25.562.

The compliance to the CRI is optional, upon customer request.

ELECT TO COMPLY

Airbus has proposed and EASA has accepted the elect to comply to CS25.562 initial revision for passenger seats or cabin attendant seat or both cabin attendant and passenger seats to be compliant

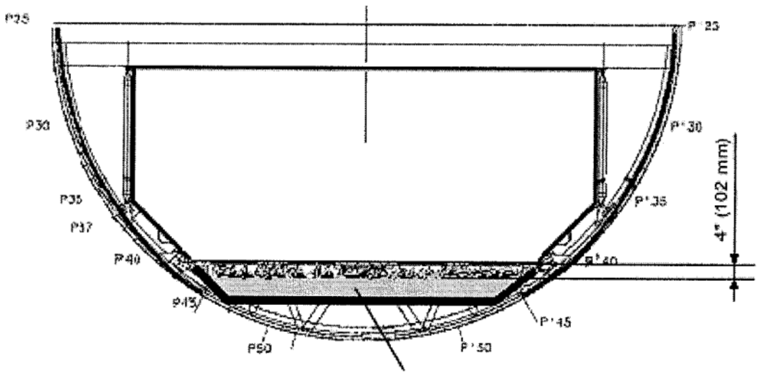
Therefore, when any such seats are installed this CRI (E-31) must be defined in the certification requirements of the applicable modification.

EQUIVALENT SAFETY FINDING	E-32: Fuselage burn through protection in bilge area
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	FAR 25.856(b), JAR 25.853, JAR 25.855
ADVISORY MATERIAL:	N/A

BACKGROUND

In order to improve the overall aircraft flammability standard, Airbus voluntarily elected to comply with FAR 25.856(b) rule. Airbus A318/A319/A320/A321 design typically does not have thermal/acoustic insulation installed on the fuselage skin in the bilge areas (the area below the lower lobe cargo floor). Instead, most Airbus airplanes have the insulation installed on the underside of the cargo floor, and per the flame penetration requirements of 25.856(b), this insulation would be subject to the fire penetration resistance test of appendix F, part VII. Since implementing this level of fire protection into the insulation on the floor panels presents several design and implementation challenges, Airbus has proposed an alternative method of compliance under the equivalent level of safety provisions of Part 21A 16B.

EQUIVALENT SAFETY FINDING



The existing cargo floor panels have been tested and the results showed that the layers are flame penetration resistant in terms of FAR 25.586 (b). The floor panels constitute a fire barrier (Barrier 1), with a determined amount of openings (drain pans, Power Drive Units, etc). The cargo compartment lining is qualified and certified according to 25.855, appendix F part Ill, and constitutes also a fire barrier (Barrier 2)..

With respect to the burn through resistance of LDCC floor, the barrier 1 acts as a "filter". Airbus has demonstrated that the remaining heat flux that passes through it dissipates in the LDCC (forward and aft sections). The amount of heat flux to which the cargo lining and cargo ceiling (Barrier 2) are exposed reduces extremely significantly. The analysis performed shows that the heat flux to which the cargo ceiling (Barrier 2) can be exposed is below the maximum heat flux value mandated by the rule. Furthermore, tests performed by Airbus have demonstrated that the temperature at the level of the cargo ceiling (Barrier 2) never exceeds 1700°F (927°C) within 4 minutes.

Airbus has demonstrated that the LDCC constitutes an effective burn through barrier. The combination of Barrier 1 according to FAR Part 25.856 (b) and of the Barrier 2 according to FAR Part 25.855 (c) increases the time for evacuation in case of a post-crash fire sufficiently to meet the intent of the requirements of FAR 25.856 (b).

Based on the LDCC demonstration, similar analysis has been conducted for all the different Lower Deck Compartments, and demonstrates that these compartments provide an effective flame penetration protection.

In view of the above considerations and related test evidences, the LDCC on Airbus Single Aisle provides in the Bilge Area a fire barrier equivalent to that requested by FAR 25.856(b) . Therefore compliance with CRI E-28 has been demonstrated through an equivalent level of safety approach.

SPECIAL CONDITION	**E-34: Seats with inflatable restraints**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.562(c)(5)
ADVISORY MATERIAL:	N/A

BACKGROUND

In the frame of the compliance with FAR 121.311 at Amdt 315, A318/A319/A320/A321 would be designed to fully satisfy the requirements of JAR/FAR 25.562 (typically FAR 121- operators and EU/Foreign operators on a voluntary basis).
With respect to compliance with JAR/FAR 25.562(c)(5), Airbus has proposed the application of inflatable lap belts as a mean to reduce the potential for head injury in the event of an accident.
Inflatable lap belts were an unusual design feature on passenger seats that was not specifically addressed in JAR/FAR 25. Therefore, a special condition and guidance material has been needed to address requirements particularly applicable to installation of those systems in an airplane.

SPECIAL CONDITION

1) HIC Characteristic

It is acceptable for the HIC (Head Injury Criterion) to have such a non-linear or step change characteristic provided that the value does not exceed 1000 at any condition at which the inflatable lap belt does or does not deploy, up to the maximum severity pulse specified by the requirements. Tests must be performed to demonstrate this taking into account any necessary tolerances for deployment.

2) Intermediate Pulse Shape
EASA considers that for the evaluation and testing of less severe pulses, a similar triangular pulse should be used with acceleration, rise time, and velocity change scaled accordingly.

3) Protection during Secondary Impacts
In the case where a small impact is followed by a large impact, if the minimum deceleration severity at which the airbag is set to deploy is unnecessarily low, the bag's protection may be lost by the time the second larger impact occurs. It must be substantiated that the trigger point for airbag deployment has been chosen to maximize the probability of the protection being available when needed.

4) Protection of Occupants other than 50th Percentile
Sufficient evidence must be provided that other size occupants are protected.
A range of stature from a two-year-old child to a ninety-five percentile male must be considered.
In addition the following situations must be taken into account:
- The seat occupant is holding an infant, including the case where a supplemental loop infant restraint is used:
- The seat occupant is a child in a child restraint device.

- The seat occupant is a pregnant woman

5) Occupants Adopting the Brace Position
There is no requirement for protection to be assessed or measured for set occupants in any other position or configuration than seated alone upright, as specified in FAA AC 25.562-1A (dated 19 January 1996). However, it must be shown that the inflatable lap belt does not, in itself, form a hazard to any occupant in a brace position during deployment.

6) It must be shown that the gas generator does not release hazardous quantities of gas or particulate matter into the cabin.

7) It must be ensured by design that the inflatable lap belt cannot be used in the incorrect orientation (twisted) such that improper deployment would result.

8) The probability of inadvertent deployment must be shown to be acceptably low. The seated occupant, or anyone who may be positioned close to the inflatable lap belt, must not be seriously injured as a result of the inflatable label inadvertent (or not).

9) It must be demonstrated that the inflatable lap belt when deployed does not impair access to the buckle, and does not hinder evacuation, including consideration of adjacent seat places and the aisle.

10) There must be a means for a crewmember to verify the integrity of the inflatable lap belt activation system prior to each flight, or the integrity of the inflatable lap belt activation system must be demonstrated to reliably operate between inspection intervals.

11) It must be shown that the inflatable lap belt is not susceptible to inadvertent deployment as a result of wear and tear, or inertial loads resulting from in-flight or ground manoeuvres likely to be experienced in service.

12) The equipment must meet the requirements of JAR 25.1316. Electro static discharge must also be considered.

13) The equipment must meet the requirements for HIRF with an additional minimum RF test for the threat from passenger electronic devices of 15 Watts radiated power.

14) The inflatable lap belt mechanisms and controls must be protected from external contamination associated with that which could occur on or around passenger seating.

15) The inflatable lap belt installation must be protected from the effects of fire such that no hazard to occupants will result.

16) The inflatable lap belt must provide adequate protection for each occupant regardless of the number of occupants of the seat assembly or adjacent seats considering that unoccupied seats may have active inflatable lap belts, which may be buckled or unbuckled.

17) Each inflatable lap belt must function properly following any separation in the fuselage.

18) It is acceptable for the material of the inflatable bags to have an average burn rate of no greater than 2.5 inches/minute when tested using the horizontal flammability test of JAR25 Appendix F, part I, paragraph (b)(5).

SPECIAL CONDITION	**E-37: SA New Engine Option (NEO) Water/Ice in Fuel System**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.951(c), CS25J951(c)
ADVISORY MATERIAL:	N/A

BACKGROUND

On 17th of January 2008 a British Airways Boeing Model 777-236 powered by two Rolls-Royce Model RB211 Trent 895–17 turbofan engines operating flight BA038 Beijing – London crash landed short of London Heathrow runway.
The subsequent investigation led by the Air Accidents Investigation Branch of the United Kingdom established that an un-commanded reduction in thrust occurred on both engines as a result of reduced fuel flows. The investigation determined that under certain conditions, over a long period of low fuel temperatures, ice may accumulate in the main tanks and/or in the associated engine fuel feed systems. The release of the accumulated ice, as a result of increased fuel flow, of increased ambient temperature, of airframe deformation resulting from turbulent conditions during approach, could create a restriction within the engine fuel feed system. A restriction in the engine fuel feed system, if not corrected, may result in failure to achieve a commanded thrust level, with subsequent forced landing of the aeroplane. No abnormal water concentrations were identified in the fuel system, and subsequent analysis of fuel samples have shown the fuel met all applicable standards, including for water content.

CS 25.951(c) reads:
Each fuel system must be capable of sustained operation throughout its flow and pressure range with fuel initially saturated with water at 26,7ºC (80ºF) and having 0.20 cm3 (0·75cc) of free water per liter (US gallon) added and cooled to the most critical condition for icing likely to be encountered in operation.
The assumption retained to show compliance with this requirement was that the free water was being evenly dispersed into fuel (indeed, the AMC to CS E.670 applicable to the engine fuel system explicitly mentions this assumption). On this basis, the compliance was achieved by assessing individually the ability of the fuel system components to perform adequately their function with those levels of free water.
The investigation following the Boeing 777 accident has shown that this assumption might not be valid. It appears that at least for some aircraft designs, and under some conditions, water/ice can accumulate and be suddenly released, directly contradicting the "evenly dispersed" hypothesis.

SPECIAL CONDITION

The applicant shall establish that:
1) The free water (or ice) remains evenly dispersed in the fuel under all operating conditions, or
2) The applicant must establish the threat(s) (quantity of ice, temperature) that can be released. The complete fuel system (including the engine) must be shown to be tolerant to such sudden release of ice, without significant adverse effect(s) on the powerplant system.
Note: this issue is also applicable to the APU, if the installation is essential (ref. CS 25J951(c)).

EQUIVALENT SAFETY FINDING	**E-43: SA New Engine Option (NEO) Thrust Reverser Testing**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.934, CS-E 890
ADVISORY MATERIAL:	N/A

BACKGROUND

The A320neo, equipped with Pratt & Whitney PW1100G-JM or CFM LEAP-1A engines, is fitted with thrust reversers.
Airbus shall therefore demonstrate compliance with CS 25.934 which requires that the "*thrust reversers installed on turbo-jet engines must meet the requirements of CS-E 890*" which deals with thrust reverser testing.
CS-E 890 (b) requests that "*The thrust reverser shall be fitted to the Engine for the whole of the Endurance Test of CS-E 740 and a representative control system shall be used*".
However, both engine manufacturers do not intend to install the A320neo thrust reverser unit during their Engine type certification 150h Endurance test requested by CS-E 890, but will use slave C-ducts.
Similar situations have occurred on other large transport aircraft, usually resulting from the thrust reverser being an airframe part not supplied by the engine manufacturer.

EQUIVALENT SAFETY FINDING

The following substantiation method provides a level of safety equivalent to a literal compliance demonstration with CS 25.934/CS-E 890.
1) Forward testing part
Strict compliance with CS-E 890(b) requirements for the forward mode testing part will not be demonstrated. Indeed, slave C-ducts instead of a real A320neo thrust reversers will be used for the engine CS-E 740 endurance certification test.
Engine manufacturers and their Engine Airworthiness Authorities have agreed in the past that the effect on the engine functioning of slave C-ducts with aerodynamic and mechanical characteristics equivalent to those of a real thrust reverser will be similar to the effect of a real thrust reverser.
Therefore, the evaluation of the impact of the engine functioning on the stowed thrust reverser, as required by CS-E 890(b) requirements, will be based on use of other engine service readiness endurance testing.
Airbus, in association with the Engine and Nacelle manufacturers, will define an acceptable endurance cycle format for these alternate tests in order to demonstrate that:
- The time spent at maximum level of thrust will be at least equivalent to the one for CS-E 740 endurance test
- The number of accelerations / decelerations from extreme levels of thrust will be at least equivalent to the one for CS-E 740 endurance test

2) Reverse testing part

The same thrust reverser unit that had performed the forward thrust endurance testing will then be installed on an engine in order to perform the 200 reverse cycles required by CS-E 890(c).

EQUIVALENT SAFETY FINDING	**E-44: SA New Engine Option (NEO) PW1100G-JM/Fan zone non-fire zone**
APPLICABILITY:	TC: A319-17XN/A320-27XN/A321-27XN
REQUIREMENTS:	CS 25.1181(a)
ADVISORY MATERIAL:	N/A

BACKGROUND

CS 25.1181 provides the definition of designated fire zones. CS 25.1181(a)(6) indicates this include the compressor section of turbine engines. The fan section is a compressor section of a turbine engine.
CS 25.1181(b) identifies the requirements which a fire zone must meet (25.867, 25.869, and 25.1185 to 25.1203).
The fan zone of the PW1100G-JM has not been classified by Airbus as a designated fire zone.
Airbus should justify that any requirement applicable to designated fire zones, which the fan zone of the PW1100G-JM installation does not meet, are compensated by factors which provide an equivalent level of safety, according to the provision of Part 21.21(c)(2).

EQUIVALENT SAFETY FINDING

On the PW1100G-JM, the fan compartment is not classified as a designated fire zone and thus does not contain fire detection and extinguishing systems.
This zone (compressor, later named as fan compartment), however, still meets the intent of CS 25.1181(a)(6) as its architecture and operating environment inherently protects against the start and continued propagation of a fire.
This inherent protection provides an equivalent level of safety to those areas classified as a designated fire zone and containing fire detection and extinguishing systems.

Additional design precautions preclude the initiation of a fire and therefore Airbus considers that the PW1100G-JM fan zone layout provides compensating factors to demonstrate an equivalent level of safety to those areas classified as a designated fire zone.

SPECIAL CONDITION	E-45: Engine Cowl Retention
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.901(b)(2), 25.901(c), 25.1193
ADVISORY MATERIAL	N/A

BACKGROUND

In-service experience on the Airbus A318/319/320/321 shows a large number of events of fan cowl loss separation occurring on both CFM-56 and V2500 powered airframes. Most of the time, it has been possible to trace the initiating factor of the cowl separation as being a maintenance error, generally resulting from failure of maintenance crew to properly close the fan cowl latches. Flight crews were not able to detect this situation during their pre-flight walkaround or check, the cowl being liberated during the subsequent take-off run or during climb. Such events are not unique to the Airbus Single Aisle family, and similar records exist on other aircraft. The FAA had issued NPRM 89-25 proposing the introduction of cowl latch retention requirements, including cockpit indication for unclosed latches. The final rule was however never published.
Considering this adverse in-service experience and the potential consequences associated with fan cowl separation, this CRI is raised to introduce a Special Condition, as per the provision of 21A.16B(a)3, introducing specific requirements for fan cowl retention.

SPECIAL CONDITION

Add to CS 25.1193 the following material:

CS 25.1193 **Cowling and nacelle skin.**
* * * * *

(e) Each aeroplane must--
    (4) Be designed and constructed to minimize any inflight opening or loss of engine cowling which could prevent continued safe flight and landing.
(f) The retention system for each removable or openable cowling must—
    (1) Keep the cowling closed and secured under the operational loads identified in paragraph (a) of this requirement following each of these specific conditions:
        (i) Improper fastening of any single latching, locking, or other retention device, or the failure of single latch or hinge; or
        (ii) (reserved).
    (2) Have readily accessible means of closing and securing the cowling that do not require excessive force or manual dexterity; and(3) Have a reliable means for effectively verifying that the cowling is secured prior to each take-off.

Note 1: all dispatch configuration (MMEL and CDL) shall be considered for showing compliance with this Special Condition.
Note 2: typically, for turbofan, the cowling addressed under this Special Condition are fan cowling; thrust reverser cowls have shown a satisfactory in-service experience and are not intended to be addressed under the requirements of this Special Condition.

SPECIAL CONDITION	E-48: Fuel Tank Safety
APPLICABILITY:	Post-TC: A318/A319/A320/A321
REQUIREMENTS:	CS 25.981 Amdt 1
ADVISORY MATERIAL:	AMC 25.981

BACKGROUND

Following various in-service events, including the Boeing 747-131 accident which occurred on 16th of July 1996 off Long Island (flight TWA800), FAA and JAA have required Type Certificate holders to conduct design reviews in order to verify their products did not feature any unsafe condition possibly associated with fuel tank safety. FAA issued SFAR 88, which mandated FAR 25.981 as introduced by Amdt 102, and JAA required the members states to conduct design review per INT/POL/25/12. It should be noted that while it is commonly stated the products which were reviewed are 'SFAR 88 compliant' or 'INT/POL compliant', actually it was not practical for most designs to demonstrate full compliance to FAR 25.981 as introduced by Amdt 102. Instead, FAA and JAA agreed to use an additional filter – a harmonized unsafe condition criteria – to determine which corrective actions will be required to close the fuel tank safety design reviews. The unsafe condition criteria made a distinction between low and high flammability exposure tanks; while for high flammability exposure tanks full FAR 25.981 compliance was required, for low flammability exposure tanks the criteria relied on addressing 'no single failure', 'no known combination of failures', and 'no adverse in-service experience'.
These design reviews were conducted as a one-time exercise, and most were completed by 2002/2003. On most designs their outcome prompted issuance of Airworthiness Directives to correct specific unsafe condition(s).
Issuance of ADs on product fully compliant with their original certification demonstrate the original fuel tank safety requirements are not adequate. However, the certification basis was not updated, and still features the requirements established for the original certification of the product (in the case of the Airbus Single aisle family, this is 25.981 in JAR-25 change 11). This resulted for subsequent design changes potentially affecting fuel tank safety in having a certification basis less stringent than the design review previously conducted to address SFAR 88.

To cover the development and certification of new design changes on SA family, the certification basis has been upgraded to CS 25.981

SPECIAL CONDITION

The applicant shall demonstrate that any design change potentially affecting fuel tank safety is compliant with CS 25.981 as modified at Amendment 1, and its associated guidance material as found in AMC 25.981(a). From the release date of this Special Condition, any qualification activity related to the fuel tank ignition risk should consider up-to-date standards, as delineated in the AMC to 25.981(a). The use of other standards will have to be explicitly agreed with the Agency.

Note 1: It is fully recognized that on an existing design this might not be always practical. In such cases, the applicant, with the explicit agreement of EASA, might consider alternative to this Special Condition.

Note 2: CS 25.981 post Amendment 1 and FAR 25.981 post Amendment 102 are Significant Standard Differences (SSD). While both requirements have their own backgrounds and merits, it certainly appears some specific text of FAR 25.981 is difficult to address, for instance the considerations related to latent failure not shown to be extremely improbable. EASA clearly does not intend to pre-empt the application of FAR 25.981 at Amendment 102 with this Special Condition: it is our understanding that FAA is working to establish a policy on this topic. Since both rules are SSD the assessment associated with Change Product Rule (21.101 and associated guidance material) might result in different decisions regarding the need to update the original certification basis.

EQUIVALENT SAFETY FINDING	**E-49: SA New Engine Option (NEO) LEAP_1A Fuel Filter Location**
APPLICABILITY:	TC: A319-15XN/A320-25XN/A321-25XN
REQUIREMENTS:	CS 25.997(d)
ADVISORY MATERIAL:	N/A

BACKGROUND

CS 25.997 requires that
"*There must be a fuel strainer or filter between the fuel tank outlet and the inlet of either the fuel metering device or an engine driven positive displacement pump, whichever is nearer the fuel tank outlet. This fuel strainer or filter must*
(d) have the capacity (with respect to operating limitations established for the engine) to ensure that engine fuel system functioning is not impaired, with the fuel contaminated to a degree (with respect to particle size and density) that is greater than that established for the engine in CS–E."
LEAP-1A engine fuel system does not feature a fuel filter meeting the position required by CS 25.997(d).

EQUIVALENT SAFETY FINDING

There is a fuel strainer positioned as requested by CS25.997: upstream of the HP pump inlet and a main fuel filter, meeting CS25.997(d) filtering requirements, downstream of the HP fuel pump.
Nevertheless, Airbus considers that the proposed design provides an equivalent level of safety to the design required by CS 25.997.
As part of engine type certification, dedicated engine testing will be completed to demonstrate the capability of the LEAP-1A Fuel system to satisfactory operate under contamination levels defined by CS-E/FAR 33.
Both the strainer and the filter are by-passed and monitored, thus direct compliance to 1305(c) is claimed.
The proposed fuel system architecture and filtering capacity provide a level of safety equivalent to a literal compliance demonstration with CS25.997(d) .
The strainer that meets the requirement of 25.997 in term of position does not have an indication before it reaches the capacity required by 25.997(d) as this capacity is ensured by the main filter. Since that strainer does have an indication at a different capacity but the main filter has an indication before reaching the capacity required by 25.997(d), the design is equivalently safe to the one requested in 1305(c)(6).

EQUIVALENT SAFETY FINDING	E-51: SA New Engine Option (NEO) Oil Temperature Indication
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.1549(a)
ADVISORY MATERIAL:	N/A

BACKGROUND

CS 25.1549(a) requires that each maximum safe operating limit must be marked with a red radial or a red line. Although written for conventional indicators, this has been generally applied to digital CRT/LCD indications by using a colour coding consistent with the conventional indicators.

The A320neo engine oil temperature is displayed on the ECAM (Electronic Centralized Aircraft Monitoring) display screen.

The indication is provided in digital form:
• It is normally green,
• It pulses green if the temperature exceeds a limit threshold
• It turns amber if the temperature exceeds that limit threshold for more than a set time or the maximum oil temperature indicated by the engine manufacturer without delay.

EQUIVALENT SAFETY FINDING

The A320neo oil temperature indication on ECAM does not literally comply with CS 25.1549(a) which would require the indication to turn red instead of amber when the maximum limit is exceeded.

It is however consistent with Airbus past practice for Engine oil temperature indication to have green digits for normal range, flashing green digits between steady state and transient declared (Engine TCDS) limits when duration is below declared time limit, and steady amber digits above the declared time limit and when oil temperature is beyond transient limit. Such display is already into service on all other Airbus applications including A320 Legacy Aircraft. On this matter A320neo changes do not introduce any novelty.

Airbus believe that the engine oil temperature indication as defined for the A320neo provides a level of safety equivalent to an indication literally compliant to CS 25.1549(a) for the reasons detailed below:
• The exceedance of the maximum oil temperature limit does not require an immediate action from the crew. This has been justified on previous Airbus application and will equally be true for the A320 neo. As such an amber colour is appropriate as per CS 25.1322.
• The exceedance of the maximum oil temperature limit is annunciated, in addition to the amber indication on the ECAM, by an amber master caution located in each pilot's field of view associated with a single aural chime (inhibited during critical flight phases such as take-off). This amber caution triggers an ECAM message procedure (reduce power and shut down the engine if it is not possible to maintain the oil temperature below the limit). CS 25.1305, which

lists the required powerplant instruments and warnings, requires an oil pressure warning or caution. The current design therefore exceeds the current CS 25 requirements by providing an unmistakable indication to the crew in case of oil temperature exceedance.

EASA has found the design to be equivalently safe to CS 25.1549(a).

EQUIVALENT SAFETY FINDING	**E-52: PW1100G-JM and LEAP-1A areas adjacent to Designated Fire Zone Fan zone (CS-25.1182) and PW1100G-JM (2.5 bleed) (CS 25.1181)**
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.1103(b), 25.1165(e), 25.1181, 25.1182, 25.1183, 15.1185(c), 25.1187, 25.1189, 25.1191, 25.1195 to 1203
ADVISORY MATERIAL:	N/A

BACKGROUND

On SA NEO applications, Airbus assessed the Propulsion System areas adjacent to Designated Fire Zone (DFZ) versus compliance to CS 25.1182 and 25.1181.

This analysis evidenced that SA NEO PPS areas adjacent to DFZ are not all strictly compliant to CS 25.1182 as no fire detection and extinguishing systems will be installed in these areas.

In addition, one Flammable Fluid Leakage Zones area on PW1100G-JM (2.5 bleed area) is not strictly compliant to 25.1181 as it is positioned in a compressor area.

Airbus requested an Equivalent Safety Finding to meet the intent of CS-25.1182 for areas adjacent to DFZ for PW1100G-JM and LEAP1A DFZ and of CS25.1181 for PW1100G-JM (2.5 bleed area) considering compensating factors which provide an equivalent level of safety, according to the provisions of Part 21A.21(c)(2).

EQUIVALENT SAFETY FINDING

<u>SAneo PW1100G-JM</u>

PW1100G-JM PPS has one Designated Fire Zone in the core.
The fan compartment and the translating sleeves compartment are a Flammable Fluid Leakage Zone. Inlet compartment, lower aft beam compartment and translating sleeve compartment are considered as non-fire zones.
The exhaust system is a Fire Zone and the inlet is a non-fire zone

The design architecture and operating environment inherently protects against the start and continued propagation of a fire and therefore EASA considers that the PW1100G-JM areas adjacent to DFZ provide compensating factors to demonstrate an equivalent level of safety to those areas classified as a designated fire zone.
In addition design of the 2.5 bleed area ensures compliance to CS 25.1181.
The proposed substantiation method provides a level of safety equivalent to a literal compliance demonstration with CS25.1181 and CS25.1182.

<u>SAneo LEAP-1A</u>

The LEAP-1A has 2 DFZ: Fan Area and Core area

The design precautions preclude the initiation of a fire and therefore EASA considers that the LEAP-1A areas adjacent to DFZ provide compensating factors to demonstrate an equivalent level of safety to those areas classified as a designated fire zone.

The proposed substantiation method provides a level of safety equivalent to a literal compliance demonstration with CS25.1182.

EASA considers that the proposed substantiation method provides a level of safety equivalent to a literal compliance demonstration with CS25.1181 (2.5 bleed and Track Lock box on the PW) and CS25.1182 (areas adjacent to DFZ).

SPECIAL CONDITION	E-55: CFM LEAP-1A - Fan blade loss, effects at airplane level
APPLICABILITY:	TC: A319-15XN/A320-25XN/A321-25XN
REQUIREMENTS:	25.901(c), 25.903(c), 25.903(d)(1), 25.1309(b)
ADVISORY MATERIAL:	AMC 25.901(c), AC 25-24, AMC 20.128A

BACKGROUND

The CFM LEAP-1A engine manufacturer demonstrated fan blade failure (ref. CS-E 810) using a reduced fragment size compared with the usual interpretation recorded in the AMC E 810, which guidelines are to release the blade at the top of the retention member. Instead, it is proposed to release the blade fragment at the flowpath, leaving a part of the fan blade in the disk.

Fan blade separation is normally classified at worst as 'major', based upon design precautions taken at engine and aircraft levels, respectively the fan containment system and an airframe sized to sustain fan blade out loads as well as demonstration of the ability of the airframe and systems to sustain engine windmilling.

Under this interpretation of CS-E 810, liberation of a full fan is not taken into account for the fan blade out demonstration. This directly impacts several related areas which are interconnected with aircraft certification, including the fan containment system dimensioning, the fan blade out loads and fan windmilling characteristics.

Paragraphs 25.901(c) and 25.1309(b) introduce a requirement for having no catastrophic condition resulting from a single failure. This is applicable to the complete aircraft, engine included. From CS- 25 Amendment 1, CS 25.901(c) has been modified and lists exceptions to that principle, for engine case burnthrough, uncontained engine failure and propeller blade release, which are addressed under specific requirement (25.903(d)(1) and 25.907). This does not include fan blade failure, since fan blade failure is addressed by CS-E.

If full blade liberation can still occur as a result of single failure(s) of the fan system, even with a very low probability, the existence of any potential catastrophic consequence(s) constitutes a noncompliance to 25.901(c). This therefore needs to be carefully identified and assessed.

The impact of the CS-E Special Condition S1 referenced in TCDS E.110 on CS25 prompted EASA to also issue the Special Condition E-55, as the absence of the failure case "Fan Blade liberation at the top of the retention mean" declared by CFM does not allow aircraft manufacturer to conclude to the absence of catastrophic consequences should this failure happen. EASA shall then assume that a catastrophic failure may result from a Full Engine Fan Blade Liberation.

Although the terms of the CS-E Special condition required the Full Blade liberation to be Extremely Improbable, i.e. making this failure case compliant to 25.1309(b)(1)(i), this failure case is still remaining not compliant with the 25.1309(b)(1)(ii), i.e. "*and does not result from a single failure*" (i.e. "No Single Failure" criteria for catastrophic failure condition).

SPECIAL CONDITION

Add to CS 25.901(c) the following material:
CS 25.901 Installation

(c) The powerplant installation must comply with CS 25.1309, except that the effects of the following need not comply with CS 25.1309(b):

(4) fan blade failure at the top of the retention means
(as per LEAP-1A Special Condition, compliance to 25.1309 considers fan blade failure at the inner annulus flowpath line)

Reversion	**E-65: Fuel tanks – Reversion from CS 25.963[e(1)] at Amdt 15 to CS 25.963[e(1)] at Amdt 13**
APPLICABILITY:	A319-171N
REQUIREMENTS:	CS25.963 (e)(1)
ADVISORY MATERIAL:	---

BACKGROUND

The application of the latest requirements does not contribute materially to the level of safety of the product (GM to 21.A.101).

CONDITIONS

The A319-171N design features described by Airbus shall be maintained in any subsequent type design change, modification, or repair to ensure the level of safety on which the reversion is granted. In particular a changed design must demonstrate a compliance with following conditions:

- The fuel tank surface area within the debris impact area shall not increase compared to the reference aircraft.
- The fuel tank surface area that could be penetrated or perforated by debris shall not increase compared to reference aircraft.
- The overall fuel tank surface area that could be penetrated or perforated by debris shall not be larger than 5% of the total tank surface in in +15°/-45° swept area.
- The individual fuel tank surface area that could be penetrated or perforated by debris shall not be larger than 10% of the total tank surface in in +15°/-45° swept area.
- There shall be no individual fuel tank surface that could be penetrated or perforated by debris due to direct impingement.
- There shall be no change to the engine threat within the class of the of reference engine (for example, but not limited to, in term of rotation speed, technology, debris type…)
- There shall be no change to the fuel tank skin (eg. thickness, material or assembly details)
- In addition to these aforementioned design features, in-service experience inputs were also used in the determination to grant the reversion. Therefore, these inputs (UERF events with small debris impact on fuel tank lower cover, Center Fuel Tank A319 fleet average usage) shall also be verified to be acceptable to the Agency in any subsequent type design change, modification, or repair to ensure the product agreed level of safety is maintained.

SPECIAL CONDITION	E-67: Cabin Evacuation - Protection from Fuel Tank Explosion due to External Fuel Fed Ground Fire
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.863, CS 25.867, CS 25.856(b), 25.994, CS25.981(a)(1)(2) and 25.1309(a) at Amendment 23, CS25.963(e)(2) at Amendment 14, CS25.975(a)(7) at Amendment 21 CS 25.803(a) at Amendment 15
ADVISORY MATERIAL:	AMC 25.863(a), AMC 25.963(e), AMC 25.975(a)(7), AMC 25.856 / FAA AC25.856-2A

BACKGROUND

EASA received an application for a major change to type design on a large aeroplane.

1) The design change introduces a conformal fuselage structural fuel tank[2] to the aeroplane, also called rear centre tank (RCT) located behind the wheel bay, in the lower section of the fuselage, partially replacing the aft cargo compartment.
   The integration of a conformal fuselage structural fuel tank located below the cabin floor presents challenges in terms of occupant's protection against the risks of external fire burnthrough, fuel vapour ignition and fuel tank explosion as well as challenges to ensure crashworthiness of this fuel tank. The protection against external fire burnthrough and crashworthiness are addressed through other Special Condition that were published by EASA.

   This SC therefore addresses only the risk of fuel ignition and fuel tank explosion.

   The experience gathered with large aeroplanes carrying more than 19 passengers, equipped with classical wing fuel tanks (incl. centre wing fuel tanks) and auxiliary tanks located in cargo compartments, is considered satisfactory in terms of protection of the cabin occupants during post crash evacuation from the risk of fuel tank explosion generated by an external fuel fed ground fire. However, the proposed RCT installation, because of its design and location, is considered as an unusual or novel design feature for this category of aeroplanes with regards to this risk.

2) The CS-25 at Amendment 23 includes several specifications that address the risk of fuel vapours ignition. However, none of them adequately covers the risk of ignition in a RCT as introduced on this aeroplane in case of external fuel fed ground fire:
   - CS 25.863 considers the minimisation of the probability of ignition and resultant hazards due to the ignition of flammable fluids or vapours that might escape from a fluid system.
   - CS 25.867 considers the fire protection in specific zones around the nacelle.
   - CS 25.963(e)(2) requires the Fuel Tank Access Covers to "*have the capacity to withstand the heat associated with fire at least as well as an access cover made from aluminium alloy in dimensions*

[2] Conformal fuselage structural fuel tank: A structural fuselage fuel tank, that shares some boundaries with the fuselage skin.

appropriate for the purpose for which they are to be used except that the access covers need not be more resistant to fire than an access cover made from the base fuel tank structural material." This rule was created following an accident where a fuel tank access panel failed from impact damage causing a fuel leak from a perforated wing tank and generated an external fuel fed ground fire.
- CS 25.975(a)(7) specifies that fuel tank vent systems must prevent explosions, for a minimum of 2 minutes and 30 seconds, in case of external ground fire.
- CS 25.981(a)(1) and (2) require to demonstrate that no aircraft systems operation, failure, malfunction may cause an increase of temperature inside the fuel tank beyond a temperature that has a safe margin below the lowest expected auto-ignition temperature of the fuel.

The inerting of the fuselage tank, while introduced in the frame of compliance with CS 25.981(b), is primarily focussed at protecting the fuel tank against internal design failure modes that could ignite fuel vapours. Moreover, the agreed compliance means of the inerting system is based on a statistical objective following a Monte-Carlo analysis per CS-25 Appendix N. This strategy cannot be assumed to meet the safety objective of protection against external ground fire hazards.
However, Flammability Reduction Systems or Ignition Mitigation Means can be considered provided their performance could be demonstrated to prevent ignition of RCT fuel vapours by an external ground fire.
In accordance with 21.B.75(a)(1) of Annex Part-21 to Regulation (EU) 748/2012 for novel or unusual design features, there is the need to address the threat of RCT fuel vapour ignition in case of external fuel fed ground fire.

Considering all the above, the following Special Condition is set:

SPECIAL CONDITION

In order to protect cabin occupant's evacuation from fuselage tank explosion in case of ground external fuel fed fire, the large transport category aeroplane design must prevent ignition of fuel tank vapour (due to hot surface) from occurring in a conformal fuselage structural tank during the evacuation

Definition

A conformal fuselage structural fuel tank is a structural fuselage fuel tank, which shares some boundaries with the fuselage skin.

EQUIVALENT SAFETY FINDING	E-68: RCT thermal model validation for flammability exposure demonstration
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	CS 25.981(b)(3), Appendix M25.2(b), N25.3(c)(5) (Amdt 23)
ADVISORY MATERIAL:	FAA AC 25.981-2A

BACKGROUND

As part of the A321-Neo product development, Airbus has applied for the certification of the A321-XLR (Extra Long Range) aircraft, which includes the installation of an integral rear centre fuel tank (RCT). The tank is located in the lower fuselage below the cabin floor, with the fuel tank spanning across 8 frames and designed to carry 12,900litres of fuel. The forward boundary of the tank is the main landing gear bay bulkhead, and the lower boundary follows the existing profile of the fuselage skin, while the upper, aft and side panels of the tank within the fuselage are subject to the cabin pressurisation loads. An active Fuel Tank Flammability Reduction Mean is implemented in the RCT in order to ensure that RCT fuel vapor flammability will remain compliant with the objectives set by CS25.981(b)(2) requirement.

Indeed, the requirement CS 25.981(b)(3) is stating:

> *"Any active Flammability Reduction means introduced to allow compliance with sub-paragraph (2) must meet appendix M of CS-25."*

In addition, the requirement M25.2(b) is stating:

> *"The applicant must validate that the FRM meets the requirements of paragraph M25.1 of this appendix with any aeroplane or engine configuration affecting the performance of the FRM for which approval is sought."*

The requirement CS25.981(b)(2) is calling Appendix N for Fuel Tank Flammability objectives (referred as Fleet Average Flammability Exposure). In the Appendix N, the requirement N25.3(c)(5) is stating:

> *"Fuel Tank Thermal Characteristics. If fuel temperature affects fuel tank flammability, inputs to the Monte Carlo analysis must be provided that represent the actual bulk average fuel temperature within the fuel tank throughout each of the flights being evaluated. For fuel tanks that are subdivided by baffles or compartments, bulk average fuel temperature inputs must be provided either for each section of the tank or for the section of the tank having the highest flammability exposure. Input values for this data must be obtained from ground and flight test data or a thermal model of the tank that has been validated by ground and flight test data."*

The integral structural RCT is requiring extensive certification and development activities that resulted in aircraft configuration evolution. The initial RCT configuration now includes:

- Fibre Metal Laminate (FML) fuselage skin replacing Aluminium skin,
- Extended and re-designed Belly Fairing and sliding provisions,
- Internal RCT Liner.

Type Certification configuration was frozen too late to be integrated for the flight test aircraft without costs and delay that were considered not commensurate by the applicant. The applicant elected then to build the flight test aircraft with the initially proposed configuration. Consequently, the discrepancy between flight test aircraft configuration and the TC configuration induces certification impacts that have to be reconciliated.

In particular, the usual validation process of the thermal model used for compliance with CS25.981(b)(3) for active Fuel Tank Flammability Reduction Means allowing compliance with Fuel Tank Flammability requirement of CS25.981(b)(2) cannot be applied. Indeed, the fuel tank flammability model used for the Monte-Carlo analysis cannot be directly validated by flight test data due to the configuration discrepancy between the RCT at Type Configuration and RCT at Flight Test aircraft configuration. This discrepancy is not by default permitted by the prescriptive compliance requirement N25.3(c)(5).

EASA received from Airbus a request for an Equivalent Safety Findings proposing alternative means to demonstrate compliance with the safety intent of the requirement CS25.981(b)(3), Appendix M25.2(b). and N25.3(c)(5) using compensating factors.

EQUIVALENT SAFETY FINDING

1. APPLICABILITY

Airbus A321-253NY & -271NY

1.1 CS REQUIREMENTS AFFECTED

CS25.981(b)(3), Appendix M25.2(b). and N25.3(c)(5)

2. COMPENSATING FACTORS:

In lieu of validating the fuel tank thermal model used for Monte-Carlo analysis (the Rapid Thermal Model or RTM) by ground and flight test data as described by Appendix N 25.3(c)(5), the RTM is validated by using detailed thermal models (named hereafter Full Fuselage Thermal Models (FFTM)). A first A321XLR FFTM (FFTMMSN1) for the test aircraft configuration is to be correlated with temperature measurements from the flight test campaign with the aircraft in the actual flight test configuration. The second FFTM (FFTMTC) is to be built using the first FFTMMSN1 and adjustments introduced by the material changes using rig test data to cover any configuration evolution.

Due to the fact that validation is not performed using actual reality data (flight test data) but using simulated data (detailed thermal models data), the following compensating factors must be demonstrated to provide an equivalent level of safety:

- The A321XLR RCT Detailed thermal models (FFTMs) shall be described including software tool used and methodology (FE-mesh justification, boundaries conditions, temporal resolution, material properties justification, etc…). Any assumption, approximation and/or simplification taken to simulate the RCT and/or the aircraft flight shall be identified and justified with relevant margins integrated.

- The parameters of $FFTM_{TC}$ model (Material thermal conductivity, Mass, Specific Heat,…) that will be validated by using individual local coupon testing shall be presented and accepted by the Agency. Conservative margins shall be taken prior to use in the $FFTM_{TC}$ model.

- Liner, liner installation and fuel circulation modelisation shall be detailed specifically with their thermal effects on the lower layer of fuel (comprised between fuselage skin and liner) and on main volume of fuel in RCT.

- Models' prediction accuracies and consecutive conservative margins justification shall be provided for Agency acceptance. In particular, the successive use of several models ($FFTM_{MSN1}$, $FFTM_{TC}$, RTM) is potentially inducing additional inaccuracies that shall be covered with margins to get confidence between results that would be provided by F/T aircraft at the TC configuration and RTM model prediction.

SPECIAL CONDITION	E-1005: Resistance to fire - Terminology
APPLICABILITY:	A320
REQUIREMENTS:	JAR 25.853(d); 25.863(b)(4); 25.867(a)
ADVISORY MATERIAL:	ACJ 25.1181

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Revise the definitions of "Fire resistant", "Fireproof! And "Standard Flame" as follows:

"Fireproof" with respect to materials, components and equipment means the capability to withstand for a period of 15 minutes the application of the "Standard Flame".

Note: For materials this is considered to be equivalent to the capability of withstanding a fire at least as well as steel or titanium in dimensions appropriate for the purposes for which they are used.

"Fire Resistant" with respect to materials, components and equipment means the capability to withstand for a period of at least 5 minutes the application of the "Standard Flame".

Note: For materials this may be equivalent to the capability of withstanding a fire at least as well as aluminium alloy in the dimension appropriate for the purposes for which they are used.

"Standard Flame" with respect to component and equipment means a flame developing a nominal temperature of 1100 degrees C (2000 degrees F), the characteristics of which are similar to those described in an international standards organization Technical Report No. TR/2685. The latter standard also contains acceptable test procedures for use with the "Standard Flame".

Amend JAR 25.853(d) as follows:
In the first sentence delete the word "and constructed of at least fire resistant materials … under normal use" and replace them by "and constructed of materials adequate in resistance to fire such that any fire likely to occur in it under normal use will be contained"

Amend JAR 25.863(b)(4) as follows:
Delete the words "Fireproof Containment" and replace with the words "Fire Containment"

Amend JAR 25.867(a) as follows:
Delete the words "Must be at least Fire Resistant" and replace by the words "must be constructed of materials at least equivalent in resistance to fire to aluminium alloy in dimensions appropriate for the purpose for which they are used".

Amend ACJ to JAR 25.1811 as follows:
Delete the words "British Standard … Dated December 1973" and replace by the words "International Standards Organization Technical Report No. TR/2685"

SPECIAL CONDITION	E-2105: Type III Overwing Emergency Exit access
APPLICABILITY:	A320
REQUIREMENTS:	JAR 25.813(c)(1), JAR 25.807(a)(3)
ADVISORY MATERIAL:	N/A

Statement of Issue I:

As a result of positioning the Type III sill height to meet the step down requirements of JAR 25.807(a)(3) and hence preclude the need for a supplementary step outside the aircraft, the passenger seat cushion immediately adjacent to the overwing exit encroaches into the outline of the exit in the fuselage.

JAR 25.813(c)(1) requires that the projected opening of the exit provided may not be obstructed and there must be no interference in opening the exit by seats, berths or other protrusions for the width of a passenger seat.

The actual opening in the fuselage is however larger than the minimum, i.e. 20″ x 40″ rather than 20″ x 36″.

The Airworthiness Authorities are prepared to accept compliance by Equivalent Safety based upon the following:

- Tests have shown that such an encroachment will not interfere with the effective opening of each overwing hatch.
- The actual opening in the side of the fuselage is larger than the minimum required.
- The seat cushion is readily compressible down to the level of the exit outline, assuming a force of 170 LB evenly distributed over 40 square inches (this criteria has been found to be an acceptable means of compliance on other aircraft types).

JAA Conclusion:

JAA accepts an Equivalent Safety finding to JAR 25.813(c) on the basis that:

- The A320 Type III exit is 4″ oversize (20″ x 40″ for a minimum required of 20″ x 36″)
- The seat cushion does not encroach into the minimum required exit opening.
- The seat cushion is readily compressible.
- A minimum of 7″ unobstructed access is provided to the Type III exit.
- Step down requirement of JAR 25.807 is met without providing any supplementary step outside.

In addition, it has been demonstrated by test that there is no interference in opening the exit.

Statement of Issue II:

The outboard seat adjacent to the emergency exit has been equipped with thinner seat cushion and the comfort is reduced. This could be improved by an increase of the outboard seat cushion height to 18.8" (instead of 16.8") in combination with a minimum 10" passageway leading to the exit.

Test has demonstrated that with a minimum access passageway to each Type III exit of 10", there is sufficient width of exit sill to allow compliance with JAR 25.807(a)(3), i.e. the 'step down' is from the sill rather than the compressed seat cushion.

JAA Conclusion:

An Equivalent Safety finding with JAR 25.813(c)(1) is granted on the basis that:

- There is no interference with exit operation (as demonstrated by test), provided the seat cushion height is limited to 18.8".
- Whilst the seat cushion does intrude into the 'exit opening provided', this is compensated by the provision of a larger than minimum Type III exit size, i.e. the seat cushion line is beneath the 20" x 36" minimum exit opening.

EQUIVALENT SAFETY FINDING	**E-2107: Passenger extension to 180**
APPLICABILITY:	A320
REQUIREMENTS:	JAR 25.807
ADVISORY MATERIAL:	N/A

Statement of Issue:

An application was made on September 30, 1992 to JAA for certification of maximum number of passengers of 180.

Paragraph 25.807(c)(1) of JAR specifies for passenger seating configuration, the number and types of Emergency Exits for each side of the fuselage.
The maximum seating capacity allowable under JAR 25.807(c)(1) for A320 exit configuration is 179 (2 Type I and 2 Type III).

However, the exits size for front and rear doors on the A320 is such (32x73 inches) that they are oversized Type I and therefore can be considered as a non-standard exit arrangement.

The same exit size is being used on a derivative of the A320, for which Latin Square Tests have been conducted in order to establish an appropriate rating for that kind of exits. These tests have shown that, when associated with the performance of the slide installed at these exits, a rating of 55 passengers is appropriate.

It should also be noted that the full scale emergency evacuation demonstration of the A320 with 179 passengers has demonstrated compliance with JAR 25.803(c) with sufficient margin to justify 180 passengers.

Under those conditions, a maximum capacity of 180 passengers is requested for the A320.

JAA Conclusion:

Based upon the demonstrated higher rating for the floor level exits and the adequate margins for 179 passengers shown in the 90 seconds demonstration, and used as a basis to show compliance to JAR 25.803(c), the JAA accept 180 passengers as the maximum capacity for the A320 on the basis of an Equivalent Safety Finding.

SPECIAL CONDITION	E-3001: Exit configuration
APPLICABILITY:	A321
REQUIREMENTS:	JAR 25.807 JAR 25.809
ADVISORY MATERIAL:	N/A

BACKGROUND

The A321 exit configuration consists of 4 pairs of non-standard exits and thus the arrangement is covered by neither table 25.807(c)(1) nor table 25.807(c)(2). In addition, these exits are oversized Type I exits.

The exit arrangement and sizes are as follows:

1L/1R - 4L/4R: 32" wide X 73" high (unchanged A320 standard)
2L: 30" wide X 73" high
2R: 30" wide X 73" high
3L/3R: 30" wide X 60" high.

AI wish to take credit for 55 pax for each pair of these oversized Type I exits.

AI proposes to show that the A321 exit arrangement should be certificated for a maximum capacity of 220 passengers. A latin square test comparing the A321 exit with a standard Type I exit has been conducted.

SPECIAL CONDITION E3 (SC.E3)

- Add to JAR 25.807(c) a subparagraph (7) reading:

For oversized Type I exits, the increase of the rating over 45 passengers must be demonstrated by tests.

- Replace JAR 25.809(f)(1)(ii) by:

It must be automatically erected within 10 seconds from the time the exit opening means is actuated.

EQUIVALENT SAFETY FINDING	E-3003: Access to doors 2&3
APPLICABILITY:	A321
REQUIREMENTS:	JAR 25.813 JAR 25.785
ADVISORY MATERIAL:	AC 25.785-1B

BACKGROUND

Airbus proposes A321 interior arrangements with a single Cabin Attendant Seat (CAS) on one side of the fuselage at doors 2 and 3

The single CAS located on the side of the fuselage is judged to be remote from the exit on the opposite side of the cabin, further than the distance of the three seat rows (as per AC 25.785-1B).

EQUIVALENT SAFETY FINDING

Airbus requested an Equivalent Safety Finding to propose a single cabin attendant seat at doors 2 and 3.

EASA agreed that the test performed on A321 legacy aircraft to demonstrate that there were no significant difficulties for the cabin attendant to reach the usable exit side before the first passengers when coming from the attendant seat located outboard at the opposite side of the fuselage.

Evidence is required in terms of the ability of a cabin attendant to reach the far exit before any passenger, so that he/she can effectively open the exit and manage the passenger flow onto the slide against any resulting passenger crowding at this exit.

The ability of the outboard seated cabin attendant to reach the opposite exit shall be covered by the cabin crew training program.

EQUIVALENT SAFETY FINDING	E-4001: Exit configuration
APPLICABILITY:	A319
REQUIREMENTS:	JAR 25.807 (c) Change 13, OP90-1 JAR 25.809 Change 11
ADVISORY MATERIAL:	N/A

Statement of Issue

For an aeroplane equipped with two pairs of Type I exits and one pair of Type Ill exits, JAR 25.807(c) Change 13 allows a maximum passenger capacity of 139 passengers.

The exit configuration of the A319 consists of two pairs of non-standard floor level exits (oversized Type 1), and one pair of Type Ill overwing exits. For this configuration, Airbus Industrie has requested certification for a number of passengers of 145, using data from the A321.

For the A319, the exits arrangement and sizes are as follows:

forward doors:	1L/1R 32" wide x 73" high (unchanged A320/A321 standard)
overwing exits:	2L/2R 20" wide x 40" high (unchanged A320 standard Type Ill)
aft doors:	3L/3R 32" wide x 73" high (unchanged A320/A321 standard)

The forward and aft doors satisfy the minimum dimensions and assist means inflation time criteria of the proposed Type C exit in NPRM 90-04 [i.e. 30" wide x 48" high, 10 seconds inflation time].

JAA Position

The requirement stated in JAR 25.807(c) at Change 13 as amended by Orange Paper 90-1 shall be satisfied.

With regards to the maximum passenger seating capacity of aircraft equipped with "oversized Type I doors", the following policy is to be followed for approval of maximum seating capacity of passengers:

The JAAC agreed in principle that an Equivalent Safety Finding procedure based

- either on a test programme (to be defined)
- or on NPRM 90-4

shall be used to approve maximum passenger seating capacity of aircraft using 'oversized' Type I exits provided that the test programme resulting from Cabin Safety study group is agreed by JAAC.

For the A319, an Equivalent Safety Finding to JAR 25.807(c)(1) Change 13 OP90-1 is granted by JAA provided that NPRM 90-4 provisions are met.

EQUIVALENT SAFETY FINDING	E-4105: Type III Overwing Emergency Exit Access
APPLICABILITY:	TC: A319
REQUIREMENTS:	JAR 25.813(c)(1) JAR 25.807(a)(3)
ADVISORY MATERIAL:	N/A

BACKGROUND

As a result of positioning the type III sill height to meet the step down requirements of JAR 25.807(a)(3) and hence preclude the need for a supplementary step outside the aircraft, the passenger seat cushion immediate adjacent to the overwing exit encroaches into the outline of the exit in the fuselage. JAR 25.813(c)(1) requires that the projected opening of the exit provided may not be obstructed and there must be no interference in opening the exit by seats, berths or other provisions for the width of a passenger seat.

The proposed design is to allow the outboard seat cushion height to reach up to 18.8", in combination with a minimum 10" passageway leading to the exit.

The actual opening in the fuselage is however larger than the minimum i.e. 20"x 40" rather than 20"x 36".

EQUIVALENT SAFETY FINDING

Test has demonstrated that with a minimum access passageway to each Type Ill exit of 10 inches, there is sufficient width of exit sill to allow compliance with JAR 25.807(a)(3), i.e. the step down is from the sill rather than the compressed seat cushion.

Compliance with 25.813(c)(1) is considered to be achieved by equivalent safety finding on the basis that:

- there is no interference with exit operation (as demonstrated by test), provided the seat cushion height is limited to 18.8";

- whilst the seat cushion does intrude into the 'exit opening provided', this is compensated by the provision of a larger than minimum Type Ill exit size, i.e. the seat cushion line is beneath the 20" x 36" minimum exit opening.

SPECIAL CONDITION	E-5001: Emergency landing conditions
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR 25.562 except (c)(5) and (6) at Change 14
ADVISORY MATERIAL	N/A

BACKGROUND

The JAA considers that JAR 25.562 brings a significant improvement in the safety standards, and that the application of 25.562 to the certification basis should be considered, to the greatest extent possible, for all large passenger transport aircraft derivatives whenever a significant change in cabin size (width or length) is introduced.

ELECT TO COMPLY

Airbus industry elects to comply with the JAR 25.562 except (c)(5) and (6) at Change 14.

The JAA team accept Airbus Industry proposal to comply with JAR 25.562 except 25.562(c)(5) and (c)(6) (HIC and leg injury). The JAA team accept Airbus Industry argument that, for the A318, full compliance with head and leg injury criteria is introducing an additional burden, for a relatively limited safety benefit, when compared to the significant safety benefits introduced by 25.562 (a), (b) and (c)(1)(2)(3)(4)(7)(8).

EQUIVALENT SAFETY FINDING	**E-5004: Exit Configuration**
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR 25.807(d) and 25.810(a) change 14
ADVISORY MATERIAL	N/A

BACKGROUND

For an aeroplane equipped with two pairs of Type I exits and one pair of Type Ill exits, JAR 25.807(d) Change 14 allows a maximum passenger capacity of 139 passengers.

The exit configuration of the A318 consists of two pairs of non-standard floor level exits (oversized Type 1), and one pair of Type Ill overwing exits. For the two pairs of non-standard floor level exits (oversized Type I), Airbus has requested for certification of the A318 maximum passenger seating capacity; a rating of 55 passengers per pair of oversized Type I, based on A319 data.

For the A318, the forward and aft floor level exits size is:

32” wide X 73” high (unchanged A320/A321/A319 standard).

The forward and aft doors satisfy the minimum dimensions and assist means inflation time criteria of the Type C exit defined in FAR 25 Amendment 88 (i.e. 30” wide X 48” high, 10 seconds inflation time)..

An Equivalent Safety Finding to JAR 25.807(d) and 25.810(a) at Change 14 may be granted, provided that the applicable requirements of FAR 25 Amendment 88 regarding Type C Exit pairs rated for 55 passengers are met.

EQUIVALENT SAFETY FINDING:

- In accordance with A319 CRI E4001 and due to the shortened fuselage of A318, the distance between the forward door and the over wing exit, as well as the distance between the over wing exit and the aft door, are acceptable.

- Maximum passenger seating capacity of A318 has been demonstrated in accordance with NPRM 90-4 provisions (which was later adopted as FAR Amdt 88), based on A319 data for a rating of 55 passengers per each pair of oversized Type I (Type C in NPRM 90-4) exits.

EQUIVALENT SAFETY FINDING	**E-5005: Type III Overwing Emergency Exit Access**
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR 25.813(c)(1), 25.807(a)(3) change 14
ADVISORY MATERIAL	N/A

BACKGROUND

As a result of positioning the type III sill height to meet the step down requirements of JAR 25.807(a)(3) and hence preclude the need for a supplementary step outside the aircraft, the passenger seat cushion immediate adjacent to the overwing exit encroaches into the outline of the exit in the fuselage. JAR 25.813(c)(1) requires that the projected opening of the exit provided may not be obstructed and there must be no interference in opening the exit by seats, berths or other provisions for the width of a passenger seat.

The proposed design is to allow the outboard seat cushion height to reach up to 18.8” measured from cabin floor, in combination with a minimum 10” passageway leading to the exit.

The actual opening in the fuselage is however larger than the minimum, i.e. 20"x 40" rather than 20"x 36".

EQUIVALENT SAFETY FINDING

Validity of above proposal has been demonstrated by test: with a minimum access path to each Type III exit of 10”, width of the exit sill is sufficient to allow compliance with JAR 25.807(a)(3) i.e. the “step down” starts from the sill rather than from the compressed seat cushion.

Compliance with 25.813(c)(1) is considered to be achieved by equivalent safety finding on the basis that:

- there is no interference with exit operation (as demonstrated by test), provided the seat cushion height is limited to 18.8";

- whilst the seal cushion does intrude into the 'exit opening provided', this is compensated by the provision of a larger than minimum Type Ill exit size, i.e. the seat cushion line is beneath the 20" x 36" minimum exit opening.

EQUIVALENT SAFETY FINDING	E-5006: Packs off operation
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR 25.831(a)
ADVISORY MATERIAL	N/A

BACKGROUND

JAR 25.831(a) states:

"Each passenger and crew compartment must be ventilated and each crew compartment must have enough fresh air (but not less than 10 cubic feet per minute per crew member) to enable crew members to perform their duties without undue discomfort or fatigue. (See ACJ 25.831(a))"

Taking into consideration that there are some air-conditioning packs off operation periods (i.e., at take-off, no fresh air for crew members) for the Model A318, direct compliance to JAR 25.831(a) is not possible.

An equivalent safety finding may be used for showing compliance to § 25.831(a) provided the following is considered:

1. There must be a means to annunciate to the flight crew that the pressurization system (conditioned air supply) is selected off.

2. The Equivalent Safety Finding must document that the ventilation system continues to provide an acceptable environment in the passenger cabin and cockpit for the brief period when the ventilation system is not operating. The degradation of crewmember air quality must not reach the level that would cause undue discomfort and fatigue to the point that it could affect the performance of their duties.

3. Furthermore, equipment environment should be evaluated during those short periods to ensure equipment reliability and performance are not impaired. This evaluation should cover the extremes of ambient hot air temperatures in which the airplane is expected to operate.

4. In addition, the air conditioning packs-off operation is intended to be a short duration operation. Therefore, the maximum period of operation in this configuration should be defined by the applicant and specified in the AFM, along with any related operating procedures necessary to maintain compliance with the regulatory issues discussed above. An example of establishing " the maximum period of operation (short duration) for take-off', would be an operational phase beginning with turning packs off when cleared into position for take-off, and ending when packs were turned back on after take-off thrust was reduced to climb thrust or

when accomplishing the "after take-off' check list.

EQUIVALENT SAFETY FINDING

1. When Packs are selected off, an indication is given to the crew on ECAM.

2. It will be shown by analysis that the ventilation system continues to provide an acceptable environment in the passenger cabin and cockpit when the air conditioning packs are switched off for the short duration of "packs-off operation". The parameter that will be used for compliance finding will be the carbon dioxide concentration and temperature reached at the end of the "packs-off operation".

3. On A318, the electronic equipment in the avionics bay is cooled by an independent ventilation system which will be not affected by the packs off operation.

4. In the Flight Manual the take-off procedure will be amended in order to include the packs-off procedure. The AFM will indicate when the air conditioning packs are allowed to be switched off and when they need to be switched on again (in accordance with current existing SOP).

EQUIVALENT SAFETY FINDING	FCD-MULTI-01: T3 Evaluation Process
APPLICABILITY:	A318/A319/A320/A321, A330, A340, A350, A380
REQUIREMENTS:	CS FCD.425(g)
ADVISORY MATERIAL	-

1. APPLICABILITY

This ESF to CS FCD.425(g) may be applied if:
- Type specific pilot training is required for the installation of the same equipment, system or function on more than one aircraft type of the same type certificate holder.
- The training differences levels associated with the installation of this equipment, system or function on a candidate aircraft are determined as level C or D in accordance with CS-FCD initial issue.

1.1. AFFECTED CS

CS FCD.425(g)

2. Equivalent Safety Finding

In lieu of direct compliance to CS FCD.425(g), and provided that the below compensating factors are fulfilled, for the installation of the same equipment, system or function on an additional aircraft type or variant of the same type certificate holder, the validity of the T3 evaluation results for the basic aircraft may be extended to a variant of that aircraft type or to another aircraft type of the same applicant and training credits between types based on commonalities shall be granted, even if the appropriate level for training is determined as level C or D.

3. COMPENSATING FACTORS
   a. The equipment, system or function installed on a variant of the same aircraft type or another aircraft type of the same type certificate holder shall:
      - be identical; and:
      - have the same pilot interface; and
      - be operated according to the same procedures, under normal, abnormal and emergency operations; and
   b. The variant of the aircraft type or the other aircraft type from the same type certificate holder on which the equipment, system or function is installed has no influence on its functionality and the related pilot interface; and
   c. The proposed differences training and checking programmes and training devices are evaluated through a T3 evaluation in accordance with CS FCD.425(g) by the same type certificate holder; and
   d. It is excluded that a new T3 evaluation on the candidate aircraft would lead to a different result compared to the results from the original T3 evaluation performed in accordance with CS FCD.425(g).

SPECIAL CONDITION	F-GEN-01: Installation of non-rechargeable lithium batteries
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	CS 25.601, 25.863, 25.869, 25.1301, 25.1309, 25.1353(c), 25.1529, 25.1360(b)
ADVISORY MATERIAL	N/A

In lieu of the requirements of CS 25.1353(c)(1) through (c)(4), non-rechargeable lithium batteries and battery installations must comply with the following special conditions:

1. Be designed so that safe cell temperatures and pressures are maintained under all foreseeable operating conditions to preclude fire and explosion.

2. Be designed to preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

3. Not emit explosive or toxic gases in normal operation, or as a result of its failure, that may accumulate in hazardous quantities within the airplane.

4. Must meet the requirements of CS 25.863(a) through (d).

5. Not damage surrounding structure or adjacent systems, equipment or electrical wiring of the airplane from corrosive fluids or gases that may escape and that may cause a major or more severe failure condition.

6. Have provisions to prevent any hazardous effect on airplane structure or essential systems caused by the maximum amount of heat it can generate due to any failure of it or its individual cells.

7. Have a means to detect its failure and alert the flight crew in case its failure affects safe operation of the aircraft.

8. Have a means for the flight crew or maintenance personnel to determine the battery charge state if its function is required for safe operation of the airplane.

Note 1: A battery system consists of the battery and any protective, monitoring and alerting circuitry or hardware inside or outside of the battery. It also includes vents (where necessary) and packaging. For the purpose of this special condition, a battery and battery system are referred to as a battery.

Note 2: These Special Conditions apply in lieu of 25.1353(c)(1) through (c)(4) to non-rechargeable lithium battery and battery installations as follows:
- All new, changed or relocated non-rechargeable lithium battery and battery installations
- All existing non-rechargeable lithium battery installations affected by a design change, even if the battery or battery installation itself does not change (ex: change in ambient temperature or pressure environment in which the battery operates, change on the electrical load on a battery):

Section 25.1353(c)(1) through (c)(4) will remain in effect for other battery installations.
Note 3: For very small non-rechargeable lithium batteries (equal or less than 2 Watt-hour of energy), an acceptable MoC with this Special Conditions is showing these batteries compliant with Underwriters Laboratories (UL) 1642 or UL 2054

Note 4: For the purpose of SCs 7 and 8, "safe operation of the airplane" is defined as continued safe flight and landing following failures or other non-normal conditions. The following are examples of devices with batteries that are not required for continued safe flight and landing of the airplane: emergency locator transmitters, underwater locator beacons, seat belt air bag initiators and flashlights. A backup flight instrument with a non-rechargeable lithium battery is an example that would be required for safe operation of the airplane.

Note 5: Minimum Operational Performance Standards (MOPS) for Non–Rechargeable Lithium Batteries DO-227A + risk assessment at A/C level (limited to SC 3, 4, 5 & 6) is an acceptable MoC to the SC's 1 to 6 contained in this CRI. Alternative Means of Compliance can be proposed by the applicant to show compliance with the SC's included in this CRI and agreed by EASA in a case by case basis.

SPECIAL CONDITION	**F-MULTI-04: Rechargeable Lithium Ion batteries installation**
APPLICABILITY:	A318 / A319 / A320 / A321 all models
REQUIREMENTS:	JAR/CS1 25.601, JAR/CS1 25.863, JAR/CS1 25.1353(c)
ADVISORY MATERIAL	N/A

Identification of Issue

Lithium-Ion (Li-Ion) / Lithium Polymer (Li-Po) batteries, intended to be used for storage on the aeroplane within this project, have specific failure and operational characteristics, and maintenance requirements that differ significantly from that of the nickel cadmium (Ni-Cd) and lead acid rechargeable batteries currently covered by JAR/CS1 -25.

There is very limited experience regarding the use of rechargeable Li-Batteries in aviation applications. However, other users of this technology ranging from wireless telephone manufacturers to the electric vehicle industry have noted significant safety issues regarding the use of these types of batteries.

Therefore, on the basis of Part 21, 21A.16B, the proposed Special Condition is to establish appropriate airworthiness standards for Li-Battery installations on Large Aeroplanes and to ensure, as required by JAR/CS1 25.601, that these battery installations do not have hazardous or unreliable design characteristics.

The current requirements governing the installation of batteries in Large Aeroplanes are covered under (JAR/CS1) 25.1353(c). Requirements from (JAR/CS1) 25.1353(c) are essentially unchanged from initial JAR code. An increase in incidents involving battery fires and failures that accompanied the increased use of Nickel-Cadmium (Ni-Cd) batteries in Large Aeroplanes resulted in additional rulemaking affecting the requirements for small and large aeroplanes. The result of these rulemaking activities on the battery requirements for large aeroplanes was the addition of JAR/CS1 25.1353(c)(5)(6) which apply only to Ni-Cd battery installations.

The proposed use of Li-Batteries has prompted EASA to review the adequacy of the existing battery requirements with respect to that chemistry. As the result of this review, EASA has determined that the existing requirements do not adequately address several failure, operational, and maintenance characteristics of Li-Batteries that could affect safety and reliability of those battery installations.

Some of the significant safety issues regarding the use of these types of batteries, noted by the other users of this technology, are described in the following paragraphs:

<u>Overcharging</u>
Li-Batteries in general are significantly more susceptible to internal failures that can result in self-sustaining increases in temperature and pressure (i.e. thermal runaway) than their Ni-Cd and lead-acid counterparts. This is especially true for overcharging which causes heating and destabilisation of the components of the cell which can cause the formation of highly unstable metallic lithium which can ignite resulting in a self-sustaining fire or explosion. Certain types of Li batteries pose a potential safety problem because of the instability and flammability of the

organic electrolyte employed by the cells of those batteries. Due to the higher amount of electrolyte in larger batteries, the severity of thermal runaway increases with increasing battery capacity.

Overdischarging
Discharge of some versions of the Li cell beyond a certain voltage can cause corrosion of the electrodes of the cell resulting in loss of battery capacity that cannot be reversed by recharging. This loss of capacity may not be detected by the simple voltage measurements commonly available to flight crews as a means of checking battery status, a problem shared with Ni-Cd batteries.

Flammability of Cell Components
Unlike Ni-Cd and lead-acid cells, some types of Li cells employ, in a liquid state, electrolytes that are known to be flammable. This material can serve as a source of fuel for an external fire in the event of a breach of the cell container.

The proposed Special Condition adopts the following requirements as a means of addressing these concerns:

- Inclusion of those sub-paragraphs of JAR/CS1 25.1353 that are applicable to Li batteries with adaptation to the perceived risk posed by those batteries.
- Inclusion of the flammable fluid fire protection requirements of JAR/CS1 25.863. In the past, this requirement was not applied to the batteries of Large Aeroplanes since the electrolytes used in lead-acid and Ni-Cd batteries are not considered to be flammable.
- Addition of new requirements to address the potential hazards of overcharging and over discharging that are unique to Li battery designs.
- Addition of maintenance requirements to ensure that batteries used as spares are maintained in an appropriate state of charge (SOC).

In the absence of relevant experience, the Special condition proposed at the time is generic in nature and does not differentiate between different types of lithium chemistry, battery capacity or intrinsic safety features of the batteries used. It is envisaged that some adaptation will need to be done in the future to tailor the Li battery requirements to those different characteristics.

Special Condition

In lieu of the requirements of JAR/CS1 25.1353(c) the following applies:

(a) Lithium batteries and battery installations must be designed and installed as follows:

1- Safe cell temperatures and pressures must be maintained during any probable charging or discharging condition, or during any failure of the charging or battery monitoring system not shown to be extremely remote. The Li battery installation must be designed to preclude explosion in the event of those failures.

2- Li batteries must be designed to preclude the occurrence of self-sustaining, uncontrolled increases in temperature or pressure.

3- No explosive or toxic gasses emitted by any Li battery in normal operation or as the result of any failure of the battery charging or monitoring system, or battery installation not shown to be extremely remote, may accumulate in hazardous quantities within the aeroplane.

4- Li battery installations must meet the requirements of JAR/CS[1] 25.863(a) through (d).
5- No corrosive fluids or gasses that may escape from any Li battery may damage surrounding aeroplane structures or adjacent essential equipment.
6- Each Li battery installation must have provisions to prevent any hazardous effect on structure or essential systems that may be caused by the maximum amount of heat the battery can generate during a short circuit of the battery or of its individual cells.
7- Li battery installations must have a system to control the charging rate of the battery automatically so as to prevent battery overheating or overcharging, and,
   i. A battery temperature sensing and over-temperature warning system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition or,
   ii. A battery failure sensing and warning system with a means for automatically disconnecting the battery from its charging source in the event of battery failure.
8- Any Li battery installation whose function is required for safe operation of the aeroplane, must incorporate a monitoring and warning feature that will provide an indication to the appropriate flight crewmembers, whenever the capacity and SOC of the batteries have fallen below levels considered acceptable for dispatch of the aeroplane.
9- The Instructions for Continued Airworthiness must contain maintenance procedures for Lithium-ion batteries in spares storage to prevent the replacement of batteries whose function is required for safe operation of the aeroplane, with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at low SOC.

(b) Compliance with the requirements of this Special Condition must be shown by test or, with the concurrence of EASA, by analysis.

Minimum Operational Performance Standards (MOPS) for Rechargeable Lithium Batteries DO- 311A is an acceptable means of compliance with these requirements.

Alternative Means of Compliance can be proposed by the applicant to show compliance with the SC.

[1] *The requirements/ certification specifications referenced in the Special Condition are applied at the change/ amendment of the original type certification basis of the basic aircraft as defined in the relevant EASA TCDS.*

SPECIAL CONDITION	F-1: Stalling and Scheduled Operating Speeds
APPLICABILITY:	A320 Family
REQUIREMENTS:	JAR 25.103; 25.107; 25.121, 25.125, 25.201, 25.203, 25.205, 25.207
ADVISORY MATERIAL:	N/A

1 - Definitions:

This Special Condition is concerned with novel features of the A320 family and uses terminology that does not appear in JAR 25.

The following definitions shall apply:

- *High incidence protection system*: A system that operates directly and automatically on the aeroplane's flying controls to limit the maximum incidence that can be attained to a value below that at which an aerodynamic stall would occur.

- *Alpha-floor system*: A system that automatically increases thrust on the operating engines when incidence increases through a particular value.

- *Alpha-limit*: The maximum steady incidence at which the aeroplane stabilises with the high incidence protection system operating and the longitudinal control held on its aft stop).

- V_{min}: The minimum steady flight speed in the aeroplane configuration under consideration with the high incidence protection system operating. See section 3 of this Special Condition.

- $V_{min\ 1g}$: V Min corrected to 1g conditions. See section 3 of this Special Condition.

- V_{S1g}: The minimum speed in the configuration under consideration at which the aeroplane can develop a lift equal to the weight of the aeroplane with engines set to idle thrust. This speed may be demonstrated with the high incidence system adjusted to permit a higher incidence to be achieved, than is possible with the normal production system.

2 - Capability and Reliability of the High Incidence Protection System

The paragraphs of JAR 25 quoted in reference (25.103, 25.107, 25.121, 25.125, 25.201, 25.203, 25.205 and 25.207) may be amended in accordance with this Special Condition provided that acceptable capability and reliability of the high incidence protection system can be established by flight test, simulation, and analysis as appropriate. The capability and reliability required are as follows:

1. It shall not be possible during pilot induced manoeuvres to encounter a stall and handling characteristics shall be acceptable, as required by section 6 of this Special Condition.

2. The aeroplane shall be protected against stalling due to the effects of windshears and gusts at low speeds as required by section 7 of this Special Condition.

3. The ability of the high incidence protection system to accommodate any reduction in stalling incidence resulting from residual ice must be verified.

4. The reliability of the system and the effects of failures must be acceptable in accordance with JAR 25.1309.

3 - Minimum Steady Flight Speed and One G Stall Speed.

Delete existing JAR 25.103 and replace as follows:

JAR 25.103: Minimum steady flight speed and one g stall speed

(a) The minimum steady flight speed, V_{min}, must be determined with:

(1) The high incidence protection system operating normally.

(2) Idle thrust and alpha-floor system inhibited;

(3) All combinations of flap settings and landing gear position for which V_{min} is required to be determined.

(4) The weight used when V_{S1G} is being used as a factor to determine compliance with a required performance standard;

(5) The most unfavourable centre of gravity allowable; and

(6) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system

(b) The minimum steady flight speed is the final stabilised calibrated airspeed obtained when the aeroplane is decelerated at an entry rate not exceeding 1 knot per second until the longitudinal control is on its stop.

(c) The one-g minimum steady flight speed, V_{min1g}, is the minimum calibrated airspeed at which the aeroplane can develop a lift force (normal to flight path) equal to its weight, whilst at an angle of attack not greater than that at which the minimum steady flight speed of sub-paragraph (b) was determined.

(d) The one-g stall speed, V_{S1G}, must be determined with:

(1) Idle thrust and Alpha-floor system inhibited;

(2) All combinations of flap settings and landing gear position for which V_{S1G} is required to be determined;

(3) The weight used when V_{S1G} is being used as a factor to determine compliance with a required performance standard;

(4) The most unfavourable centre of gravity allowable; and

(5) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

4 - Scheduled Operating Speeds

4.1 Take-off Speeds

Delete existing JAR 25.107(b) and replace as follows:

JAR 25.107(b): V2 in terms of calibrated airspeed, may not be less than:
(1) 1.13 V_{S1G}.
(2) 1.10 times V_{MC} established under JAR 25.149.
(3) A speed that provides the manoeuvre capability specified in paragraph 4.4.

4.2 Climb one engine inoperative

In JAR 25.121(c) Final Take-off amend "at not less than 1.25 V_S" to read "at not less than the greater of 1.18 V_{S1G} and a speed that provides the manoeuvre capability specified in paragraph 4.4, with...".

4.3 Landing Speeds

In JAR 25.125 the value of V_{REF} used for landing performance determination must not be less than:

(1) 1.23 V_{S1G};
(2) V_{MCL} established under JAR 25.149(f), (See ACJ 25.125(a)(2));
(3) A speed that provides the manoeuvre capability specified in paragraph 4.4.

4.4 Manoeuvrability at operating speeds

The manoeuvring capabilities in a constant speed coordinated tum at forward center of gravity, as specified in the table below, must be free of stall warning (if any) or other characteristics which might interfere with normal manoeuvring.

CONFIGURATION	SPEED	MANOEUVERING BANK ANGLE IN A COORDINATED TURN	THRUST / POWER SETTING
TAKE-OFF	V_2	30°	ASYMMETRIC WAT-LIMITED (1)
TAKE-OFF	V_2 + (xx) (2)	40°	ALL ENGINES CLIMB (3)
EN-ROUTE	V_{FTO}	40°	ASYMMETRIC WAT-LIMITED (1)
LANDING	V_{REF}	40°	SYMMETRIC FOR A -3° FLIGHT PATH ANGLE

<u>NOTES</u>:

(1) A combination of weight, altitude and temperature (WAT) such that the thrust or power setting produces the minimum climb gradient specified in JAR 25.121 for the flight condition.

(2) Airspeed approved for all engines initial climb.

(3) That thrust or power setting which, in the event of failure of the critical engine and without any crew action to adjust the thrust or power of the remaining engines, would result in the thrust or power specified for the take-off condition at V2, or any lesser thrust or power setting that is used for all engines-operating initial climb.

5 - Stall Warning

5.1 Normal operation

If the conditions of paragraph 2 are satisfied, equivalent safety to the intent of JAR 25.207, Stall Warning, shall be considered to have been met without provision of an additional, unique warning device.

5.2 Failures cases

Following failures of the high incidence protection system, not shown to be extremely improbable, such that capability of the system no longer satisfies items 1, 2 and 3 of paragraph 2 stall warning must be provided in accordance with JAR 25.207(a) and (b).

6 - Handling Characteristics at High Incidence

6.1 High incidence Handling Demonstrations.

Delete existing JAR 25.201 and replace as follows:

JAR 25.201: High incidence handling demonstration.

(a) Manoeuvres to the limit of the longitudinal control, in the nose up sense, must be demonstrated in straight flight and in 30° banked turns with:

(1) The high incidence protection system operating normally.

(2) Initial power conditions of:
(i) Power off
(ii) The power necessary to maintain level flight at $1.5V_{S1G}$, where V_{S1G} corresponds to the one g stall speed with flaps in approach position, the landing gear retracted and maximum landing weight.

(3) Alpha-floor system operating normally unless more severe conditions are achieved with inhibited alpha floor.

(4) Flaps, landing gear and deceleration devices in any likely combination of positions.

(5) Representative weights within the range for which certification is requested; and

(6) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

(b) The following procedures must be used to show compliance with JAR 25.203.(*)

(1) Starting at a speed sufficiently above the minimum steady flight speed to ensure

that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction does not exceed one knot per second until the control reaches the stop.

(2) The longitudinal control must be maintained at the stop until the aeroplane has reached a stabilised flight condition and must then be recovered by normal recovery techniques.

(3) The requirements for turning flight manoeuvre demonstrations must also be met with accelerated rates of entry to the incidence limit, up to the maximum rate achievable.

(*) as amended by this special condition

6.2 Characteristics In High Incidence Manoeuvres

Delete existing JAR 25.203 and the associated ACJ. Replace as follows:

JAR 25.203: Characteristics in High Incidence Manoeuvres.

(a) Throughout manoeuvres with a rate of deceleration of no more than 1 knot per second, both in straight flight and in 30° banked tums, the aeroplane's characteristics shall be as follows:

(1) There shall not be any abnormal nose-up pitching.

(2) There shall not be any uncommanded nose-down pitching, which would be indicative of stall. However reasonable attitude changes associated with stabilising the incidence at Alpha limit as the longitudinal control reaches the stop would be acceptable.

(3) There shall not be any uncommanded lateral or directional motion and the pilot must retain good lateral and directional control, by conventional use of the controls, throughout the manoeuvre.

(4) The aeroplane must not exhibit severe buffeting of a magnitude and severity that would act as a deterrent to completing the manoeuvre specified in JAR 25.201(a)*.

(*) as amended by this Special Condition

(b) In manoeuvres with increased rates of deceleration some degradation of characteristics is acceptable, associated with a transient excursion beyond the stabilised Alpha-limit. However the aeroplane must not exhibit dangerous characteristics or characteristics that would deter the pilot from holding the longitudinal control on the stop for a period of time appropriate to the manoeuvre.

(c) It must always be possible to reduce incidence by conventional use of the controls.

(d) The rate at which the aeroplane can be manoeuvred from trim speeds associated with scheduled operating speeds such as V_2 and V_{REF} up to Alpha-limit shall not be unduly damped or be significantly slower than can be achieved on conventionally controlled transport aeroplanes.

6.3 High Incidence Handling with the Critical Engine Inoperative

Delete existing JAR 25.205 and replace as follows:

JAR 25.205: High incidence handling-critical engine inoperative

(a) It must be possible to safely recover from a manoeuvre to Alpha-limit with the critical engine inoperative:

(1) With the high incidence protection system operating normally;

(2) Without applying power to the inoperative engine;

(3) With high lift devices and landing gear retracted;

(4) With the operating engine at up to 75% of maximum continuous power, or up to power at which the wings can be held level with use of maximum control travel (prior to operation of the alpha-floor system) whichever is less; and

(5) With the alpha-floor system working normally.

(b) The operating engine may be throttled back during the recovery from the manoeuvre to Alpha-limit.

7 – Atmospheric Disturbances

Operation of the high incidence protection system must not adversely affect aircraft control during expected levels of atmospheric disturbances, nor impede the application of recovery procedures in case of windshear.

8 - Speeds Associated with Other Requirements

JAR 25 specifies requirements that have to be met at speeds quoted as factors of the stall speed V_S. For the A320 family, V_S will be interpreted in each paragraph of the requirements according to the table of APPENDIX 1.

9 - Alpha floor

The Alpha-floor setting must be such that the aircraft can be flown at normal landing operational speeds and manoeuvred up to bank angles consistent with the flight phase without triggering Alpha-floor.

In addition there must be no alpha-floor triggering unless appropriate when the aircraft is flown in usual operational manoeuvres and in turbulence.

APPENDIX 1 TO SPECIAL CONDITION

1 - Replace JAR 25.21 paragraph (b) by:

(b) The flying qualities will be evaluated at the most unfavourable CG position.

2 - In lieu of JAR 25.119 paragraph (b):

(b) A climb speed which is:

(1) not less than
i) 1.08 V_{S1G} for aeroplanes with four engines on which the application of power results in significant reduction in stalling speed; or
ii) 1.13 V_{S1G} for all other aeroplanes

(2) not less than V_{MCL}; and

(3) not more than the greater of V_{REF} and V_{MCL}

3 - Replace JAR 25.121 paragraph (d) by:

(d) Discontinued approach - In a configuration in which V_{S1G} does not exceed 110% of the V_{S1G} for the related all-engines-operating landing configuration, the steady gradient may not be less than 2.1% for two-engined aeroplanes, and 2.7% for four-engines aeroplanes with:

(1) The critical engine inoperative, the remaining engines at the available take-off thrust;

(2) The maximum landing weight; and

(3) A climb speed established in connexion with normal landing procedures; but not exceeding 1.41 V_{S1G}.

4 - Replace the speeds V_S mentioned in the following JAR 25 requirements as follows:

JAR 25.145 (a):	V_{min} in lieu of V_S
JAR 25.145 (b) (1):	1.32 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.145 (b) (4):	1.32 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.145 (b) (6):	1.32 V_{S1G} in lieu of 1.4 V_{S1} Vmin in lieu of 1.1 V_{S1} 1.6 V_{S1G} in lieu of 1.7 V_{S1}
JAR. 25.145 (c):	1.13 V_{S1G} in lieu of 1.2 V_{S1}
JAR 25.147 (a):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.147 (a) (2):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.147 (c):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.147 (d):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.149 (c):	1.13 V_{S1G} in lieu of 1.2 V_{S1}
JAR 25.161 (b):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.161 (c) (1):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.161 (c) (2):	1.3 V_{S1G} in lieu of 1.4 V_{S1}
JAR 25.161 (c) (3):	1.3 V_{S1G} in lieu of 1.4 V_{S1}

JAR 25.161 (d): $1.3\ V_{S1G}$ in lieu of $1.4\ V_{S1}$.

JAR 25.175 (a): not applicable, see SC F-4

JAR 25.175 (d): not applicable, see SC F-4

JAR 25.177 (a): $1.13\ V_{S1G}$ in lieu of $1.2\ V_{S1}$

JAR 25.177 (b) (1): $1.13\ V_{S1G}$ to $1.23\ V_{S1G}$ in lieu of $1.2\ V_{S1}$ to $1.3\ V_{S1}$

JAR 25.177 (b) (2): $1.13\ V_{S1G}$ to $1.23\ V_{S1G}$ in lieu of $1.2\ V_{S1}$ to $1.3\ V_{S1}$

JAR 25.177(b) (3): $1.23\ V_{S1G}$ in lieu of $1.3\ V_{S1}$

JAR 25.233 (a): $0.2\ V_{S1G}$ in lieu of $0.2\ V_{S0}$

JAR 25.237: $0.94\ V_{S1G}$ in lieu of V_{S0}

JAR 25.735 (f) (2): $0.94\ V_{S1G}$ in lieu of V_{S0}

JAR 25.773 (b) (1) (i): $1.5\ V_{S1G}$ in lieu of $1.6\ V_{S1}$

JAR 25.1323(c) (1) (i): $1.23\ V_{S1G}$ in lieu of $1.3\ V_{S1}$.

JAR 25.1323(c) (1) (ii): $1.23\ V_{S1G}$ in lieu of $1.3\ V_{S0}$

JAR 25.1323 (c) (2): "From $1.23\ V_{S1G}$ to V_{min}" in lieu of "1.3 Vs to stall warning speed" and "speeds below V_{min}" in lieu of "speeds below stall warning"

JAR 25.1325 (e): replace $1.3\ V_{S0}$ by $1.3\text{x}0.94\ V_{S1G}$
$1.8\ V_{S1}$ by 1.Bx0.94 V_{S1G}.

SPECIAL CONDITION	F-3: Side Stick Maximum Forces for Temporary and Prolonged Application
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.143(c)
ADVISORY MATERIAL:	ACJ 25.143(c)

BACKGROUND

Due to the use on A320 of a side stick, limits forces for temporary and prolonged application in pitch and roll given in JAR 25.143(c) are not valid as they are only relative to conventional controls (ACJ 25.143(c)).

SPECIAL CONDITION

The maximum forces applicable to a side-stick which is controlled by one hand are:

Values in pound of force as applied to the side stick	in Pitch	In Roll
For temporary application	25 lb	7 lb
For prolonged application	8 lb	5 lb

SPECIAL CONDITION	**F-4: Static Longitudinal Stability**
APPLICABILITY:	TC: A319/A320/A321
REQUIREMENTS:	JAR 25.171, 25.173, 25.175
ADVISORY MATERIAL:	N/A

BACKGROUND

The longitudinal control laws proposed for A320 provide a neutral stability within the normal flight envelope. Therefore the A/C definition does not literally comply with the static longitudinal stability requirements of JAR 25.171, 173 and 175.

SPECIAL CONDITION

1. Analysis of the requirement:

The aim of the requirement is to ensure that when the aircraft is disturbed from a steady longitudinal flight condition, it tends to return close to the conditions from which it has been disturbed.

2. Aircraft characteristics

In order to comply with the above objective, the EFCS control laws have been designed to provide outside the normal flight envelope a positive static longitudinal stability with a stable slope of the stick force versus speed curve of not less than 2/3 pound per 6 kt.

These characteristics ensure a positive tendency to return inside the normal flight envelope even with a neutral stability inside this normal envelope.

3. Conclusion

The principle of operation of the longitudinal control laws proposed for the A320 is acceptable taking into account the high speed and low speed protection, as providing a level of safety equivalent to that intended by the regulation.

SPECIAL CONDITION	**F-8: Load factor limitation law – stick force per G**
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	JAR 25.143(f)
ADVISORY MATERIAL:	N/A

BACKGROUND

Control laws proposed on A320 are such that there is no stick force per "g" in a stabilized turn for bank angles lower than 33 o. This is in disagreement with the letter of the JAR 25.143(f) requirement.

The objectives of JAR 25.143(f) are clearly stated as follows:

a) "stick force to attain load factors likely to be reached in operation must not be excessive with regard to the need for manoeuvrability".
b) "stick force to reach the limit structural load must not be so small that this load factor can easily be reached inadvertently".
c) Variation of stick force with normal load factor must be such that it might not lead to over control.

SPECIAL CONDITION

Add new paragraph 25.143 (h):

In the absence of other limiting factors:

1) The positive limiting load factor must not be less than 2.5g (2.0g with high lift devices extended) for the EFCS normal state.
2) The negative limiting load factor must be equal to or more negative than minus 1.0g (0.0g with high lift devices extended) for the EFCS normal state.

SPECIAL CONDITION	**F-9: Dual control system**
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	JAR 25.671
ADVISORY MATERIAL:	N/A

Add to JAR 25.671:

The electronic side stick controller coupling design must provide for corrective and/or overriding control inputs by either pilot. When annunciation of controller is provided, it must not be confusing to the flight crew.

SPECIAL CONDITION	F-10: Accelerate-stop distances
APPLICABILITY:	A321
REQUIREMENTS:	JAR 25.109, 25.113,25.735
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus Industrie asked the JAA to use as a Special Condition the most advanced draft of NPA 25B-244 to determine the accelerate-stop distances, take-off distances and braking performance.

Also, Airbus Industrie is allowed to take benefit of any changes that would occur from the JAA/FAA rulemaking process for forthcoming A321 models and retroactivity for A321-111/-112/-131 models.

SPECIAL CONDITION (NPA 25B-244)

1 PROPOSED AMENDMENTS TO JAR 1.

1.1 Add definitions of "Take-off decision speed" and "Screen height" to JAR 1.1 as follows:

"Take-off decision speed" means a speed in the take off at which, if the pilot activates the first deceleration device (spoilers, brakes, throttles, etc.) at this speed, the aeroplane can be stopped within the accelerate-stop distance and, alternatively, if the take-off is continued beyond this speed with the critical engine failed at V_{EF}, the aeroplane can achieve the take-off screen height within the take-off distance.

"Screen height" means the height of an imaginary screen which the aeroplane would just clear when taking off or landing in an unbanked attitude with landing gear extended.

1.2 Add a definition of the abbreviation VEF to JAR 1.2 as follows:

"V_{EF}" means the speed at which the critical engine is assumed to fail during take-off.

2. PROPOSED AMENDMENTS TO JAR 25

2.1 Amendment to JAR 25.101 General

Add a new sub-paragraph (i) to read as follows:

(i)The accelerate-stop and landing distances prescribed in JAR 25.109 and 25.125, respectively, must be determined with all the aircraft brake assemblies on the fully worn limit of their allowable wear range.

2.2 Amendment to JAR 25.105: Take-off

Amend sub-paragraph (c) to read as follows:

(c) The take-off data must be based on smooth, dry and wet, hard-surfaced runways.

2.3 Amendment to JAR 25.109: Accelerate-stop distance

Amend sub-paragraph (a), add a new sub-paragraph (b), re-designate existing (b) as sub-paragraph (c), add a new sub-paragraph (d) and re-designate existing sub-paragraph (c) and (d) as (e) and (f) respectively. JAR 25.109 would thus read as follows

JAR 25.109 Accelerate-stop distance.

(a) The accelerate-stop distance on a dry runway is the greater of the following distances:

(1) The sum of the distances necessary to-

(i) Accelerate the aeroplane from a standing start with all engines operating to V_{EF} for take-off from a dry runway;

(ii) Accelerate the aeroplane from V_{EF} to V_1, assuming the critical engine fails at V_{EF}; and

(iii) Come to a full stop on a dry runway from the point reached at the end of the acceleration period prescribed in sub-paragraph (a)(1)(ii) of this paragraph, assuming that the pilot does not apply any means to retard the aeroplane until that point is reached; plus

(iv) A distance equivalent to 2 seconds at V_1 for take-off from a dry runway.

(2) The sum of the distances necessary to -

(i) Accelerate the aeroplane from a standing start with all engines operation to V_1 for take-off from a dry runway; and

(ii) Come to a full stop on a dry runway from the point reached at the end of the acceleration period prescribed in sub-paragraph (a)(2)(i) of this paragraph, assuming that the pilot does not apply any means to retard the aeroplane until that point is reached; plus

(iii) A distance equivalent to 2 seconds at V_1 for take-off from a dry runway.

(b) The accelerate-stop distance on a wet runway is the greater of the following distances:

(1) The accelerate-stop distance on a dry runway determined in accordance with sub-paragraph (a) of this paragraph.

(2) The accelerate-stop distance determined in accordance with sub-paragraph (a) of this paragraph, except that the runway is wet and the corresponding values of V_{EF} and V_1 are used. The wet runway stopping requirements of this paragraph must be determined assuming a braking coefficient of friction equal to one half the dry runway braking coefficient determined in meeting the requirements of sub-paragraph (a) of this paragraph, unless a higher wet runway braking coefficient of friction has been demonstrated (See ACJ 25.109(b)).

(c) (As existing sub-paragraph (b)).

(d) The effects of available reverse thrust-

(1) may not be included as an additional means of deceleration when determining the accelerate-stop distance on a dry runway, and

(2) may be included as an additional means of deceleration using recommended reverse thrust procedures when determining the accelerate-stop distance on a wet runway, provided the requirements of sub-paragraph (c) of this paragraph are met.

(e) (As existing sub-paragraph (c)).

(f) (As existing sub-paragraph (d)).

2.4 ACJ 25.109 (b)

Add a new ACJ 25.109(b) to read as follows:

ACJ 25.109(b) Accelerate-stop distance (Acceptable Means of Compliance)

[See Jar 25.109(b)]

The means of demonstrating a wet braking coefficient of friction greater than one half of the dry value shall be agreed with the Authority. It should be determined whether the demonstrated performance is applicable to the full range of wet runway surface conditions that are expected to be encountered in service. Alternatively, the use of performance based on a braking coefficient of friction greater than one half of the dry value shall be restricted to specified runways and/or to the provision and maintenance of a specified runway surface condition.

2.5 Amendment to JAR 25.113: Take-off distance and take-off run.

Amend sub-paragraph (a), add a new sub-paragraph (b) and amend existing sub-paragraph (b) and redesignate it as (c). JAR 25.113 would then read as follows:

JAR 25.113 Take-off distance and take-off run.

(a) Take-off distance on a dry runway is the greater of:

(1) The horizontal distance along the take-off path from the start of the take-off to the point at which the aeroplane is 35 ft above the take-off surface, determined under JAR 25.111 for a dry runway; or

(2) (As existing sub-paragraph (a)(2))

(b) Take-off distance on a wet runway is the greater of:

(1) The take-off distance on a dry runway determined in accordance with sub-paragraph (a) of this paragraph; or

(2) The horizontal distance along the take-off path from the start of the take-off to the point at which the aeroplane is 15 ft above the take-off surface, determined under JAR 25.111 for a wet runway; or

(3) (As existing sub-paragraph (a)(2))

(c) If take-off distance includes a clearway, the take-off run is the greater of:

(1) The horizontal distance along the take-off path from the start of the take-off to a point equidistant between the point at which VLOF is reached and the point at which the aeroplane is 35 ft above the take-off surface, as determined under JAR 25.111, except that, in the case of take-off on a wet runway, this distance need not be greater than the horizontal distance determined in accordance with sub-paragraphs (b)(1) and (b)(2) of this paragraph.

(2) (As existing sub-paragraph (b)(2)).

2.6 Amendment to JAR 25.115

Amend sub-paragraph (a) to read as follows:

JAR 25.115: Take-off flight path.

(a) The take-off flight path shall be considered to begin 35 ft above the take-off surface at the end of the take-off distance determined in accordance with JAR 25.113(a) or (b).

2.7 Amendment to JAR 25.735: Brakes.

Amend sub-paragraphs (f) and (h), add a new sub paragraph (i) and redesignate existing sub-paragraph (i) as (j). Jar 25.735 (f) though (j) would then read as follows:

(f) The design landing brake kinetic energy capacity rating of each main wheel-brake assembly that is on the fully worn limit of its allowable wear range may not be less than the kinetic absorption requirements determined under either of the following methods:

(1) (Unchanged)

(2) (Unchanged)

(g) (Unchanged)

(h) The rejected take-off brake kinetic energy capacity rating of each main wheel-brake assembly that is on the fully worn limit of its allowable wear range may not be less than the kinetic energy absorption requirements under either of the following methods:

(1) (Unchanged)

(2) (Unchanged)

(i) In addition, a flight test demonstration of the maximum kinetic energy rejected take-off shall be conducted with no more than 10% of the allowable brake wear range remaining.

(j) (As existing sub-paragraph (i))

2.8 Amendment to JAR 25 X 1591: Supplementary performance information

2.8.1. Delete the words "wet and" on the 6th line of sub-paragraph (a).

2.8.2. Delete "wet/" from the 3rd and 6th lines of subparagraph (b)

2.8.3. Delete sub-paragraph (c)(1) and combine the introduction to sub-paragraph (c) with (c)(2) to read as follows:

(c) Supplementary performance information for runways contaminated with standing water, slush, loose snow, compacted snow or ice must be furnished. Information on the effect of runway contaminants …performance information of JAR 25.1587.

2.8.4. Amend sub-paragraph (d) to read as follows:

(d) The information required by sub-paragraph (a) of this paragraph may be established by calculation or by testing.

2.9 Amendments to AMJ 25 X 1591

2.9.1. Delete the words "for Take-off from Wet Runways and" from the title.

2.9.2. Delete the words "take-off performance information for wet runways and" from the 2nd line of paragraph 1.

2.9.3. Delete the opening words of sub-paragraph 3.1 "Take-off performance information for wet runways and".

2.9.4. Delete the whole of sub-paragraph 3.2.

2.9.5. Delete "wet/" from the 3rd line of sub-paragraph 6a.

SPECIAL CONDITION	F-11: Accelerate-stop distances and related performance
APPLICABILITY:	TC: A318, A319, A320, A321 Post-TC: A320-200 series with OCTOPUS AFM
REQUIREMENTS:	JAR 25.101, 25.105, 25.109, 25.113, 25.115, 25.735, 25x1591 at Change 13;
ADVISORY MATERIAL:	N/A

BACKGROUND

Amendment to the TC basis for the A320 Family AFM accelerate stop distances and related matters to permit use of the most advanced version of NPA 25B, D, G-244 but taking into account wet runway braking agreements reached between AIA, AECMA, FAA and JAA in the development of the final rule.

SPECIAL CONDITION

Accelerate-stop distances and related performance.

1. Amendments to JAR 1.

1.1. Amend the definition of V_1 in JAR 1.2 as follows:

"V_1" means the maximum speed in the take-off at which the pilot must take the first action (eg. apply brakes, reduce thrust, deploy speed brakes) to stop the aeroplane within the accelerate-stop distance. V_1 also means the minimum speed in the take-off, following a failure of the critical engine at V_{EF} at which the pilot can continue the take-off and achieve the required height above the take-off surface within the take-off distance.

1.2. Add a definition of the abbreviation V_{EF} to JAR 1.2 as follows:

"V_{EF}" means the speed at which the critical engine is assumed to fail during take-off.

2. Amendment to JAR 25.101: General.

Amend sub-paragraph (i) to read as follows:

(i) The accelerate-stop and landing distances prescribed in JAR 25.109 and 25.125, respectively, must be determined with all the aircraft brake assemblies at the fully worn limit of their allowable wear range.

3. Amendment to JAR 25.105 Take-off.

Amend sub-paragraph (c) to read as follows:

(c) The take-off data must be based on:

(1) Smooth, dry and wet, hard-surfaced runways and, optionally;

(2) Grooved and/or porous friction course wet, hard-surfaced runways;

4. Amendment to JAR 25.109; Accelerate-stop distance

Amend JAR 25.109 to read as follows:

JAR 25.109 Accelerate-stop distances

(a) The accelerate-stop distance on a dry runway is the greater of the following distances:

(1) The sum of the distances necessary to:

(i) Accelerate the aeroplane from a standing start with all engines operating to V_{EF} for take-off from a dry runway.

(ii) Accelerate the aeroplane from V_{EF} to V_1 and subsequently to the highest speed reached, assuming the critical engine fails at V_{EF} and

(iii) Come to a full stop on a dry runway from the point reached at the end of the acceleration period prescribed in sub-paragraph (a)(1)(ii) of this paragraph, assuming that the pilot does not apply any means to retard the aeroplane until V_1 is reached; plus

(iv) A distance equivalent to 2 seconds at V_1 for take-off from a dry runway.

(2) The sum of the distance necessary to:

(i) Accelerate the aeroplane from a standing start with all engines operating to V_1 for take-off from a dry runway and subsequently to the highest speed reached and

(ii) Come to a full stop on a dry runway from the point reached at the end of the acceleration period prescribed in sub-paragraph (a)(2)(i) of this paragraph, assuming that the pilot does not apply any means to retard the aeroplane until V_1 is reached, and that all engines are still operating; plus

(iii) A distance equivalent to 2 seconds at V_1 for take-off from a dry runway.

(b) The accelerate-stop distance on a wet runway is the greater of the following distances;

(1) the accelerate stop-distance on a dry runway determined in accordance with sub-paragraph (a) of this: or

(2) The accelerate-stop distance determined in accordance with sub- paragraph (a) of this paragraph, except that the runway is wet and the corresponding wet runway values of V_{EF} and V_1 are used. The wet runway stopping requirements of this paragraph must be determined assuming for smooth wet runways, the braking coefficient of friction· versus speed determined using the standard given in Appendix 2, and not exceeding the braking coefficient of friction determined in meeting the requirements of Sec. 25.101 (i) and sub-paragraph (a) of this section. Optionally, for acceptably maintained grooved or porous friction course runways, a braking coefficient of friction not more than 70% of the demonstrated dry-runway, anti-skid controlled braking coefficient determined in meeting the requirements of Sec. 25.101 (i) and sub-paragraph (a) of this section.

Alternatively for acceptably maintained grooved or porous friction course runways, the braking coefficient of friction versus speed determined using the standard, given in Appendix 2 and meeting the requirements of Sec. 25.101 (i) and sub-paragraph (a) of this section.

(c) Except as provided in sub-paragraph (d)(1) of this paragraph, means other than wheel brakes may be used to determine the accelerate-stop distance if that means:

(1) is safe and reliable

(2) is used so that consistent results can be expected under normal operating conditions; and

(3) is such that exceptional skill is not required to control the aeroplane.

(d) The effects of available reverse thrust:

(1) Shall not be included as an additional means of deceleration when determining the accelerate-stop distance on a dry runway and

(2) May be included as an additional means of deceleration using recommended reverse thrust procedures when determining the accelerate-stop distance on a wet runway, provided the requirements of sub-paragraph (c) of this paragraph are met.

(e) The landing gear must remain extended throughout the accelerate-stop distance.

(f) If the accelerate-stop distance includes a stopway with surface characteristics substantially different from those of the runway, the take-off data must include operational correction factors for the accelerate-stop distance. The correction factors must account for the particular surface characteristics of the stopway and the variations in these characteristics with seasonal weather conditions (such as temperature, rain, snow and ice) within the established operational limits.

5. Amendment to JAR 25.113: Take-off distance and take off run·

Amend JAR 25.113 to read as follows:

JAR 25.113 Take-off distance and take-off run.

(a) Take-off distance on a dry runway is the greater of:

(1) The horizontal distance along the take-off path from the start of the take-off to the point at which the aeroplane is 35 ft above the take-off surface, as determined by a procedure consistent with JAR 25.111.

(b) Take-off distance on a wet runway is the greater of:

(1) The take-off distance on a dry runway determined in accordance with sub-paragraph (a) of this paragraph; or

(2) The horizontal distance along the take-off path from the start of the take-off to thc_ point at which the aeroplane is 15 ft above the take-off surface, achieved in a manner consistent with the achievement of V_2 before reaching 35 ft above take-off surface determined under JAR 25.111 for a wet runway.

(c) If the take-off distance includes a clearway, the take-off run is greater of:

(1) The horizontal distance along the take-off path from the start of the take-off to a point equivalent between the point at which V_{LOF} is reached and the point at which the aeroplane is 35 ft above the take-off surface, as determined under JAR 25.111, except that, in the case of take-off on a wet-runway, this distance need not be greater than the horizontal distance determined in accordance with sub-paragraphs (b)(1) and (b)(2) of this paragraph; or

(2) 115%·of the horizontal distance along the take-off path with all engines operating, from the start of the take-off to a point equidistant between the point at which V_{LOF} is reached and the point at which the aeroplane is 35 ft above the take-off surface, determined by a procedure consistent with JAR 25.111.

6. Amendment to JAR 25.115 Take-off Flight Path.

Amend sub-paragraph (a) to read as follows:

JAR 25.115 Take-off flight path.

(a) The take-off flight path shall be considered to begin 35 ft above the take-off surface at the end of the take-off distance determined in accordance with JAR 25.113 (a) or (b), as appropriate for the runway surface condition.

7. Amendment to JAR 25.735: Brakes.

Amend JAR 25.735(f) through (j) to read as follows:

(f) The design landing brake kinetic energy capacity rating of each main wheel brake assembly shall be used during qualification testing of the brake to the applicable Joint Technical Standard Order (J-TSO) or an acceptable equivalent. This kinetic energy rating may not be less than the kinetic energy absorption requirements determined under either of the following methods:

(1) The brake kinetic energy absorption requirements must be based on a rational analysis of the sequence of events expected during operational landings at maximum landing weight. This analysis must include conservative values of aeroplane speed at which the brakes are applied, braking coefficient of friction between tyres and runway, aerodynamic drag, propeller drag or powerplant forward thrust and (if more critical) the most adverse single engine or propeller malfunction.

(2) Instead, of a rational analysis, the kinetic energy absorption requirements for each main wheel brake assembly may be derived from the following formula, which assumes an equal distribution of braking between main wheels:

$$KE = 0.0443\ W\ V\ 2\ /\ N$$

Where:

KE = kinetic energy per wheel (ft.lb);

W = design landing weight (lb);

V = aeroplane speed in knots. V must not be less than Vso, the power off stalling of the aeroplane at sea-level, at the design landing weight, and in the landing configuration; and

N = number of main wheels with brakes.

The formula must be modified in case of unequal braking distributions.

(g) In the landing case the minimum stalling speed rating or each main wheel-brake assembly (that is, the initial speed used in the dynamometer tests) may not be more than the

V used in the determination of kinetic energy in accordance with sub-paragraph (f) of this paragraph, assuming that the test procedures for wheel-brake assemblies involve a specified rate of deceleration, and, therefore for the same amount of kinetic energy, the rate of energy absorption (the power absorbing ability of the brake) varies inversely with the initial speed.

(h) The rejected take-off brake kinetic capacity rating of each main wheel-brake assembly that is at the fully worn limit of its allowable brake wear range shall be used during qualification testing of the brake to the applicable Joint Technical Standard Order (J-TSO) or an acceptable equivalent. This kinetic energy rating may not be less than the kinetic energy absorption requirements determined under either of the following methods:

(1) The brake kinetic energy absorption requirements must be based on a rational analysis of the sequence of events expected during an accelerate-stop manoeuvre. This analysis must include conservative values of aeroplane speed at which the brakes are applied, braking coefficient of friction between tyres and runway, aerodynamic drag, propeller drag or powerplant forward thrust and (if more critical) the most adverse single engine or propeller malfunction.

(2) Instead of rational analysis, the kinetic energy absorption requirements for each main wheel-brake assembly may be derived from the following formula, which assumes an equal distribution of braking between main wheels:

$$KE = 0.0443\ W\ V\ 2\ /\ N$$

Where:

KE = kinetic energy per wheel (ft.lb)

W = aeroplane weight (lb)

and W and V are the most critical combination of weight and speed.

The formula must be modified in cases of designed unequal braking distribution.

(i) In addition, a flight test demonstration of the maximum kinetic energy rejected take-off shall be conducted with not more than10% of the allowable brake wear range remaining;

(j) For each power-operated brake system incorporating an accumulator, the flight crew must be provided with an indication that adequate accumulator pressure is available.

8. Amendment to JAR 25X1591: Supplementary performance information.

8.1 Delete the words ‘wet and’ on the 6th line of sub-paragraph (a).

8.2 Delete ‘wet/’ from the 3rd and 6thlines of sub-paragraph (b).

8.3 Delete sub-paragraph (c)(1) and combine the introduction to sub-paragraph (c) with (c)(2) to read as follows:

(c) Supplementary performance information for runways contaminated with standing water, slush, loose snow, compacted snow or ice must be furnished. Information on the effect of runway contaminants ...... performance information of JAR 25.1587.

8.4 Amend sub-paragraph (d) to read as follows:

(d) The information required by sub-paragraph (a) of this paragraph may be established by calculation or by testing.

9. Amendments to AMJ 25x1591.

9.1 Delete the words "for Take-off from Wet Runways and" from the title.

9.2 Delete the words "take-off performance information for wet runways and" from the 2nd line of paragraph 1.

9.3 Delete the opening words of sub-paragraph 3.1 "Take-off performance information for wet runways and".

9.4 Delete the whole of sub-paragraph 3.2.

9.5 Delete "wet/" from the 3rd line of sub-paragraph 6a.

SPECIAL CONDITION	F-13: SA New Engine Option (NEO) Fuel System Low Level Indication – Fuel Exhaustion
APPLICABILITY:	TC: A319-1XXN/A320-2XXN/A321-2XXN
REQUIREMENTS:	CS 25.1305 (a)(2)
ADVISORY MATERIAL:	N/A

BACKGROUND

Several accidents have resulted from all engine flame-out due to fuel exhaustion. Other in-service incidents have seen flame-out of at least one powerplant unit resulting from improper fuel distribution in the aeroplane fuel system. Improper distribution caused fuel exhaustion in fuel tank feeding the affected engine.
The causes for the fuel starvation are various:
- increased fuel consumption in combination with incorrect fuel management,
- fuel leaks, not detected in time, or incorrectly managed (management of the fuel imbalance instead of the fuel leak)
- fuel system failures – with improper failure recognition and accommodation,
- incorrect fuel quantity management before departure (upload and distribution).

Contributing factors may include: lack of (independent) fuel low level warning, lack of adequate fuel system warning, or crews lack of confidence in the fuel system warnings.

This special condition requires a fuel quantity indicating system that provides for adequate fuel system information and alerting to the crew, including a specific low fuel level warning, in order to provide early information to the crew of abnormal situations that may result in engine fuel starvation.

SPECIAL CONDITION

Replace the current CS 25.1305(a) (2) with the following requirement:

(a)(2) A fuel quantity indicating system, which:
(i) displays to the crew the total quantity of usable fuel on board,
(ii) is capable of indicating to the crew the total quantity of usable fuel in each tank
(iii) provides a low fuel level warning for any tank and/or collector cell that should not be depleted of fuel in normal operations. This warning must be such that:

> (1) it is provided to the crew in a timely manner in order to allow continued safe flight and landing,
> (2) its correct functioning is not affected by any single failure that could cause an erroneous indication of the normal fuel gauging system.

(iv) provides adequate fuel system information to the crew, including alerts, that consider abnormal fuel management or transfer between tanks, and possible fuel leaks in the tanks, the fuel lines and other fuel system components and the engines.

In the past, EASA has accepted, as Means of Compliance for similar special conditions, different alerts and warnings, including, Fuel used/Fuel on board disagree, based on normal gauging system (mass measure) and engine fuel flowmeters input, compared with the fuel on board stored at first engine start, Lateral Imbalance, based either on normal gauging system or discrete system, or engine fuel leak, based on comparison between engine fuel flowmeters readings, in order to detect possible abnormal high fuel consumption on one engine and hence a possible leak downstream the engine flowmeter.

SPECIAL CONDITION	F-16: Static Directional and Lateral Stability
APPLICABILITY:	Post-TC: A319/A320/A321 equipped with mod 160500/160023 (Sharklet)
REQUIREMENTS:	JAR 25.177(b)(c)(d) Ch16, SC F-5004 (A318)
ADVISORY MATERIAL:	ACJ 25.177(c)(d)

BACKGROUND

The SA with Sharklets, like the Single Aisle family, are equipped with an Electronic Flight Control System.

The SA have a flight control design feature according to which side stick deflection in the roll axis commands roll rate. As a result:

- static lateral stability as defined in JAR 25.177(b) by the tendency to raise the low wing in a sideslip with the aileron controls free will be neutral.

- the stick force in the roll axis will be zero (neutral stability) during the straight, steady sideslip flight manoeuvre of JAR 25.177(c) and will not be "substantially proportional to the angle of sideslip" as required by the rule.

In addition, compared to JAR25.177(c) at change 11, JAR25.177(c) at change 16 introduces:

- a modification in §25.177(c): addressing the domain of sideslip angles appropriate to the operation of the aeroplane , and

- a new separate paragraph 25.177(d): addressing the domain of sideslip angles greater than those prescribed in (c), and up to the angle at which full rudder control is used (previously addressed in §25.177(c))

SC F-5004, which requires that "The aircraft shall be shown to have suitable stability in any condition normally encountered in service, including the effects of atmospheric disturbances", is applicable to lateral/directional axis.

A new Special Condition is therefore needed for SA fitted with Sharklets to take into account flight control system characteristics and JAR 25.177 evolutions.

(For SA without Sharklets, refer to SC-F6 which amends JAR 25.177(c) ch11)

SPECIAL CONDITION

- Remove JAR 25.177(b).
- Replace JAR 25.177(c) with the following:

(c) In straight, steady sideslips over the range of sideslip angles appropriate to the operation of the aeroplane, but not less than those obtained with one-half of the available rudder control input or a rudder control force of 801 N (180 lbf), the rudder control movements and forces must be substantially proportional to the angle of sideslip in a stable sense; and the factor of proportionality must lie between limits found necessary for safe operation. This requirement must be met for the configurations and speeds specified in sub-paragraph (a) of this paragraph. (see ACJ 25.177(c))

EQUIVALENT SAFETY FINDING	**F-19: Flight in Icing Conditions**
APPLICABILITY:	Post-TC: A319/A320/A321 equipped with mod 160500/160023 (Sharklet)
REQUIREMENTS:	25.1419(c)
ADVISORY MATERIAL:	N/A

BACKGROUND

The paragraph 25.419(c) requires flight tests of the aeroplane or its components in measured natural atmosphere. Discussion lead to an acceptance of a combination of flight testing in dry air with artificial ice shapes and analysis for demonstration of compliance with applicable airworthiness requirements for flight in icing conditions.

EQUIVALENT SAFETY FINDING F-19

For demonstration of compliance with applicable airworthiness requirements for flight in icing conditions a combination of flight testing in dry air with artificial ice shapes and analysis can be accepted as an equivalent level of safety provided:

(a) A comparative flight testing is performed with artificial ice-shapes in dry air to determine the differences between the new and an existing approved aircraft configuration.

(b) Those differences are expected to be only small due to the fact that only a small portion of the wing surface or empennage has been modified.

(c) The original ice shapes of the approved aircraft configuration have been validated by flight testing in natural icing conditions.

(d) The proposed artificial ice shapes for the modified part have been accepted by the airworthiness authorities

(e) There is service experience that allows to take credit for the qualification of the original aircraft for flight in icing conditions.

(f) The compliance program is accepted by the airworthiness authorities.

(g) The results of the flight testing and analysis reports are considered adequate.

In this case the verification of ice shapes and testing of aircraft characteristics in measured natural icing conditions will not be required.

EQUIVALENT SAFETY FINDING	F-20: Minimum mass flow of supplemental oxygen
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	JAR 25.1443(c)
ADVISORY MATERIAL:	N/A

In lieu of the airworthiness requirements of JAR 25.1443(c) and associated standards of TSO C64a/SAE AS 8025, the following compliance method is considered acceptable:

For passengers and cabin crew members, it shall be shown, that the passenger oxygen system provides an equivalent level of protection from hypoxia as detailed below:

(1) Between 10,000 ft and 18,500 ft cabin pressure altitude, the supplemental oxygen system for the passenger and cabin crew shall provide a blood oxygenation level that is equivalent with the blood oxygenation level reached at 10,000 ft cabin pressure altitude when breathing standard air. Breathing standard air at 10,000 ft cabin pressure altitude provides a mean tracheal oxygen partial pressure of 100 mmHg as required by JAR 25.1443(c).

(2) Between 18,500 ft and 40,000 ft cabin pressure altitude, the supplemental oxygen system for the passenger and cabin crew shall provide a blood oxygenation level that is equivalent with the blood oxygenation level reached at 14,000 ft cabin pressure altitude when breathing standard air. Breathing standard air at 14,000 ft cabin pressure altitude provides a mean tracheal oxygen partial pressure of 83.8 mmHg as required by JAR 25.1443(c).

TEST SET UP

(a) The blood oxygenation level in human bodies is characterised by the stabilised arterial blood oxygen saturation level (SaO2). The purpose of the test is to demonstrate that the supplemental oxygen dispensing equipment ensures test subjects SaO2 levels, which are sufficient or at least as high as the applicable baseline SaO2:

  (1) 10,000 feet baseline: At 10,000 ft cabin pressure altitude, the "10,000 ft baseline" SaO2 of test subjects will be measured while breathing standard air. In the next step, the cabin pressure will be reduced in steps up to 18,500 ft cabin pressure altitude while the test subjects are breathing supplemental oxygen at a flow rate that matches the "10,000 ft base-line" SaO2 level.

  (2) 14,000 feet baseline: At 14,000 ft cabin pressure altitude, the "14,000 ft baseline" SaO2 of test subjects will be measured while breathing standard air. In the next step, the cabin pressure will be reduced in steps up to 40,000 ft cabin pressure altitude while the test subjects are breathing supplemental oxygen at a flow rate that matches the "14,000 ft base-line" SaO2 level.

(b) The cabin altitude depending oxygen flow rates will be recorded and later used to specify the cabin altitude depending oxygen flow performance of the supplemental oxygen dispensing equipment. The test results from the 10,000 feet baseline will be used for the cabin pressure altitude range of 10,000 to 18,500 ft, whereas the 14,000 feet baseline will be used for the cabin pressure altitude range of 18,500 to 40,000 ft.

(c) The testing shall be accomplished in accordance with established industry practices. The evaluation of the passenger oxygen system performance must include an agreed number of masks and randomly selected novice human subjects. If new and novel test methods are used statistical means must be provided to justify the quantity of test subjects.

(d) The test subjects shall be exposed to the full range of altitudes for which the system will be certified to. A series of exposures at increments of at maximum 7,500 feet pressure altitude is acceptable for compliance demonstration. Existing data might also be used such as data from previous qualification tests or compliance findings, provided that the applicant can sufficiently justify the validity of those data.

(e) To address the increased breathing rate of a panicking person, the equipment must deliver the in the above mentioned paragraph "a1" and "a2" specified oxygen flow rate under the JAR 25.1443(c) specified tidal volume and breathing rate, which may be demonstrated by tests using a breathing machine (breathing machine performance as specified in SAE ARP 1109B).

(f) For a subset of the test runs, the altitude chamber may be simulated on ground by using hypoxic gas mixtures.

EQUIVALENT SAFETY FINDING	**F-21: Crew determination of quantity of oxygen in passenger oxygen System**
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	JAR 25.1441(c)
ADVISORY MATERIAL:	N/A

In lieu of the airworthiness requirements of JAR 25.1441(c), the following is considered acceptable if substantiated following the compliance method as described in further below:

If the oxygen source is a lifetime sealed oxygen high-pressure cylinder, the oxygen source can be considered as full oxygen capacity provided the oxygen quantity has not depleted since the date of manufacture.

1) A detailed description of the design details must be provided to describe the compensating features which provide an equivalent level of safety.

2) The oxygen supply source is designed and tested to ensure that it will retain its required quantity of oxygen or chemicals throughout its expected life limit under foreseeable operating conditions.

3) A means is provided for maintenance to readily determine when oxygen is no longer available in the supply source due to inadvertent activation.

4) The life limit of the oxygen supply source is established by test and analysis.

5) Each oxygen supply source is labelled such that the expiration date can be easily determined by maintenance.

6) Airbus defines maintenance and inspection procedures in the maintenance planning documents to ensure that the oxygen supply source
   a. that are discharged are removed from the airplane,
   b. are not installed on the airplane past their expiration date.

7) Each oxygen supply source does not supply oxygen to more than six oxygen masks.

SPECIAL CONDITION	**F-37: ATN over SATCOM**
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	CS 25.1301 / CS 25.1309 / CS ACNS.B.DLS.B1.001
ADVISORY MATERIAL:	ETSO-C159c / ARINC 741

BACKGROUND

Airbus applied for the certification of a new function on a Large Aeroplane, which allows to use SATCOM SBB (Inmarsat Swift Broadband satellite communications) in combination with the datalink types ATN B1 and ATS B2 including ATS B2 with backwards compatibility to ATN B1.

Furthermore, in the frame of the Single European Sky ATM Research (SESAR) Project, the project PJ.14- W2-107 also aims at offering the capability to use existing satellite communication technology ("SATCOM Class A") to support Air Traffic Services (ATS) datalink using ATN B1 or ATS B2 including ATS B2 with backwards compatibility to ATN B1 datalink services.

Such solutions, and in particular the use of a SATCOM subnetwork for ATN, are not currently addressed in CS-ACNS Issue 4. Issue 4 of the CS-ACNS does not consider SATCOM and although it does refer to FANS 1/A which also uses SATCOM in the context of CS ACNS.B.DLS.B1.015, this reference is only made in the context of integrating FANS 1/A with ATN B1 or ATS B2 in so called 'Dual Stack' installations. Therefore, as per point 21.B.75 of Part 21 (Annex I to Regulation (EU) No 748/2012), special conditions have to be introduced.

There is therefore the need to extend the applicability of CS-ACNS, Subpart B, section 2 – Data Link Services to also cover the ATN over SATCOM capability.

SPECIAL CONDITION

Requirement: CS ACNS.B.DLS.B1.001 issue 4

1. In amendment to CS ACNS.B.DLS.B1.001 this Special Condition applies to the use of SATCOM SBB (Inmarsat Swift Broadband satellite communications) in combination with the following datalink types: ATN B1, ATS B2, including ATS B2 with backwards compatibility to ATN B1.
2. The design of the data link system supporting Air Traffic Services (ATS) must define the types of data link systems and of data link subnetworks used. Applicants may select one or several types of data link systems and the pairing with one or several data link subnetworks, in accordance with the intended use.
3. The standards and requirements applicable to such subnetwork and datalink types as defined in CS ACNS Subpart B Section 2 Data Link Services (DLS) shall be used.

EQUIVALENT SAFETY FINDING	F-38: CS 25.1438 – Pressurisation and Low Pressure Pneumatic Systems
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	CS 25.1436, CS 25.1438 at Amdt 23
ADVISORY MATERIAL:	AMC 25.1436, AMC 25.1438

BACKGROUND

On September 2, 1998 the FAA issued a notice of a new task to harmonise FAR section 25.1438 with JAR paragraphs 25X1436 and 25.1438. The FAA and JAA have asked the Aviation Rulemaking Advisory Committee (ARAC) to provide advice and recommendations on harmonisation of the FAA regulations and JAA requirements for pressurisation and pneumatic systems.

The Mechanical Systems Harmonisation Working Group (MSHWG), set up by the ARAC to provide the recommendation, has provided a report to the ARAC committee, which proposes a new harmonised pneumatic and pressurisation rule to satisfy both the FAA and JAA. This report has been approved by the ARAC, but up to now the FAA and EASA did not start the official rule making process to include the proposed ARAC recommendation into the actual FAR and CS regulations (because the former JAA requirements and the ACJ are identical to the current CS 25 requirements and AMC, the outcome of the ARAC is still applicable to the latter).

The intent of the proposed rule is to combine the requirements of FAR section 25.1438, EASA CS 25 paragraphs 25.1436 and 25.1438, and EASA AMC for paragraphs 25.1436 and 25.1438 into one rule.

CS 25.1436 has been applied to gas storage devices such as hydraulic system accumulators and nitrogen bottles used in backup thrust reverser and flight controls, and nitrogen bottles used in door opening and evacuation systems. The FAA applies Department of Transportation (DOT) regulations to gas storage devices such as nitrogen and oxygen bottles. The MSHWG found it acceptable to include requirements for gas storage devices in the rule. However, the group agreed to accept that each country can apply national standards in addition to the proposed minimum requirement for gas storage devices.

As a result, the intent of CS 25.1436 and its AMC is captured within the harmonised rule for 25.1438, therefore eliminating the need for a separate rule. CS 25.1436, AMC 25.1436(b)(3) and AMC 25.1436(c)(2) are proposed to be deleted.

The multipliers in the advisory material for CS 25 paragraphs 25.1436 and 25.1438 are changed, based on aeroplane manufacturer design practices and service history of aeroplane bleed air systems.

The values highlighted in the CS 25 Appendix L are superseded by those in the proposed rule.

Appendix L of CS 25 is proposed to be deleted.

The rule format is similar to the AMC for CS 25.1438, but the design standards have been placed in the text of the rule instead of in the AMC. AMC 25.1438 is proposed to be deleted and paragraph CS 25.1438 is proposed to be replaced by the new rule, which combines the above-mentioned requirements. On September 2, 1998 the FAA issued a notice of a new task to harmonise FAR section 25.1438 with JAR paragraphs 25X1436 and 25.1438. The FAA and

JAA have asked the Aviation Rulemaking Advisory Committee (ARAC) to provide advice and recommendations on harmonisation of the FAA regulations and JAA requirements for pressurisation and pneumatic systems.

The Mechanical Systems Harmonisation Working Group (MSHWG), set up by the ARAC to provide the recommendation, has provided a report to the ARAC committee, which proposes a new harmonised pneumatic and pressurisation rule to satisfy both the FAA and JAA. This report has been approved by the ARAC, but up to now the FAA and EASA did not start the official rule making process to include the proposed ARAC recommendation into the actual FAR and CS regulations (because the former JAA requirements and the ACJ are identical to the current CS 25 requirements and AMC, the outcome of the ARAC is still applicable to the latter).

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As a result, the intent of CS 25.1436 and its AMC is captured within the harmonised rule for 25.1438, therefore eliminating the need for a separate rule. CS 25.1436, AMC 25.1436(b)(3) and AMC 25.1436(c)(2) are proposed to be deleted.

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The values highlighted in the CS 25 Appendix L are superseded by those in the proposed rule.

Appendix L of CS 25 is proposed to be deleted.

The rule format is similar to the AMC for CS 25.1438, but the design standards have been placed in the text of the rule instead of in the AMC. AMC 25.1438 is proposed to be deleted and paragraph CS 25.1438 is proposed to be replaced by the new rule, which combines the above-mentioned requirements.

EQUIVALENT SAFETY FINDING

1. APPLICABILITY

   Commercial Air Transport - Large aeroplane - Airbus A321-253NY

1.1 AFFECTED CS

   CS 25.1436, CS 25.1438 at Amdt 23

2. COMPENSATING FACTORS

An equivalent safety finding to CS 25.1436 and CS 25.1438 is proposed by the following:

- *Delete CS 25.1436*
- *Delete AMC 25.1436(b)(3)*
- *Delete AMC 25.1436(c)(2)*
- *Delete Appendix L of CS 25*
- *Delete AMC 25.1438*
- *Replace CS 25.1438 by the following CS 25.1438:*

CS 25.1438 Pneumatic Systems

a) *This requirement applies to pneumatic systems and elements (components and ducting) served by gas storage devices such as, evacuation, water systems, accumulators and/or pressurised gas from compressors such as engine and APU bleed air, air conditioning, pressurisation, engine starting, ice protection, and pneumatic actuation systems. Design compliance may be in the form of analysis, test, or combination of analysis and test. All foreseen normal and failure mode combinations of environmental loads (installation, thermal, vibration, and aerodynamic), pressures, temperatures, material properties, and dimensional tolerances must be considered.*
This requirement is not applicable to portable gas storage devices.

b) *Each element of the system must be designed to operate without detrimental permanent deformation or increase in design leakage that would prevent the element from performing its intended function. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions. The pressure must be applied long enough to ensure complete expansion of the test element. After being subjected to the above conditions and on normal operating conditions being restored, the element should operate as designed.*
   1. *1.5 times maximum normal operating pressure*
   2. *1.33 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures per flight hour*
   3. *1.0 times the failure pressure occurring in the probability range between 10E-05 and 10E-07 failures per flight hour*
   4. *1.0 times the maximum normal operating pressure in combination with the limit structural loads.*

c) *Each element of the system must be designed to operate without rupture or increase in design leakage, that is likely to endanger the aeroplane or its occupants. For demonstrating compliance, the following factors are to be applied to the pressure at the associated temperature for the most critical of the following conditions. The pressure must be applied long enough to ensure complete expansion of the test element. After being subjected to the above conditions and on normal operating conditions being restored, the element need not operate normally.*

1. *3.0 times maximum normal operating pressure. Except for pressurisation system elements which shall use a factor of 2.0 time maximum normal operating pressure*
2. *2.66 times the failure pressure occurring in the probability range between 10E-03 to 10E-05 failures per flight hour*
3. *1.5 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures/flight hour is applicable to components. Except for ducting which shall use a factor of 2.0 times the failure pressure occurring in the probability range between 10E-05 to 10E-07 failures per flight hour*
4. *1.0 times the failure pressure occurring in the probability range 10E-07 and 10E-09 failures per flight hour*
5. *1.5 times the maximum normal operating pressure in combination with the 1.0 times the ultimate structural loads.*

d) *If the failure of an element can result in a hazardous condition, it must be designed to withstand the fatigue effects of all cyclic pressures, including transients, and associated externally induced loads and perform as intended for the design life of the element under all environmental conditions for which the aeroplane is certified.*

e) *In addition, each gas storage device installed on an aeroplane must meet the requirement of this rule and not cause hazardous effects by exploding.*

SPECIAL CONDITION	F-103: Take-off distance, take-off run and accelerate stop distance on wet runways
APPLICABILITY:	TC: A320 (except A320-233 and all A320 with OCTOPUS AFM)
REQUIREMENTS:	JAR 25.109 (a), JAR 25.113 (a)(2) (UK N.V.), JAR 25.113 (b)(2) (UK N.V.),JAR 25X133
ADVISORY MATERIAL:	ACJ 25X133

BACKGROUND

Compared with the basic JAR 25.113, the UK National variant introduced operation on wet runways by the new 25.113 (a)(2), (b)(2) and 25.109 (a). ACJ 25X133 requires that a V_{1max} for decision to abandon take-off and a V_{1min} for decision to continue take-off be presented in Flight Manual.

SPECIAL CONDITION

Wet Runway Performance

The following rules apply for wet runway performance determination:

1. Accelerate stop distance:

The accelerate stop distance is determined in accordance with CRI F102.

2. Take-off distance

Take-off distance is the horizontal distance along the take-off path-from the start of the take-off to the point at which the aeroplane is 15 ft above the take-off surface achieved in a manner consistent with the achievement of V_2 before reaching 35 ft above the take-off surface, determined under JAR 25.111 corresponding to V_1 appropriate to a wet runway.

3. Take-off run:

If the take-off distance includes a clearway, the take-off run is the horizontal distance along the take-off path from the start of the take-off to the point at which V_{LOF} is reached determined under JAR 25.111 corresponding to V_1 appropriate to a wet runway.

SPECIAL CONDITION	F-114: Landing Target Threshold Speeds
APPLICABILITY:	TC: A320
REQUIREMENTS:	JAR 25.125 (a) (10) (UK National Variant)
ADVISORY MATERIAL:	N/A

BACKGROUND

The UK National Variant was believed by CAA to demand a necessary consideration of VAT1, if the landing distance, determined in accordance with JAR 25.125 is to remain valid for the one-engine-inoperative case.

SPECIAL CONDITION

The JAR 25.125 (a) (10) UK National Variant introduces additional condition to the steady gliding approach speed. The steady "gliding" approach speed of JAR 25.125 (a) (2) must be not less than the greater of:

- VAT0, and
- VAT1 minus 5 Knots.

SPECIAL CONDITION	F-119: Security protection of Aircraft systems and networks
APPLICABILITY:	Post TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.1309 change 11
ADVISORY MATERIAL:	EUROCAE ED-202A/RTCA DO-326A, EUROCAE ED-204/RTCA DO-355.

IDENTIFICATION OF ISSUE:

Airbus intends to install new systems with connectivity to non-trusted services in the Airbus Single Aisle aircraft which may introduce the potential for unauthorized electronic access to Aircraft Systems.
They may introduce new threats to the safety of the aircraft by the exploitation of potential known and unknown vulnerabilities with the aim to intentionally alter the integrity and availability of critical data, aircraft networks, systems or databases.
JAR/CS 25 does not address Cyber Security and AMJ/AMC 25 1309 explicitly exclude act of sabotage from the list of events to be addressed during the safety assessment.

Such systems having connectivity to non-trusted services are considered by EASA to be an architecture which may introduce potential security risks having an effect on safety not addressed in the current regulations or safety assessment methods. Therefore, this Special Condition (SC) has been established to address the issue.

Special condition

a) The applicant shall ensure security protection of the aircraft systems from unauthorized electronic access through the system introducing connectivity to non-trusted services, if corruption of these systems (including hardware, software, data) by an inadvertent or intentional attack would impair safety, and

b) The applicant shall ensure that the security threats to the aircraft systems, including those possibly caused by maintenance activity on the system having connectivity to non-trusted services or by any unprotected equipment/devices connected to this system, are identified, assessed and risk mitigation strategies are implemented to protect the aircraft systems from all adverse impacts on safety, and

c) When required by paragraph (a), the applicant shall make available procedures and instructions for continued airworthiness to ensure security protections are maintained.

Paragraph b) of the SC requires that security threats possibly caused by maintenance activity be identified, assessed and associated risks mitigated if the safety could be adversely impacted.

Regarding security considerations about maintenance activity, it is agreed that security threats possibly caused by uploading Field Loadable Software (FLS) including databases, be considered only if those FLS are remotely sent from a ground network, received by an onboard system having connectivity to this ground network, transmitted and automatically installed on the aircraft systems to be upgraded

Therefore, the protection of the FLS is not required if installed by another means (notably by manual wired or physical connection on wing).

EQUIVALENT SAFETY FINDING	**F-122: Crew Determination of Quantity of Oxygen in Passenger Oxygen System**
APPLICABILITY:	Post TC: A319/A320/A321
REQUIREMENTS:	JAR 25.1441 (c)
ADVISORY MATERIAL:	N/A

BACKGROUND

This modification consists of installing a Decentralized Gaseous Pulsed Oxygen System (DPOS) with a long duration supply up to 60min.

No means will be incorporated to inform the crew of the quantity of oxygen available in each source of supply. As design, the system will not meet the JAR 25.1441 (c) which requires to provide a means to allow the crew to readily determine, during flight, the quantity of oxygen available in each oxygen supply source.

This CRI records the request for Equivalent Safety Findings made by Applicant for compliance with JAR 25.1441(c).

Equivalent Safety Finding

1) A detailed description of the design details must be provided to describe the compensating features which provide an equivalent level of safety.

2) The oxygen supply source is designed and tested to ensure that it will retain its required quantity of oxygen or chemicals throughout its expected life limit under foreseeable operating conditions.

3) A means is provided for maintenance to readily determine when oxygen is no longer available in the supply source due to inadvertent activation.

4) The life limit of the oxygen supply source is established by test and analysis.

5) Each oxygen supply source is labeled such that the expiration date can be easily determined by maintenance.

6) Airbus defines maintenance and inspection procedures in the maintenance planning documents to ensure that the oxygen supply source
   a. that are discharged are removed from the airplane,
   b. are not installed on the airplane past their expiration date.

7) Each oxygen supply source does not supply oxygen to more than six oxygen masks.

EQUIVALENT SAFETY FINDING	F-125: Minimum Mass Flow of Passenger Supplemental Oxygen
APPLICABILITY:	Post TC: A319/A320/A321
REQUIREMENTS:	JAR 25.1443(c)
ADVISORY MATERIAL:	N/A

BACKGROUND

This modification consists in installing a DECENTRALIZED GASEOUS PULSED OXYGEN SYSTEM (DPOS) with a long duration supply up to 60 min.
Airbus has submitted a request for an Equivalent Level of Safety to JAR 25.1443(c) for the Airbus A319/A320/A321 all models. The JAR 25.1443(c) specifies a minimum mass flow requirement for passenger and cabin crew supplemental oxygen systems in terms of mean tracheal partial pressure, breathing rate and tidal volume per breath.
The system proposed by Airbus will not deliver oxygen per the minimum mass flow performance parameters specified in JAR 25.1443(c).
This CRI records the request for Equivalent Safety Finding made by Airbus for compliance with JAR 25.1443(c) and provides the EASA position.

Equivalent safety finding

In lieu of the airworthiness requirements of JAR 25.1443(c) and associated standards of TSO C64a/SAE AS 8025, the following compliance method is considered acceptable:
For passengers and cabin crew members, it shall be shown, that the passenger oxygen system provides an equivalent level of protection from hypoxia as detailed below:

1. Between 10,000 ft and 18,500 ft cabin pressure altitude, the supplemental oxygen system for the passenger and cabin crew shall provide a blood oxygenation level that is equivalent with the blood oxygenation level reached at 10,000 ft cabin pressure altitude when breathing standard air. Breathing standard air at 10,000 ft cabin pressure altitude provides a mean tracheal oxygen partial pressure of 100 mmHg as required by JAR 25.1443(c).
2. Between 18,500 ft and 40,000 ft cabin pressure altitude, the supplemental oxygen system for the passenger and cabin crew shall provide a blood oxygenation level that is equivalent with the blood oxygenation level reached at 14,000 ft cabin pressure altitude when breathing standard air. Breathing standard air at 14,000 ft cabin pressure altitude provides a mean tracheal oxygen partial pressure of 83.8 mmHg as required by JAR 25.1443(c).
3. During an actual decompression event and sudden exposure to high cabin pressure altitudes, it is likely that cabin occupants may begin to experience symptoms of hypoxia with decreasing SAO2 levels for many reasons, such as delays in donning their supplemental oxygen masks. In order to provide an equivalent level of protection, the pulse oxygen system should allow the user to recover from lowered SAO2 levels at a rate equal to or better than they would, using an oxygen system where the oxygen flow was determined by using traditional test methods and assuming delivery of a homogeneous gas mixture to comply with JAR 25.1443(c). This could be accomplished by ensuring that a big bolus volume of oxygen is available when the oxygen mask is first donned such that the users SAO2 levels would fully recover to baseline values

before using a smaller bolus of oxygen intended to sustain the user at the baseline value. As an alternative, comparative data should be provided to demonstrate that the time to return from lowered SAO2 levels to baseline or greater values using a pulse oxygen supply is either unchanged or medically insignificant compared to the use of systems where the minimum flow rate was determined assuming a homogeneous gas mixture is delivered to the user.

SPECIAL CONDITION	F-0311-001: Flight Recorders including Data Link Recording
APPLICABILITY:	Post-TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.1301, JAR 25.1457, JAR 25.1459
ADVISORY MATERIAL:	EUROCAE ED-112, ED-93 ICAO Annex 6, Part I, Chapter 6.3.4 Data link recorders, Commission Regulation No. EC 29/2009, EU-OPS (Commission Regulation (EU) 965/2012), EASA Part OPS (NPA 2009- 02b), AC 20-160

BACKGROUND

Commission Regulation (EC) No 29/2009 "laying down requirements on the data link services for the Single European Sky", requires certain aircraft operating in designated airspace to be equipped with systems capable of providing Datalink Services (DLS), with the intention to augment or replace voice communications. For new aircraft, the requirements of EC 29/2009 apply from January 1st, 2011.
In addition CAT.IDE.A.195 of Commission Regulation (EU) 965/2012, proposes new operational requirements for recording of data link communications, including, but not limited to the required data link services identified in Annex II to European Commission Regulation EC No. 29/2009. The CAT.IDE.A.195 requirements would apply to aircraft first issued with an individual Certificate of Airworthiness on or after April 8, 2014.
The abovementioned regulations cover airspace and operational requirements, but reveal a loophole which would result in aircraft equipped with the capability to provide DLS, not being required to record the DLS messages.

The intent of the following SC was to allow accident investigators to have, as far as practicable, a recording of all communication received or sent by each crew member. With the introduction of data link technology, much of the information which was previously transmitted by voice communications will be replaced by data link messages.

SPECIAL CONDITION

Effectivity:
The following effectivity should be applicable:

- SC F-0311-001 is applicable for all European operators operating a/c for which the individual CofA is first issued on or after 8 April 2014 (aligned with EU OPS CAT.IDE.A.195).
- ☐SC F-0311-001 is applicable for all a/c for which the individual certificate of airworthiness is first issued on or after 1 January 2016 (aligned with ICAO Annex 6 Part I paragraph 6.3.3.), except for US operators that operate under part FAR121, and FAR125.

The flight recorder (Cockpit Voice Recorder or Flight Data Recorder) shall record:

(a) Data link communications related to air traffic services (ATS Communications*) to and from the aeroplane.

(b) All messages whereby the flight path of the aircraft is authorized, directed or controlled, and which are relayed over a digital data link rather than by voice communication.
(c) The minimum recording duration shall be equal to the duration of the Cockpit Voice Recorder, and the recorded data shall be time correlated to the recorded cockpit audio.
(d) To enable an aircraft operator to meet the intent of current EU OPS 1.160 (a)(4)(ii) Commission Regulation (EU) 965/2012 (CAT.IDE.A.195 (b)), information shall be provided explaining how the recorded data can be converted back to the format of the original data link messages in order to determine an accurate sequence of events for the aircraft and the cockpit operation.

* ATS communications (ATSC) are defined by ICAO as communications related to air traffic services including air traffic control, aeronautical and meteorological information, position reporting and services related to safety and regularity of flight.

SPECIAL CONDITION	F-1001: Static directional and lateral stability
APPLICABILITY:	A318/A319/A320/A321
REQUIREMENTS:	JAR 25.177
ADVISORY MATERIAL:	N/A

BACKGROUND

Because of the A320 roll axis design feature in which aileron force commands roll rate, the stabilized portion of constant heading sideslips may result in zero aileron force.

This condition could exist up to 33 ° bank.

This characteristic could be considered as a non-compliance with the requirements of JAR 25-177(c).

SPECIAL CONDITION

The purpose of the requirement is to require non negative yaw and roll stability except for some specified cases described in JAR 25-177(b) where a small divergence may be accepted provided ease of pilot command is not impaired.

The existing requirement of JAR 25.177(c) allows discretion in the factor of proportionality between aileron force (or movement) and sideslip. The proposed lack of aileron force for bank angles up to 33 ° is acceptable within the scope of this discretion. Therefore no formal revision to the requirement is necessary.

SPECIAL CONDITION	F-2011: Fixed Throttle Concept
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.779 (b), JAR 25.1143
ADVISORY MATERIAL:	N/A

BACKGROUND

On conventional aeroplanes cockpit throttle position follows automatic commanded power changes during autothrottle operation.

Airline pilots indicate that visual and tactile feedback information offered by throttle movements is used as primary cues to monitor autothrottle operation during approach since thrust level instrumentation is not in the pilot's immediate instrument scan.

On the A320 this possibility is hampered by the lack of throttle movement in Autothrottle mode.

SPECIAL CONDITION

Amend special condition S33 by introducing the following paragraph:

(6) "It must be shown by test and analysis that adequate cues are provided to the crew to monitor thrust changes during autothrust operation."

ELECT TO COMPY	F-2013: Take-off and Landing performance
APPLICABILITY:	Post-TC: A320-200 series
REQUIREMENTS:	JAR 25.101, 25.105, 25.109, 25.113, 25.115, 25.735, 25.X1591 SC F11, S79
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus applied for the introduction of OCTOPUS computerized Flight Manual on the A320 family.

ELECT TO COMPLY

Taking profit of Octopus introduction, Airbus Industrie elects to comply with the following new regulations for the A320 brakes & BSCU standards:

- Accelerate-Stop Distances and related performances A320-233 SC/IM F11 (NPA 25BDG-244),
- Worn Brakes qualification: A320-233 SC/IM S79 (NPA 25BDG-244),
- Landing distances extrapolation with altitude: A321 IM F13 (removal of the 2% conservatism factor per 1000 ft).

ELECT TO COMPLY	**F-3012: Accelerate-stop distances and Related Performance Brakes requirement, qualification and testing**
APPLICABILITY:	TC: A321-200 series
REQUIREMENTS:	JAR 25.101, 25.105, 25.109, 25.113, 25.115, 25.735, 25x1591 at Change 13
ADVISORY MATERIAL:	N/A

BACKGROUND

For the A321 series 200, AIRBUS INDUSTRIE elects to comply with the NPA 25 B,D,G -244 dated January 1996 (amended 24.4.96, 22.5.96, 7.6.96, 4.7.96).

ELECT TO COMPLY

AIRBUS INDUSTRIE elects to comply with the NPA 25 B,D,G -244 dated January 1996 (amended 24.4.96, 22.5.96, 7.6.96, 4.7.96).

SPECIAL CONDITION	**F-5001: Stalling and scheduled operating speeds**
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR 25.103, 25.107, 25.121, 25.125, 25.201, 25.203, 25.205, 25.207
ADVISORY MATERIAL:	N/A

IDENTIFICATION OF ISSUE:

The A318 is equipped, like the A320, A319 and A321, with a low-speed protection system providing against stall a protection that cannot be overridden by the pilot.
The requirements of JAR 25 must therefore be adapted to consider this stall protection function.
Special Condition F-1 and Interpretative Material F-1 have been developed for A320 certification.
The JAR 25 paragraphs affected by this special condition have been upgraded to change 13 for A319 certification, therefore the existing A320 Special Condition F-1 and Interpretative Material F-1 were revised to be consistent with JAR 25 Change 13.
The JAR 25 paragraphs affected by this special condition have been upgraded to change 14 plus Orange Paper 96/1 for A318 certification, therefore the existing A319 Special Conditions F-1 and Interpretative Material F-1 need to be revised to be consistent with JAR 25 Change 14 plus Orange Paper 96/1.

SPECIAL CONDITION

1. Definitions

This Special Condition is concerned with novel features of the A320 and uses terminology that does not appear in JAR 25.
The following definitions shall apply:

- High incidence protection system: A system that operates directly and automatically on the aeroplane's flying controls to limit the maximum incidence that can be attained to a value below that at which an aerodynamic stall would occur.
- Alpha-floor system: A system that automatically increases thrust on the operating engines when incidence increases through a particular value. (see IM F-5001 paragraph 2)
- Alpha-limit: The maximum steady incidence at which the aeroplane stabilises with the high incidence protection system operating and the longitudinal control held on its aft stop.
- Vmin: The minimum steady flight speed in the aeroplane configuration under consideration with the high incidence protection system operating. See section 3 of this Special Condition.
- Vmin1g: Vmin corrected to 1g conditions. See section 3 of this Special Condition.
- Vs1g: The minimum speed in the configuration under consideration at which the aeroplane can develop a lift equal to the weight of the aeroplane with engines set to idle thrust. This speed may be demonstrated with the high incidence system

adjusted to permit a higher incidence to be achieved, than is possible with the normal production system.

2. Capability and Reliability of the Hiqh Incidence protection System.

Those paragraphs of JAR 25 quoted in reference may be amended in accordance with this Special Condition provided that acceptable capability and reliability of the high incidence protection system can be established by flight test, simulation, and analysis as appropriate. The capability and reliability required are as follows:

1- It shall not be possible during pilot induced manoeuvres to encounter a stall and handling characteristics shall be acceptable, as required by section 6 of this Special Condition.
2- The aeroplane shall be protected against stalling due to the effects of windshear's and gusts at low speeds as required by section 7 of this Special Condition.
3- The ability of the high incidence protection system to accommodate any reduction in stalling incidence resulting from residual ice must be verified.
4- The reliability of the system and the effects of failures must be acceptable in accordance with JAR 25.1309.

3. Minimum Steady Flight Speed and One g Stall Speed

Delete existing JAR 25.103 and replace as follows:

JAR 25.103: Minimum steady flight speed and one g stall speed

(a) The minimum steady flight speed, Vmin, must be determined with:

1- The high incidence protection system operating normally.
2- Idle thrust and alpha-floor system inhibited.
3- All combinations of flap settings and landing gear position for which Vmin is required to be determined.
4- The weight used when Vslg is being used as a factor to determine compliance with a required performance standard.
5- The most unfavourable centre of gravity allowable; and
6- The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.

(b) The minimum steady flight speed is the final stabilised calibrated airspeed obtained when the aeroplane is decelerated at an entry rate not exceeding 1 knot per second until the longitudinal control is on its stop.

(c) The one-g minimum steady flight speed, Vmin 1g, is the minimum calibrated airspeed at which the aeroplane can develop a lift force (normal to the flight path) equal to its weight, whilst at an angle of attack not greater than that at which the minimum steady flight speed of sub-paragraph (b) was determined.

(d) The one-g stall speed, Vs1g, must be determined with:

1. Idle thrust and Alpha-floor system inhibited.
2. All combinations of flap settings and landing gear for which Vs1g is required to be determined.

3. The weight used when Vs1g is being used as a factor to determine compliance with a required performance standard.
4. The most unfavourable centre of gravity allowable; and
5. The aeroplane trimmed for straight flight at a speed by the automatic trim system.

4. Scheduled operating speeds

4.1. Take off Speeds

Delete existing JAR 25.107(b) and replace as follows:
JAR 25.107(b): V2, in terms of calibrated airspeed, may not be less than:

(1) 1.13 VSIG
(2) 1.10 times VMC established under JAR 25.149
(3) A speed that provides the manoeuvre capability specified in paragraph 4.4

4.2. Climb one engine Inoperative

In JAR 25.121(c) Final Take-off, amend "   at not less than 1.25 Vs ..." to read "...at not less than the greater of 1.18 VSIG and a speed that provides the manoeuvre capability specified in paragraph 4.4, with...".

4.3. Landing Speeds

In JAR 25.125 the value of VREF used for landing performance determination must not be less than:

(1) 1.23 Vs1G
(2) VMCL established under JAR 25-149(f)
(3) A speed that provides the manoeuvre capability specified in paragraph 4.4

4.4. Manoeuvrability at operating speeds

The manoeuvring capabilities in a constant speed coordinated turn at forward centre of gravity, as specified in the table below, must be free of stall warning (if any), or other characteristics which might interfere with normal manoeuvring.

CONFIGURATION	SPEED	MANOEUVRING BANK ANGLE IN A COORDINATED TURN	THRUST/POWER SETTING
TAKE-OFF	V2	30°	ASSYMETRIC WATLIMITED
TAKE-OFF	V2+ XX (2)	40°	ALL ENGINES CLIMB
EN ROUTE	VFTO	40°	ASSYMETRIC WATLIMITED
LANDING	VREF	40°	SYMETRIC FOR -3° FLIGHT PATH ANGLE

(1) A combination of weight, altitude and temperature (WAT) such that the thrust or power setting produces the minimum climb gradient specified in JAR 25.121 for the flight condition.

(2) Airspeed approved for all engines initial climb.
(3) That thrust or power setting which, in the event of failure of the critical engine and without any crew action to adjust the thrust or power of the remaining engines, would result in the thrust or power specified for the take-off condition at V2, or any lesser thrust or power setting that is used for all engines-operating initial climb.

5. Stall Warning

5.1 Normal operation

If the conditions of paragraph 2 are satisfied, equivalent safety to the intent of JAR 25.207, Stall Warning, shall be considered to have been met without provision of an additional, unique warning device.

5.2 Failure cases

Following failures of the high incidence protection system, not shown to be extremely improbable, such that capability of the system no longer satisfies items 1, 2 and 3 of paragraph 2 stall warning must be provided in accordance with JAR 25.207(a) and (b) (See Interpretative Material IM F-5001 paragraph 5)

6. Handling Characteristics at High Incidence

6.1 High Incidence Handling Demonstrations.

Delete existing JAR 25.201 and replace as follows:

JAR 25.201: High incidence handling demonstration

(a) Manoeuvres to the limit of the longitudinal control, in the nose up sense, must be demonstrated in straight flight and in 30° banked turns with:
  (2) The high incidence protection system operating normally>
  (3) Initial power conditions of:
    i. Power off
    ii. The power necessary to maintain level flight at 1.5 Vs1g, where Vs1g corresponds to the one g stall speed with flaps in approach position, the landing gear retracted and maximum landing weight.
  (4) Alpha-floor system operating normally unless more severe conditions are achieved with inhibited alpha floor.
  (5) Flaps, landing gear and deceleration devices in any likely combination of positions
  (6) Representative weights within the range for which certification is requested; and
  (7) The aeroplane trimmed for straight flight at a speed achievable by the automatic trim system.
(b) The following procedures must be used to show compliance with JAR 25.203. (*)
  (1) Starting at a speed sufficiently above the minimum steady flight speed to ensure that a steady rate of speed reduction can be established, apply the longitudinal control so that the speed reduction does not exceed one knot per second until the control reaches the stop

(2) The longitudinal control must be maintained at the stop until the aeroplane has reached a stabilised flight condition and must then be recovered by normal recovery techniques.
(3) The requirements for turning flight manoeuvre demonstrations must also be met with accelerated rates of entry to the incidence limit, up to the maximum rate achievable.

(*) as amended by this special condition

6.2 Characteristics in High Incidence Manoeuvres

Delete existing JAR 25.203 and the associated ACJ.
Replace as follows:

JAR 25.203: Characteristics in High Incidence Manoeuvres.

(a) Throughout manoeuvres with a rate of deceleration of not more than 1 knot per second, both in straight flight and in 30° banked turns, the aeroplane's characteristics shall be as follows:
(1) There shall not be any abnormal nose- up pitching.
(2) There shall not be any uncommanded nose-down pitching, which would be indicative of stall. However reasonable attitude changes associated with stabilising the incidence at Alpha limit as the longitudinal control reaches the stop would be acceptable.
(3) There shall not be any uncommanded lateral or directional motion and the pilot must retain good lateral and directional control, by conventional use of the controls, throughout the manoeuvre.
(4) The aeroplane must not exhibit severebuffeting of a magnitude and severity that would act as a deterrent to completing the manoeuvre specified in JAR 25.201(a)*.

(*) As amended by this Special Condition

(b) In manoeuvres with increased rates of deceleration some degradation of characteristics is acceptable, associated with a transient excursion beyond the stabilised Alpha-limit. However, the aeroplane must not exhibit dangerous characteristics or characteristics that would deter the pilot from holding the longitudinal control on the stop for a period of time appropriate to the manoeuvre.
(c) It must always be possible to reduce incidence by conventional use of the controls.
(d) The rate at which the aeroplane can be manoeuvred from trim speeds associated with scheduled operating speeds such as V2 and Vref up to Alpha-limit shall not be unduly damped or be significantly slower than can be achieved on conventionally controlled transport aeroplanes.

6.3 High Incidence Handling with the Critical Engine Inoperative

Revoked

7. Atmospheric Disturbances

Operation of the high incidence protection system must not adversely affect aircraft control during expected levels of atmospheric disturbances, nor impede the application of recovery procedures in case of windshear. (See interpretative material IM F-5001 paragraph 9)

8. Speeds Associated with Other Requirements

JAR 25 specifies requirements that have to be met at speeds quoted as factors of the stall speed Vs. For the A330/A340 Vs will be interpreted in each paragraph of the requirements according to the appendix.

9. Alpha floor

The Alpha-floor setting must be such that the aircraft can be flown at normal landing operational speeds and manoeuvred up to bank angles consistent with the flight phase without triggering Alpha-floor.

In addition, there must be no alpha-floor triggering unless appropriate when the aircraft is flown in usual operational manoeuvres and in turbulence.

APPENDIX TO SPECIAL CONDITION F-5001

1. JAR 25.21:
add the following paragraph 25.21 (b):

(b) The flying qualities will be evaluated at the most unfavourable CG position.

2. In lieu of JAR 25.119 paraqraph (b)

(b) A climb speed which is:

(1) not less than
i) 1.08 Vs1g for aeroplanes with four engines on which the application of power results in significant reduction in stalling speed; or
ii) 1.13 Vs1g for all other aeroplanes

(2) not less than Vmcl; and

(3) not more than the greater of Vref and Vmcl

3. Replace JAR 25.121 paraqraph (d) by:

(d) Discontinued approach- In a configuration in which Vslg does not exceed 110% of the Vs1g for the related all-engines-operating landing configuration, the steady gradient may not be less than 2.1% for two-engined aeroplanes, and 2.7% for four-engines aeroplanes with-
(1) the critical engine inoperative, the remaining engines at the go-around thrust setting.

(2) The maximum landing weight; and

(3) A climb speed established in connexion with normal landing procedures; but not exceeding 1.41 Vs1g.

4. Replace the speeds Vs mentioned in the following JAR 25 requirements as follows:

JAR 25.145 (a)	Vmin in lieu of Vs
JAR 25.145 (b) (1)	1.32 Vs1g in lieu of 1.4 Vs1
JAR 25.145 (b) (4)	1.32 Vs1g in lieu of 1.4 Vs1
JAR 25.145 (b) (6)	1.32 Vs1g in lieu of 1.4 Vs1 Vmin in lieu of 1.1 Vs1 1.6 Vs1g in lieu of 1.7 Vs1
JAR 25.145 (c)	1.13 Vs1g in lieu of 1.2 Vs1
JAR 25.147 (a)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.147 (a) (2)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.147 (c)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.147 (d)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.149 (c)	1.13 Vs1g in lieu of 1.2 Vs
JAR 25.161 (b)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.161 (c) (1)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.161 (c) (2)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.161 (c) (3)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.161 (d)	1.3 Vs1g in lieu of 1.4 Vs1
JAR 25.175 (a)	not applicable, see SC F-1003
JAR 25.175 (d)	not applicable, see SC F-1003
JAR 25.177 (a)	1.13 Vs1g in lieu of 1.2 Vs1
JAR 25.177 (b) (1)	1.13 Vs1g to 1.23 Vs1g in lieu of 1.2 Vs1 to 1.3 Vs1
JAR 25.177 (b) (2)	1.13 Vs1g to 1.23 Vs1g in lieu of 1.2 Vs1 to 1.3 Vs1
JAR 25.177 (b) (3)	1.23 Vs1g in lieu of 1.3 Vs1
JAR 25.181 (a)	1.13 Vs1g in lieu of 1.2 Vs
JAR 25.233 (a)	replace 0.2 Vs0 by 0.2 Vs1g
JAR 25.237	0.94 Vs1g in lieu of VSO
JAR 25.735 (f) (2)	0.94 Vs1g in lieu of VSO
JAR 25.773 (b) (1)(i)	1.5 Vs1g in lieu of 1.6 Vs1
JAR 25.1001 (c) (1)	.94 Vs1g in lieu of Vs1
JAR 25.1001 (c) (3)	.94 Vs1g in lieu of Vs1
JAR 25.1323(c) (1) (i)	.94 Vs1g in lieu of Vs1
JAR 25.1323(c) (1) (ii)	.94 Vs1g in lieu of VSO
JAR 25.1323 (c) (2)	"From 1.3 x 0.94 Vs1g to Vmin" in lieu of "1.3 Vs to stall warning speed" and "speeds below Vmin" in lieu of "speeds below stall warning"
JAR 25.1325(e)	replace 1.3Vs0 by 1.3 x .94 Vs1g and 1.8Vs1 by 1.8 x .94 Vs1g

SPECIAL CONDITION	**F-5004: Static Longitudinal Stability and Low energy awareness**
APPLICABILITY:	TC: A318 Post TC: A319/A320A321 with mod 160500/160023 (Sharklet)
REQUIREMENTS:	JAR 25.171, 25.173, 25.175, SC F5001
ADVISORY MATERIAL:	IM F5001

BACKGROUND

The A318 longitudinal control laws provide a neutral stability within the normal flight envelope. Therefore, the aircraft design does not literally comply with the static longitudinal stability requirements of JAR 25.171, 25.173, and 25.175. These requirements must consequently be replaced by a special condition.

NOTE: this Special Condition is also applicable for A319/A320/A321 aircraft equipped with modification 160500 or 160023 (Sharklets).

Past experience on aircraft fitted with a flight control system providing a neutral longitudinal stability shows there is insufficient feedback cue of excursion below operational speeds. Protection systems associated with these laws secure the aircraft against stall but are not sufficient to prevent low speed excursions because they intervene far below normal operational speeds, and until intervention, there are no stability cues since the aircraft remains trimmed. Additionally, the pitching moment due to thrust variation is reduced by the flight control laws. Recovery from a low speed excursion may become hazardous when the low speed situation is associated with a low altitude and with the engines at idle, i.e. when there is a low energy situation. These low energy situations must be avoided and therefore the pilots must be given adequate cues when approaching such situations.

SPECIAL CONDITION

The aircraft shall be shown to have suitable stability in any condition normally encountered in service, including the effects of atmospheric disturbances.

The aircraft, fitted with flight control laws presenting neutral longitudinal stability significantly below the normal operating speeds, must provide adequate awareness to the pilot of a low energy state.

SPECIAL CONDITION	F-5011: Steep Approach and Landing
APPLICABILITY:	Post-TC: A318
REQUIREMENTS:	JAR 25X20, 25.121(d), 25.125
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus applied for approval of the Airbus A318 for approach and landing at airfields where there is a steep final approach path up to 5.5 degrees. The basic regulation standard does not cover this type of operation (it is considered to cover approaches up to 4.5 degrees), and this CRI is intended to set the safety standard the aircraft must meet to achieve certification for approach and landing at airfields where there is a final approach path above 4.5 degrees.

NPA 25B-267 (Final Rule) entitled "JAR 25, Subpart 8, Steep Approach Landing Requirements", dated March 1999, was the result of a request from the operating and manufacturing industries to JAA to produce a NPA for Steep Approach and Landing. This NPA has been used in several JAA projects and can be considered as an agreed standard.

Recent certification experience has raised questions on NPA 25B-267. These were discussed within the JAA Flight Steering Group (FstG) which has finally resulted in FWP 737, issue 6.
An agreement between Airbus Industrie, JAA and EASA, and it is therefore considered acceptable to use FWP737 issue 6 with the following amendment:

At the end of paragraph (SAL) 25.5 (a), add:

"For condition (2), it must be possible to achieve an approach path angle 2° steeper than the selected approach path angle in all configurations which exist down to the initiation of the flare, which must not occur above 150% of the screen height. The flare technique used must be substantially unchanged from that recommended for use at the selected approach path angle"

Corresponding Special Condition, Appendix SAL and Interpretative Material are proposed and agreed.

SPECIAL CONDITION

1. Add a subparagraph (d) to JAR 25X20 Applicability.

(d) For an aeroplane where approval is sought for approach and landing using a final approach path angle greater than or equal to 4.5°, the additional requirements of Appendix (SAL) will apply.

2. Add Appendix (SAL), Additional Airworthiness Requirements for Approval of a Steep Approach Landing Capability.

APPENDIX (SAL)

ADDITIONAL AIRWORTHINESS REQUIREMENTS FOR APPROVAL OF A STEEP APPROACH LANDING CAPABILITY

(SAL) 25.1 Applicability

This appendix contains airworthiness requirements that enable an aeroplane to obtain approval for a steep approach landing capability using an approach path angle greater than or equal to 4.5° (a gradient of 7.9%).

The requirements of this appendix cover only JAR 25 Subparts B and G and they apply in lieu of 25.121(d). They also apply in lieu of 25.125 if a reduced landing distance is sought, or if the landing procedure (speed, configuration, etc.) differs significantly from normal operation, or if the screen height is greater than 50 ft. Additional requirements may apply with respect to aeroplane systems or equipment or other relevant items such as autopilot, flight guidance or GPWS. It is likely that the GPWS mode 1 (sink rate) envelope will need modification to prevent nuisance alerts. Also, the structural implications of the increased probability of high rates of descent at touch down must be considered.

If a steep approach approval is required for flight in icing conditions, substantiation must be provided accordingly for the steep approach condition.

An applicant may choose to schedule information for an all-engines approach or for an approach with one engine inoperative. If an all-engines approach is scheduled, it is assumed that a diversion is required if an engine failure occurs prior to the decision to land.

(SAL) 25.2 Definitions

For the purposes of this Appendix:

Steep Approach Landing: An approach to land made using a glide path angle greater than or equal to 4.5°, as selected by the applicant.

Screen Height: The reference height above the runway surface from which the landing distance is measured. The screen height is a height selected by the applicant, at 50ft or another value from 35 to 60ft.

$V_{REF(SAL)}$ is the calibrated airspeed selected by the applicant, used during the stabilised approach at the selected approach path angle and maintained down to the screen height defined above. $V_{REF(SAL)}$ may not be less than 1.23 V_{SR}, V_{MCL} or a speed that provides the manoeuvring capability specified in JAR 25.143(g), whichever is greater and may be different to the V_{REF} used for standard approaches.

$V_{REF(SAL)-1}$ is the calibrated airspeed selected by the applicant, used during the stabilised one-engine-inoperative approach at the selected approach path angle and maintained down to the screen height defined above. $V_{REF(SAL)-1}$ may not be less than $V_{REF(SAL)}$.

(SAL) 25.3 Steep Approach Landing Distance (Applicable only if a reduced landing distance is sought, or if the landing procedure (speed, configuration, etc.) differs significantly from normal operation, or if the screen height is greater than 50ft).

(a) The steep approach landing distance is the horizontal distance necessary to land and to come to a complete stop from the landing screen height and must be determined (for standard temperatures, at each weight, altitude and wind within the operational limits established by the applicant for the aeroplane) as follows:-

(1) The aeroplane must be in the all-engines-operating or one-engine-inoperative steep approach landing configuration, as applicable.

(2) A stabilised approach, with a calibrated airspeed of $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$, as appropriate, and at the selected approach angle must be maintained down to the screen height.

(3) Changes in configuration, power or thrust, and speed must be made in accordance with the established procedures for service operation. (See ACJ 25.125(a)(3)).

(4) The landing must be made without excessive vertical acceleration, tendency to bounce, nose over or ground loop and with a vertical touchdown velocity not greater than 6 ft/sec.

(5) The landings may not require exceptional piloting skill or alertness.

(b) The landing distance must be determined on a level, smooth, dry, hard-surfaced runway. (See ACJ 25.125(b)). In addition-

(1) The pressures on the wheel braking systems may not exceed those specified by the brake manufacturer.

(2) The brakes may not be used so as to cause excessive wear of brakes or tyres (see ACJ 25.125(b)(2)).

(3) Means other than wheel brakes may be used if that means –
(i) Is safe and reliable;
(ii) Is used so that consistent results can be expected in service; and
(iii) Is such that exceptional skill is not required to control the aeroplane.

(c) Reserved.

(d) Reserved.

(e) The landing distance data must include correction factors for not more than 50% of the nominal wind components along the landing path opposite to the direction of landing, and not less than 150% of the nominal wind components along the landing path in the direction of landing.

(f) If any device is used that depends on the operation of any engine, and if the landing distance would be noticeably increased when a landing is made with that engine assumed to fail during the final stages of an all-engines-operating steep approach, the steep approach landing distance must be determined with that engine inoperative unless the use of compensating means will result in a landing distance not more than that with each engine operating.

(SAL) 25.4 Climb: One-Engine-Inoperative

In a configuration corresponding to the normal all-engines-operating procedure in which V_{SR} for this configuration does not exceed 110% of the V_{SR} for the related all- engines-operating steep approach landing configuration the steady gradient of climb may not be less than 2.1% for two-engined aeroplanes, 2.4% for three-engined aeroplanes, and 2.7% for four-engined aeroplanes, with:-

(a) The critical engine inoperative, the remaining engines at the go-around power or thrust setting;
(b) The maximum landing weight;
(c) A climb speed of $V_{REF(SAL)}$; and
(d) The landing gear retracted.

(SAL) 25.5 Safe Operational and Flight Characteristics

(a) It must be demonstrated that it is possible to complete a stabilised approach in calm air down to the commencement of the landing flare, followed by a touchdown and landing without displaying any hazardous characteristics for the following conditions (see AMC (SAL) 25.5):

(1) The selected approach path angle at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate;
(2) An approach path angle 2° steeper than the selected approach path angle, at $V_{REF(SAL)}$ or $V^{REF(SAL)-1}$ as appropriate; and

(3) The selected approach path angle at $V_{REF(SAL)}$ minus 5 knots or $V_{REF(SAL)-1}$ minus 5 knots as appropriate.

For conditions (1), (2) and (3) -:

(i) The demonstration must be conducted at the most critical weight and centre of gravity, either with all-engines-operating or with the critical engine inoperative, as appropriate;

(ii) The rate of descent must be reduced to 3 feet per second or less before touch down;

(iii) Below a height of 200 ft, no action shall be taken to increase power or thrust apart from those small changes as are necessary to maintain an accurate approach;

(iv) No nose depression by use of longitudinal control shall be made after initiating the flare other than those small changes necessary to maintain a continuous and consistent flare flight path; and

(v) The flare, touchdown and landing may not require exceptional piloting skill or alertness.

For conditions (1) and (3), the flare must not be initiated above the screen height.

For condition (2), it must be possible to achieve an approach path angle 2° steeper than the selected approach path angle in all configurations which exist down to the initiation of the flare, which must not occur above 150% of the screen height. The flare technique used must be substantially unchanged from that recommended for use at the selected approach path angle.

(b) All-Engines-Operating Steep Approach. It must be demonstrated that the aeroplane can safely transition from the all-engines-operating steep landing approach to the one-engine-inoperative approach climb configuration with one engine having been made inoperative for the following conditions:

(i) The selected steep approach angle;

(ii) An approach speed of $V_{REF(SAL)}$;

(iii) The most critical weight and centre of gravity; and

(iv) For propeller powered aeroplanes, the propeller of the inoperative engine shall be at the position it automatically assumes following an engine failure at high power.

(c) In addition, for propeller powered aeroplanes, it must be demonstrated that controllability is maintained following an engine failure at approach power and with the propeller at the position it automatically assumes.

(d) The height loss during the manoeuvre required by sub-paragraph (SAL) 25.5(b) must be determined.

(e) It must be demonstrated that the aeroplane is safely controllable during a landing with one engine having been made inoperative during the final stages of an all-engines-operating steep approach for the following conditions:

(i) The selected steep approach angle;
(ii) An approach speed of $V_{REF(SAL)}$;
(iii) The most critical weight and centre of gravity; and
(iv) For propeller powered aeroplanes, the propeller of the inoperative engine shall be at the position it automatically assumes following an engine failure at approach power.

(f) One-Engine-Inoperative Steep Approach. It must be demonstrated that the aeroplane can safely transition from the one-engine-inoperative steep landing approach to the approach climb configuration for the following conditions:

(i) The selected steep approach angle;
(ii) An approach speed of $V_{REF(SAL)-1}$;
(iii) The most critical weight and centre of gravity; and
(iv) For propeller powered aeroplanes the propeller of the inoperative engine may be feathered.

(SAL) 25.6 Aeroplane Flight Manual

The AFM supplement for steep approach landing shall include the following:

(a) The steep approach landing distance determined in accordance with paragraph (SAL) 25.3 of this appendix for the selected screen height and aeroplane configuration. The landing distance data may additionally include correction factors for runway slope and temperature other than standard, within the operational limits of the aeroplane, and may provide the required landing field length including the appropriate factors for operational variations prescribed in the relevant operating regulation.

(b) The more limiting of the landing WAT limits derived in accordance with:

(1) JAR 25.119, and
(2) The one-engine-inoperative approach climb requirement of paragraph (SAL) 25.4 of this appendix.

(c) Appropriate limitations and detailed normal, non-normal and emergency procedures. Where an aeroplane is not approved for deliberate one-engine- inoperative steep approach landings, this limitation shall be stated.

(d) A statement that the presentation of the steep approach limitations, procedures and performance reflects the capability of the aeroplane to perform steep approach landings but that it does not constitute operational approval.

(e) A statement of headwind and crosswind limitations if they are different from those for non-steep approaches. The tailwind limitation is 5 knots, unless test evidence shows that more than 5 knots is acceptable.

(f) The reference steep approach glide slope angle and the screen height used for determination of the landing distance must be specified.

(g) The height loss during a go-around from the all-engines-operating steep landing approach to the approach climb configuration with one engine made inoperative, determined in accordance with (SAL) 25.5(d).

SPECIAL CONDITION	**G-11: Turbine Engine - Maximum Take-off Power and/or Thrust Duration**
APPLICABILITY:	TC: A318/A320
REQUIREMENTS:	JAR 1 – Definition and abbreviation
ADVISORY MATERIAL:	N/A

BACKGROUND

JAR 1 General definition for turbine engine:

"Maximum take-off power and/or thrust includes consideration of a maximum continuous period of 5 minutes".

Continuous use of take-off thrust up to 10 minutes in case of engine failure can be based on engine certification (Mention of corresponding engine capability on the Engine TCDS).

SPECIAL CONDITION

Replace JAR 1 definition applicable to A320 by:

"...5 minutes "When specifically requested and approved under JAR E (section 4-BCAR Section C issue 13) continuous periods in excess of 5 minutes may be applicable in the event of a power unit having failed or been shut down".

SPECIAL CONDITION	G-17: Operational Proving Flights
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	BCAR Chapter A 5.2 paragraph 2.4/3.55 (F) SC G.17 and (G) SC G.17
ADVISORY MATERIAL:	N/A

BACKGROUND

Some countries require "route proving" under the administrative procedures as condition for Type Certification. The "JAR Guidance on Administrative Procedures for Basic Type Certification of Aeronautical Products to JAR" do not contain a statement to cover this subject. Furthermore:

- JAR 25 does not include requirement concerning "endurance demonstration'';

- For already certificated AI product the endurance demonstration was required by a complementary condition based on FAR 21.35;

- Wording of this condition and FAR 21.35 is questionable and the objective of the requirement needs clarification.

SPECIAL CONDITION

Where the Applicant is required to carry out a period of flying representative of operational use, to demonstrate that the aircraft is suitable for operation over representative routes, the number of flight hours required shall be agreed using the guidelines given below:

The objectives of this period of flying are:

- to demonstrate the adequacy of the design and its ability to operate in a typical operational environment.

- to carry out a systematic check of operation of all components to determine whether they perform their intended function without introducing safety hazards.

- to prove the adequacy on the crew complement in scheduled airline operation.

- to execute scheduled Maintenance Inspections Actions during the test programme to determine whether there are any failures or incipient failures in any of the components which might be a hazard to safe flight.

For the purpose of this flying the aircraft shall be of a standard comparable to the Type Definition.

EQUIVALENT SAFETY FINDING	G-228: Alternative to CS 25.1563 Airspeed Placard
APPLICABILITY:	TC: A321-2XXNY
REQUIREMENTS:	JAR/CS 25.1563
ADVISORY MATERIAL:	N/A

BACKGROUND

A321neo XLR will be fitted with Enhanced Take-Off Configuration function (ETOC) like A350. This is an aircraft function related to the flap system, which main objective is to improve the aircraft take-off performance.

The optimization of the aircraft performance at take-off is mainly driven by:

- Maximizing climb capabilities,
- Minimizing take-off distance and
- Maximizing take-off weight.

In order to optimize the trade-off between these three performance parameters, the function principle established by the ETOC is to increase the number of high-lift configurations for take-off in comparison with the A321neo ACF.

CS 25.1563 - Airspeed Placard specifies that "*A placard showing the maximum airspeeds for wing-flap extension for the take-off, approach, and landing positions must be installed in clear view of each pilot.*"

On the A321neo ACF, on the airspeed placard there is one maximum flap extended speed (V_{FE}) per configuration. With ETOC function being part of A321neo XLR Type Design Definition and increasing the number of available take-off configurations, CS 25.1563 would require to display all the V_{FE} for all configurations on the airspeed placard of A321neo XLR. Expanding the airspeed placard to list all the V_{FE}s would clutter the placard and negatively impact the readability with a risk of false readings.

EQUIVALENT SAFETY FINDING

1. APPLICABILITY

   Airbus A321-253NY & -271NY

   1.1. CS REQUIREMENT AFFECTED

   CS 25.1563

2. Limitations of the Equivalent Safety Finding:

a. Additional high lift configurations are provided for the take-off phase only (Enhanced Take-Off Configuration {ETOC} function), i.e., these additional configurations cannot be set in approach and landing flight phases.
b. All non-ETOC related maximum flap extended speeds (V_{FE}) are provided on the airspeed placard.

3. Set of compensating factors for the omission of high lift take-off configuration V_{FE} from the airspeed placard as otherwise specified by CS 25.1563:

a. The maximum flap extended speed (V_{FE}) for a selected flap/slat configuration is displayed on the primary flight display (PFD) on the speed scale when the "V_{FE}" is within the speed range visible on the speed scale.

b. As soon as the flap lever is moved out of the selected take-off position during an ETOC take-off, the maximum flap extended speed (V_{FE}) of the configuration attained is provided on the airspeed placard.

c. In the case of loss of V_{FE} indications on all PFDs during an ETOC take-off, if the flight crew is directed to refer to the V_{FE} of an ETOC configuration, the placard shall be complemented with the information that the airspeed placard does not indicate the V_{FE} for ETOC configurations. If the placard is not complemented in this way, an appropriate AFM instruction shall be established how to derive adequate maximum speeds to respect while completing the take-off.

d. The maximum flap extended speeds (V_{FE}) for all flap/slat configurations including ETOC configurations selectable in normal operations are provided via the aircraft flight manual (AFM).

e. All ETOC flap/slats configurations are protected either by a flaps load relief system or an auto-retraction system.

f. For all ETOC flap/slats configurations, an overspeed warning is provided.

SPECIAL CONDITION	H-01: Enhanced Airworthiness Programme for Aeroplane Systems - ICA on EWIS
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	PART 21A.16B(a)(3), 21A.3B(c)(1), CS 25.1529 + Appendix H
ADVISORY MATERIAL:	N/A

Add to: **Appendix H Instructions for Continued Airworthiness**

H25.5 Electrical Wiring Interconnection Systems Instructions for Continued Airworthiness

The applicant must prepare Instructions for Continued Airworthiness (ICA) applicable to Electrical Wiring Interconnection System (EWIS) as defined below that include the following:

Maintenance and inspection requirements for the EWIS developed with the use of an enhanced zonal analysis procedure (EZAP) that includes:

a. Identification of each zone of the aeroplane.
b. Identification of each zone that contains EWIS.
c. Identification of each zone containing EWIS that also contains combustible materials.
d. Identification of each zone in which EWIS is in close proximity to both primary and back-up hydraulic, mechanical, or electrical flight controls and lines.
e. Identification of –
   - Tasks, and the intervals for performing those tasks, that will reduce the likelihood of ignition sources and accumulation of combustible material, and
   - Procedures, and the intervals for performing those procedures, that will effectively clean the EWIS components of combustible material if there is not an effective task to reduce the likelihood of combustible material accumulation.
f. Instructions for protections and caution information that will minimize contamination and accidental damage to EWIS, as applicable, during the performance of maintenance, alteration, or repairs.

The ICA must be in the form of a document appropriate for the information to be provided, and they must be easily recognizable as EWIS ICA.

For the purpose of this Appendix H25.5, the following EWIS definition applies:

(a) Electrical wiring interconnection system (EWIS) means any wire, wiring device, or combination of these, including termination devices, installed in any area of the aeroplane for the purpose of transmitting electrical energy, including data and signals between two or more intended termination points. Except as provided for in subparagraph (c) of this paragraph, this includes:

(1) Wires and cables.

(2) Bus bars.

(3) The termination point on electrical devices, including those on relays, interrupters, switches, contactors, terminal blocks, and circuit breakers and other circuit protection devices.

(4) Connectors, including feed-through connectors.

(5) Connector accessories.

(6) Electrical grounding and bonding devices and their associated connections.

(7) Electrical splices.

(8) Materials used to provide additional protection for wires, including wire insulation, wire sleeving, and conduits that have electrical termination for the purpose of bonding.

(9) Shields or braids.

(10) Clamps and other devices used to route and support the wire bundle.

(11) Cable tie devices.

(12) Labels or other means of identification.

(13) Pressure seals.

(b) The definition in subparagraph (a) of this paragraph covers EWIS components inside shelves, panels, racks, junction boxes, distribution panels, and back-planes of equipment racks, including, but not limited to, circuit board back-planes, wire integration units and external wiring of equipment.

(c) Except for the equipment indicated in subparagraph (b) of this paragraph, EWIS components inside the following equipment, and the external connectors that are part of that equipment, are excluded from the definition in subparagraph (a) of this paragraph:

(1) Electrical equipment or avionics that is qualified to environmental conditions and testing procedures when those conditions and procedures are -

(i) Appropriate for the intended function and operating environment, and

(ii) Acceptable to the Agency.

(2) Portable electrical devices that are not part of the type design of the aeroplane. This includes personal entertainment devices and laptop computers.

(3) Fibre optics.

SPECIAL CONDITION	P-01: FADEC
APPLICABILITY:	TC: A320/A321
REQUIREMENTS:	JAR 25.901, 25.903
ADVISORY MATERIAL:	N/A

BACKGROUND

A320/A321 engines incorporate a Full Authority Digital Engine Control (FADEC) ensuring electrical control and exchanging appropriate signals with the associated aircraft computers

Although several aircraft equipped with FADEC have been certified, this feature is still considered an unusual feature. It must be shown that the safety level is not degraded compared with aircraft with hydromechanical engine control systems.

The adequacy of existing regulations, although adequate, for both engine and aircraft certifications, might need special interpretations to be defined for engines equipped with electronic control.

Airbus Industrie will comply for the FADEC system with the relevant JAR 25 requirements applicable to A321 aircraft. The concerned paragraphs are:

JAR 25-581 /-631 / -X899 / -901 /-903 / -933 / -939 / -1103(d) / -1143(a)(b)(c) / -1155 / -1163 / -1301 / -1305[(a)(3) to (a)(7)] (a)(9) [(c)(1) to (c)(5)] (c)(8) / -1305(d) / -1309 / -1351(b) / 1353(a) (b) / -1355(c) / -1357(a) / -1431 / -1521(a) / -1527.

SPECIAL CONDITION

The overall propulsion control system including the FADEC and associated electronic equipment, must be substantiated to have an availability of the functions essential for safe flight and landing, in the installed configuration, at least equivalent to those of conventional propulsion control system of a similar type encompassing a hydromechanical engine control system which has already been certified to the JAR regulations.

SPECIAL CONDITION	**P-27: Flammability Reduction System**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.1309, FAR 25.981(c)
ADVISORY MATERIAL:	N/A

1. Special Condition

1.1 General

The following special conditions are part of the type design certification basis for Airbus A318/A319/A320/A321 with a centre tank(s) equipped with a Flammability Reduction System (FRS).

Compliance with these special conditions does not relieve the applicant from compliance with the existing certification requirements.

These special conditions define additional requirements for the design and installation of a FRS that will inert fuel tanks with NEA in order to reduce the fleet average flammability exposure to 3% or less of the operational time for the aeroplane under evaluation. This 3% value is based upon the results of unheated wing tank Monte Carlo flammability analysis that gives results typically around this value. In order to address the high-risk phases of flight (i.e., warm/hot day pre-flight ground operations and climb where flammable conditions are more likely to occur), when the FRS is functional, it will be required to reduce the flammability exposure in each of these phases of operation to 3% or less of the operational time in those phases.

Irrespective of the addition of FRS, ignition source minimisation must still be applied to the tanks. Therefore the applicant is required to summarise modifications required for ignition source minimisation to be applied to the centre tank in compliance with INT/POL/25/12 (CS 25.1309).

The applicant may propose that MMEL relief is provided for aircraft operation with the FRS unavailable. Appropriate justification in accordance with normal policies and procedures including mitigating factors must be provided.

1.2 Definitions

(a) *Bulk Average Fuel Temperature.* The average fuel temperature within the fuel tank, or different sections of the tank if the tank is subdivided by baffles or compartments.

(b) *Flammability Exposure Evaluation Time (FEET).* For the purpose of these special conditions, the time from the start of preparing the aeroplane for flight, through the flight and landing, until all payload is unloaded and all passengers and crew have disembarked. In the Monte Carlo programme, the flight time is randomly selected from the Mission Range Distribution (Appendix 2, Table 3), the pre-flight times are provided as a function of the flight time, and the post- flight time is a constant 30 minutes.

(c) *Flammable.* With respect to a fluid or gas, flammable means susceptible to igniting readily or to exploding. A non-flammable ullage is one where the gas mixture is too lean or too rich to burn and/or is inert per the definition below.

(d) *Flash Point.* The flash point of a flammable fluid is the lowest temperature at which the application of a flame to a heated sample causes the vapour to ignite momentarily, or "flash". A test for jet fuel is defined in the *ASTM* specification*, D56, "Standard Test Method for Flash Point by Tag Close Cup Tester"*.

(e) *Hazardous Atmosphere.* An atmosphere that may expose any person(s) to the risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a space), injury, or acute illness.

(f) *Inert.* For the purpose of these special conditions, the tank is considered inert when the bulk average oxygen concentration within each compartment of the tank is 12% or less at sea level up to 10,000 feet, then linearly increasing from 12% at 10,000 feet to 14.5% at 40,000 feet, and extrapolated linearly above that altitude (based on FAA test data).

(g) *Inerting*. A process where a non-combustible gas is introduced into the ullage of a fuel tank to displace sufficient oxygen so that the ullage becomes inert.

(h) *Monte Carlo Analysis.* An analytical tool that provides a means to assess the degree of fleet average and warm day flammability exposure time for a fuel tank. See Appendices 1 and 2 of these special conditions for specific guidelines on conducting a Monte Carlo analysis.

(i) *Transport Effects*. Transport effects are the effects on fuel vapour concentration caused by low fuel conditions (mass loading), fuel condensation, and vapourisation.

(j) *Ullage, or Ullage Space*. The volume within the tank not occupied by liquid fuel at the time interval under evaluation.

1.3 System Performance and Reliability

It must be demonstrated that the FRS reduces tank flammability to levels defined in these special conditions. This should be shown by complying with performance and reliability requirements as follows:

(a) The applicant must submit a combined fleet performance and reliability analysis (Monte Carlo analysis as described in Appendices 1 and 2) that must:

(1) Demonstrate that the overall fleet average flammability exposure of each fuel tank with a FRS installed is equal to or less than 3% of the FEET; and

(2) Demonstrate that neither the performance (when the FRS is operational) nor reliability (including all periods when the FRS is inoperative) contributions to the overall fleet average flammability exposure of a tank with a FRS installed are more than 1.8 percent (this will establish appropriate maintenance inspection procedures and intervals as required in paragraph 1.4 of these special conditions).

(b) The applicant must submit a Monte Carlo analysis that demonstrates that the FRS, when functional, reduces the overall fleet average flammability exposure of each fuel tank with a FRS installed for warm day ground and climb phases to a level equal to or less than 3% of the FEET in each of these phases for the following conditions:

(1) The analysis must use the subset of 80°F (26.7°C) and warmer days from the Monte Carlo analyses done for overall performance, and

(2) The flammability exposure must be calculated by comparing the time during ground and climb phases for which the tank was flammable and not inert with the total time for the ground and climb phases.

(c) The applicant must provide data from ground testing and flight testing that:

(1) validate the inputs to the Monte Carlo analysis needed to meet paragraphs 1.3(a), (b) and (c)(2) of these special conditions; and

(2) substantiate that the NEA distribution is effective at inerting all portions of the tank where the inerting system is needed to show compliance with these paragraphs.

(d) The applicant must validate that the FRS meets the requirements of paragraphs (a), (b), and (c)(2) of this section with any combination of interfacing systems (e.g. electrical power system) approved for the aeroplane that may affect FRS reliability and performance.

(e) Sufficient accessibility for maintenance personnel, or the flightcrew, must be provided to FRS status indications that are necessary to meet the reliability requirements of paragraph 1.3(a) of these special conditions.

(f) The access doors and panels to the fuel tanks (including any tanks that communicate with an inerted tank via a vent system), and to any other enclosed areas that could contain NEA under normal or failure conditions, must be permanently stenciled, marked, or placarded as appropriate to warn maintenance crews of the possible presence of a potentially hazardous atmosphere. The proposal for markings does not alter the existing requirements that must be addressed when entering aeroplane fuel tanks.

(g) Oxygen-enriched air produced by the FRS must not create a hazard during normal operating conditions.

(h) Any FRS failures, or failures that could affect the FRS, with potential catastrophic consequences shall not result from a single failure or a combination of failures not shown to be extremely improbable.

(i) It must be shown that the fuel tank pressures will remain within limits during normal operating conditions and failure conditions.

(ii) Identify critical features of the fuel tank system to prevent an auxiliary fuel tank installation from increasing the flammability exposure of main tanks above that permitted under paragraphs 1.3(a)(1), (2) and (b) of these special conditions and to prevent degradation of the performance and reliability of the FRS.

1.4 Maintenance

The FRS shall be subject to analysis using conventional processes and methodology to ensure that the minimum scheduled maintenance tasks required for securing the continuing airworthiness of the system and installation are identified and published as part of the CS 25.1529 compliance. Maintenance tasks arising from either the Monte Carlo analysis or a CS 25.1309 safety assessment shall be dealt with in accordance with the principles laid down in FAA AC 25.19. The applicant shall prepare a validation programme for the associated continuing airworthiness maintenance tasks, fault finding procedures, and maintenance procedures.

1.5 In-Service Monitoring

Following introduction to service the applicant must introduce an event monitoring programme, accruing data from a reasonably representative sample of global operations, to ensure that the implications of component failures affecting the FRS are adequately assessed on an on-going basis. The applicant must:

(a) Provide a report to the primary certification authority (PCA) on a quarterly basis for the first five years of service introduction. After that period the requirement for continued reporting will be reviewed by the PCA.

(b) Provide a report to the validating authorities on a quarterly basis for a period of at least two years following introduction to service.

(c) Develop service instructions or revise the applicable aeroplane manuals, in accordance with a schedule agreed by the PCA, to correct any failures of the FRS that occur in service that could increase the fleet average or warm day flammability exposure of the tank to more than the exposure requirements of paragraphs 1.3(a) and 1.3(b) of these special conditions.

APPENDIX 1 to Special Condition P-27

1. Monte Carlo Analysis

(a) A Monte Carlo analysis must be conducted for the fuel tank under evaluation to determine fleet average and warm day flammability exposure for the aeroplane under evaluation. The analysis must include the parameters defined in Appendices 1 and 2 of these special conditions. The aeroplane specific parameters and assumptions used in the Monte Carlo analysis must include:

(1) FRS Performance – as defined by system performance.

(2) Cruise Altitude – as defined by aeroplane performance.

(3) Cruise Ambient Temperature – as defined in Appendix 2 of these special conditions.

(4) Overnight Temperature Drop – as defined in Appendix 2 of these special conditions.

(5) Fuel Flash Point and Upper and Lower Flammability Limits – as defined in Appendix 2 of these special conditions.

(6) Fuel Burn – as defined by aeroplane performance.

(7) Fuel Quantity – as defined by aeroplane performance.

(8) Fuel Transfer – as defined by aeroplane performance.

(9) Fuelling Duration – as defined by aeroplane performance.

(10) Ground Temperature – as defined in Appendix 2 of these special conditions.

(11) Mach Number – as defined by aeroplane performance.

(12) Mission Distribution – the applicant must use the mission distribution defined in Appendix 2 of these special conditions or may request EASA approval of alternative data.

(13) Oxygen Evolution – as defined by aeroplane performance or as defined in Appendix 2 of these special conditions.

(14) Maximum Aeroplane Range – as defined by aeroplane performance.

(15) Tank Thermal Characteristics – as defined by aeroplane performance.

(16) Descent Profile Distribution – the applicant must use either a fixed 2500 feet per minute descent rate or may request EASA approval of alternative data.

(b) The assumptions for the analysis must include:

(1) FRS performance throughout the flammability exposure evaluation time;

(2) Vent losses due to crosswind effects and aeroplane performance;

(3) Periods when the system is operating properly but fails to inert the tank;

Note: Localized concentrations above the inert level as a result of fresh air that is drawn into the fuel tank through vents during descent would not be considered as flammable.

(4) Expected system reliability;

(5) The MMEL/MEL dispatch inoperative period assumed in the reliability analysis, (60 flight hours must be used for a 10-day MMEL dispatch limit unless an alternative period has been approved by the PCA), including action to be taken when dispatching with the FRS inoperative (Note: The actual MMEL dispatch inoperative period data must be included in the engineering reporting requirement of paragraph 1.5 of these special conditions);

(6) Possible periods of system inoperability due to latent or known failures, including aeroplane system shut-downs and failures that could cause the FRS to shut down or become inoperative; and

(7) Effects of failures of the FRS that could increase the flammability of the fuel tank.

(8) Ancillary tanks where significant vapour transfer takes place, such as surge tanks, must be considered flammable if any primary fuel tank connected to the tank contains flammable vapors. In addition, these ancillary tanks are considered inert if all primary tanks are inert.

(c) The Monte Carlo analysis, including a description of any variation assumed in the parameters (as identified under paragraph (a) of this appendix) that affect fleet average or warm day flammability exposure, and substantiating data must be submitted to EASA for approval.

APPENDIX 2 to Special Condition P-27

1. Monte Carlo Model

(a) The FAA has developed a Monte Carlo model that can be used to develop a specific analysis model for the Boeing 747 to calculate fleet average and warm day flammability exposure for a fuel tank. The program requires the user to enter the aeroplane performance data specific to the aeroplane model being evaluated, such as maximum range, cruise mach number, typical step climb altitudes, tank thermal characteristics specified as exponential heating/cooling time constants, and equilibrium temperatures for various fuel tank conditions. The general methodology for conducting a Monte Carlo model is described in AC 25.981-2.

(b) The FAA model, or one with modifications approved by the FAA, must be used as the means of compliance with these special conditions. Contact EASA Certification Directorate to obtain the correct version of the model to use. The following procedures, input variables, and data tables must be used in the analysis if the applicant develops a unique model to determine fleet average flammability exposure for a specific aeroplane type.

2. Monte Carlo Variables and Data Tables

(a) Fleet average flammability exposure is the percent of the mission time the fuel tank ullage is flammable for a fleet of an aeroplane type operating over the range of actual or expected missions and in a world-wide range of environmental conditions and fuel properties. Variables used to calculate fleet average flammability exposure must include atmosphere, mission length (as defined in paragraph 1.2 Definitions, as FLEET), fuel flash point, thermal characteristics of the fuel tank, overnight temperature drop, and oxygen evolution from the fuel into the ullage. Transport effects are not to be allowed as parameters in the analysis.

(b) For the purposes of these special conditions, a fuel tank is considered flammable when the ullage is not inert and the fuel vapour concentration is within the flammable range for the fuel type being used. The fuel vapour concentration of the ullage in a fuel tank must be determined based on the bulk average fuel temperature within the tank. This vapour concentration must be assumed to exist throughout all bays of the tank. For those aeroplanes with fuel tanks having different flammability exposure within different compartments of the tank, where mixing of the vapour or NEA does not occur, the Monte Carlo analysis must be conducted for the compartment of the tank with the highest flammability. The compartment with the highest flammability exposure for each flight phase must be used in the analysis to establish the fleet average flammability exposure. For example, the centre wing fuel tank in some designs extends into the wing and has compartments of the tank that are cooled by outside air, and other compartments of the tank that are insulated from outside air. Therefore, the fuel temperature and flammability is significantly different between these compartments of the fuel tank.

(c) Atmosphere

(1) In order to predict flammability exposure during a given flight, the variation of ground ambient temperatures, cruise ambient temperatures, and a method to compute the transition from ground to cruise and back again must be used. The variation of the ground and cruise ambient temperatures and the flash point of the fuel are defined by a Gaussian curve, given by the 50 percent value and a ± 1 standard deviation value.

(2) The ground and cruise temperatures are linked by a set of assumptions on the atmosphere. The temperature varies with altitude following the International Standard Atmosphere (ISA) rate of change from the ground temperature until the cruise temperature for the flight is reached. Above this altitude, the ambient temperature is fixed at the cruise ambient temperature. This results in a variation in the upper atmosphere (tropopause) temperature. For cold days, an inversion is applied up to 10,000 feet, and then the ISA rate of change is used. The warm day subset (see paragraph 1.3 (b) (1) of these special conditions) for ground and climb uses a range of temperatures above 80°F (26.7°C) and is included in the Monte Carlo model.

(3) The analysis must include a minimum number of flights, and for each flight a separate random number must be generated for each of the three parameters (i.e. ground ambient temperature, cruise ambient temperature, and fuel flash point) using the Gaussian distribution defined in Table 1. The applicant can verify the output values from the Gaussian distribution using Table 2.

(d) Fuel Properties.

(1) Flash point variation. The variation of the flash point of the fuel is defined by a Gaussian curve, given by the 50 percent value and a ± 1-standard deviation value.

(2) Upper and Lower Flammability Limits. The flammability envelope of the fuel that must be used for the flammability exposure analysis is a function of the flash point of the fuel selected by the Monte Carlo for a given flight. The flammability envelope for the fuel is defined by the upper flammability limit (UFL) and lower flammability limit (LFL) as follows:

(i) LFL at sea level = flash point temperature of the fuel at sea level minus10 degrees F. LFL decreases from sea level value with increasing altitude at a rate of 1 degree F per 808 ft.

(ii) UFL at sea level = flash point temperature of the fuel at sea level plus 63.5 degrees F. UFL decreases from the sea level value with increasing altitude at a rate of 1 degree F per 512 ft.

Note: Table 1 includes the Gaussian distribution for fuel flash point. Table 2 also includes information to verify output values for fuel properties. Table 2 is based on typical use of Jet A type fuel, with limited TS-1 type fuel use.

Table 1. Gaussian Distribution for Ground Ambient, Cruise Ambient, and Flash Point

	Temperature in Deg F		
Parameter	Ground Amb.	Cruise Amb.	Flash Point (FP)
Mean Temp	59.95	-70	120
neg 1 std dev	20.14	8	8
pos 1 std dev	17.28	8	8

% Probability of Temps & Flash Point Being Below the Listed Values	Ground Amb.	Cruise Amb.	Flash Point	Ground Amb.	Cruise Amb.	Flash Point (FP)
	Deg F	Deg F	Deg F	Deg C	Deg C	Deg C
1	13.1	-88.6	101.4	-10.5	-67.0	38.5
5	26.8	-83.2	106.8	-2.9	-64.0	41.6
10	34.1	-80.3	109.7	1.2	-62.4	43.2
15	39.1	-78.3	111.7	3.9	-61.3	44.3
20	43.0	-76.7	113.3	6.1	-60.4	45.1
25	46.4	-75.4	114.6	8.0	-59.7	45.9
30	49.4	-74.2	115.8	9.7	-59.0	46.6
35	52.2	-73.1	116.9	11.2	-58.4	47.2
40	54.8	-72.0	118.0	12.7	-57.8	47.8
45	57.4	-71.0	119.0	14.1	-57.2	48.3
50	59.9	-70.0	120.0	15.5	-56.7	48.9
55	62.1	-69.0	121.0	16.7	-56.1	49.4
60	64.3	-68.0	122.0	18.0	-55.5	50.0
65	66.6	-66.9	123.1	19.2	-55.0	50.6
70	69.0	-65.8	124.2	20.6	-54.3	51.2
75	71.6	-64.6	125.4	22.0	-53.7	51.9
80	74.5	-63.3	126.7	23.6	-52.9	52.6
85	77.9	-61.7	128.3	25.5	-52.1	53.5
90	82.1	-59.7	130.3	27.8	-51.0	54.6
95	88.4	-56.8	133.2	31.3	-49.4	56.2
99	100.1	-51.4	138.6	37.9	-46.3	59.2

Table 2. Verification of Table 1

(e) Flight Mission Distribution

(1) The mission length for each flight is determined from an equation that takes the maximum mission length for the aeroplane and randomly selects multiple flight lengths based on typical airline use.

(2) The mission length selected for a given flight is used by the Monte Carlo model to select a 30-, 60-, or 90- minute time on the ground prior to takeoff, and the type of flight profile to be followed. Table 3 must be used to define the mission

distribution. A linear interpolation between the values in the table must be assumed.

Table 3. Mission Range Distribution
Aeroplane Maximum Range - Nautical Miles (NM)

Flight Length (NM) From	To	1000	2000	3000	4000	5000	6000	7000	8000	9000	10000
		Distribution of missions Lengths(%)									
0	200	11.7	7.5	6.2	5.5	4.7	4.0	3.4	3.0	2.6	2.3
200	400	27.3	19.9	17.0	15.2	13.2	11.4	9.7	8.5	7.5	6.7
400	600	46.3	40.0	35.7	32.6	28.5	24.9	21.2	18.7	16.4	14.8
600	800	10.3	11.6	11.0	10.2	9.1	8.0	6.9	6.1	5.4	4.8
800	1000	4.4	8.5	8.6	8.2	7.4	6.6	5.7	5.0	4.5	4.0
1000	1200	0.0	4.8	5.3	5.3	4.8	4.3	3.8	3.3	3.0	2.7
1200	1400	0.0	3.6	4.4	4.5	4.2	3.8	3.3	3.0	2.7	2.4
1400	1600	0.0	2.2	3.3	3.5	3.3	3.1	2.7	2.4	2.2	2.0
1600	1800	0.0	1.2	2.3	2.6	2.5	2.4	2.1	1.9	1.7	1.6
1800	2000	0.0	0.7	2.2	2.6	2.6	2.5	2.2	2.0	1.8	1.7
2000	2200	0.0	0.0	1.6	2.1	2.2	2.1	1.9	1.7	1.6	1.4
2200	2400	0.0	0.0	1.1	1.6	1.7	1.7	1.6	1.4	1.3	1.2
2400	2600	0.0	0.0	0.7	1.2	1.4	1.4	1.3	1.2	1.1	1.0
2600	2800	0.0	0.0	0.4	0.9	1.0	1.1	1.0	0.9	0.9	0.8
2800	3000	0.0	0.0	0.2	0.6	0.7	0.8	0.7	0.7	0.6	0.6
3000	3200	0.0	0.0	0.0	0.6	0.8	0.8	0.8	0.8	0.7	0.7
3200	3400	0.0	0.0	0.0	0.7	1.1	1.2	1.2	1.1	1.1	1.0
3400	3600	0.0	0.0	0.0	0.7	1.3	1.6	1.6	1.5	1.5	1.4
3600	3800	0.0	0.0	0.0	0.9	2.2	2.7	2.8	2.7	2.6	2.5
3800	4000	0.0	0.0	0.0	0.5	2.0	2.6	2.8	2.8	2.7	2.6
4000	4200	0.0	0.0	0.0	0.0	2.1	3.0	3.2	3.3	3.2	3.1
4200	4400	0.0	0.0	0.0	0.0	1.4	2.2	2.5	2.6	2.6	2.5
4400	4600	0.0	0.0	0.0	0.0	1.0	2.0	2.3	2.5	2.5	2.4
4600	4800	0.0	0.0	0.0	0.0	0.6	1.5	1.8	2.0	2.0	2.0
4800	5000	0.0	0.0	0.0	0.0	0.2	1.0	1.4	1.5	1.6	1.5
5000	5200	0.0	0.0	0.0	0.0	0.0	0.8	1.1	1.3	1.3	1.3
5200	5400	0.0	0.0	0.0	0.0	0.0	0.8	1.2	1.5	1.6	1.6
5400	5600	0.0	0.0	0.0	0.0	0.0	0.9	1.7	2.1	2.2	2.3
5600	5800	0.0	0.0	0.0	0.0	0.0	0.6	1.6	2.2	2.4	2.5
5800	6000	0.0	0.0	0.0	0.0	0.0	0.2	1.8	2.4	2.8	2.9
6000	6200	0.0	0.0	0.0	0.0	0.0	0.0	1.7	2.6	3.1	3.3
6200	6400	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.4	2.9	3.1
6400	6600	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.8	2.2	2.5
6600	6800	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.2	1.6	1.9
6800	7000	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	1.1	1.3
7000	7200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.7	0.8
7200	7400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.5	0.7
7400	7600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.5	0.6

7600	7800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5	0.7
7800	8000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.8
8000	8200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.8
8200	8400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.0
8400	8600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	1.3
8600	8800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.1
8800	9000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8
9000	9200	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
9200	9400	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2
9400	9600	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
9600	9800	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
9800	10000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1

(f) Fuel Tank Thermal Characteristics

(1) The applicant must account for the thermal conditions of the fuel tank both on the ground and in flight. The Monte Carlo model, available on the website listed above, defines the ground condition using an equilibrium delta temperature (relative to the ambient temperature) that the tank will reach given a long enough time, with any heat inputs from aeroplane sources. Values are also input to define two exponential time constants (one for a near empty tank and one for a near full tank) for the ground condition. These time constants define the time for the fuel in the fuel tank to heat or cool in response to heat input. The fuel is assumed to heat or cool according to a normal exponential transition, governed by the temperature difference between the current temperature and the equilibrium temperature, given by ambient temperature plus delta temperature. Input values for this data can be obtained from validated thermal models of the tank based on ground and flight test data. The inputs for the in-flight condition are similar but are used for in-flight analysis.

(2) Fuel management techniques are unique to each manufacturer's design and variations in fuel quantity within the tank for given points in the flight, including fuel transfer for any purpose, must be accounted for in the model. The model uses a "tank full" time, specified in minutes, that defines the time before touchdown when the fuel tank is still full. For a centre wing tank used first, this number would be the maximum flight time, and the tank would start to empty at takeoff. For a main tank used last, the tank will remain full for a shorter time before touch down, and would be "empty" at touch down (i.e., tank empty at 0 minutes before touch down). For a main tank with reserves, the term empty means at reserve level rather than totally empty. The thermal data for tank empty would also be for reserve level.

(3) The model also uses a "tank empty" time to define the time when the tank is emptying, and the program uses a linear interpolation between the exponential time constants for full and empty during the time the tank is emptying. For a tank that is only used for long-range flights, the tank would be full only on longer range flights and would be empty a long time before touch down. For short

flights, it would be empty for the whole flight. For a main tank that carried reserve fuel, it would be full for a long time and would only be down to empty at touch down. In this case, empty would really be at reserve level, and the thermal constants at empty should be those for the reserve level.

(4) The applicant must propose means to validate thermal time constants and equilibrium temperatures to be used in the analysis. The applicant may propose using a more detailed thermal definition, such as changing time constants as a function of fuel quantity, provided the details and substantiation information are acceptable and the Monte Carlo model programme changes are validated.

(g) Overnight Temperature Drop

(1) An overnight temperature drop must be considered in the Monte Carlo analysis as it may affect the oxygen concentration level in the fuel tank. The overnight temperature drop for these special conditions will be defined using:

- A temperature at the beginning of the overnight period based on the landing temperature that is a random value based on a Gaussian distribution; and
- An overnight temperature drop that is a random value based on a Gaussian distribution.

(2) For any flight that will end with an overnight ground period (one flight per day out of an average of "x" flights per day, depending on use of the particular aeroplane model being evaluated), the landing outside air temperature (OAT) is to be chosen as a random value from the following Gaussian curve:

Table 4. Landing OAT

Parameter	Landing Temperature °F
Mean Temp	58.68
neg 1 std dev	20.55
pos 1 std dev	13.21

(3) The outside ambient air temperature (OAT) drop for that night is to be chosen as a random value from the following Gaussian curve:

Table 5. OAT Drop

Parameter	OAT Drop Temperature °F
Mean Temp	12.0
1 std dev	6.0

(h) Oxygen Evolution

The oxygen evolution rate must be considered in the Monte Carlo analysis if it can affect the flammability of the fuel tank or compartment. Fuel contains dissolved gases, and in the case of oxygen and nitrogen absorbed from the air, the oxygen level in the fuel can exceed 30 percent, instead of the normal 21 percent oxygen in air. Some of these gases will be released from the fuel during the reduction of ambient pressure experienced in the climb and cruise phases of flight. The applicant must consider the effects of air evolution from the fuel on the level of oxygen in the tank ullage during ground and flight operations and address these effects on the overall performance of the FRS. The applicant must provide the air evolution rate for the fuel tank under evaluation, along with substantiation data.

(i) Number of Simulated Flights Required in Analysis

In order for the Monte Carlo analysis to be valid for showing compliance with the fleet average and warm day flammability exposure requirements of these special conditions, the applicant must run the analysis for an appropriate number of flights to ensure that the fleet average and warm day flammability exposure for the fuel tank under evaluation meets the flammability limits defined in Table 6.

Table 6. Flammability Limit

Number of Flights in Monte Carlo Analysis	Maximum Acceptable Fuel Tank Flammability (%)
1,000	2.73
5,000	2.88
10,000	2.91
100,000	2.98
1,000,000	3.00

EQUIVALENT SAFETY FINDING	**P-1002: Thrust Reverser Autorestow**
APPLICABILITY:	Post-TC: A320
REQUIREMENTS:	JAR 25.933(a)
ADVISORY MATERIAL:	N/A

BACKGROUND

JAR 25.933 (a) (change 11) requires that:

"(a) Each engine reversing system intended for ground operation only must be designed so that, during any reversal in flight, the engine will produce no more than flight idle thrust. In addition, it must be shown by analysis or test, or both, that:

(1) The reverser can be restored to the forward thrust position; or,

(2) The aeroplane is capable of continued safe flight and landing under any possible position of the thrust reverser."

On A320, the Thrust Reverser Restow is automatically activated by the FADEC upon detection of an unlock or deployed condition.

AIRBUS is proposing to delete the thrust reverser automatic in-flight restow function.

The proposed design does not comply with JAR 25.933(a)(1). Compliance or Equivalent Safety demonstration is required

EQUIVALENT SAFETY FINDING

A Equivalent Safety Finding can be granted for A320-214 (equipped with CFM 56-5B4 engines) Thrust Reverser Restow function, on the basis of the following reasons

(i) The inadvertent in-flight deployment of any thrust reverser is extremely improbable.

(ii) The deletion of the auto restow function improves the protection against inadvertent in-flight deployment.

(iii) The positive contribution of the auto restow function was never taken in previous safety assessment.

(iv) Any thrust reverser malfunction during reverser sequence on the ground, or prior to take-off, will be covered by automatic restow sequence and .dedicated warning 'REV FAULT', if unsuccessful, will be provided to the crew to prohibit dispatch.

EQUIVALENT SAFETY FINDING	P-3008: Thrust reverser autorestow
APPLICABILITY:	TC: A321
REQUIREMENTS:	JAR 25.933 (a)
ADVISORY MATERIAL:	N/A

BACKGROUND

Current JAR 25.933 (a) (change 11) requires that:

"Thrust reverser system intended for ground use only be designed so that the engine will produce no more than idle thrust during any reversal in flight.

In addition, it must be shown that:

1) The reverser can be restored to the forward thrust position or,
2) The aeroplane is capable of safe flight and landing under any possible position of the thrust reverser.''

The thrust reverser restow on A321 is automatically activated by the FADEC upon detection of an unlock or deployed condition.

AIRBUS is proposing to delete the thrust reverser automatic in flight restow function for the following reasons:

- it simplifies the design,

- this feature is not necessary since it has been shown that inadvertent in flight deployment of any thrust reverser is extremely improbable.

- the suppression of this feature improves the design precautions taken to minimise the risk of thrust reverser deployment in case of certain failures conditions and de creases the probability of this event.

EQUIVALENT SAFETY FINDING

The autorestow function is proposed to be deleted for flight phases only, as basic design for Type Certification.

Any thrust reverser malfunction during reverser sequence on the ground or prior to take-off will be covered by automatic restow sequence and dedicated warning "REVFAULT if unsuccessful will be provided to the crew to prohibit dispatch.

For the flight phases, it is demonstrated in the Reverser Analysis that deleting the autorestow function improves the protection against inadvertent in flight deployment.

The positive contribution of the autorestow function was never taken in previous safety assessment.

The deletion of the in-flight autorestow does not adversely affect the consequences for the aircraft in the two following cases:

1) Attempted aircraft go around following touch down and reverser deployment.

- It is found that the thrust reversers will have been stowed before the aircraft is airborne. Therefore, this scenario does not lead to a safety hazard caused by thrust reverser incorrect position.

2) Uncommanded deployment during the ground take-off roll:

- This failure case is found to be an extremely improbable event.

EQUIVALENT SAFETY FINDING	**P-4008: Thrust Reverser Autorestow**
APPLICABILITY:	TC: A319-111, -112, -113, -114 , A318
REQUIREMENTS:	JAR 25.933(a)
ADVISORY MATERIAL:	N/A

BACKGROUND

JAR 25.933 (a) (change 11) requires that:

"(a) Each engine reversing system intended for ground operation only must be designed so that, during any reversal in flight, the engine will produce no more than flight idle thrust. In addition, it must be shown by analysis or test, or both, that:

(1) The reverser can be restored to the forward thrust position; or,

(2) The aeroplane is capable of continued safe flight and landing under any possible position of the thrust reverser."

AIRBUS is proposing to delete the thrust reverser automatic in-flight restow function.

The proposed design does not comply with JAR 25.933(a)(1). Compliance or Equivalent Safety demonstration is required

EQUIVALENT SAFETY FINDING

As for A320 CFM models, an Equivalent Safety Finding can be granted for A319 (equipped with CFM 56-5B5 or -5B6, and, -5A4 or -5A5 engines) Thrust Reverser Restow function, on the basis of the following reasons

(i) The inadvertent in-flight deployment of any thrust reverser is extremely improbable.

(ii) The deletion of the auto restow function improves the protection against inadvertent in-flight deployment.

(iii) The positive contribution of the auto restow function was never taken in previous safety assessment.

(iv) Any thrust reverser malfunction during reverser sequence on the ground, or prior to take-off, will be covered by automatic restow sequence and .dedicated warning 'REV FAULT', if unsuccessful, will be provided to the crew to prohibit dispatch.

SPECIAL CONDITION	P-5004: Engine Sustained Imbalance
APPLICABILITY:	TC: A318-121,-122
REQUIREMENTS:	JAR 25.901, 25.903, 25.629, 25.571
ADVISORY MATERIAL:	N/A

BACKGROUND

Service experience has shown that engine blade and bearing mechanical or structural failures may lead to high imbalance and vibratory loads in the airframe and engine. These vibratory loads may cause damage to primary structure and critical systems. Furthermore, vibrations on the flight deck may create a problem for the flight crew in flying the aeroplane. This CRI addresses the effects of sustained vibrations resulting from the failed engine, both before spool down and during the subsequent windmilling event. The dynamic transient loads occurring as a result of engine seizure and deceleration are not covered by this CRI.

The Pratt & Whitney PW6000 powerplant installation (engine, engine mounts and nacelle) is classified as a significant change. The A318-121, -122 fitted with PW6000 engines will be shown to be capable of continued safe flight and landing after partial or complete loss of an engine fan blade, including ensuing damage to other part of the engine or after a shaft support failure.

Demonstration will be done using CRI P-5004 / Advisory Circular 25-24 dated August 2, 2000 as a mean of compliance only applicable to changed parts: engine, engine mounts and nacelle. For unchanged parts, Airbus will demonstrate that the safety level associated with PW engines is at least as good as the safety level associated with the existing engines.

SPECIAL CONDITION

"It must be shown by a combination of tests and analyses, that after partial or complete loss of an engine fan blade, including ensuing damage to other part of the engine, or after a shaft support failure, the Airbus A318 is capable of continued safe flight and landing.

The evaluation must show that before spool down and during continued operation at windmilling engine rotational speeds, the engine induced vibrations will not cause damage to either the primary structure of the airplane, or to critical equipment that would jeopardise continued safe flight and landing. The degree of flight deck vibration must not prevent the flight crew from operating the airplane in a safe manner.

This includes the ability to read and accomplish checklist procedures. The evaluation must consider the effects on continued safe flight and landing from the possible damage to primary structure, including, but not limited to, engine mounts, inlets, nacelles, wing, and flight control surfaces, as well as critical equipment (including connectors) mounted on the engine or the airframe. For the windmilling condition, the evaluation must cover the expected diversion time for the airplane."

SPECIAL CONDITION	**S-11: Limit Pilot Forces and Torques**
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.397(c)
ADVISORY MATERIAL:	N/A

BACKGROUND

The limit piloting forces given in JAR 25.397(c) refer to a conventional control stick and not a side stick where forces are applied by the wrist and not the arm.

SPECIAL CONDITION S-11

Add to JAR 25.397(c):

For aircraft equipped with stick controls designed for forces to be applied by one wrist and not arms, the limit pilot forces are as follows:

1) For all components between and including the handle and its control stops:

Pitch	Roll
Nose up: 200 lbf	Nose left: 100 lbf
Nose down: 200 lbf	Nose right: 100 lbf

2) For all other components of the side stick control assembly, but excluding the internal components of the electrical sensor assemblies, to avoid damage as result of an in-flight jam.

Pitch	Roll
Nose up: 125 lbf	Nose left: 50 lbf
Nose down: 125 lbf	Nose right: 50 lbf

SPECIAL CONDITION	**S-23: Standby Gyroscopic Horizon**
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.1303 (b) (4) French National Variant
ADVISORY MATERIAL:	N/A

BACKGROUND

The French National Variant keeps for JAR the same request as FAR: third attitude instrument system usable through flight altitude of 360° of pitch and roll and installed in accordance with JAR 25.1321 (a).

SPECIAL CONDITION

Interpretative material to JAR 25.1303 (b) (4) French NV.

"The use of vertical references having controlled gyro precession or its equivalent in the case of a stable platform is not prohibited, but precession should not occur at a pitch attitude closer to the horizontal than 70°, and should be completed within an attitude change of 15°".

SPECIAL CONDITION	S-24: VMO/MMO Warning (setting)
APPLICABILITY:	TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 1303 (c) French National Variant
ADVISORY MATERIAL:	N/A

BACKGROUND

The French National Variant (and the FAR regulation) limit VMO/MMO warning to: VMO + 6 kt and MMO + 0,01, inclusive of equipment and adjustment tolerances.

SPECIAL CONDITION

It is proposed to adopt French National Variant since the French NV and the basic-test are satisfied for the following:

a) The warning adjustment will be defined by the condition that with addition of the positive tolerance, the value of VMO + 6 kt and MMO + 0,01 will be obtained.

b) The system tolerances available for A320 are such that both FAA (or French variant) and JAR 25.1303 (c) conditions can be satisfied with the proposed adjustment:

- VMO + 4 kt (tolerance ≤ 2 kt)
- MMO + 0,005 (tolerance ≤ 0,0025)

SPECIAL CONDITION	**S-30: Autoflight system**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.1329(h), 25.1335
ADVISORY MATERIAL:	NPA 25F-160

Background

A320 is equipped with an Automatic Flight function together with a Flight Management function, for which the conventional function partitioning has been deeply revised (more integrated system, linked to Electric Flight Control and Engine Control). Cruise and approach modes of the autopilot / flight director are covered by JAR 25.1329 / 1335 and ACJ 25.1329, while take-off, autoland and operations in reduced visibility conditions are subject to NPA's prepared by the JAR AWO group.
No specific regulation exists for the Flight Management System, nor for the Delayed Flap Approach function.
Clarification on the various applicable requirements, acceptable means of compliance and possible additional airworthiness criteria is needed.

Special condition

Delete JAR 25.1329(h) and JAR 25.135 and in each case substitute the following

Means must be provided to indicate to the flight crew the current mode of operation and any modes armed by the pilot. Selector switch position is not acceptable as a mean of indication

SPECIAL CONDITION	S-33: Autothrust system
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.1329, 25.1141, 25.1143
ADVISORY MATERIAL:	N/A

Background

As a consequence of no actuation of the throttle levers during ATS functioning most Autothrottle disconnections will result in a thrust increase up to the thrust limit as computed for the selected throttle position (thrust demand before ATS disconnect is normally less than the selected limit).
As this is considered as a novel feature it is necessary to establish criteria to ensure the acceptability of this feature, particularly in relation to Autothrottle disengagement, in all normal and abnormal operation of the aeroplane.

Special condition

For autothrust system certification the following requirements must be complied with:

a. Disconnection of the ATS shall be by means of a quick release control readily useable by both pilots
b. Automatic disengagement of ATS shall be indicated by an appropriate aural warning
c. Disconnection of the ATS and manual throttle control recovery shall not result in:
   i. Significant disturbances in engine thrust, flight path or speed control:
   ii. Exceedance of engine limitations.
d. The ATS shall be compatible with the manual control including the manual flare
e. The flight manual shall contain procedures for the ATS usage to ensure that failure conditions meet the requirements of JAR 25.1309 and its ACJ n.1 in the most adverse conditions (low visibility, wind, gust, windshear, etc…)
f. It must be shown by test and analysis that adequate cues are provided to the crew to monitor thrust changes during normal autothrust operation.

SPECIAL CONDITION	**S-52: Operation without normal electrical power**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.1351(d)
ADVISORY MATERIAL:	N/A

Background

JAR defines battery as the only electrical power which is not "normal". This interpretation is too limitative in some cases.

Special condition

Replace JAR 25.1351(d) by the following

ii. Unless it can be shown that the loss of the normal generated electrical power system is Extremely Improbable, an alternate high integrity electrical power system, independent of the normal generated electrical power system(s), must be provided to power those services necessary to complete a flight and make a safe landing. The services to be powered must include:
   1. those required for immediate safety and which must continue to operate, following the loss of all normal electrical power without the need for flight crew action:
   2. those required for continued controlled flight;
   3. those required for descent, approach and landing.

iii. Failures, including junction box, control panel or wire bundle fires, which could result in the loss of both the normal and alternate systems must be shown Extremely Improbable.

EQUIVALENT SAFETY FINDING	**S-53: Passenger information signs**
APPLICABILITY:	A320
REQUIREMENTS:	JAR 25.791, 25.1309(e), 25.1357(e)
ADVISORY MATERIAL:	N/A

Background

The function of passenger information: signs (no smoking, fasten seat belts) required by 25.791, will be performed by a digital data bus ring main and a single power supply circuit on each side of the a/c. Each power supply circuit supplies both, no smoking and fasten seat belts signs for illumination.

Equivalent Safety Finding

In the case of a failure of the power supply of one side of the a/c, the associated no smoking and fasten seat belts signs are lost but the remaining signs on the other side of the a/c are still available and legible to each passenger.

SPECIAL CONDITION	S-54: Electrical power – Circuit protective devices
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.1357 (d), (f)
ADVISORY MATERIAL:	N/A

Background

§ 25.1357 (d) required the ability to reset a circuit breaker or replace a fuse which is essential to safety in flight. § 25.1357 (f) required spare fuses (if used) for use in flight.
In modern aircraft, fuses and circuit breakers are mainly used in the main power centers but no replacement can be effected in flight. Consequently strict conformance to these paragraphs is not always satisfied.

Special condition

Add the following to JAR 25.1357(d)

If fuses are used, there must be spare fuses for use in flight equal to at least 50% of the number of fuses for each rating required for complete circuit protection.

Delete entirely JAR 25.1357(f)

SPECIAL CONDITION	**S-61: Brakes - means of retardation other than wheel brakes**
APPLICABILITY:	TC: A320 (except A320-233 and all A320 with OCTOPUS AFM)
REQUIREMENTS:	JAR 25.735(f)(1) and its French National Variant
ADVISORY MATERIAL:	N/A

BACKGROUND

JAR requirement, compared to FAR one, introduces the possibility to take into account other means of retardation in addition to wheel brakes. French National Variant deletes this possibility.

SPECIAL CONDITION

Adopt French National Variant (identical to FAR text) due to the fact that:
- A320 is compatible with the use of wheel brakes only;
- It is safer to consider only one means of retardation for demonstration.

SPECIAL CONDITION	**S-62: Rejected take-off brakes kinetic energy**
APPLICABILITY:	A319 / A320 / A321
REQUIREMENTS:	JAR 25.735(h)
ADVISORY MATERIAL:	N/A

Background

French NV deletes means of retardation other than wheel brakes.
German and UK NV ask to take into account residual temperature before taxying.
This SC proposes to keep French National Variant.:

Replace JAR 25.735(h)(1) by the following:

The brake kinetic energy absorption requirements must be based on a rational analysis of the sequence of events expected during an accelerate-stop manoeuvre. This analysis must include conservative values of aeroplane speed at which the brakes are applied, braking coefficient of friction between tyres and runway, aerodynamic drag, propeller drag, or powerplant forward thrust and (if more critical) the most adverse single engine or propeller malfunction.

SPECIAL CONDITION	S-72: Flight recorder
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.1459(a)(4)
ADVISORY MATERIAL:	N/A

Background

UK National Variant asked for a validity check of the data recorded instead of a tape movement check. (JAR Basic text and FAR identical).

Special Condition

Replace 25.1459(a)(4) by:

There is an aural or visual means for pre-flight checking that a record has been properly done.

SPECIAL CONDITION	S-74: Abnormal attitudes
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.671(f)
ADVISORY MATERIAL:	N/A

Background

JAR 25 must be adapted to take into account inadvertent operation of protections outside their flight boundaries of operation.

Special Condition

Add to JAR 25.671 new paragraph (f):

(f) In the case of abnormal attitude or excursion of any other flight parameter outside protected flight boundaries that might be reached due to external events:

(a) the Electric Flight Control System (EFCS) shall continue to operate
(b) the design of the EFCS control laws, including the automatic protection functions, must not hinder aircraft recovery.

SPECIAL CONDITION	S-75: Lightning protection indirect effects
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.581, 25X899, 25.954, 25.1309
ADVISORY MATERIAL:	N/A

Background

It is required that recent knowledge on severe and multiple lightning strike threat levels and probability be taken into consideration in establishing the acceptability of the indirect effects lightning protection provisions employed.

Special Condition

Add to JAR 25.x899 new paragraph (f):

(f) 1. Each system whose failure to function properly would prevent the continued safe flight and landing or the airplane, must.be designed and installed to ensure that the aircraft operation is not affected during and after exposure to lightning.

(f) 2. Each system whose failure to function properly would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions, must be designed and installed to ensure that it can perform its intended function after exposure to lightning.

SPECIAL CONDITION	S-76: Effect of external radiations upon aircraft systems
APPLICABILITY:	TC: A319/A320/A321
REQUIREMENTS:	JAR 25.1309 (a) and (b), JAR 25.1431 (a)
ADVISORY MATERIAL:	N/A

BACKGROUND

Military experience has shown that radiated transmissions from civil or military stations may cause interference with critical flight systems (e.g. flight or engine controls) such as to cause system loss or malfunction which can cause hazard to the aircraft.

Such ground transmission may be at varying power and frequency levels and may be produced by ground installations whose actual performance is secret.

SPECIAL CONDITION

Add to JAR 25.1431 new paragraph (d):

(d) 1. Each system whose failure to function properly would prevent the continued safe flight and landing of the airplane, must be designed and installed to ensure that the aircraft operation is not affected during and after exposure to external radiation.

(d) 2. Each system whose failure to function properly would reduce the capability of the airplane or the ability of the flight crew to cope with adverse operating conditions, must be designed and installed to ensure that it can perform its intended function after exposure to external radiation.

SPECIAL CONDITION	S-76-1: Protection from the effect of HIRF
APPLICABILITY:	TC: A318 Post-TC: A319/A320/A321
REQUIREMENTS:	JAR 25.1309 (a) and (b), JAR 25.1431 (a)
ADVISORY MATERIAL:	N/A

BACKGROUND

The A319/A320/A321 aircraft are equipped with electric and electronic systems that perform essential and critical functions that must be adequately protected against external electromagnetic radiation of high intensity.

Since the type certification of the first A320 aircraft model, the external environment describing the High Intensity Radiated Fields (HIRF) has been more accurately defined than in special condition SC S76.

This progress should be applied to the certification of future A319./A320/A321 aircraft models and equipment modifications.

The JAA Interim Policy INT/POL/25/2 dated Feb 10, 1992 gives a definition of:
- the certification HIRF environment, and,
- the normal HIRF environment.

The paper provides the certification requirements and means of compliance with an environment definition.

SPECIAL CONDITION S76-1

Add to JAR 25.1431 new paragraph (d):

The aeroplane systems and associated components, considered separately and in relation to other systems, must be designed and installed so that:

(d) (1) Each system that performs a critical or essential function is not adversely affected when the aeroplane is exposed to the Normal HIRF Environment.

(d) (2) All critical functions must not be adversely affected when the aeroplane is exposed to the Certification HIRF Environment.

(d) (3) After the aeroplane is exposed to the Certification HIRF environment, each affected system that performs a critical function recovers normal operation without requiring any crew action, unless this conflicts with other operational or functional requirements of that system.

SPECIAL CONDITION	**S-77: Integrity of control signal**
APPLICABILITY:	A318 / A319 / A320 / A321
REQUIREMENTS:	JAR 25.671
ADVISORY MATERIAL:	N/A

Background

On conventional airplanes, transmission of control signals to flight control surfaces was made through hydromechanical devices.

Failure conditions described in JAR 25.671 are difficult to apply to other types of signal transmission, specifically electrical linkages. It is therefore necessary to amend the criteria to introduce a more general requirement to cover integrity of electrical digital signal transmission due to the use of EFCS (Electronic Flight Control System).

Special Condition

Add to JAR 25.671 new paragraph (g)

(g) Control and command signal transmission lines of Electrical Flight Control System must be designed and installed to provide adequate signal integrity and protection against unintentional alterations from internal or external sources

SPECIAL CONDITION	S-79: Brakes requirements, qualification and testing
APPLICABILITY:	TC: A318/A319 TC: A320-233 Post-TC: A320-200 series with OCTOPUS AFM TC: A321-100 series
REQUIREMENTS:	JAR 25.735, NPA 25 BDG-244
ADVISORY MATERIAL:	N/A

BACKGROUND

For the A320 Family, Airbus Industrie requests amendment to the Joint Certification Basis for the AFM accelerate stop distances and related matters, to permit use of the most advanced version of NPA 25-B,D,G-244, but taking into account wet runway braking agreements reached between AIA, AECMA, FAA and JAA.

The NPA 25-B,D,G-244 requires the application of JAA Interim Policy 2515 and the associated Interim Policy 2516 (see JAA document 'Administrative and Guidance Material').

The Messier Bugatti brake, equipped with carbon disks being manufactured by Carbone Industrie according to a so-called SEPCARB III process, has been developed for an application on A320 Family.

Aim of this CRI is as follows:

a- to state clearly what are brake qualification and testing requirements.

b- to establish clearly whether the brake qualification and testing job fully covers not only the INT/POL 25/6, but also the JAR 25.735 requirements as amended by the CRI F-11

SPECIAL CONDITION

1 - Amend JAR 25.735 (a) to read as follows:

a) each brake must be approved and tested in accordance With JAA INT/POL 25/8 (included in the JAA Administrative and Guidance material) issue 1 dated the 10th of February 1992 (see ACJ 25.735(a)).

2 - Amend JAR 25.735 (f) through (j) to read as follows:

(f)* The design landing brake kinetic energy capacity rating of each main wheel brake assembly shall be used during qualification testing of the brake to the applicable Joint Technical Standard Order (J-TSO) or an acceptable equivalent. This kinetic energy rating may not be less than the kinetic energy absorption requirements determined under either of the following methods:

(1) The brake kinetic energy absorption requirements must be based on a rational analysis of the sequence of events expected during operational landings at maximum landing weight. This analysis must include conservative values of aeroplane speed at which the brakes are applied, braking coefficient of friction between tyres and runway, aerodynamic drag, propeller drag or powerplant forward thrust and (if more critical) the most adverse single engine or propeller malfunction. (See ACJ 25.135 (f) (1) and (h) (1)).

(2) Instead of a rational analysis, the kinetic energy absorption requirements for each main wheel-brake assembly may be derived from the following formula, which assumes an equal distribution of braking between main wheels:

$$KE = 0.0443\ W\ V\ 2\ /\ N$$

Where:

KE = kinetic energy per wheel (ft.lb);

W = design landing weight (lb);

V = aeroplane speed in knots. V must not be less than Vso, the power off stalling of the aeroplane at sea-level, at the design landing weight, and in the landing configuration; and

N = number of main wheels with brakes.

The formula must be modified in case of unequal braking distributions.

(g)* In the landing case the minimum stalling speed rating or each main wheel-brake assembly (that is, the initial speed used in the dynamometer tests) may not be more than the V used in the determination of kinetic energy in accordance with sub-paragraph (f) of this paragraph, assuming that the test procedures for wheel-brake assemblies involve a specified rate of deceleration, and, therefore for the same amount of kinetic energy, the rate of energy absorption (the power absorbing ability of the brake) varies inversely with the initial speed.

(h)* The rejected take-off brake kinetic capacity rating of each main wheel-brake assembly that is at the fully worn limit of its allowable brake wear range shall be used during qualification testing of the brake to the applicable Joint Technical Standard Order (J-TSO) or an acceptable equivalent. This kinetic energy rating may not be less than the kinetic energy absorption requirements determined under either of the following methods:

(1) The brake kinetic energy absorption requirements must be based on a rational analysis of the sequence of events expected during an accelerate-stop manoeuvre. This analysis must include conservative values of aeroplane speed at which the brakes are applied, braking coefficient of friction between tyres and

runway, aerodynamic drag, propeller drag or powerplant forward thrust and (if more critical) the most adverse single engine or propeller malfunction. (See ACJ 25.735 (f) and (h)(1)).

(2) Instead of rational analysis, the kinetic energy absorption requirements for each main wheel-brake assembly may be derived from the following formula, which assumes an equal distribution of braking between main wheels:

KE = 0.0443 W V 2 / N

Where:

KE = kinetic energy per wheel (ft.lb)

W = aeroplane weight (lb)

and W and V are the most critical combination of weight and speed.

The formula must be modified in cases of designed unequal braking distribution.

(i)* In addition, a flight test demonstration of the maximum kinetic energy rejected take-off shall be conducted with not more than10% of the allowable brake wear range remaining;

(j)* For each power-operated brake system incorporating an accumulator, the flight crew must be provided with an indication that adequate accumulator pressure is available.

3 – Add a new paragraph JAR 25.735 (k) to read as follows:

(k) each wheel and brake assembly must be provided with a means to indicate the limit of permitted wear. The means must be reliable and readily inspectable. (See ACJ 25.735 (k)).

* Note: only applicable to A318, A319 & A320

EQUIVALENT SAFETY FINDING	SE-42: Symbolic EXIT Signs as an alternate to red exit signs for passenger aircraft
APPLICABILITY:	Post-TC: A318/A319/A320/A321
REQUIREMENTS:	JAR 25.812 (b)(1)(i), (b)(1)(ii) and (e)(2)
ADVISORY MATERIAL:	N/A

BACKGROUND

European operators usually operate in countries in which passengers are not English native speakers. JAR 25.812 requires the red exit signs to have the word "EXIT", which is not understandable by the majority of European passengers. This is leading the European Operators to ask for multi lingual "EXIT" signs in their aircraft (use of English and national translations). Consequently manufacturers have problems in meeting the current sign lettering requirements, whenever they have to accommodate two (or more) languages in the exit sign units. Furthermore, multi languages exit signs are causing additional burden whenever the aircraft is sold to different countries with different languages.

JAA NPA 25D-327 proposes symbolic exit signs that are already used in the building and other transportation applications as an alternative to the red lettering EXIT signs. These EXIT signs are designed with white symbols and green backgrounds, derived from ISO 3864 and are suitable for the emergency exit signs defined in JAR 25.812(b)(1)(i), (b)(1)(ii), and (e)(2).

EQUIVALENT SAFETY FINDING

Based on the conclusions and the recommendations of the JAA CSSG, Airbus proposes to adopt the NPA proposal as alternate to comply with JAR 25.812(b)(1), with some adaptations.
The symbolic exit signs, derived from ISO 3864, were tested (Cranfield University, 1995), according to ISO 9186 procedures, with questionnaires to an international travelling population speaking 61different languages. They have confirmed the preference for white figures green background for the 3 typical marking signs high in the cabin and for the symbolic exit identifiers of the floor proximity system. Compliance with the brightness requirements of JAR 25.812 was demonstrated with the white symbol providing the most illuminated portion of the sign.

In March 2000, following the JAA CSSG recommendations, the symbolic exit lightning level was successfully compared with the building condition contained in BS 5499 "Code of Practice for Escape Route signing". The specific formula established for symbolic exit signs established the correlation between the viewing distance and the height of the sign at given illumination levels. The analysis found a good correlation between the heights of the symbolic exit sign found on ATR 72 and A300 A340) and building minimum standards. The formula was agreed by the CSSG to serve as the design standard for the proposed symbolic signs, with certain conservatism.

The JAA CSSG also concluded that the symbolic exit sign designs, which indicate the actual location of the exit, JAR 25.811(d)(1) and JAR 25.811 (d)(2) are sufficiently understood by the travelling public tested. The CSSG further concluded that the symbolic sign depicting exits further down the aisle JAR 25.811(d)(3) despite failing to meet the 66% comprehensive criteria of ISO 9186 demonstrated the greatest comprehension among the 4 alternatives tested and has significantly greater comprehension than the existing language sign.

The following symbolic exit signs are an acceptable alternative to the red lettering exit signs:

For Exit locator sign (JAR 25.811 (d)(1)):

For Exit marking sign (JAR 25.811(d)(2)) and for Exit sign on bulkhead or divider (JAR 25.811(d)(3)):

For Exit identifier for JAR 25.812(e)(2):

In place of the arrow proposed by the NPA, an Exit Identifier Symbolic sign (according 25.812(e)(2)) with a running man is agreed. So, the following symbolic exit sign, that derives from ISO/WD 3864-3 and ISO/CD 16069 "Safety way Guidance System" and Draft BS 5499: Part 4 Code of Practice for Escape Route Signing", is agreed for the identifiers of floor level exits required by JAR 25.812(e)(2).

2 – Brightness versus Height calculation:

In order to reduce the installation burden, Airbus will keep the 60mm height of the existing lettered EXIT sign. Airbus will also keep a luminance of 25ft-L because higher brightness values cannot be guaranteed with existing sign housings (and it will have only minor effect).

The maximum viewing distance is 18,28m (60 ft), which is the maximum distance between two emergency exits. The test was successfully performed with EASA representative witness. It was demonstrated that the symbolic exit sign is better or equal to the current 'EXIT' sign for a distance of 18,28m (60ft). No limitations are requested for the viewing distance.

The use of symbolic exit signs as an alternate to the red lettering Exit signs will be beneficial for the passenger safety, as it is easily understandable by the majority of the passengers travelling in Europe.

EQUIVALENT SAFETY FINDING	**SE-63: Green Arrow and "Open" Placard for Emergency Exit Marking**
APPLICABILITY:	Post TC: A318/A319/A320/A321
REQUIREMENTS:	CS 25.811 (e)(4)
ADVISORY MATERIAL:	-

BACKGROUND:

The Single Aisle (SA) family will be equipped with symbolic signs in accordance with EASA CS25.811 (g) and CS 25.812(b) (1) at Amdt.5, as defined in EASA AMC to CS25.812 (b) (1).These symbolic signs are white with a green background.

CS 25.811 (e)(4) states:
"(4) All Type II and larger passenger emergency exits with a locking mechanism released by motion of a handle, must be marked by a red arrow with a shaft at least 19mm (0. 75inches) wide, adjacent to the handle, that indicates the full extent and direction of the unlocking motion required. The word OPEN must be horizontally situated adjacent to the arrowhead and must be in red capital letters at least 25 mm (1 inch) high. The arrow and word OPEN must be located on a background, which provides adequate contrast."

EQUIVALENT SAFETY FINDING

The Information displayed on the emergency exits should provide a consistent and coherent message to anyone operation the door in normal and emergency conditions. In that respect, a green arrow and green word "OPEN" on the door are more accurate on aircraft that are equipped with symbolic signs defined in EASA CRI SE-42, compared to the red ones. The green color code used is standing for "positive" actions (e.g. correct/ ready).

In addition, the industry standard SAE ARP 5770 documents the improved contrast of green compared to red, thus the green marking meets the intent of the rule by providing a clear and readily visible indication of the full extent and direction of the unlocking handle motion. The green arrow and word "open" installed on the door will provide an accurate contrast to the background of the door linings.
Based on these arguments, Airbus opinion is that a green arrow as well as a green word "OPEN" provide an equivalent level of safety to the requirements of JAR25.811 (e)(4).

EQUIVALENT SAFETY FINDING	**SE-4005: Minimum approach break-off height**
APPLICABILITY:	TC: A318/A319
REQUIREMENTS:	JAR AWO 1341(c)(2), 313, 314, 316, 381
ADVISORY MATERIAL:	N/A

BACKGROUND

At the time of A319 TC JAR AWO was requiring that a Minimum Approach Break-off Height (MABH) be established.

According to JAR AWO 313:

The MABH is the altitude at which a catastrophic effect is extremely improbable if a go-around is carried out without external references according to the standard procedure, and the probability of contacting the runway during a go-around is less than 10^{-4}.

The operational Decision Height (DH) may not be lower than the MABH.

In the same time, the FAA had no requirement for a MABH, but was relying on a demonstration of a safe go-around from any altitude down to touchdown.

Agreement was reached in the JAA/FAA Harmonisation working group that, since aeroplane systems are required by JAR AWO 316 to demonstrate that a safe go-around can be accomplished from any point to touchdown, the MABH concept can be removed from JAR AWO without detriment to safety of operation. In its place, information would be included in the approved Airplane Flight Manual giving go-around height loss information on which operational decision heights, if required, can be based.

EQUIVALENT SAFETY FINDING

1. Safety considerations

1.1 A go-around of the aircraft from a very low altitude may result in inadvertent runway contact. The safety of this procedure will be established by the following:

(a) The guidance Information and control provided by the go-around mode will be retained and shown to have safe and acceptable characteristics throughout the manoeuvre;

(b) The other systems (e. g. automatic throttle, brakes. spoilers. and reverse thrust) will not operate in a way that would adversely affect the safety of the go-around manoeuvre.

1.2 Inadvertent selection of the go-around after touch-down will not result in an unsafe manoeuvre or prevent the pilot from completing a roll-out and bringing the aircraft to a safe stop.

2. Performance

Height losses from a range of altitudes during the approach and flare will be determined when under automatic control and when using the landing guidance system as appropriate.

(a) Height losses will be determined by flight testing (typically 10 go-arounds) supported by simulation;

(b) The effects of variation in parameters such as weight, centre of gravity, configuration and wind will be considered;

(c) Normal procedures for a go-around with all engines operating will be followed.

3. Airplane Flight Manual

Information will be included in the Approved Flight Manual giving go-around height loss information on which operational decision height, if required, can be based.

EQUIVALENT SAFETY FINDING SPECIAL CONDITION	SE-5002: AFM - RVR limits
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR AWO Change 1 § 304, 305, 321, 381 JAR AWO Change 2 § 481
ADVISORY MATERIAL:	N/A

BACKGROUND

The setting of RVR limits is addressed in the applicable operating regulations, e.g. JAR-OPS Subpart E OPS1.430 and its Appendix 1. To avoid conflict with these regulations and not to compromise operational decision making, the operational specialists of the Authorities have requested that JAR AWO be clarified to avoid RVR minima being expressed as Flight Manual limitations. Instead, information on RVR values, encountered during airworthiness certification, is invited to aid the establishment of operating minima. Current practice amongst the certification authorities varies, with some setting precise visibility limitations in the Flight Manual, others not. This change to the regulations will contribute to a consistent approach. Thus, the proposed changes to JAR-AWO clarify usage of the RVR term.

EQUIVALENT SAFETY FINDING TO NPA AWO 10 - AIRWORTHINESS HARMONIZATION PACKAGE N° 2

These discussions have been formalized in NPA AWO 10 – Airworthiness Harmonization package n° 2 dated February 1997. The JAA team agrees that NPA AWO 10 proposal n°1 covering "Advice on RVR minima in the Flight Manual" be included in the A318 Type Certification Basis as an equivalent safety level.

SPECIAL CONDITION

1.1 Revise the Introduction to JAR-AWO Subpart 3, Section B, 3rd paragraph to read:

"The RVR limit is set by the responsible national authority in accordance with applicable operating regulations and provides visibility at and below the Decision Height.......safety level."

1.2 Revise the Introduction to JAR-AWO Subpart 3, Section C, 2nd paragraph, 5th sentence, to read:

"The RVR limit is set by the responsible national authority in accordance with applicable operating regulations."

1.3 Revise the Introduction to JAR-AWO Subpart 3, Section D, 1st paragraph, by deleting the 2nd and 3rd sentences and substituting:

"Any required RVR limit is set by the responsible national authority in accordance with applicable operating regulations."

1.4 In JAR-AWO 304(b), delete the cross reference to JAR-AWO 305.

1.5 Delete JAR-AWO 305 in its entirety.

1.6 Revise JAR-AWO 321(c)(4) to read:

"Automatic ground roll control or head-up ground roll guidance (see JAR-AWO 304)."

1.7 Delete the references to JAR-AWO 305 from JAR-AWO 321(d)(4).

1.8 Delete "(see JAR-AWO 305 on visibility conditions)" from JAR-AWO 381(a).

1.9 Revise JAR-AWO-381(a) by adding the following NOTE:

"NOTE: Actual RVR minima to be used are subject to operational regulation and may vary from one state to another taking account of local circumstances. For this reason, RVR minima should not be included in the Aeroplane Flight Manual as Limitations. To aid operational assessment and the establishment of landing minima, the RVR values encountered during airworthiness certification may be given. "

1.10 Revise the Introduction to JAR-AWO Subpart 4, 2nd paragraph by:

- deleting the 1st and 2nd sentences, and substituting:

"The RVR limits for take-off of transport aircraft are set by the responsible national authority in accordance with applicable operating regulations.

- revising the 3rd sentence to read:

"The purpose.....to permit a reduction of these limits but not.......visual reference."

- deleting the last sentence.

1.11 Revise JAR-AWO 481(a) by adding the following NOTE:

"NOTE: Actual RVR minima to be used are subject to operational regulation and may vary from one state to another taking account of local circumstances. For this reason, RVR minima should not be included in the Aeroplane Flight Manual as Limitations. To aid operational assessment and the establishment of take-off minima, the RVR values encountered during airworthiness certification may be given. "

EQUIVALENT SAFETY FINDING	SE-5005: Category III Operations - Excess Deviation Alerts
APPLICABILITY:	TC: A318
REQUIREMENTS:	JAR AWO 236
ADVISORY MATERIAL:	N/A

BACKGROUND

Airbus has designed the A318 so that the excess localizer deviation alerts are inhibited under 15 ft whatever the kind of autoland operations.

JAR AWO 236(c) at change 1 is applicable to A318. The design for the LOC excess deviation is common to all AIRBUS SA aircraft, and exists since the first A320 certification.

Airbus interpretation of JAR AWO 236(c) is that LOC excessive deviation alert is required down to DH, but is not required down to the ground in NO DH operations. The NO DH auto-land operation concept is different from operations that would be conducted with a DH = 0. In consequence, AIRBUS considers that the A318 design where the LOC excessive deviation alert is inhibited below 15 feet, complies with JAR AWO Change 1 requirement for auto-land operation with NO DH.

AIRBUS proposes to assess with JAA on A318 flight simulator all realistic scenarios associated to LOC deviation greater than 20 micro Amperes below 15 feet. These scenarios should take into account AIRBUS procedures for NO DH auto-land operations, and consider:

- failure characteristics and probabilities of LOC emitter, LOC receptor or Auto-pilot
- nominal Auto-pilot performance but with external perturbations, like cross-winds and gusts

The objective will be to demonstrate that based on operation with and average skill pilot, the safety objectives in NO DH operations are fulfilled on the A318 without the LOC excessive deviation alert below 15 feet.

Previous evaluation for failure cases below 15 feet was even that pilot decision to take over the Auto-pilot and continue manually the landing may be safer than performing a Go-Around.

EQUIVALENT SAFETY FINDING

Airbus will demonstrate that A318 design, e.g. LOC excessive deviation below 15 ft, meets autoland safety objective for operations with or without DH.

The proposed demonstration (that based on operation with and average skill pilot, the safety objectives in NO DH operations are fulfilled on the A318 without the LOC excessive deviation alert below 15 feet) is therefore acceptable.

EQUIVALENT SAFETY FINDING	**SM-2004: PAX Doors**
APPLICABILITY:	TC: A320
REQUIREMENTS:	JAR 25.783 (f)
ADVISORY MATERIAL:	N/A

BACKGROUND

No physical means to prevent pressurization are incorporated in the A320 pax door as required by §25.783 (f).

Compliance or equivalent safety demonstration required.

EQUIVALENT SAFETY FINDING

The intent of the rule is that initiation of pressurization to an unsafe level is prevented when the doors are not fully closed and locked. The level is considered as unsafe when the combination of loads that apply to a door in flight (including static and dynamic loads) would result in door opening and subsequent depressurization.

To reach an equivalent safety with the intent of the rule, it must be shown that the pressurization levels reached when the door is not fully closed and locked will make inadvertent door opening impossible, taking into account human factors and possible wear of mechanical parts.

A320 passenger doors are Type 1 plug-in emergency exits having a directional component of movement that is inward with respect to the mean pressure plane of the body cutout.

In order to open these doors, there is an inward initial opening movement followed by an upward movement tangential to the fuselage shape. The closed but not locked position of the doors is unlikely to occur since the locking mechanism is provided with two overcentered features, one on the locking shaft, the other on the lifting mechanism, leading to an immediate return to the closed and locked position.

The A320 passenger doors do not incorporate a means to prevent initiation of pressurization because the levels of pressure which may be reached with a partly opened door are not unsafe levels within the flight envelope if the door is inadvertently opened and because the pressure never forces the door to open.

An inadvertent opening of a closed but not locked door is extremely improbable.

EQUIVALENT SAFETY FINDING	SM-2005: Cargo Compartment Doors
APPLICABILITY:	TC: A320
REQUIREMENTS:	JAR 25.783 (e)
ADVISORY MATERIAL:	N/A

BACKGROUND

The provision to visually inspect the locking mechanism for A320 cargo compartment door is by indication of the handle and vent positions and not by a provision for direct visual inspection of the locking mechanism as required by §25.783 (e).

Compliance or equivalent safety demonstration required.

EQUIVALENT SAFETY FINDING

The locking mechanism can only be operated when the door is fully closed and the vent door can only be closed when all the locks are secured.

Incorrect assembly of the locking and latching mechanism is possible but prevents the correct and complete function of the mechanism to an extent which is clear and obvious.

Therefore an equivalent safety to direct visual inspection of the locking mechanism is achieved.

EQUIVALENT SAFETY FINDING	**SM-2007: Bulk Cargo Doors**
APPLICABILITY:	TC: A320
REQUIREMENTS:	JAR 25.783 (f)
ADVISORY MATERIAL:	N/A

BACKGROUND

No physical means to prevent pressurization are incorporated in the A320 bulk door as required by §25.783 (f).

Compliance or equivalent safety demonstration required.

EQUIVALENT SAFETY FINDING

When the door is not fully closed, there is a significant gap between door and aircraft structure (at the bottom and sides of the doors) which acts as a vent to prevent pressurization to an unsafe level.

When this inward opening door is not fully locked, the cabin pressure forces the door to close: there is no unsafe pressurization level.

EQUIVALENT SAFETY FINDING	SM-3001: Cabin doors N°1 and 4
APPLICABILITY:	TC: A321
REQUIREMENTS:	JAR 25.783 (f)
ADVISORY MATERIAL:	N/A

BACKGROUND

No physical means to prevent pressurization are incorporated in the A321 Cabin door 1 & 4 (identical to A320 door 1 & 4).

Compliance or equivalent safety demonstration required.

EQUIVALENT SAFETY FINDING

A finding of equivalent safety is granted based on the following:

A321 passenger cabin doors are plug-in emergency exits having a directional component of movement that is inward with respect to the mean pressure plane of the body cut-out.

In order to open these doors, there is an inward initial opening movement followed by an upward movement tangential to the fuselage shape.

The closed but not locked position of the door is unlikely to occur since the locking mechanism is provided with two overcentered features, one on the locking shaft, the other on the lifting mechanism, leading to are immediate return to the closed and locked position.

The A320/A321 passenger doors do not incorporate a means to prevent initiation of pressurization-because the levels of pressure which may be reached with a partly opened door are unsafe levels within the flight envelope if the door inadvertently opened and the pressure never forces the door to open.

An inadvertent opening of a closed but not locked door is extremely improbable.

EQUIVALENT SAFETY FINDING	SM-3002: Cabin Doors N°2 and N°3
APPLICABILITY:	TC: A321
REQUIREMENTS:	JAR 25.783 (f)
ADVISORY MATERIAL:	N/A

BACKGROUND

No physical means to prevent pressurization are incorporated in the A321 Cabin door 2 and 3 (Similar to A320/A321 door 1 & 4).

Compliance or equivalent safety demonstration required.

EQUIVALENT SAFETY FINDING

A finding of equivalent safety is granted based on the following:

A321 doors 2 and 3 are plug-in emergency exits having a directional component of movement that is inward with respect to the mean pressure plane of the body cut-out.

In order to open these doors, there is an inward initial opening movement followed by an upward movement tangential to the fuselage shape.

The closed but not locked position of the door is unlikely to occur since the locking mechanism is provided with two overcentered features, one on the locking shaft, the other on the lifting mechanism, leading to are immediate return to the closed and locked position.

The A320/A321 passenger doors do not incorporate a means to prevent initiation of pressurization-because the levels of pressure which may be reached with a partly opened door are unsafe levels within the flight envelope if the door inadvertently opened and the pressure never forces the door to open.

An inadvertent opening of a closed but not locked door is extremely improbable.

EQUIVALENT SAFETY FINDING	SM-3004: Bulk cargo doors
APPLICABILITY:	TC: A321
REQUIREMENTS:	JAR 25.783 (f)
ADVISORY MATERIAL:	N/A

BACKGROUND

No physical means to prevent pressurization are incorporated in the A321 bulk cargo door (identical to A320) as required by JAR 25.783(f).

Compliance or equivalent safety demonstration required.

EQUIVALENT SAFETY FINDING

A finding of equivalent safety is granted, based on the following:

- When the door is not fully closed, there is a significant gap between door and aircraft structure (at the bottom and sides of the door) which acts as a vent to prevent pressurization to an unsafe level.

- When this inward opening door is not fully locked, the cabin pressure forces the door to close: there is no unsafe pressurization level.

EQUIVALENT SAFETY FINDING	SM-4004: Passenger doors No 1 and 4 (i.e. forward and aft passenger doors)
APPLICABILITY:	TC: A318/A319
REQUIREMENTS:	JAR 25.783 (f)
ADVISORY MATERIAL:	N/A

BACKGROUND

Paragraph JAR 25.783 (f) at Change 11 is applicable to the A319. According to this requirement, external doors must have provisions to prevent the initiation of the pressurization of the airplane to an unsafe level, if the door is not fully closed and locked.

No physical means to prevent pressurization are incorporated in the A319 Cabin doors numbered 1 and 4. The proposed design does not comply with 25.783(f).

As for A320 (SM2004), equivalent safety finding was requested required.)

EQUIVALENT SAFETY FINDING

A finding of equivalent safety is granted based on the following:

A319 passenger cabin doors are plug-in emergency exits having a directional component of movement that is inward with respect to the mean pressure plane of the body cut-out.

In order to open these doors, there is an inward initial opening movement followed by an upward movement tangential to the fuselage shape.

The closed but not locked position of the door is unlikely to occur since the locking mechanism is provided with two independent overcentered features, each of them being maintained by a separate spring unit (fail-safe design), one on the locking shaft, the other on the lifting mechanism. They are foolproof, as it is not possible to arm the slide release mechanism when the door is not fully closed and locked.

- Specifically, the overcentering mechanism ensures that the doors:

(a) either move to the closed and locked position, without the aid of the cabin pressurization, for any expected environmental condition, including wind, and any damage that might be expected to occur in service and, with consideration of rigging tolerances and in-service wear,

(b) or move to partially open position so that cabin pressurization to an unsafe level is prevented.

- Any likely door position, including the presence of debris has been considered, and it has been established that no unsafe level of pressurization was associated to any position of these doors

- The A319 passenger doors do not incorporate a means to prevent initiation of pressurization because the levels of pressure which may be reached with a partly opened door are not unsafe levels within the flight envelope if the door inadvertently opened. The pressure never forces the door to open, when the door is closed but not fully locked, either inadvertently or as a result of a mechanical failure.

- An inadvertent opening of a closed but not locked door is extremely improbable.

The design concept of these doors is based on previous in-service experience with no case of inadvertent opening (under any level of pressurization) during more than 19 million flight hours.

Although the design of the A319 passenger door does not comply literally with the first sentence of 25.783(f), it is considered that the content of the requirement is met due to the factors listed above.