This annex to the EASA TCDS IM.A.120 was created to publish selected special conditions / deviations / equivalent safety findings that are part of the applicable certification basis:

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Certification Review Items:

ADMINISTRATIVE ITEM	A-10: Additional requirements for import
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 21
ADVISORY MATERIAL:	N/A

In their application for JAA Validation, Boeing requested that the JAA's investigation followed the principles of Concurrent and Cooperative Certification. The procedures followed in the subsequent investigation were largely based on that principle.
Boeing designed the B737-700 aiming to comply with both FAA and JAA requirements.
Although Boeing have essentially achieved this aim, there are a small number of JAA requirements that the FAA Type Design Standard will not comply with. This CRI defines those requirements as the Additional Requirements for Import.

DISCUSSION

1. JAA POSITION
The JAA Joint Type Certification Basis is defined by CRI A-01. Those requirements must be satisfied at the time of Type Certification along with those Additional National Design Requirements defined by CRI A-02.
Any JAA requirements for Type Certification defined in CRI's A-01 and A-02, that are not complied with by the Type Design Standard, Type Certificated by the FAA, must be included in the JAA Additional Requirements for Import. The Type Design Standard is defined by CRI A-06. Additional National Design Requirements other than those for Type Certification are administered under CRI's A-03 to A-05 inclusive. Each respective country must ensure that their requirements under these CRI's are satisfied.

(…)

6 CONCLUSION
(February 1998)
Further to the proposed list of ARI’s previously identified in this CRI (reference paragraph 6) Boeing has proposed to show compliance with JAR 25.201(d) at Change 14 as amended by NPA 25B-261, by incorporation of a modification to the speed Trim System, (reference the conclusion in CRI B-15). The JAA are including reference to this modification as an ARI, within this CRI.
In addition, reference to compliance with 25.X745 (d) for towbarless towing has been included, as administered by CRI D-06 and identified through relevant amendment to the Flight Manual.
The table below summarises the JAA Additional Requirements for Import.

Reference		Description / Boeing Proposed Means of Compliance	Comment	Boeing Avionics Option Ref
JAR	25.0201(d) Chg 14 as amended by NPA 25B-261	Speed Trim System Modification.		
JAR	25.0251 25.1585	JAA Flight Rules (0.3g manoeuvring margin).	Option satisfies JAA ARI.	*78
JAR	25.0631	Fin reinforcement for birdstrike protection on rudder control quadrant area.	Aircraft Serial no.s 1 through 4 and 6 do not embody the JAA required standard.	
JAR	25.X745 25.1583(j)	Towbarless Towing Flight Manual Limitation.		
JAR	25.785 (h) 25.1541(a)(2)	Flight attendant seats, required to be occupied for direct view compliance, are to be placarded.		
JAR	25.0812 (l)	Floor Proximity Lighting System		
JAR	25.1351 (d)	Emergency Power Supplies, satisfied by 60 Minute Standby Battery		
JAR	25.1411 (f)	Life Preserver Access		
JAR	25.1439 (a)	Protective Breathing Equipment Availability		
JAR	25.1441 (d)	Flight Crew Oxygen Masks with Automatic Pressure Breathing		
JAR	25.1447 (c)(3)	Oxygen Dispensing Units in Galley Areas		
JAR	AWO 321 Change 2	Radio Altitude Callouts for CAT III Operations (Callouts Approaching DH and at DH)	Option satisfies JAA ARI	*103
JAR AMJ	25.1303 25-11, 5.e	Navaid Suppression on CDS.	Option satisfies JAA ARI	75
JAR AMJ	25.1303 25-11, 8.d	Display ILS flags for NCD ILS data vs. no ILS flags displayed.	Option **not allowed**, basic definition satisfies JAA ARI	18

REVERSION:	**A. 11-02: Pressurised Cabin Loads**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.365
ADVISORY MATERIAL:	N/A

Replacing JAR 25.365 (change 13 plus Orange Papers 90/1 and 91/1) by FAR 25.365 Amendment 0 is acceptable, when applying the guidelines of NPA 21-7.
All rapid decompression scenarios (resulting from penetration of the fuselage due to uncontained engine failure) will be included by Boeing when showing compliance to JAR 25.903(d)(1). In addition the rapid decompression scenarios (resulting from penetration of the fuselage due to uncontained engine failure) not shown to be extremely improbable will be included by Boeing when showing compliance to FAR 25 Amendment 0.

REVERSION:	**A. 11-04: Emergency Landing Dynamic Loads**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.562 (change 13)
ADVISORY MATERIAL:	N/A

The reversion to JAR 25 Change 12 with respect to JAR 25.562 is accepted by the JAA. CRI A-01, JAA Joint Type Certification Basis, will be amended accordingly. Under the CCC process FAR 25.562 at Amendment 25-64 is included in the Jointly Agreed Type Certification Basis. Each NAA prepared to accept an aircraft without compliance to FAR 25.562 at Amendment 25-64 should note the FAA position with respect to issuance of a waiver for inclusion in an Export Certificate of Airworthiness.

FAA POSITION

The FAA Type Certification Basis for the Model 737-700 airplane includes FAR Part 25.562 Emergency Landing Dynamic Conditions. The FAA rationale for inclusion of FAR 25.562 in the certification basis is that the installation of 16g seats can provide significant improvements in passenger safety. Additionally, a major portion of the requirements of FAR 25.562 will be requirements of FAR Part 121 prior to the 737-700 certification.

The current JAA position of not requiring JAR 25.562 to be in the certification basis is different than the FAA certification basis which requires compliance with FAR 25.562. Each JAA member country accepting a 737-600, -700, or -800 without compliance to FAR 25.562 will have to issue a waiver of the FAR 25.562 requirements which will be included in the Export Certificate of Airworthiness.

Based on the JAA granting a reversion to JAR Part 25, Change 12, the FAA assumes that no FAA resources will be expended in qualifying 16g seats for the 737-700 exported into the JAA member states.

REVERSION:	**A. 11-05: Fatigue and Damage Tolerance**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.571
ADVISORY MATERIAL:	N/A

For structure that is not significantly modified JAA agrees to a partial reversion as detailed below:

(a) General

This subparagraph refers to other subparagraphs of JAR 25.571 and also to JAR 25.1529. The JAR-25 applicable to these requirements (as defined below) will dictate the applicability of this subparagraph

(b) Damage Tolerance Evaluation

1) Attached to this CRI is a table defining what structure of the B737-600/700/800 is considered to be new/significantly modified and what structure is considered to be not significantly modified, compared to the previous B737 models. It also defines the requirement level to which compliance has to be shown.

2) For structure defined as not significantly modified, the JAA team propose to adopt the following Special Condition in the certification basis of the B737-600/700/800:

Replace the current JAR 25.571(b) (Change 13 plus Orange Papers 90/1 and 91/1) by the following text:

(b) Fail safe strength. It must be shown by analysis, tests, or both, that catastrophic failure or excessive structural deformation, that could adversely affect the flight characteristics of the aeroplane, are not probable after fatigue failure or obvious partial failure of a single principal structural element. After these types of failure of a single principal structural element, the remaining structure must be able to withstand static loads corresponding to the following:

(1) The limit symmetrical manoeuvring conditions specified in JAR 25.337 up to Vc and in JAR 25.345.
(2) The limit gust conditions specified in JAR 25.341 (a) at the specified speeds up to Vc and in JAR 25.345.
(3) The limit rolling conditions specified in JAR 25.349 and the limit unsymmetrical conditions specified in JAR 25.367 and JAR 25.427, at speeds up to Vc.
(4) The limit yaw manoeuvring conditions specified in JAR 25.351 at the specified speeds up to Vc.
(5) For pressurised cabins, the following conditions :
(i) The normal operating differential pressure combined with the expected external aerodynamic pressures applied simultaneously with the flight loading conditions specified in sub-paragraphs (b)(1) to (b)(4) of this paragraph if they have a significant effect.
(ii) The maximum value of normal operating differential pressure (including the expected external aerodynamic pressures during 1 g level flight) multiplied by a factor of 1.15 omitting other loads.
(6) For landing gear and directly-affected airframe structure, the limit ground loading conditions specified in JAR 25.473 (a) thru (d), JAR 25.491 and JAR 25.493.

These loads will be the basis of the fail safe loads for the revised SSIP

3) Also, for structure defined as not significantly modified, an agreement on a programme addressing continued airworthiness of the Boeing 737-600/700/800 should be reached prior to JAA Type Certification. Additional discussions between Boeing and FAA/JAA specialists will

have to provide further clarification on and agreement of this programme. This discussion will be documented in a separate CAI (ref. CAI 03-13).

(c) Safe life Evaluation

The JAA concurs with the Boeing position that all safe-life parts of the B737-600/700/800, will comply with JAR 25.571(c) Change 13 (plus Orange Papers 90/1 and 91/1). Separate discussion will have to take place between Boeing and the JAA on the means of compliance.

(d) Sonic Fatigue Strength

The JAA concurs with the Boeing position that compliance will be shown with JAR 25.571(d) Change 13 (plus Orange Papers 90/1 and 91/1). Separate discussion will have to take place between Boeing and the JAA on the means of compliance.

(e) Discrete Source Evaluation

The JAA concurs with the Boeing position that compliance will be shown with JAR 25.571(e) Change 13 (plus Orange Papers 90/1 and 91/1), except as noted in CRI A.11-2. Separate discussion will have to take place between Boeing and the JAA on the means of compliance.

B737-600/700/800

Classification of Structure
(attachment to CRI A.11-5)

Component	Classification	JAR 25.571(b)
Wing		
Wing Box	SM	Ch. 13 + 2 OP’s
TE flaps	SM	Ch. 13 + 2 OP’s
LE devices	SM	Ch. 13 + 2 OP’s
Spoilers	SM	Ch. 13 + 2 OP’s
Fuselage	NSM	See Special Condition
Forward access door	SM	Ch. 13 + 2 OP’s
Forward airstairs door	SM	Ch. 13 + 2 OP’s
EE bay door	SM	Ch. 13 + 2 OP's
Automatic overwing exit	SM	Ch. 13 + 2 OP's
Horizontal Stabiliser	NSM	See Special Condition
Vertical Stabiliser	NSM	See Special Condition
Strut	New	Ch. 13 + 2 OP’s
Nacelle	New	Ch. 13 + 2 OP’s
Primary Flight Controls		
Elevator (1)	NSM	See Special Condition
Rudder (1)	NSM	See Special Condition
Aileron (1)	NSM	See Special Condition
-tab (1)	SM	Ch. 13 + 2 OP’s

NSM = Not Significantly Modified (compared to previous B737 models)
SM = Significantly Modified (compared to previous B737 models)

(1) Compliance will also be shown to JAR 25.603, Change 13 plus Orange Papers 90/1 and 91/1.

REVERSION:	**A. 11-06: Fasteners**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.607(a)
ADVISORY MATERIAL:	N/A

A reversion to FAR 25.607(a) at Amendment 0 is agreed for systems/structure that are not significantly modified and are not affected by such modifications. Such areas are to be agreed by FAA and JAA and documented by Boeing.

In order to introduce this reversion into the JAA certification basis the following will apply:

For systems/structure that are not significantly modified and are not affected by such modifications replace the text of JAR 25.607(a) with that of FAR 25.607 as follows:

> **"No self Locking nut may be used on any bolt subject to rotation during aeroplane operation."**

REVERSION:	A. 11-08: Lift and Drag Device Indicator
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.21, 671, 672, 695 and 699 (change 13)
ADVISORY MATERIAL:	N/A

JAR 25.21, 25.671 and 25.672 at Change 13 will be included in the JAA Joint Certification Type Basis. This eliminates the need for compliance with Paragraph 25.695 which is not included in JAR 25 at Change 13.

JAA accept the reversion on JAR 25.699(a) Change 13 to FAR 25.699 amendment 0 which only concerns wing flap position indication and doesn't require position indication for spoilers.

The high lift device systems will be required to comply with JAR 25.699 at change 13 and both the lift and drag system will be required to comply with JAR 25.699 (b) and (c) at change 13.

REVERSION:	**A. 11-11: Doors**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.783(f)
ADVISORY MATERIAL:	N/A

JAA agrees to grant a reversion from JAR 25.783(f) Change 13, to replace the text with that of FAR 25.783(f) Amendment 15. This applies to doors of the existing design, any subsequent changes, or changes that affect the doors will need to be reviewed in consideration as to whether this amendment level remains applicable.

REVERSION:	**A. 11-12: Seat, Berths, Safety Belts and Harness**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.785(b)
ADVISORY MATERIAL:	N/A

The request for a reversion from JAR 25.785(a) at Change 13 to JAR 25.785(a) at Change 12 is accepted.

REVERSION:	**A. 11-13: Direct view and cabin attendant seat**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.785h(1) & (2) Change 13
ADVISORY MATERIAL:	N/A

JAA agrees to grant a reversion from JAR 25.785h(1) and (2) Change 13, to replace the text with that of FAR 25.785h(2) (Direct View) and (5) (Cabin Attendant Seat Design) at Amendment 32, following the proposed MOC D.

Following consultation with National Aviation Authorities, the CAA has advised that they are likely to issue an ANDR that will define their criteria for complying with JAR 25.785 h(i) which will not allow the use of MOC D.

REVERSION:	**A. 11-16: Equipment Systems and Installations**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.1309
ADVISORY MATERIAL:	AMJ 25.1309

The JAA wishes to draw attention to the Acceptable Techniques section of JAR AMJ 25.1309 paragraph 8 for the aircraft.

The JAA notes that for systems that are new, significantly modified and / or significantly affected by change, Major failure conditions must also be considered. JAR AMJ 25.1309 para 12(c) provides acceptable guidance material.

A reversion to FAR 25.1309 Amdt 25-0 is granted for those systems that are not; new, significantly modified and/or affected by a significantly change.

REVERSION:	**A. 11-23: Windshields and Windows**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.775(d)
ADVISORY MATERIAL:	N/A

JAA agrees that a reversion may be granted for the windshields and windows from JAR 25.775(d) Change 13 (including Orange Papers 90/1 and 91/1) to the amendment level in the original FAA Certification Basis FAR 25.775(d) at Amendment 0.

CERTIFICATION BASIS:	**A-CCD: OSD Cabin Crew Data (CCD) certification basis**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER/-8
REQUIREMENTS:	Regulation (EU) 748/2012 of 03 August 2012, as amended by EU Regulation N°69/2014, Article 7a Annex I (Part 21) 21.A.17B
ADVISORY MATERIAL:	N/A

Certification basis for the establishment of Operational Suitability Data (OSD) Cabin Crew for B737-600/-700/-800/-900/-900ER, the currently applicable:

- CS-CCD, Initial Issue dated 31 January 2014

CERTIFICATION BASIS:	**A-MMEL:OSD Master Minimum Equipment List – Cert. basis**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER/-8
REQUIREMENTS:	EU Regulation N°69/2014, Article 7a Annex I (Part 21) 21.A.17B
ADVISORY MATERIAL:	N/A

JAR-MMEL/MEL Amendment 1, Section1, Subparts A and B is the appropriate OSD MMEL certification basis for the B737-600/-700/-800/-900/-900ER.

CERTIFICATION BASIS:	**D926A105: OSD Flight Crew**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER/-8
REQUIREMENTS:	EU Regulation N°69/2014, Article 7a Annex I (Part 21) 21.A.17B
ADVISORY MATERIAL:	N/A

The data contained in this document are agreed on the basis of elect to comply with CS-FCD, Initial Issue, dated 31 Jan 2014.

EQUIVALENT SAFETY FINDING:	**B-05/MAX: Longitudinal trim at Vmo**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS 25.161(a), CS 25.161(c)(3), CS 25.1301(a) and CS 25.1309(a)
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

The aisle stand trim switches can be used to trim the airplane throughout the flight envelope and fully complies with the reference regulation Simulation has demonstrated that the thumb switch trim does not have enough authority to completely trim the aircraft longitudinally in certain corners of the flight envelope, e.g. gear up/flaps up, aft center of gravity, near Vmo/Mmo corner, and gear down/flaps up, at speeds above 230 kts.
In those cases, longitudinal trim is achieved by using the manual stabilizer trim wheel to position the stabilizer. The trim wheel can be used to trim the airplane throughout the entire flight envelope.
In addition, the autopilot has the authority to trim the airplane in these conditions.
The reference regulation and policy do not specify the method of trim, nor do they state that when multiple pilot trim control paths exist that they must each independently be able to trim the airplane throughout the flight envelope.
Boeing did not initially consider this to be a compliance issue because trim could always be achieved, even during the conditions where use of the aisle stand trim switch was required.
Subsequent to flight testing, the FAA-TAD expressed concern with compliance to the reference regulation based on an interpretation of the intent behind “trim”. The main issue being that longitudinal trim cannot be achieved throughout the flight envelope using thumb switch trim only.

EASA POSITION

Boeing set the thumb switch limits in order to increase the level of safety for out-of-trim dive characteristics (CS 25.255(a)(1)). The resulting thumb switch limits require an alternative trim method to meet CS 25.161 trim requirements in certain corners of the operational envelope.

The need to use the trim wheel is considered unusual, as it is only required for manual flight in those corners of the envelope.

The increased safety provided by the Boeing design limits on the thumb switches (for out-of-trim dive characteristics) provides a compensating factor for the inability to use the thumb switches throughout the entire flight envelope. Furthermore, the additional crew procedures and training material will clearly explain to pilots the situations where use of the trim wheel may be needed due to lack of trim authority with the wheel mounted switches.

The trim systems on the 737Max provide an appropriate level of safety relative to longitudinal trim capability.

EQUIVALENT SAFETY FINDING:	B-06/MAX: En-route climb
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS 25.123(a) and (b)
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

Amendment 25/3 changes to CS §25.123 regarding en route climb speed (Venroute):
- Establishes a minimum speed criteria (Venroute ≥ VFTO)
- Requires evaluation compared to stall speed with ice

The objectives of the amended regulation are appropriate; however, there are two issues that prevent a direct showing of literal compliance for the 737 MAX. These are:

1) At some weights, the 737 MAX VFTO is expected to be faster than the speed selected for en route climb. This is in conflict with the literal wording of the regulation, but as described in the next section this does not conflict with the intent of the regulation.

2) The regulation requires that the en route climb speed be compared to VSR with ice and VFTO, both of which are only defined for altitudes within a few thousand feet of maximum airport altitudes, while en route climb speeds must be determined up to higher altitudes.

For these two reasons, an equivalent level of safety finding is necessary to establish a clear path for demonstration of compliance.

EASA POSITION

The proposed compensating factors meet the level of safety intended by the regulation.

SPECIAL CONDITION:	**B-10: Stall Warning Thrust Bias**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.207(c) as amended by NPA 25B-215
ADVISORY MATERIAL:	N/A

JAR 25.207(c) as amended by NPA 25B-215. Amend this paragraph to remove references to engines idling and throttles closed and the reference stall speed so that it reads as follows:

"(c) When the speed is reduced at a rate not exceeding 1 knot per second, stall warning must begin, in each normal configuration, at a speed, V_{SW}, exceeding the speed where CL is first a maximum by not less than 3 knots or 3%, whichever is greater. Stall warning must continue throughout the demonstration, until the angle of attack is reduced to approximately that at which stall warning is initiated. [See ACJ 25.207(c)]".

The effect of these amendments is to extend the requirement for a minimum stall warning margin to thrust levels above flight idle. It is not necessarily the intention that full stalls be demonstrated at maximum thrust, but it must be shown that thrust bias does not result in stall warning margins below the level required in JAR 25.207(c).

SPECIAL CONDITION	**C-01: Pressurised Cabin Loads**
APPLICABILITY:	Boeing B737-600/-700/-800/-900
REQUIREMENTS:	JAR 25.365 and JAA INT/POL/25/7
ADVISORY MATERIAL:	N/A

In addition to the specific requirement of JAR 25.365(e), all structure, components or parts, both internal and external to the pressurised compartments, the failure of which could interfere with continued safe flight and landing, must be designed to withstand the differential pressure loads resulting from a sudden release of pressure through the openings specified in JAR 25.365(e) at any approved operating altitude.

In complying with this requirement, the differential pressure must be combined in a rational and conservative manner with the 1-g level flight loads and any loads arising from the emergency depressurisation conditions. These may be considered as ultimate conditions; however any deformations associated with these conditions must not interfere with continued safe flight and landing.

SPECIAL CONDITION	**C-02/MAX: Design Manoeuvre Requirements**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS 25.331, 25.349, 25.351
ADVISORY MATERIAL:	N/A

Add to CS 25.331(c) paragraph (c)(3):
It must be established that manoeuvre loads induced by the system itself (e.g. abrupt changes in orders made possible by electric rather than mechanical combination of different inputs) are acceptably accounted for.
Replace CS 25.349(a) by:
(a) Manoeuvring: the following conditions, speeds and cockpit roll control motions (except as the motions may be limited by pilot effort) must be considered in combination with an aeroplane load factor from zero to two-thirds of the limit positive manoeuvring load factor. In determining the resulting control surface deflections the torsional flexibility of the wing must be considered in accordance with CS 25.301(b):
(1) Conditions corresponding to maximum steady rolling velocities and conditions corresponding to maximum angular accelerations must be investigated. For the angular acceleration conditions zero rolling velocity may be assumed in the absence of a rational time history investigation of the manoeuvre.

(2) At VA movement of the cockpit roll control up to the limit is assumed. The position of the cockpit roll control must be maintained until a steady roll rate is achieved and then must be returned suddenly to the neutral position.
(3) At VC, the cockpit roll control must be moved suddenly and maintained so as to achieve a roll rate not less than that obtained in sub-paragraph (2) of this paragraph.
(4) At VD, the cockpit roll control must be moved suddenly and maintained so as to achieve a roll rate not less than one-third of that obtained in sub-paragraph (2) of this paragraph.
(5) It must be established that manoeuvre loads induced by the system itself (i.e. abrupt changes in orders made possible by elec¬trical rather than mechanical combination of different inputs) are accepta¬bly accounted for.
Amend paragraph CS 25.351(a) as follows:
(a) With the aeroplane in unaccelerated flight at zero yaw, it is assumed that the cockpit rudder control is suddenly displaced (with critical rate) to the maximum deflection, as limited by the stops.
Add to CS 25.351 paragraph (e):
(e) It must be established that manoeuvre loads induced by the system itself (i.e. abrupt changes in orders made possible by elec¬trical rather than mechanical combination of different inputs) are accepta¬bly accounted for.

SPECIAL CONDITION:	C-11: Interaction of Systems and Structure
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.302
ADVISORY MATERIAL:	N/A

1) Add the following text :

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 influence 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).

2) Replace the current ACJ 25.301(b) with the following text:

ACJ 25.301(b)
Loads (Interpretative material)
See JAR 25.301 (b) and JAR 25.361(d)

1. In the determination of the load conditions up to the prescribed limit load level, any significant non-linearity (e.g. due to aerodynamics and/or aeroelasticity) should be taken into account unless it would be conservative to ignore such non-linearities.

2. The engine and its mounting structure are to be stressed to the loading cases for the aeroplane as a whole, including manoeuvring and gust loading conditions, together with conservative estimates of torque, thrust, gyroscopic loading and any loading which may result from engine fans. Full allowance should be made for structural flexibility effects in landing cases. This also applies to auxiliary power units.

3) Add the following ACJ :

ACJ 25.302
Interaction of systems and structures (interpretative material)

1. INTRODUCTION

This ACJ defines criteria which are found adequate for an aeroplane equipped with systems which directly, or as a result of a failure or malfunction, affect structural performance, and should therefore be associated with agreed methods of demonstrations.
This ACJ is intended to be applicable to flight controls, load alleviation systems and flutter control systems. If this ACJ is used for other systems, care should be taken that some items might have to be adapted to the specific system.
These criteria only address the direct structural consequences of the systems responses and performances and therefore cannot be considered in isolation but should be included in the overall safety evaluation of the aircraft. The presentation of these criteria may, in some instances, duplicate standards already established for this evaluation.
The defined criteria are applicable to structure, the failure of which could prevent continued safe flight and landing.
Beyond these criteria, additional studies may be defined depending upon the specific characteristics of the aircraft. The purpose of these studies is to examine areas where there is concern that current writing of the requirements may not be sufficient in order to check certain situations which are considered realistic. The precise need for additional requirements associated with these studies and/or their level of severity will depend on the

sensitivity of the aircraft to those conditions and the conclusion that these problems may show the aircraft to have a lower level of safety than a conventional aircraft.

2. DEFINITIONS

2.1 Structural performance:
Capability of the aeroplane to meet the structural requirements of JAR-25.

2.2 Flight limitations:
Limitations which can be applied to the aeroplane flight conditions following an in flight occurrence and that are included in the Flight Manual (e.g. Speed limitations, avoidance of severe weather conditions etc.).

2.3 Operational limitations
Limitations - including flight limitations - that can be applied to the aircraft operating conditions before dispatch (e.g. fuel and payload limitations).

2.4 Probabilistic terms:
The probabilistic terms, such as probable, improbable and extremely improbable, used in this ACJ should be understood as defined in AMJ 25.1309.

2.5 Failure Condition:
The term failure condition is defined in AMJ 25.1309, however this ACJ applies only to system failure conditions that affect the structural performance of the aeroplane (e.g. failure conditions that induce loads or change the response of the aeroplane to inputs such as gusts or pilot actions).

3. SYSTEM FULLY OPERATIVE

With the system full operative the following apply:

3.1 Determination of limit loads

Limit loads should be derived in all normal operating configurations of the systems from all the limit conditions specified in Subpart C, taking into account any special behaviour of such systems or associated functions or any effect on the structural performance of the aircraft which may occur up to the limit loads. In particular any significant non-linearity (rate of displacement of control surface, thresholds or any other system non-linearities) should be accounted for in a realistic or conservative way when deriving limit loads from limit conditions.

3.2 Strength requirements

The aircraft should meet the strength requirements of JAR-25 (static strength, residual strength) using the specified factors to derive ultimate loads from the limit loads defined above. The effect of non-linearities should be investigated beyond limit conditions to ensure the behaviour of the systems presents no anomaly compared to the behaviour below the limit conditions. However, conditions beyond limit conditions need not to be considered when it can be shown that the aeroplane has design features that make it impossible to exceed those limit conditions.

3.3 Flutter requirements

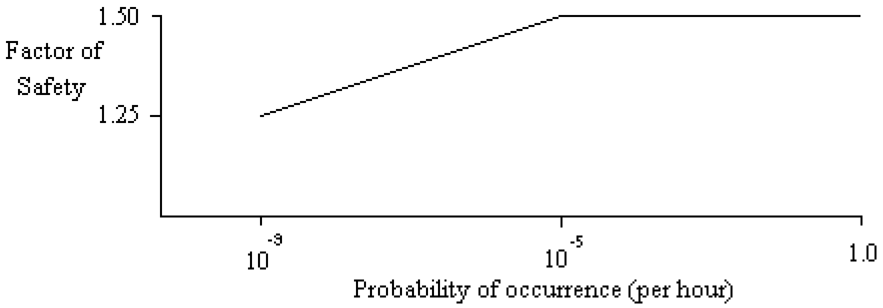
The aeroplane must meet the aeroelastic stability requirements of JAR 25.629.

4. SYSTEM IN FAILURE CONDITION

4.1 For any system failure condition not shown to be extremely improbable, the following apply:

4.1.1 At the time of occurrence

Starting from 1g level flight conditions, a realistic scenario, including pilot corrective actions, should be established to determine the loads occurring at the time of failure and immediately after failure. The aeroplane should be able to withstand these loads, multiplied by an appropriate factor of safety that is related to the probability of occurrence of the failure. The factor of safety (F.S.) is defined in Figure 1.



(i) These loads should also be used in the damage tolerance evaluation required by JAR 25.571 (b) if the failure condition is probable.

(ii) A flutter, divergence and control reversal justification should be made up to V_D or 1.15 V_C, whichever is greater. However at altitudes where the speed is limited by Mach number, compliance need be shown only up to M_D as defined in JAR 25.335 (b). For failure conditions which result in a speed increase beyond V_C/M_C, freedom from flutter and divergence should be shown to increased speeds, so that the above speed margins are maintained.

(iii) Notwithstanding the strength conditions described in this subparagraph, failure of the system which result in forced structural vibrations (oscillatory failures) must not produce peak loads that could result in detrimental deformation of the primary structure.

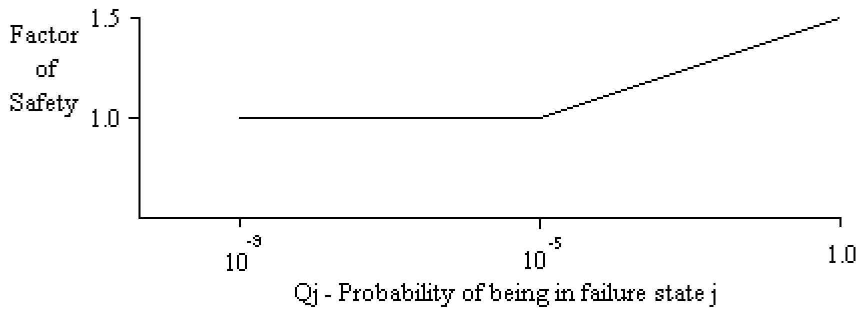
4.1.2 For continuation of the flight

For the aeroplane in the system failed state, and considering any appropriate reconfiguration and flight limitation, the following apply:

(i) Static and residual strength should be determined for loads derived from the following conditions:

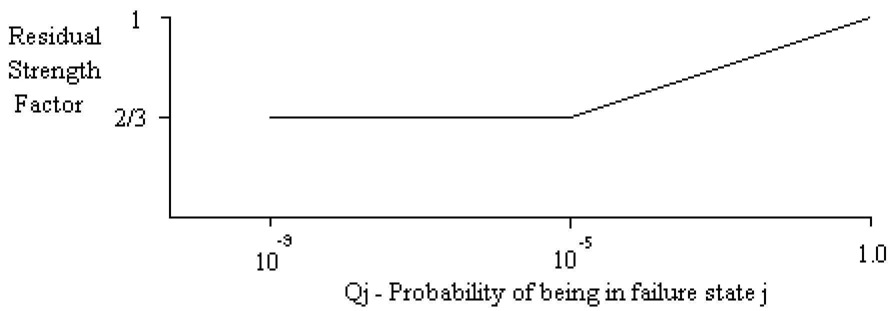
- the limit symmetrical manoeuvring conditions specified in § 25.331 at speeds up to V_C and in § 25.345
- the limit gust conditions specified in § 25.341 at speeds up to V_C and in § 25.345
- the limit rolling conditions specified in § 25.349 and the limit unsymmetrical conditions specified in §§ 25.367 and 25.427 (b) and (c) at speeds up to V_C
- the limit yaw manoeuvring conditions specified in § 25.351 at speeds up to V_C
- the limit ground loading conditions specified in §§ 25.473 and 25.491

(ii) For static strength substantiation, each part of the structure should be able to withstand the loads in subparagraph 4.1.2(i) multiplied by a factor of safety depending on the probability of being in this failure state. The factor of safety is defined in Figure 2.



$Q_j = T_j * p_j$ where
T_j = Average time spent in failure condition
P_j = Probability of occurrence of failure mode
Note: If P_j is greater than 10^{-3}, per flight hour then a 1.5 factor of safety must be used and static and residual strength must be determined for loads derived from all limit conditions specified in Subpart C for the reconfigured aeroplane.

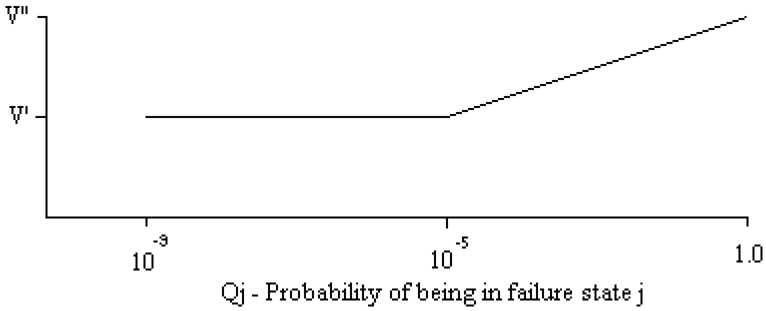
(iii) For the residual strength substantiation as defined in JAR 25.571(b), structures affected by failure of the system and with damage in combination with the system failure, a reduced factor may be applied to the residual strength loads of JAR 25.571(b). However the residual strength level should not be less than the 1g flight load combined with the loads introduced by the failure condition plus two thirds of the load increments of the conditions specified in JAR 25.571(b) applied in both positive and negative directions (if appropriate). This residual strength substantiation need not be conducted for improbable failure conditions.
The residual strength factor (R.S.F.) is defined in Figure 3.



$Q_j = T_j * p_j$ where
T_j = Average time spent in failure condition
P_j = Probability of occurrence of failure mode
Note: If P_j is greater than 10^{-3}, per flight hour then a residual strength factor of 1.0 should be used.

(iv) If the loads induced by the failure state have a significant influence on damage propagation then their effects must be taken into account.

(v) Freedom from flutter, divergence and control reversal should be shown up to a speed as defined in Figure 4.



V' = Clearance speed required for failure conditions as defined in sub-paragraph 4.1.1(ii)
V" = Clearance speed required for normal (unfailed) conditions by JAR 25.629(b).
$Q_j = T_j * P_j$ where:
T_j = Average time spent in failure condition
P_j = Probability of occurrence of failure mode
Note: If P_j is greater than 10^{-3}, per flight hour, then the clearance speed must not be less than V"

(vi) Freedom from flutter, divergence and control reversal should also be shown up to V', in Figure 4, for any probable failure condition combined with any damage required or selected for investigation by JAR 25.571(b).

(vii) If the Mission Analysis method is used to account for continuous turbulence, all the systems failure conditions associated with their probability should be accounted for in a rational or conservative manner in order to ensure that the probability of exceeding the limit load is not higher than the value prescribed in ACJ 25.305(d).

4.2 Warning considerations

For system failure detection and warning the following apply:

4.2.1 Before flight

The system should be checked for failure conditions, not extremely improbable, that degrade the structural capability below the level required by JAR-25. The crew should be made aware of these failures, if they exist, before flight.

4.2.2 During flight

The existence of any failure condition, which is not extremely improbable, during flight that could significantly affect the structural capability of the aeroplane (for example, a reduction in factor of safety below 1.25, or flutter margin below V"), and for which the associated reduction in airworthiness can be minimised by suitable flight limitations, should be signalled to the crew.

4.2.3 For dispatch in known failure condition

If the aeroplane is to be knowingly dispatched in a system failure condition that reduces the structural performance then operational limitations should be provided whose effects, combined with those of the failure condition, allow the aeroplane to meet the structural requirements of JAR-25. Subsequent system failures should also be considered.

4) Delete the current ACJ 25.1329 5.2.1(a) and ACJ 25.1329 5.2.2(a)

5) Insert the following ACJ 25.1329 5.2.6 :

In case the failure condition produces any additional load on the structure or has an impact on the structural capabilities of the aeroplane, this must be addressed according to §25.302.

SPECIAL CONDITION:	9ER/C-11: Interaction of Systems and Structure
APPLICABILITY:	Boeing B737-900ER
REQUIREMENTS:	JAR 25.302
ADVISORY MATERIAL:	ACJ 25.301 ACJ 25.302

The CRI C-11 Interaction of Systems and Structure raised for B737-700 is applicable to B737-900ER.

EQUIVALENT SAFETY FINDING:	**C-15/PTC: Structural Certification Criteria for Large Antenna Installations**
APPLICABILITY:	Boeing B737-800/-900ER
REQUIREMENTS:	JAR 25.23, 25.251, 25.301, 25.365, 25.571, 25.581, 25.603, 25.605, 25.609, 25.613, 25.629, 25.631, 25.841, 25.901, 25.1419, 25.1529, and Appendix H
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

The consequences of loss of an antenna and/or radome become more significant with an increased size and weight of the antenna/radome installation. Therefore, past practice as applied to small antenna installations may not always be sufficient when applied to a large antenna installation. In fact, if loss of the antenna and/or radome is deemed catastrophic either due to decompression, or due to the antenna and/or radome striking the vertical or horizontal stabilizers, or for some other reason, then the structural certification criteria are more stringent.

EASA POSITION

EASA requests that the applicant provides the means of compliance for each of the regulations identified below.

JAR 25.23 Load Distribution Limits
The effect of the antenna/radome installation on the weight, centre of gravity, and load distribution limits of the aeroplane must be considered. These changes must be documented in the weight and balance document as required by JAR 25.29 and JAR 25.1519.

JAR 25.251 Vibration and Buffeting (CRI C-05 per TCDS A.120)
The effects of vibration and buffeting on the aeroplane must be considered, as well as on the antenna/radome installation itself up to VDF/MDF.
Boeing has requested an equivalent level of safety ELOS (FAA has raised IP F-1) finding to show by means other than flight testing that the installation of this Ku-Band antenna will not cause excessive vibration under any speed and power conditions up to VDF/MDF.

JAR 25.301(b) Flight Loads Validation
Methods used to determine load intensities and distribution must be validated by flight load measurement unless the methods used for determining those loading conditions are shown to be reliable, or conservative.

JAR 25.365(e) Pressurized Compartment Loads
Rapid pressurization of the antenna compartment (radome) must be considered as outlined in JAR 25.365(e)(3) if loss of the radome/antenna could interfere with continued safe flight and landing. JAR 25.365(e)(3) requires the consideration of "the maximum opening caused by aeroplane or equipment failures not shown to be extremely improbable."
EASA's interpretation of JAR 25.365(e)(3) is that to address structural failures, the opening size resulting from a skin bay failure (bounded by two adjacent frames and two adjacent stringers) should generally be considered (i.e. is not extremely improbable) as a minimum opening size, unless a smaller opening can be justified based upon the maximum level of cracking that can be conservatively expected when a directed inspection for the structure under the radome exists in the ALS. (The assumed crack size and resulting opening should account for bulging affects and the possibility of missed opportunities for detection.) Failures to equipment and items such as seals should also be considered separately and in combination with structural failures as appropriate.
Consideration of JAR 25.365(e)(1) is not required as the engine disintegration is assumed to adequately "vent" any remaining section of radome if the compartment beneath is penetrated. Application of the formula hole size requirement of JAR 25.365(e)(2) is also not required,

since, for the size of radome being considered, the majority of hole sizes up to the maximum stated in the formula will exceed the boundary of the antenna/radome. Furthermore, the potential for such large openings to create debris problems equivalent to or worse than the loss of the antenna alone supports the position that application of JAR 25.365(e)(2) to such antenna would be beyond the accepted intent of the rule. Rather, the focus for compliance to the decompression requirement should be consideration of any airframe or equipment failures not shown to be extremely improbable, as explained above.

JAR 25.571 Damage Tolerance and Fatigue Evaluation of Structure (CRI A.11-05 per TCDS A.120)
A damage tolerance evaluation must be performed on any radome/antenna structure whose failure due to fatigue, corrosion or accidental damage could result in loss of the antenna/radome and subsequent tail strike, or other hazard such as rapid decompression of the aeroplane. Any inspection that is determined necessary as a result of this evaluation must be addressed as per JAR 25.1529 and Appendix H.

JAR 25.581 Lightning Strike
The antenna and radome installation must be designed such that the aeroplane is protected against catastrophic effects from lightning.

JAR 25.603 Materials
Materials used must conform to approved specifications. The suitability of the material to withstand the operational environment (e.g. temperature and humidity) must be assessed.

JAR 25.605 Fabrication Methods
The methods of fabrication used must produce a consistently sound structure. Each new fabrication method must be substantiated by a test program.

JAR 25.609 Protection of Structure
Each part of the structure must be suitably protected against deterioration or loss of strength in service and must have provisions for ventilation and drainage where necessary for protection.

JAR 25.613 Material Strength Properties and Design Values
Design values used to design the antenna/radome installation must be established on a statistical basis. The applicant must take into account the operational environmental conditions (e.g. temperature and humidity) when establishing design values.

JAR 25.629 Aeroelastic Stability Requirements (CRI C-05 per TCDS A.120)
The applicant must demonstrate by analysis and/or test that the aeroplane is free from aeroelastic instability with the antenna and radome installed. This may be accomplished by a comparative analysis showing that the aeroelastic stability of the aeroplane will be unaffected by the change. If the antenna/radome installation is not conformal to the fuselage, such as an antenna/radome mounted above the fuselage, the installation itself must also comply with JAR 25.629.

JAR 25.631 Bird Strike
The applicant must show that a bird strike on the antenna/radome, including attachments, will not prevent continued safe flight and landing. This includes consideration of parts that may separate from the aeroplane. This requirement need not be considered if it can be demonstrated that a bird cannot strike the antenna/radome, including attachments, within the normal flight envelope.

JAR 25.841 Cabin Pressurization
Certain aeroplanes approved for operation at high altitude (above 41.000 ft) have Special Conditions addressing pressurization. For these aeroplanes, the requirements defined in the Special Condition apply to any modification of the pressure vessel.

JAR 25.901(c) Sustained Engine Imbalance

The applicant may need to consider the effects of sustained engine imbalance (windmilling) if the antenna/radome design is such that it would be susceptible to structural failure due to vibration. It must be shown that the resulting vibration will not cause a structural failure of the antenna/radome installation that would result in a foreseeable hazard, either at the point of failure or downstream.
AMC 25-24 provides further guidance on this subject.

JAR 25.1419 Icing
Ice shedding from the antenna/radome installation should be considered. It must be shown that such shedding and the resulting damage to other parts of the aeroplane does not interfere with continued safe flight and landing.

JAR 25.1529 & Appendix H Instructions for Continued Airworthiness
The applicant must demonstrate compliance by developing an appropriate maintenance and inspection program.

Airworthiness Directives
The applicant should address any Airworthiness Directive(s) applicable to the area of the antenna/radome installation.

The means of demonstrating compliance with §25.251(b) is cited in the rule ("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"). Therefore, a flight demonstration out to VDF/MDF is required to demonstrate compliance with the rule.

When external modifications are made to an existing type design, compliance with §25.251(b) must be addressed. The FAA 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. However, if the original certification for this rule does not remain valid due to potential effects of the external modification, direct compliance with the rule must be re-demonstrated.

The Applicant proposes to demonstrate that the modifications to this aircraft have not affected the 737NG series aircraft compliance with §25.251(b) using a combination of design similarity and aerodynamic analysis. Documents have been prepared to demonstrate that the design does not affect the original compliance finding of "free from excessive vibration" for the aircraft.

The analysis is based on computational fluid dynamics (CFD) and has been performed using a validated (Navier-Stokes) code. This analysis was performed by a company having personnel with significant experience with CFD analyses and having successfully completed similar analyses on previous FAA programs.

In addition, certification flight testing up to VMO/MMO will be conducted on a production 737-800 aircraft to perform a qualitative assessment that no buffeting condition exists up to that speed to show compliance with §25.251.

A CFD flow field analysis for the 737-800 will be provided to support the position that the modified aircraft will be free from excessive vibration under any appropriate speed up to VDF/MDF. The local flow fields around the area of modification will be used to demonstrate local unsteady flow characteristics. Flow field characteristics downstream of the modified area will also be used to validate the Ku band antenna radome installation design and location that ensures attached flow, thus demonstrating compliance with regard to §25.251(b).

This result will be applied to the 737-900ER by similarity analysis.
In summary, based on the proposal above, the applicant states that an in-flight demonstration of the Boeing 737NG aircraft out to VDF/MDF is not required to demonstrate compliance with FAR §25.251(b).

EQUIVALENT SAFETY FINDING:	9ER/C-20: Fuel tank access covers
APPLICABILITY:	Boeing B737-900ER
REQUIREMENTS:	JAR 25.963(g) change 14
ADVISORY MATERIAL:	ACJ 25.963(g) ACJ 25.963-1 AMJ 20-128A P-NPA 25E-304

Statement of Issue

JAR 25 change 14 introduced a new requirement JAR25.963(g) which requires that the strength of fuel tank access doors is adequate to withstand impact from engine or tyre debris. A tyre fragment and low energy engine debris model is defined in ACJ 25.963(g).

ESF

EASA accepts the proposal for the fitment of the B777-200LR/300ER fuel tank access covers meets the intent of JAR 25.963(g) and that based on testing and acceptance of the B777 covers and relative impact energies testing would not be required to demonstrate compliance for the B737-900ER.

In addition, the covers are outside the engine debris zone.

SPECIAL CONDITION:	**D-01: Brakes Requirements Qualification and Testing**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.735/NPA 25B,D,G-244 and JAA Interim Policy INT/POL/25/6
ADVISORY MATERIAL:	N/A

A. Amend JAR 25.735(a) to read:

(a) Each brake must be approved and tested for compliance in accordance with the Policy Paper Number INT/POL/25/6 (included in JAA Administrative and Guidance Material Section Three - Certification, October 1 1993) except that Paragraph 4.v of the Policy is deleted and replaced by the following text:

Within 20 seconds of completion of the stop, or brake pressure release in accordance with sub-paragraph iv, the brake pressure shall be adjusted to the pressure equivalent to the normal parking brake pressure and maintained for 3 minutes. No continuous/sustained fire which extends above the level of the highest point of the tyre is allowed before 5 minutes have elapsed after application of the parking brake pressure; until this time has elapsed, neither fire fighting means or artificial coolants shall be applied.

The time when the first fuse plug operates, if applicable, is to be recorded.

[See also ACJ 25.735(a)].

B. Add a new paragraph 25.735 (k) to read as follows:

(k) Each wheel brake assembly must be provided with a means to indicate the limit of permitted wear. The means must be reliable and readily inspected.

C. Add a new ACJ to read as follows:
ACJ 25.735 (f)(1) as amended by NPA 25 B, D, G 244. In each case, energy to be absorbed should be established with no credit for reverse thrust.

D. Add a new ACJ to read as follows:
ACJ 25.735(k)
The brake assembly heat pack is deemed to be unserviceable and to have reached its permitted wear limit when it is no longer capable of performing all of its intended function.

DEVIATION	**D-02: Hydraulic System Proof Pressure Testing**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.1435 (b) (1)
ADVISORY MATERIAL:	N/A

DEVIATION

A range-of-motion test of the complete hydraulic system at 3400 psig and component testing at 1.5 times operating pressure (4500 psig) per JAR 25.1435 (a) (10) shall be performed instead of the test mandated by JAR 25.1435 (b) (1) which specifies using 1.5 times the working pressure.

SPECIAL CONDITION:	D-04/MAX: Towbarless towing
APPLICABILITY:	Boeing B737-8
REQUIREMENTS:	CS 25.745(d), CS 25.1309, CS 25.1322
ADVISORY MATERIAL:	JAA INT/POL/25/13

Replace the entire text of the current paragraph CS 25.745(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 AMC 25.1322).

SPECIAL CONDITION:	**D-04: Landing Gear Warning**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.729 (e)(2) to (4)
ADVISORY MATERIAL:	N/A

1. Special Condition
Delete the existing sub-paras 25.729 (e)(2) to (e)(4) inclusive and substitute the following:

(e)(2) The flightcrew must be given an aural warning that functions continuously, or is periodically repeated, if a landing is attempted when the landing gear is not locked down. (see ACJ25.729 (e))

(e)(3) The warning must give sufficient time to allow the landing gear to be locked down or a go - around to be made.

(e)(4) There must not be a manual shut-off means readily available to flightcrew for the warning required by paragraph (e)(2) of this section such that it could be operated instinctively, inadvertently or by habitual reflexive action. (see ACJ 25.729 (e))

(e)(5) The system used to generate the aural warning must be designed to minimise false or inappropriate alerts. (see ACJ.25.729 (e))

(e)(6) Failures of systems used to inhibit the landing gear aural warning, that would prevent the warning system from operating, must be improbable.

Note: This Special Condition creates a new (e) (5) and (e) (6), the present 25.729 (e)(5) must be changed into (e)(7).

2. Interpretative Material

Add to ACJ 25.729 (e) the following:

The warning required by 25.729 (e)(2) should preferably operate whatever the position of the wing trailing edge devices or the number of engines operating.

The design should be such that nuisance activation of warning is minimised, for example:

(i) When the landing gear is retracted:
-After a take-off following an engine failure.

-During a take-off when a common flap setting is used for take-off and landing.

(ii) When the throttles are closed in normal descent.

(iii) When flying at low altitude in clean or low speed configuration (special operation).

Inhibition of the warning above a safe altitude out of final approach phase either automatically or by some other means to prevent these situations is acceptable, but it should automatically reset for a further approach.

Means to deactivate the warning required in para 25.729 (e) may be installed for use in abnormal or emergency conditions provided that it is not readily available to the flight crew, i.e. the control device is protected against inadvertent actuation by the flight crew and its deactivated state is obvious to the flight crew.

EQUIVALENT SAFETY FINDING	**D-06: Towbarless towing**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**25.X745 (d)**
ADVISORY MATERIAL:	N/A

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 activities approach the capability of the design to withstand the loads. The applicant is intending to give approval to other methods of towing the airplane, typically referred to as "Towbarless Towing" which utilises means which do not connect to the aeroplane nose landing gear via the protection device installed to ensure compliance with the Requirement. Consequently, when such methods are used, compliance with the requirement cannot be assured with the current design.

The applicant state that they will provide a reliable and unmistakable warning on the TLTV when damage may have occurred to the aeroplane steering system. JAA requires that Boeing document D6-56872, which defines towbarless towing vehicle assessment criteria, must clearly define the reliability objectives for the detection means installed on the TLTV.

Section 09-11-00-2, Towing Maintenance Practices, of the 737-600/700/800 airplane maintenance manual must clearly define instructions and limitations for towing and procedures for the towing equipment.

The vehicles which have been approved in accordance with the Boeing document D6-56872 must be clearly stated in the Maintenance Manual.

On the basis that the aircraft flight manual limitations section will be amended with the following;

"towbarless towing operations are restricted to towbarless tow vehicles that are designed and operated to preclude damage to the steering system during towbarless towing operations, or which provide reliable and unmistakable warning when damage to the aeroplane steering system may have occurred. Specific Towbarless towing vehicles that are equipped with steering system protection or oversteer indication systems and are approved, are listed in Boeing documentation D6-56872, towbarless towing vehicle assessment criteria ."

EQUIVALENT SAFETY FINDING	**D-08: Forward and Aft Door Escape Slide Low Sill Height**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25.809(f)(1)(ii) change 13**
ADVISORY MATERIAL:	N/A

JAR 25.809(f)(l)(ii) requires that the escape slide be automatically erected after deployment. In certain adverse airplane attitudes, low sill height, the escape slides at the forward and aft doors may not automatically inflate. Due to the length of the automatic inflation lanyard, the escape slide must drop approximately 52.0 inches (forward door) and 50.0 inches (aft door) from the door sill for the slide to automatically inflate. The inflation lanyard must be long enough to prevent the escape slide inflation system from being activated during the inboard door movement portion of the door opening cycle and therefore cannot be shortened.

The minimum door sill height for the forward door will be 41.5 inches and 21.8 inches for the aft door. All of the following conditions must occur to produce a forward door sill height of 41.5 inches and aft door sill height of 21.8 inches and these conditions can occur at only one door at a time:

Forward Door:

a. Nose gear and one main landing gear collapses
b. Engine and nacelles gone
c. Airplane resting on wing tip opposite to collapsed main gear.

Aft Door:

a. Only one main landing gear collapses
b. Engine nacelles remain intact
c. Airplane centre of gravity falls aft of 23.0% MAC

The escape slides will inflate manually under all conditions. Development tests conducted thus far have demonstrated the escape slide to be usable at these minimum sill heights.

In summary, deployment of the escape slide at low sill height may or may not result in automatic deployment, depending on the attitude of the slide valise as it drops of the door and it hits the ground. At low sill heights, passengers may be readily evacuated without the use of a slide. In addition, flight attendants will be trained in the use of the manual backup handle for manual slide inflation. A flight attendant seat is installed near the forward and aft doors and an attendant is more likely to open the door. In any event, suitable placarding has been added to the manual inflation handle to direct manual inflation if required.

The forward and aft door escape slide installations provide an equivalent level of safety as required in JAR 25.809)(f)(l)(ii). Similar equivalent level of safety findings were provided by the FAA for the Model 737-300/400/500 aft door and 757-200 Door No. 4 escape slide installations.

EQUIVALENT SAFETY FINDING	**9ER/D-08: Forward and Aft Door Escape Slide Low Sill Height**
APPLICABILITY:	Boeing B737-900ER
REQUIREMENTS:	**JAR 25.810(a)(1)(ii) change 15**
ADVISORY MATERIAL:	N/A

ESF D-08 raised for B737-700 applies.

Please note that the applicable requirement was moved
-from JAR 25.809(f)(1)(ii) at JAR 25 change 13
-to JAR 25.810(a)(1)(ii) at JAR 25 change 15

EQUIVALENT SAFETY FINDING	**D-10: Overwing Hatch Emergency Exit Signs**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25.812(b)(1)(i)**
ADVISORY MATERIAL:	N/A

JAR 25.812(b)(1)(i) requires that the letters on the emergency exit signs have a height to stroke-width ratio of not more than 7:1 nor less than 6:1. The applicant has submitted exit signs that do not comply with the required stroke-width and are requesting an equivalent safety finding for JAR 25.812(b)(1)(i), overwing hatch emergency exit signs, on Model 737-600/700/800 airplanes.

The overwing emergency exit sign is installed above the overwing hatch(es) to aid passengers and flight crews in locating the overwing emergency exit(s).

The height to stroke-width ratio varies on portions of the exit sign letters with some strokes wider and others narrower than the requirements of JAR 25.812.

On the signs with widely spaced letters, e.g. part number BAC27NPA0368 "EXIT", the ratio varies from 6.9:1 to 5.6:1.

The conspicuity and readability of the overwing exit signs are not affected by a slight variation in height or stroke-width. The lettering is considered to produce clear, distinct and uncrowded signs and in the case of widely spaced lettering the strokes are wider than the 6:1 requirement to prevent a thin looking appearance and to enhance the legibility. Therefore, it is concluded that the proposed overwing exit signs meet the intent of JAR 25.812 by providing signs which have a legibility equivalent to that required by JAR 25.812(b)(1)(i).

EQUIVALENT SAFETY FINDING	9ER/D-12: Maximum passengers seating configuration
APPLICABILITY:	Boeing B737-900ER
REQUIREMENTS:	**JAR 25.807(d) change 15**
ADVISORY MATERIAL:	N/A

Statement of Issue

With the introduction of Mid Exit Doors (MED) on the B737-900ER model the question of maximum certificated passenger numbers arises.

ESF

Three different configurations:

- “Two doors” i.e. with the MED disabled and covered internally such that their presence is invisible to aircraft occupants
- “Three doors, type II” i.e. with the MED rated as Type II exits and provided with reduced access passageways accepted by ESF (ref. CRI 9ER/D20)
- “Three doors, type I” i.e. with the MED rated as Type I exits and their access provisions fully compliant with all CS25 requirements for Type I exits

Three different configurations and corresponding maximum numbers of passengers:

- “Two doors”: 189 passengers (same certification basis as for the B737-900, CRI D-14 and D-17)
- “Three doors, type II”: 215 passengers
- “Three doors, type I”: 220 passengers

SPECIAL CONDITION	**D-14: Exit configuration**
APPLICABILITY:	B737-600/-700/-800/-900/-900ER
REQUIREMENTS:	JAR 25.807 (Special Condition i.a.w. JAR21)
ADVISORY MATERIAL:	N/A

Special Condition Number JAA/737-700/SC/D-14 applies in combination with the Equivalent Safety Finding detailed in CRI D-17 (oversized Type I Exits), to enable the maximum passenger seat capacity as follows when the new Automatic Overwing Exits are embodied:

737-600 149 Passengers
737-700 149 Passengers
737-800 189 Passengers

Special Condition JAA/737-700/SC/D-14;

New (Novel) Design Overwing Type III Exit:
In addition to satisfying the criteria in JAR 25 at Change 13 for a Type III exit;

1) Each new (novel) design overwing Type III exit must be capable of being opened automatically after manual operation of the handle, when there is no fuselage deformation, within 3 seconds measured from the time when the opening means is actuated to the time when the exit is fully opened. If a cover is provided over the handle the removal of the cover is included in this time.

2) The access to the exit must be provided by a vertically projected passageway of at least 13 inches between seats, 10 inches of which must be within the projected opening of the exit provided. Encroachment of the seat cushion into the exit opening is allowed (see JAR 25.813(c)(1), Change 13) provided that it can be demonstrated by test that this encroachment does not adversely affect evacuation compared with the traditional hatch with no encroachment. The maximum compressed cushion encroachment allowed is 1.7 inches above exit lower sill.
The exit hatch must be automatically stowed clear of the aperture projected opening within the time specified above and the exit hatch must not impede egress.

3) In addition JAA require the following tests to establish:

a) Ease of operation
This shall include operation by naive persons, representative of the travelling public, to establish the ability of passengers to operate the exit in the established time.

b) Proof of concept
These proof of concept tests shall establish that for evacuation of passengers seated in the overwing area, they can egress the aircraft without unforeseen difficulty or hazard demonstrating that the exits provide a safe and effective means of evacuation. This must be conducted with a double overwing exit configuration, onto a representative wing escape path. The conditions of JAR 25.803 must be applied.

c) Comparison with state of the Type I exit and state of the art Type III exits.
The AOE average time to exit 40 passengers, must be less than or equal to a straight line drawn between the JAR Type III average time to exit 35 passengers, and the JAR Type I time to exit 45 passengers. In addition, an allowable tolerance of one (1) passenger will be acceptable for the AOE.

4) Seats must comply with JAR 25.562 Change 13 except 25.562(c)(5) and (c)(6).

5) The "outboard Seat Removed" configuration is not permitted for cabin arrangements with a seating capacity of 185 or more.

SPECIAL CONDITION	**D-15/MAX: Emergency Exits Configuration**
APPLICABILITY:	B737-7/-8/-9
REQUIREMENTS:	JAR 25.807 ; JAR 25.562
ADVISORY MATERIAL:	ESF CRI D-17 (737 NG)

A) Seats installed on the B737-8 must comply with JAR 25.562 Change 13 except 25.562(c)(5) and (c)(6), regardless of the seating capacity of the aeroplane.

B) Special Condition B) applies in combination with the Equivalent Safety Finding detailed in CRI D-17 (oversized Type I Exits), to enable the maximum passenger seat capacity as follows when the new Automatic Overwing Exits are embodied:

737-600	149 Passengers
737-700	149 Passengers
737-800	189 Passengers

New (Novel) Design Overwing Type III Exit:
In addition to satisfying the criteria in JAR 25 at Change 13 for a Type III exit;
1) Each new (novel) design overwing Type III exit must be capable of being opened automatically after manual operation of the handle, when there is no fuselage deformation, within 3 seconds measured from the time when the opening means is actuated to the time when the exit is fully opened. If a cover is provided over the handle the removal of the cover is included in this time. The exit hatch must be automatically stowed clear of the aperture projected opening within the time specified above and the exit hatch must not impede egress.

2) The access to the exit must be provided by:

i) a vertically projected passageway of at least 13 inches between seats, 10 inches of which must be within the projected opening of the exit provided. Encroachment of the seat cushion into the exit opening is allowed (see JAR 25.813(c)(1), Change 13) provided that it can be demonstrated by test that this encroachment does not adversely affect evacuation compared with the traditional hatch with no encroachment. The maximum uncompressed cushion encroachment allowed is 3.7 inches above exit lower sill. The maximum compressed cushion encroachment allowed is 1.7 inches above exit lower sill.

ii) In lieu of one 13 inch passageway, two 6 inch passageways with the outboard seat removed may be used.

3) In addition EASA require the following tests to establish:

i) Ease of operation
This shall include operation by naive persons, representative of the travelling public, to establish the ability of passengers to operate the exit in the established time.

ii) Proof of concept
These proof of concept tests shall establish that for evacuation of passengers seated in the overwing area, they can egress the aircraft without unforeseen difficulty or hazard demonstrating that the exits provide a safe and effective means of evacuation. This must be conducted with a double overwing exit configuration, onto a representative wing escape path. The conditions of JAR 25.803 must be applied.

iii) Comparison with state of the Type I exit and state of the art Type III exits.
The AOE average time to exit 40 passengers, must be less than or equal to a straight line drawn between the JAR Type III average time to exit 35 passengers, and the JAR Type I time to exit 45 passengers. In addition, an allowable tolerance of one (1) passenger will be acceptable for the AOE.

4) The "outboard Seat Removed" configuration is not permitted for cabin arrangements with a seating capacity of 185 or more.

5) Placards showing the method of opening the AOE (Type III) must be located on each seat back so as to be directly visible by an occupant of a seat bounding the exit access.

EQUIVALENT SAFETY FINDING	**D-16: Automatic Overwing Exit (AOE)**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25.783(f)**
ADVISORY MATERIAL:	N/A

Equivalent Safety Finding against JAR 25.783(f) requires that *"external doors must have provisions to prevent the initiation of pressurization of the airplane to an unsafe level if the door is not fully closed and locked."*. The AOE design provides a level of safety equivalent to that required by JAR 25.783(f) by a vent door which monitors the latches prior to engagement of the lock which is provided by the flight lock. Moreover, the flight lock monitors the latches condition as soon as the throttles are advanced for take-off and throughout the flight. The status of the flight lock is indicated on the flight deck.

EQUIVALENT SAFETY FINDING	**9ER/D-16: Fuselage Doors**
APPLICABILITY:	Boeing B737-900ER/-8/-9
REQUIREMENTS:	**JAR 25.783**
ADVISORY MATERIAL:	NPA25D-301

STATEMENT OF ISSUE

a) The latch drive crank and the dwell at the end of the torque bar are not considered as locks but as latches, no mechanical lock to monitor the position of the latches and to prevent them from becoming unlatched.
Boeing state that the last portion of the drive cam ensures that no loads are exerted on the latch drive cam when in the closed position. This shape is considered as an overcentering which locks the "latch" drive crank.
The latching portion of the drive cam which provides a dwell for the latch drive crank shape of the latch drive crank is considered as an overcenter arrangement. **The movement of the door is prevented by the latch drive crank in the recess of the end of the torque tube solely attached to the handle, confirming that it is latched.**

b) There is only one proximity sensor to provide flight deck indication of the door closed position and it's not the locked position. A failed sensor should result in an erroneous signal.

c) The activation and indication of the in-flight lock are unclear. It is the only means to preclude opening the door (intentionally or inadvertently) in flight.

d) The flight lock logic has been developed to ensure adequate protection from deliberate attempts to open the door in flight, while also allowing the door to open under any foreseeable emergency situation. The status of the flight lock indication is not clearly specified.

EASA POSITION

The technical provisions are sufficient to realize compliance of the door design with NPA 25D-301 Issue 1, as well as with the JAR25 change 15 on an ESF basis:

- Flight lock prevents intentional door unlatching
  - During flight including initial part of takeoff and final part of landing
  - Flight lock's failure to lock is indicated in the flight deck after landing
    - Resulting in a limited, one flight exposure
    - All dormancies/latent failures have been accounted for and analyzed. No failure will prevent flight lock indication from annunciating on the flight deck, beyond one flight cycle, if a flight lock fails to engage when commanded to engage.
    - Probability of failure to engage flight lock during takeoff roll is 4.54E-6 /flight hour

- The pressure lock prevents intentional door unlatching above 0.4 psid
  - Exposure is minimized – only short duration
    - During initial part of takeoff climb and final part of landing descent
    - While passengers are seated & belted and F/A is seated in the area

EQUIVALENT SAFETY FINDING	**D-17: Oversized Type I Exits, Maximum Number of Passengers**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25.807, JAR 21.21(c)(2)**
ADVISORY MATERIAL:	N/A

JAAC have concluded that an Equivalent Safety Finding may be granted for the maximum number of passengers requested by Boeing as follows;

737-600 145 passengers
737-700 145 passengers
737-800 180 passengers

This is based on the floor level exits satisfying the Type C exit criteria of NPRM 90-4.

EQUIVALENT SAFETY FINDING	**D-17/MAX: Packs off operation**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.831(a)(b)(c)(d), 25.1309(b)(1), 25.855(h)(2), 25.857(c)(1)(3), and 25.858(d), CRI F-14/MAX**
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

CS 25.831(a) states :
(a) Each passenger and crew compartment must be ventilated and each crew compartment must have enough fresh air (but not less than 0.28 m 3 /min. (10 cubic ft per minute) per crewmember) to enable crewmembers to perform their duties without undue discomfort or fatigue. (See AMC 25.831 (a).).

For the Model 737-8 direct compliance to CS 25.831(a) is not possible for some air-conditioning packs off operation periods (i.e., at take off, no fresh air for crew members).

EASA POSITION
Following compensating factors were demonstrated to achieve an Equivalent Level of Safety to CS 25.831(a):

- means to annunciate to the flight crew that the pressurisation system (conditioned air supply) is selected off.
- the ventilation system continues to provide an acceptable environment in the passenger cabin and cockpit for the brief period when the pressurisation system is not operating. The degradation of crewmember air quality will not reach the level that would cause undue discomfort and fatigue to the point that it could affect the performance of their duties.
- Furthermore, equipment environment is evaluated during those short periods to ensure equipment reliability and performances are not impaired. This evaluation should cover the extremes of ambient hot air temperatures in which the aeroplane is expected to operate.
- Finally, the air conditioning packs-off operation is intended to be a short duration operation. Therefore, the maximum period of operation in this configuration is 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.

EQUIVALENT SAFETY FINDING	**D-18: Slide/Raft Inflation Gas Cylinders**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25X1436**
ADVISORY MATERIAL:	N/A

Compliance to JAR 25X1436(c)(2), which requires the entire system to be tested in an airplane or mock-up to verify proper performance, will be demonstrated by means of the system level certification testing in respect of the Slide/Raft Inflation Gas Cylinders, based upon compliance with the appropriate United States DOT requirement, which is an acceptable method based upon satisfactory in-service experience with these components.

EQUIVALENT SAFETY FINDING	**D-18/MAX: Wing Flap Lever Position**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.777(e)**
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

The Boeing Model 737-7/-8/-9 aeroplane flight deck design for the wing flap control lever does not directly comply with the cockpit controls requirements of CS 25.777(e). The location of the flap control lever is to the right of the thrust control (i.e., throttle) levers on the right side of the control stand pedestal and shares the axis of rotation with the thrust control levers. Boeing has proposed compliance by and Equivalent Safety Finding (ESF).

EASA POSITION

EASA considers that Beoing’s design is equivalently safe to CS 25.777(e).
EASA accepts the following compensation and/or mitigations measures:

(2)To enable both the flight crew members to access control lever without disturbing other controls

> Compensation/Mitigation
> The Boeing design control separation distance (vertical and lateral) between the wing flap control and adjacent controls provides adequate hand clearance for either pilot to operate controls without disturbing other controls or pilot operations. While the Boeing design (flap laterally separated from throttles in lieu of aft) does require crew compensation when right seat pilot has control of throttles, compensation is minimal and in no instance is control reach challenged. While the control separation is not per requirement, control grouping and related hand movements are decreased (as compared to having the flap lever located aft of throttles).

(3)To enable both the flight crew members to observe the control lever positions from their seated position.

> Compensation/Mitigation
> From either pilot position looking forward (either looking along flight path or viewing the primary flight display (PFD)), eye movement (and in some instances slight head movement) will allow either pilot to visually identify control handle position. With regard to this aspect, the Boeing design allows pilots to more readily view the control lever position (as opposed to a design having the lever located aft of throttles).

Per considerations above, the impact of the Boeing design difference from CS25.777(e) requirement is minimal. Operationally, either a flap to throttle design having lateral separation or a fore/aft separation have been found safe.

EQUIVALENT SAFETY FINDING	**PTC/D-19: Emergency Exit Marking**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER/-8/-9 /757/767/777/747
REQUIREMENTS:	**JAR 25.811(f)**
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

The Boeing Company requests an equivalent safety finding for Jar 25.811(f)

EASA POSITION

EASA concluded that a difference in reflectance of 25 percent between the metal door sill plate and the exit door two-inch band is equivalent to the requirements of FAR 25.811(f), provided the difference of the remaining area, especially the band to the fuselage below the sill, exceeds the minimum FAA standards

EQUIVALENT SAFETY FINDING	**9ER/D-20: Oversized Type II Exit passageway Dimension**
APPLICABILITY:	B737-900ER
REQUIREMENTS:	**JAR 25.813(a); 25.1301(a); 25.1309(a) at change 15**
ADVISORY MATERIAL:	N/A

An Equivalent Safety Finding has been granted to the B737900ER to allow for 13-inch wide passageways leading to the pair of new floor level 26-inch by 51-inch tall exits (designated Mid Exit Doors, MED) in lieu of the required 20inch passageways. The associated passenger capacity is 215.

The compensating features are the following:

Considering the arrangement in total, EASA concurs that an equivalent level of safety for the major issues surrounding aircraft evacuation is achieved for a maximum passenger count of 215 with a 13-inch passageway leading to the mid-exits when the compensating features below are provided in the airplane, upon successful completion of the proposed Latin Square test and the exit configuration is as summarized below:

Exit Location	Opening Width, inches	Opening Height, inches
Forward Left	34	72
Forward Right	30	65
Type III overwing	20	36
Mid Exit between overwing and aft	26	51
Aft Left	30	72
Aft Right	30	65

The compensating features around the mid-exit are:

- stowage bins removed resulting in a raised ceiling,
- aft facing attendant seat located on the right or left hand side outboard position,
- only economy class passenger seats bordering the exit and 13-inch passageway (not hard shell 'pod' seats or monuments),
- outboard passenger seat places next to exit removed,
- 26 inch wide by 51 inch tall floor level exit opening.

It must be shown that during an in-flight emergency where the attendant must return as fast as possible to their seat when they are standing in the main aisle, he/she can access his/her RH MED seat from the main aisle as easily as would be the case if the normally required 20-inch passageway were provided. This must be shown for all combinations of attendant size and passenger size(s) seated in the exit row

An assessment must be made as to whether the reduced passageway dimension may lead to adverse affects on overall evacuation performance caused by a reduced ability of the attendant stationed at the RH MED to intervene in situations developing at or near to the LH MED.

EQUIVALENT SAFETY FINDING	9ER/D-21: Door sill reflectance
APPLICABILITY:	B737-900ER
REQUIREMENTS:	**JAR 25.811(f) at change 15**
ADVISORY MATERIAL:	N/A

Statement of Issue
(Note: this CRI is using material from B777 CRI D-LR-6)

JAR 25.811(f) requires a 2-inch colored band to outline the exit doors and the color contrast between the band and the surrounding fuselage surface to be distinguishable. The contrast must be such that if the reflectance of the darker color is 15 percent or less, the reflectance of the light color must be at least 45 percent. When the reflectance of the darker color is greater than 15 percent, at least a 30 percent difference between its reflectance and the reflectance of the lighter color must be provided.

The emergency markings on the applicable aircraft do not comply with JAR 25.811(f) in that the reflectance difference between the exit bands and the metal door sill is less than the required 30 percent.

The Boeing Company has requested an Equivalent Safety Finding to JAR 25.811(f) where the reflectance is less than 30 percent between the metal door sill and the door band since the reflectance contrast of most of the remaining area exceeds the minimum standards.

ESF

FAA Issue Paper C-14, “Door Sill Reflectance on B727, B737, B747, B757, B767 and B777”, dated September 12, 1997,documents an Equivalent Safety Finding (ESF) for §25.811 that pertains to JAA CRI D-LR-6. In the Issue Paper, the FAA determined that a difference of 25% between the metal door sill and the exit door 2” band is equivalent to the requirements of §25.811(f) provided the difference of the remaining area, especially the band to the fuselage below the sill, exceeds the minimum FAA standards (30%).

EQUIVALENT SAFETY FINDING	**9ER/D-23: Passenger information signs**
APPLICABILITY:	B737-900ER
REQUIREMENTS:	**JAR 25.791(a) at change 15**
ADVISORY MATERIAL:	N/A

Statement of Issue

JAR25.791(a) requires that if smoking is not allowed, then "No Smoking" placards are required. If smoking is allowed, lighted signs which notify when smoking is prohibited must be operable by a member of the flight crew, Boeing proposes an equivalent safety finding per JAR21.21(c)(2) for hardwiring on electrically illuminated no smoking section.

ESF

The ESF granted in the frame of the validation of the B757-300 (CRI D-05) applies:

“Either one of the following options meet the intent of 25.791:

1)For airplanes, smoking is to be allowed - Install unambiguous combination of "No Smoking" placards and lighted signs, and allow lighted installed lighted signs to remain "active" (switchable on and off by crew).

2)For airplanes, smoking is not allowed - Install electrically illuminated signs to provide the only means of conveying the no-smoking message, and hardwire those signs "ON" whenever the airplane is powered.”

SPECIAL CONDITION	**D-GEN 1 PTC: Fire Resistance of Thermal Insulation Material**
APPLICABILITY:	Boeing B737-600/-700/-800-900ER, B747-400/-400F, B767-200/-300/400ER, B777-200/-200LR/-300/-300ER
REQUIREMENTS:	CS25.856 & Appendix F
ADVISORY MATERIAL:	N/A

SPECIAL CONDITION

New CS25.856:

"Thermal/acoustic insulation material installed in the fuselage must meet the flame propagation test requirements of part VI of Appendix F to CS25, or other approved equivalent test requirements. This requirement does not apply to "small parts," as defined in subpart I of Appendix F to CS25."

Also, to maintain consistency with existing requirements, this special condition amends CS 25.853(a) and CS 25.855(d) as follows:

" JAR 25.853 Compartment interiors.

(a) Except for thermal/acoustic insulation materials, materials (including finishes or decorative surfaces applied to the materials) must meet the applicable test criteria prescribed in part I of appendix F or other approved equivalent methods, regardless of the passenger capacity of the aeroplane. "

" JAR 25.855 Cargo or baggage compartments.

(d) Except for thermal/acoustic insulation materials, all other materials used in the construction of the cargo or baggage compartment must meet the applicable test criteria prescribed in part I of appendix F or other approved equivalent methods. "

SPECIAL CONDITION	**D-GEN 2 PTC: Application of heat release and smoke density requirements to seat materials**
APPLICABILITY:	B737 -600/ -700/ -800/ -900/ -900ER/NG
REQUIREMENTS:	CS 25.853(d); Appendix F part IV & V; Part 21 § 21A.16B
ADVISORY MATERIAL:	N/A

1. Except as provided in paragraph 3 of these special conditions, compliance with JAR25, 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 0.13935 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 0.41805 m² (4.5 square feet) excluded on any portion of the assembly (e.g., outboard seat place 0.0929 m² (1 square foot), middle 0.0929 m² (1 square foot), and inboard 0.23225 m² (2.5 square feet)).

3. Seats do not have to meet the test requirements of JAR 25, 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".

EQUIVALENT SAFETY FINDING	**PTC / D-19: Emergency Exit Marking (Door Sill Reflectance)**
APPLICABILITY:	Boeing B757-300, B737-600/-700/-800/-900
REQUIREMENTS:	JAR 25.811(f)
ADVISORY MATERIAL:	N/A

FAR 25.811(f) requires a 2-inch coloured band outlining the exit, with a contrast such that if the reflectance of the darker colour is 15% or less, the reflectance of the lighter colour must be at least 45%. A minimum reflectance difference of 30% is required when the darker colour's reflectance is more than 15%. In the issue paper, the FAA concluded that a difference in reflectance of 25% percent between the metal door sill plate and the exit door two-inch band is equivalent to the requirements of FAR 25.811(f), provided the difference of the remaining area, especially the band to the fuselage below the sill, exceeds the minimum FAA standards (30%).

This CRI is closed due to similarity to the B757-300, Equivalent Safety Finding will be referenced in EASA Type Certification Bases.

EQUIVALENT SAFETY FINDING	**PTC / D-21: Emergency Exit Marking (Door Sill Reflectance)**
APPLICABILITY:	Boeing B737-600/-700/-800/-900
REQUIREMENTS:	JAR 25.811(f)
ADVISORY MATERIAL:	N/A

FAR 25.811(f) requires a 2-inch coloured band outlining the exit, with a contrast such that if the reflectance of the darker colour is 15% or less, the reflectance of the lighter colour must be at least 45%. A minimum reflectance difference of 30% is required when the darker colour's reflectance is more than 15%. In the issue paper, the FAA concluded that a difference in reflectance of 25% percent between the metal door sill plate and the exit door two-inch band is equivalent to the requirements of FAR 25.811(f), provided the difference of the remaining area, especially the band to the fuselage below the sill, exceeds the minimum FAA standards (30%).

EQUIVALENT SAFETY FINDING	PTC / D-23: Passenger Information Signs
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25.791(a)
ADVISORY MATERIAL:	N/A

Use of electrically illuminated signs in lieu of placards indicating when smoking is prohibited. The proposed equivalent safety finding is identical to that in the CRI D-05 for the B757-300, and the existing FAA Issue Paper extended to all Boeing Modells.
The EASA panel 8 specialist has reviewed the Boeing position and referenced material. It is considered to be an acceptable basis upon which an Equivalent Safety Finding to JAR25.791(a) may be granted. This ESF is the same as that which has been granted previously by EASA teams on other Boeing validation programmes:

“it is concluded that either one of the following options meet the intent of the FAR25.791 for the 757-300; and it is proposed that approval of the two following options be granted:

1) For airplanes, smoking is to be allowed - Install unambiguous combination of "No Smoking" placards and lighted signs, and allow lighted installed lighted signs to remain "active" (switchable on and off by crew).

2) For airplanes, smoking is not allowed - Install electrically illuminated signs to provide the only means of conveying the no-smoking message, and hardwire those signs "ON" when ever the airplane is powered.”

SPECIAL CONDITIONS	D-27/MAX: Installation of inflatable restraint systems
APPLICABILITY:	Boeing B737-8/-9/-7/-8200/-10
REQUIREMENTS:	CS 25.562, 25.785
ADVISORY MATERIAL:	N/A

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 should be used with acceleration, rise time, and velocity change scaled accordingly.

3) Protection During Secondary Impacts

EASA 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 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 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 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 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 (B737 MAX CRI F-04/MAX for indirect effects of lightning). Electro static discharge must also be considered.

13)The equipment must meet the requirements for HIRF (B737 MAX CRI F-01/NG and F-03/MAX) 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)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 belt.

17)The inflatable lap belt 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 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).

If lithium-ion non-rechargeable batteries are used to power the AAIR, the batteries must be comply with CRI F-GEN11. However, if rechargeable lithium-ion batteries are used, additional special conditions apply (F-29/PTC).

19)Neck Injury Criteria: The installation of inflatable restraint systems 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 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.)

SPECIAL CONDITIONS	**E-05/MAX: Engine Cowl Retention**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**25.901(b)(2), 25.901(c), 25.1193**
ADVISORY MATERIAL:	N/A

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 preclude minimize any inflight opening or loss of cowling or nacelle skin 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 paragraph following each of these specific conditions:

(i)Improper fastening of any single latching, locking, or other retention device, or the failure of any single latch or hinge retention system structural element; or

(ii) (reserved) Engine compartment fire, engine case burnthrough, or rupture of any pressurized components within the nacelle.

(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 takeoff.

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.

EQUIVALENT SAFETY FINDING	**E-09: Automatic Fuel Shut Off**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25.979(b)(1)**
ADVISORY MATERIAL:	N/A

Equivalent safety to the JAR paragraph 25.979(b)(1) requirement for a means to "allow checking for proper shutoff operation before each fuelling of the tank".
The float switch has been in service on all 737-200, -300, -400 and 0599 airplane models for many years and has proven high reliability (Mean Time Between Unscheduled Removal rate of approximately 29,000 hours).
In addition, the refuel panel indicators at the fuelling station will provide failure indication of the float switch to shutoff fuelling by flashing the quantity readouts on-off every second when the fuel loaded exceeds the maximum quantity readouts on-off every second when the fuel loaded exceeds the maximum quantity approved for that tank.
This design along with the vent system capability to handle the overflow without damage to the wing in addition to adequate fuelling instructions provided on the refuel panel (…) provide the compensating factors which provide an equivalent level of safety.

EQUIVALENT SAFETY FINDING	**E-10/MAX: Strut & Aft Strut Fairing Compartment**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.1182(a), CS 25.1183(a)**
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

The Strut and Aft Strut fairing compartment are portion of the pylon structure and do contain flammable fluids therefore are under the applicability of CS 25.1182. Among the various requirements called and imposed by CS 25.1182, CS 25.1183 requires flammable fluid containing components to be at least fire resistant
The hydraulic lines and fittings in the aft strut fairing compartment, and, fuel and hydraulic lines in the strut compartment have not been shown to be fire resistant.

EASA POSITION

Based on the materials used and construction of the flammable fluid lines installed in the strut and the aft strut fairing leakage zones, the fluid lines are intrinsically fire resistant.

The ESF was consulted from 12/01/2017 until the 2nd of February 2017. Comments were received, with no impact on the CRI.

SPECIAL CONDITION	E-10/PTC: Flammability Reduction System
APPLICABILITY:	Boeing B737-200/200C/300/400/500/600/700/800/900
REQUIREMENTS:	FAR 25.981(c), JAR 25.1309, NPA 10.2004, JAR 21.16(a)(1)
ADVISORY MATERIAL:	N/A

1.1 General

The following special conditions are part of the type design approval basis for Boeing Model 737 series with centre wing tanks equipped with a FRS utilising NEA.

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 a heated centre fuel tank 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 heated centre tank. 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 or SFAR 88.

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 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.

(j) *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 centre 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 engine model, engine thrust rating, and relevant pneumatic system configuration approved for the aeroplane.

(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 nitrogen generation system 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.

(j) Identify critical features of the fuel tank system to prevent an auxiliary fuel tank installation from increasing the flammability exposure of the centre wing tank 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 <u>Maintenance</u>

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 <u>In-Service Monitoring.</u>

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.

EQUIVALENT SAFETY FINDING	**E-11/PTC: New Interior Arrangement with Passenger Service Unit Life Vest Stowage**
APPLICABILITY:	Boeing B737-700/-800/-900ER/-8/-9
REQUIREMENTS:	JAR 25.1411(f)
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

Boeing is introducing a new interior architecture into the 737NG model aircraft. This new design includes a change to the passenger service units (PSU), which incorporates changes to the optional overhead life vest stowage compartment from a side-by-side presentation of the life vests to a sequential presentation of life vests.

It was identified during the development of the issue paper MOC that the proposed design changes in the PSU stowage configuration did not meet the FAA's criteria to be "directly accessible" per 14 CFR 25.1411(b)(1) due to the sequential deployment of life vests – i.e. a subsequent vest is presented to the passengers after the initial vest is retrieved. The issue paper MOC was then modified to reflect an ELOS for 14 CFR 25.1411(b)(1).

EASA POSITION

EASA fully agrees with the approach used by the FAA and concurs with the conclusions of the FAA Issue Paper C-1, "Equivalent Level of Safety and Means of Compliance for Life Vest Stowage in Overhead Passenger Service Units (PSU)", closed at stage 4 on 5th August 2010 and of the related FAA ELOS Memo PS10-0077-C-1, dated 13th August 2010 ".

EQUIVALENT SAFETY FINDING	**E-12/MAX: Thrust Reverser Testing**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.934, CS-E 890**
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

The Boeing B737-8, equipped with CFM LEAP-1B engines, is fitted with thrust reversers. Boeing 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, the engine manufacturer does not intend to install the Boeing B737-8 thrust reverser unit during their Engine type certification 150h Endurance test requested by CS-E 890.
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.

EASA POSITION

The use of a production thrust reverser during the forward thrust running of the engine was demonstrated as to not being necessary.

The proposed Boeing strategy is accepted as it is in line with past identified and accepted compensating factors.

EQUIVALENT SAFETY FINDING	E-15/PTC and E-16/PTC: Fuel Tank Safety
APPLICABILITY:	Boeing B737
REQUIREMENTS:	**CS 25.981**
ADVISORY MATERIAL:	AMC 25.981(a)

SPECIAL CONDITION: FUEL TANK SAFETY

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 CRI, any qualification activity should consider up-to-date standards, as delineated in the AMC to 25.981(a), instead of relying on older, obsolete standards.

Note 1: it is fully recognized that on an existing designs this approach might not be always practical. In such cases, the applicant, with the explicit agreement of EASA, might consider alternatives 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 that 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 intent to pre-empt the application of FAR 25.981 at Amendment 102 with this Special Condition; it is EASA’s 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-20/MAX: LEAP_1B Fuel Filter Location**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.997(d), CS 25.1305(c)(6)**
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE

B737-8 / LEAP-1B engine fuel system does not feature a fuel filter meeting the position required by CS 25.997(d):

> 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."

EASA POSITION

The LEAP-1B engine design meets the intent of CS 25.997(d) and CS 25.1305(c)(6). The engine fuel system components and architecture used in showing compliance to CS-E 250(c), CS-E 560(b)(1) and CS-E 670 are not modified or changed in any way after CS-E certification of the engine as a result of installing the engine onto the airframe.

25.997(d)
The EASA initial position states that the LEAP-1B engine fuel system does not strictly comply with CS 25.997 because the engine fuel filter is located upstream of the fuel metering device but is downstream of the engine driven positive displacement pump. Boeing offers the following compensating factors in the LEAP-1B engine design to show that the design meets the intent of CS 25.997(d) and the related regulation CS 25.1305(c)(6).
The LEAP-1B incorporates both a Fuel Metering Unit (FMU) and a Split Control Unit (SCU). The design of this fuel filter system employs not one filtering device as described by CS 25.997, but two filtering devices, a strainer upstream from the filter.

25.1305(c)(6)
The Boeing Model 737 MAX equipped with LEAP-1B engines incorporates a combination of status messages and alerts to notify flight and maintenance crews of actual and impending bypasses of the fuel strainer, main heat exchanger (MHX) and main fuel filter.

EQUIVALENT SAFETY FINDING	**E-22/MAX: LEAP-1B areas adjacent to Designated Fire Zone (CS-25.1182)**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.1103(b), 25.1165(e), 25.1182, 25.1183, 25.1185(c), 25.1187, 25.1189, 25.1195 to 1203**
ADVISORY MATERIAL:	AMC 25.1189, 25.1195(b)

STATEMENT OF ISSUE

On B737-8 MAX applications, Boeing assessed the Propulsion System areas adjacent to Designated Fire Zone (DFZ) versus compliance to CS 25.1182.
This analysis evidenced that B737-8 MAX Propulsion System 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.

EASA POSITION

The design has been demonstrated to be equivalently safe:

- Lower bifurcation: the only potentially flammable fluid carrying lines in this zone are constructed of a fire-proof material and exceed the fire withstanding criteria imposed by CS 25.1182(a) / CS 25.1183(a). The increase fire withstanding capability of these lines mitigates the potential for fire to propagate from the engine core fire zone into the lower bifurcation zone.
- Thrust reverser sleeve: the only potentially flammable fluid carrying components in this zone are constructed of a fire-proof material in the vicinity of the firewall and exceed the fire withstanding criteria imposed by CS 25.1182(a) / CS 25.1183(a). The increase fire withstanding capability of these components in the vicinity of the fan compartment firewall mitigates the potential for fire to propagate from the fan compartment fire zone into the thrust reverser sleeves.

EQUIVALENT SAFETY FINDING	**E-24/MAX: Wing Leading Edge Slats**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.867(a)**
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

The slat trailing edge would be penetrated by fire within the required 5 min flame exposure necessary to declare a fire resistant capability.

EASA POSITION

EASA accepts the following compensating factors on the provision that a supplementary one showing the residual (in time and/or surface) intrinsic fire withstanding capability of the slat trailing edge design is identified:

- Removal (or burn through) of the trailing edge of the wing leading edge slat would result in exposed fire resistant surfaces
- There are no exposed systems under the slat trailing edge wedge
- If the trailing edge of the wing leading edge slat is partially or entirely removed, the effect on airplane performance and handling will not create an additional hazard

This ESF was under public consultation from 23/07/2015 until 13/08/2015. No comments.

SPECIAL CONDITIONS	**E-27/MAX: Fan blade loss, effects at airplane level**
APPLICABILITY:	Boeing B737-8/-9
REQUIREMENTS:	CS25.901(c), 25.903(c), 25.903(d)(1), 25.1309(b)
ADVISORY MATERIAL:	AMC 25.901(c), AC 25-24, AMC 20.128A

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-1B Special Condition, compliance to 25.1309 considers fan blade failure at the inner annulus flowpath line)

EQUIVALENT SAFETY FINDING	E-28/MAX: Fire testing of firewall Sealant
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	25.1191
ADVISORY MATERIAL:	AMC 25.1191

STATEMENT OF ISSUE

CS 25.1191 requires that each engine be isolated from the rest of the airplane by fireproof firewalls to prevent the propagation of fire originating from the engine fire zones to the rest of the airplane and states :
(a) Each engine, fuel-burning heater, other combustion equipment intended for operation in flight, and the combustion, turbine, and tailpipe sections of turbine engines, must be isolated from the rest of the aeroplane by firewalls, shrouds, or equivalent means.
(b) Each firewall and shroud must be –
(1) Fireproof;
(2) Constructed so that no hazardous quantity of air, fluid, or flame can pass from the compartment to other parts of the aeroplane;
(3) Constructed so that each opening is sealed with close fitting fireproof grommets, bushings, or firewall fittings; and
(4) Protected against corrosion.
CS 25.1191(b)(1) requires firewall to be fireproof.
For a firewall function under fire, the following pass/fail criteria are generally been found acceptable during EASA fire test plan review:

Firewall – pass/fail criteria:

- Shall be capable of withstanding the loads specified throughout the test period.
- No significant increase of the flame pattern during the test
- No burning of the backside of the specimen during or following the burner removal at the end of the test.
- Any burning on the impingement face following burner removal shall be submitted to the checking authority for acceptance.
- No backside ignition of the outgassing during test. Outgassing of the back side shall be investigated to determine if a risk of ignition exists.
- No flame penetration.

Boeing has proposed 737-7/-8/-9 Inlet aft bulkhead and mid strut firewalls designs that include a limited amount of firewall sealant on the non-fire or “cold” side of the firewall that has a possibility of igniting during a fire in the fan compartment fire zone of core compartment fire zone respectively.

The Boeing design does not fulfil the pass criteria allowing to declare by direct compliance demonstration that the firewall sealant are fireproof since those latest are prone to have backside ignition. Boeing shall demonstrate that their design offers compensating factors.

EASA POSITION

The design was demonstrated to be equivalently safe for the inlet aft bulkhead firewall considering the flowing compensating factors:

- The area adjacent to the firewall containing the firewall sealant on the cool side are “dry bays” and do not have any flammable fluid carrying components, lines or vapor
- There are no other combustible materials adjacent to the sealant
- The sealant on the cold side is of a limited quantity which limits the potential flame size and intensity in the unlikely event of ignition

The content of the ESF has been published for public comments, no comment was received.

EQUIVALENT SAFETY FINDING	**E-29/MAX: Fueling Float Switch Installation**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.901(c), 25.981(a)(3), & (d), 25.1309(b)(1)**
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

The Boeing Model 737-7, 737-8 and 737-9 (737 MAX) airplanes will use a fueling float switch in each fuel tank to provide automatic shutoff of pressure fueling, via a fueling shutoff valve, when the fuel tanks have reached full capacity. The wiring from the fueling shutoff valve to the float switch is routed through aluminum conduit in the fuel tank. The wiring carries voltage and current levels that do not meet the intrinsically safe levels provided in Advisory Circular (AC) 25.981-1C. The float switch wiring and conduit installation on the Model 737 MAX airplanes is not a failsafe design, and therefore, it does not directly comply with CS 25.901(c), 25.981 (a)(3) and 25.1309(b)(1). Contamination of the fueling float switch by moisture or fuel, and chafing of the float switch wiring in the conduit could present an ignition source inside the fuel tank that could cause a fire or explosion. Therefore, Boeing is seeking an EASA finding of equivalent level of safety.

EASA POSITION

The aircraft design was accepted as equivalently safe considering following compensating factors:

1.Non-conductive convoluted conduit liner design is essentially a dual conduit similar to that discussed in AC 25.981-1C. The convoluted conduit liner has been shown through qualification testing to eliminate the wear and contact concern.
2.Non-conductive convoluted conduit liner design centers wires in the conduit which eliminates contact with the conduit and provides multiple support points that eliminate the wear concern seen with wires routed in conduits without the convoluted liner.
3.Float switch wiring is more flexible compared to the boost pump wiring that has been seen to chafe in the conduit, because it has only two wires verses 3 and is a smaller gage wire. These differences reduce contact pressure in the conduit liner bend areas. The convoluted liner distributes the contact pressure across 4 convolutes per inch rather than have point loads at isolated locations in the conduit.
4.Float switch conduit liner is fully qualified. Qualification tests included vibration testing simulating more than airplane life and exposure to fluids such as fuel, water, hydraulic fluid, etc. with no wear or degradation observed.
5.Inspection of float switch assemblies from 737NG airplanes with over 40,000 hours of service confirms the qualification test results showing no wear.
6.Enhanced, independent, manufacturing and maintenance controls assure the convoluted liner is installed properly.
7.The current Critical Design Configuration Control Limitation (CDCCL) will be carried forward to the 737 MAX.
8.A new Airworthiness Limitation (AWL) Airworthiness Limitation Instruction (ALI) will require periodic replacement of the main tank fueling float switch assemblies and the center tank float switch and liner system.

This ESF was published for public comments from 18/01/2017 until 08/02/2017.
No comments was received.

DEVIATION	**E-30/MAX: Engine cowl retention**
APPLICABILITY:	Boeing B737-8/-9
REQUIREMENTS:	CRI E-05/MAX (SC), 25.901(b)(2), 25.901(c), 25.1193
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE:

In-service experience on large airplanes (Boeing, Airbus,…) shows a large number of events of fan cowl loss separation occurring on engines (i.e CFM-56, V2500,…) and prompted EASA to introduce a Special Condition.
Specific requirements for fan cowl retention on the B737-7/-8/-9 were introduced by CRI E-05/MAX (SC + IM).
Design, test and certification of the final concept to show compliance to the CRI E-05/MAX Special Condition cannot be synchronized with completion of certification activities of the B737-8 and -9 therefore those latest cannot be found directly compliant since deviating to the certification basis.

EASA POSITION

EASA accepts the time deviation to CRI E-05/MAX until the 30/06/2021 provided:
-All the B737-8 and B737-9 delivered before 30/06/2021 will be retrofitted with the new EASA approved design solution compliant with the CRI E-05/MAX
-From 30/06/2016, all the B737-8 and B737-9 will be fitted at delivery with the new design solution
- All the B737-7 will be fitted at delivery with the new design solution.
-Boeing provides to EASA a programme for the design change containing a schedule for:
- o Providing EASA with the new design concept, prototyping before closure of this CRI
- o Providing EASA with the new detailed design and qualification beginning of 2017
- o Providing EASA with the new indication system as part of the -7 design and Certification Plan etc…

The CRI was consulted from 29/09/2016 to the 24/10/2016.

DEVIATION	**E-31/MAX: Fuel Quantity Indication System (FQIS) Electrostatics Threat**
APPLICABILITY:	Boeing B737-8/-9
REQUIREMENTS:	CS 25.899, CS 25.901(c), CS 25.981(a), CS 25.1309(b)
ADVISORY MATERIAL:	AMC 25.899, AMC 25.981

STATEMENT OF ISSUE:

During aircraft fuelling, the fuel may accumulate an electrical charge inside the aircraft fuel tank due to the fuel velocity. Electrostatic charge due to fuel velocity (AMC 25.899) could lead to ignition sources into fuel tank which risk of explosion is addressed via CS 25.901, CS 25.981 and CS 25.1309.
On the B737MAX, electrostatic charge on Fuel Quantity Indication System (FQIS) tank unit Lo-Z tubes, compensator Lo-Z tubes and the tank unit and compensator Hi-Z Shield are safely discharged via the wiring to the grounds within the Fuel Quantity Processor Unit (FQPU).
A failure resulting in one of these surfaces being completely isolated may result in the isolated component to exceed the minimum ignition energy of AMC 25.981.

EASA POSITION

EASA generally concurs to the Boeing proposed answer concerning the B737 MAX.
Public consultation took place from the 25th January 2017 up to the 15th of February 2017. No comments were received.
The deviation from CS 25.901(c) amdt. 11, CS 25.981(a)(3)amdt. 11 and CS 25.1309(b)(1) amdt. 11 is accepted to be granted to Boeing for the first nineteen (19) airplanes of the 737 MAX family (seventeen 737-8 and two 737-9).

SPECIAL CONDITIONS	**E-32/MAX: Fire Extinguishing Plumbing and Wiring connections**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS 25.901, CS 25.903, CS 25.1195, Part 21.A.16B (a)(3)
ADVISORY MATERIAL:	AMC 25.901, AMC 25.1195

The fire extinguishing plumbing and electrical connections must be constructed, arranged and installed such that cross connection is not possible during installation and maintenance actions (regular, trouble shooting and repair).

EQUIVALENT SAFETY FINDING	**E-33/MAX: Fuel Tank Ignition Prevention – Hot Surface Ignition Temperature**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.863, CS 25.901, CS 25.981(a)(3) , CS 25.1103**
ADVISORY MATERIAL:	AMC 25.863, AMC 25.981

STATEMENT OF ISSUE

CS 25.981Fuel tank ignition prevention (see AMC 25.981) requires :

(a) No ignition source may be present at each point in the fuel tank or fuel tank system where catastrophic failure could occur due to ignition of fuel or vapours. This must be shown by:
(1) Determining the highest temperature allowing a safe margin below the lowest expected auto-ignition temperature of the fuel in the fuel tanks.
(2) Demonstrating that no temperature at each place inside each fuel tank where fuel ignition is possible will exceed the temperature determined under sub-paragraph (a)(1) of this paragraph. This must be verified under all probable operating, failure, and malfunction conditions of each component whose operation, failure, or malfunction could increase the temperature inside the tank.
(3) Demonstrating that an ignition source does not result from each single failure and from all combinations of failures not shown to be Extremely Improbable as per 25.1309. (See AMC 25.981(a))

CS 25.863 Flammable fluid fire protection (See AMC 25.863) requires:
(a)In each area where flammable fluids or vapours might escape by leakage of a fluid system, there must be means to minimise the probability of ignition of the fluids and vapours, and the resultant hazards if ignition does occur. (See AMC 25.863 (a).)
(b) …

Boeing has proposed, for certification of the Boeing Model 737-7/-8/-9 (737 MAX) airplanes with CFM LEAP-1B engines, to use a maximum surface temperature for the fuel tanks that is above the limits provided in the guidance in AMC 25.981(a), "Ignition precautions," AMC 25.863(a) flammable fluid protection in showing compliance with the referenced regulations.

Boeing has requested use of 500 °F (260°C) as an acceptable hot surface ignition temperature in order to address failures of the bleed air system that could cause temperatures of the internal surface of the fuel tanks to exceed 200 °C.

The 400°F / 200°C value is derived from jet fuel Auto Ignition Temperature (considered at 450°F) with some margins (50°F) and had been extensively and commonly used for years in the compliance demonstrations for fire and fuel tank explosion risk problematics. This temperature had been used as well for maximum allowable hot surface temperature without further substantiation.

EASA POSITION

The aircraft design is considered equivalently safe:
there is a very specific single failure burst duct condition that will produce a transient fuel tank inner wall temperature above 400°F but the fuel tank inner wall temperature will remain below the fuel auto ignition temperature of 450°F. While this unlikely transient condition reduces the inherent margin, it still remains below the accepted auto ignition temperature of fuel.

The CRI was published for public consultation from 23/02/2017 until the 9th of March 2017. No comment was received.

DEVIATION	E-36/MAX: Right Main Fuel Tank Indication of Refuel System Failure at Full Fuel Tank Level
APPLICABILITY:	Boeing B737-7/-9/-8200
REQUIREMENTS:	CS25.979(b)(2)
ADVISORY MATERIAL:	N/A

STATEMENT OF ISSUE:

For the 737 MAX, the individual tank fueling indicators will flash when the automatic shutoff volume is exceeded, before fuel spills into the surge tank. This is an indication to the refueler that a fuel spill is imminent, therefore, refueling should be stopped.
The flashing volume threshold for the Right Main Tank was designed too high.
At certain airplane attitudes and with variability from FQIS measurement tolerances, some airplanes, if the volumetric top off (VTO) system fails to stop refueling when the right main tank is full, fuel could transfer to the right wing surge tank, drain out of the surge tank through the fuel tank vent and spill before flashing occurs on the right tank (tank 2) indicator.
This fuel spill could be hazardous if there were an ignition source in the area of the right fuel tank vent.
This system behaviour deviates from CS 25.979(b)(2) intend :
(b) An automatic shutoff means must be provided to prevent the quantity of fuel in each tank from exceeding the maximum quantity approved for that tank. This means must –
(2) Provide indication at each fuelling station of failure of the shutoff means to stop the fuel flow at the maximum quantity approved for that tank. .

EASA POSITION

EASA agrees with the analysis conducted by Boeing and determines that the deviation from CS 25.979(b)(2) still meets the essential requirements for airworthiness, and in particular 1.c. of Annex I to Regulation (EC) No 216/2008.

It is EASA opinion that the Deviation shall be limited over time.
Understanding that a design solution with a revised Fuel Quantity Processor Unit (FQPU) software will be available mid 2019 for showing direct compliance for the aircraft line number 7650 and onwards and knowing that the solution retrofit is not technically complex, the deviation is limited to 4 Years from Entry Into Service.
This CRI was published on the EASA website for the regular consultation process to be performed. At the closure of the consultation period, no comments were received.

SPECIAL CONDITION	**F-01: High Intensity Radiated Fields**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER
REQUIREMENTS:	JAR25.1431(a), change 13 & JAA Interim Policy INT/POL/25/2
ADVISORY MATERIAL:	N/A

The aeroplane systems and associated components, considered separately and in relation with other systems, must be designed and installed so that (see drat AMJ 25.1317 dated 17 January 1992):

1. each system that performs a critical or essential function is not adversely affected when the aeroplane is exposed to the normal HIRF environment
2. all critical functions must not be adversely affected when the aeroplane is exposed to the certification HIRF environment
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.

For the purpose of this section, the following definitions apply:

1. Critical function: a function whose failure would prevent the continued safe flight and landing of the aeroplane
2. Essential function: a function whose failure would reduce the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions
3. The definitions of Normal and Certification HIRF environments, frequency bqnds and corresponding average and peak levels are defined Table 1 and Table 2 of CRI F-01

TABLE 1: Certification HIRF environment

Field Strengths in Volts/Meter

Frequency	Peak	Average
10 kHz - 100 kHz	40	40
100 kHz - 500 kHz	40	40
500 kHz - 2 MHz	40	40
2 MHz - 30 MHz	100	100
30 MHz - 70 MHz	20	20
70 MHz - 100 MHz	20	20
100 MHz - 200 MHz	50	30
200 MHz - 400 MHz	70	70
400 MHz - 700 MHz	730	30
700 MHz - 1 GHz	1300	70
1 GHz - 2 GHz	2500	160
2 GHz - 4 GHz	3500	240
4 GHz - 6 GHz	3200	280
6 GHz - 8 GHz	800	330
8 GHz - 12 GHz	3500	330
12 GHz - 18 GHz	1700	180

Note: at 10 kHz – 100 kHz a High Impedance Field of 320V/m peak exists, AMJ 25.1317 should be referred to for the applicability of this environment.

TABLE 2: Normal HIRF environment

Field Strengths in Volts/Meter

Frequency	Peak	Average
10 kHz - 100 kHz	20	20
100 kHz - 500 kHz	20	20
500 kHz - 2 MHz	30	30
2MHz - 30 MHz	50	50
30 MHz - 70 MHz	10	10
70 MHz - 100 MHz	10	10
100 MHz - 200 MHz	30	30
200 MHz - 400 MHz	25	25
400 MHz - 700 MHz	730	30
700 MHz - 1 GHz	40	10
1 GHz - 2 GHz	1700	160
2 GHz - 4 GHz	3000	170
4 GHz - 6 GHz	2300	280
6 GHz - 8 GHz	530	230

SPECIAL CONDITION	**F-02: Protection from the effects of Lightning strike; direct effects**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER
REQUIREMENTS:	JAR 25X899; ACJ 25X899 and JAA INT/POL/25/03
ADVISORY MATERIAL:	N/A

The lightning current characteristics defined in table 1 and 2 of ACJ 25X899 do not line up with the latest current models as specified in the internationally agreed SAE Committee AE4L revision B and Culham CLM-R163 documents SC JAA/737-700/SC/F-02.

For compliance with JAR 25X899, the zoning and current voltage waveforms as specified in FAA AC20-53A shall be used in lieu of those specified in tables 1 and 2 of ACJ 25X899.

In addition to the FAA AC, an additional 0.5 m zone 2 extension inboard of the existing zone 1 should be considered (wing and empennage tips)

SPECIAL CONDITION	F-03: Protection from the effects of Lightning Srike; indirect effects
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER
REQUIREMENTS:	JAR25.581 ; 25X899 ; 25.954 ; 25.1309 and JAA INT/POL/25/4
ADVISORY MATERIAL:	N/A

Each system whose failure to function properly would prevent the continued safe flight and landing of the aircraft, must be designed and installed to ensure that the aircraft can perform its intended function during and after exposure to lightning.

Each system whose failure to function properly would reduce the capacity of the aeroplane 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.

The lightning strike models to be used for system justification shall be as described in FAA AC 20-136 dated March 5, 1990.

SPECIAL CONDITIONS	F-03/MAX: HIRF Protection
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS25
ADVISORY MATERIAL:	JAA INT POL 25/2 Issue 2

The aeroplane electrical and electronic systems, equipment, and installations considered separately and in relation to other systems must be designed and installed so that:

a.Each function, the failure of which would prevent the continued safe flight and landing of the aeroplane:

Is not adversely affected when the aeroplane is exposed to the Certification HIRF environment defined in Appendix 1.

Following aeroplane exposure to the Certification HIRF environment, each affected system that performs such a function automatically recovers normal operation unless this conflicts with other operational or functional requirements of that system.

b.Each system that performs a function, the failure of which would prevent the continued safe flight and landing of the aeroplane, is not adversely affected when the aeroplane is exposed to the normal HIRF environment defined in Appendix 1.

c.Each system that performs a function, the failure of which would cause large reductions in the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions, is not adversely affected when the equipment providing these functions is exposed to the equipment HIRF test levels defined in Appendix 1.

d.Each system that performs a function, the failure of which would reduce the capability of the aeroplane or the ability of the crew to cope with adverse operating conditions, is not adversely affected when the equipment providing these functions is exposed to the equipment HIRF test levels defined in Appendix 1.

EQUIVALENT SAFETY FINDING	F-07/MAX: Green Arc for Powerplant Instrument
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.1549(b)**
ADVISORY MATERIAL:	AMC CS 25.1549(b)

STATEMENT OF ISSUE
CS 25.1549(b) states:

CS 25.1549 Powerplant instruments
(See AMC 25.1549)….

> *For each required powerplant instrument, as appropriate to the type of instrument:*
>
> > *(b) Each normal operating range must be marked with a green arc or green line, not extending beyond the maximum and minimum safe limits;*

B737-8 design features powerplant instruments in accordance to CS 25.1305. Per CS 25.1549(b), these required powerplant instruments shall have a green arcs. B737-8 powerplant indicating dials are showed with white arcs for the normal operating range.

EASA POSITION
The design was accepted as equivalently safe to the 25.1549(b) requirements considering:

- the "white arcs" are dial outlines. Boeing does not use white nor green arcs on the propulsion instruments
- Green or White lights, bands or flags are not used since
1) they are not related to operational procedures
2) their elimination reduces dial face clutter and simplifies instrument display
3) equivalent safety exists with green bands removed

In addition, it was accepted that the total concept of only annunciating non-normal conditions improves effectiveness in detecting non-normal conditions due to the emphasis placed on crew awareness of non-normal indications.

SPECIAL CONDITIONS	F-11/MAX: Airworthiness standard for aircraft operations under falling and blowing snow
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS 25.1093(b), CS 25J1093(b)
ADVISORY MATERIAL:	JAA INT POL 25/2 Issue 2

Add a paragraph (ii) to CS 25.1093(b)(1) to read as follows :

CS 25.1093 Air intake system de-icing and anti-icing provisions

…

(b) Turbine engines
(1) Each turbine engine must operate throughout the flight power range of the engine (including idling), without the accumulation of ice on the engine, inlet system components, or airframe components that would adversely affect engine operation or cause a serious loss of power or thrust (see AMC 25.1093 (b).) –
(i) Under the icing conditions specified in Appendix C.
(ii) ~~Reserved~~ In falling and blowing snow within the limitations (AFM) established for the aeroplane for such operation

EQUIVALENT SAFETY FINDING	**FGEN 9-1: Minimum Mass Flow of Supplemental Oxygen “Component Qualification”**
APPLICABILITY:	Boeing 717-200, 737-200, 737-300, 737-400, 737-500, 737-600, 737-700, 737-800, 737-900, 737-900ER, 737-8, 737-9, 757-200, 757-300, 767-200, 767-300, 767-400ER, 777-200, 777-200LR, 777-300, 777-300ER, DC-9-81, DC-9-82, DC-9-83, DC-9-87, MD-11, MD-88, MD-90-30
REQUIREMENTS:	CS 25.1443(c)
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

It is proposed that EASA accept use of parameters developed by Boeing in conjunction with experts from the medical community and AS 8025 in lieu of direct compliance with the parameters specified in JAR 25.1443(c).

EASA POSITION

In common with the FAA, EASA recognises that whilst a pulse oxygen system could be made to comply with JAR/FAR25.1443(c), this would nullify the advantages realised by such a system. Recognising the above, EASA’s highlights the need to be involved in all stages of MoC development to satisfy the ESF.

EQUIVALENT SAFETY FINDING	**FGEN 9-3: Crew Determination of Quantity of Oxygen in Passenger Oxygen System**
APPLICABILITY:	Boeing 717-200, 737-200, 737-300, 737-400, 737-500, 737-600, 737-700, 737-800, 737-900, 737-900ER, 737-8, 737-9, 757-200, 757-300, 767-200, 767-300, 767-400ER, 777-200, 777-200LR, 777-300, 777-300ER, DC-9-81, DC-9-82, DC-9-83, DC-9-87, MD-11, MD-88, MD-90-30
REQUIREMENTS:	CS 25.1441(c)
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

The applicable A/C types will utilise a pulse oxygen system to protect the passengers from harmful effects of hypoxia. As designed, the system will not meet the EASA Certification Specification 25.1441(c) which requires the provision of a means to allow the crew to readily determine, during flight, the quantity of oxygen available in each oxygen supply source.
EASA recognizes that JAR 25.1441(c) had introduced at Change 13 an exception of indication for chemical generators, which was inadvertently removed at Change 16 during harmonization exercise with FAA CFR Part 25.

EASA POSITION

EASA recognises that the use of small sealed, one-time use gaseous bottles is very similar in concept to that of chemical oxygen generators, which also do not provide oxygen quantity information to the flight deck. The conditions to be met can therefore be compared to accepted practice on chemical oxygen generators and therefore be common for both types of oxygen supply sources.
EASA considers, in review of Boeing ESF request, that the system design can make the system equivalently safe to those systems that provide oxygen quantity information per JAR 25.1441(c). EASA has defined generic criteria for this specific ESF and these are listed in Appendix A of this CRI. It is the consideration of EASA that the Boeing request would meet these criteria, however EASA requests Boeing confirmation, in response to this CRI issue that, for the applicable A/C types, the passenger oxygen system provided meets the conditions listed below:

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) Boeing 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-15: Wingtip Position Lights**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	**JAR 25.1389(b)(3)**
ADVISORY MATERIAL:	N/A

The maximum intensities of the proposed position lights in the overlap areas A and B do not affect signal clarity and meet the intent of FAR & JAR 25.1389 (b) (3) because of the following reasons:

(a) the exceeding intensities of the proposed position lights in the overlap areas A & B are insignificant and would not adversely affect the signal clarity. The wingtip separation and main beam intensity levels of the position lights will maintain the clarity signal.

(b) In all cases, the exceeding intensities in the overlap areas are in extreme angles and very narrow.

(c) Each of the forward and aft position lights, equipped with two 100 watt halogen lamps, provides intensities which are substantially greater than the intensities required by the FAR & JAR 25.1391 and 25.1393.

EQUIVALENT SAFETY FINDING	**F-17: EGPWS Airworthiness Approval**
APPLICABILITY:	Boeing B737-700/-8/-9
REQUIREMENTS:	**JAR 25.1389(b)(3)**
ADVISORY MATERIAL:	N/A

The EGPWS is a new system with unique functions including the terrain awareness display, alerting function and the TCF function. There are issues associated with these unique features that *Manufacturer* must address in order to show compliance with the applicable requirements.

1. System qualification

It is reminded that the certification requirements listed in this CRI only apply to the enhanced GPWS part. The basic GPWS modes should comply with DO 161A. Furthermore, all modes of the basic GPWS must be demonstrated.

If the equipment design includes a digital computer, the software must be developed in accordance with RTCA DO-178B/EUROCAE ED-12B. If residing in the same line replaceable unit and using the same electronics hardware (e.g. microprocessors, data busses, etc.) the software of the EGPWS must be independently partitioned from the basic TSO C92 (c) GPWS.

2. Failure Modes and criticalities

a) Basic GPWS :

The addition of the EGPWS functions must not adversely affect the functionality, reliability or integrity of the basic GPWS.

b) Enhanced Part :

Loss of EGPWS display function must not adversely affect the functions of the weather radar and the predictive windshear warning (PWS).

In order to show compliance with JAR 25.1301, 1309 (b)(c)(d), Boeing must establish that the hazards associated with EGPWS installation are identified, evaluated and comply with the applicable guidance and objectives of AMJ 25.1309.

The following specific failure modes must be specifically addressed :

- Aural and Visual Alerts : Undetected loss or malfunction of the EGPWS aural and visual alerts must be remote.

- Display : The probability of misleading information on the display must be remote. The following failure modes should be specifically addressed :

- When the terrain alert is displayed and no threat is there.
- No terrain alert is displayed and there is a threat.
- No terrain is displayed and terrain is actually present.

Notes :
- here above, -*threat*- should be understood as follows : No terrain alert is displayed and terrain exists in the path of the airplane that satisfies the criteria for alerting .
- the potential for any hazards associated with crew use of the display to confirm GPWS or EGPWS alerts should be addressed.

To be consistent with the above safety criteria, any software that would cause or contribute to a major failure condition at the aircraft level should be developed to RTCA DO-178B/EUROCAE ED-12B level C.

3. Terrain Data

a. Database process.

There are currently no specific JAA certification standards for airborne terrain data bases. To minimise erroneous data that could have misleading information, the software which operates the database should be developed in accordance with RTCA DO 178B/EUROCAE ED-12B. The development and methodology used to validate the database process and verify it must be presented.
DO 200A "Preparation, Verification and Distribution of User-Selectable Navigation Database" may be used as a guideline. This process should at least show how raw data is utilised, how it will be implemented into the database, and how it will be verified. The process should also identify :

- the source of the raw data,
- what percentage of the total data base is provided by that source,
- what are the requirements for the sources data where credit is taken for the accuracy/integrity of these data.

Information should be provided to know how the source validates, and ensures quality that is delivered is what has been specified.

b. Required Terrain Accuracy

Boeing must show that the terrain database accuracy is compatible with the algorithms. This accuracy must be taken into account to show compliance to 25.1309 and to the safety objectives listed in the CRI.

c. Error Rate Acceptability.

The probability of errors contained in the database should be consistent with the safety objectives identified in the system safety analysis.

d. Update Availability.

To comply with JAR §25.1529, it must be stated in the Instructions for continued Airworthiness when the database needs to be updated and how this update has to be implemented. Means should be provided to verify the Database validity.

4. Navigation Source for EGPWS

The navigation system that serves as the navigation source for the EGPWS may affect the usability of the EGPWS system. It must be demonstrated that the accuracy of the EGPWS navigation source is suitable for each phase of flight for which approval is sought. The EGPWS navigation source may be the same as the primary navigation system for the airplane, provided that the safety objectives mentioned in this CRI are met. Areas of operations or other factors which adversely affect navigation performance to the extent that the EGPWS will be unreliable or potentially misleading must be enunciated to the flight crew.
Flight crew procedures to disable or otherwise not use the EGPWS (if necessary) must be identified.

The basic approval status of the navigation system with which the EGPWS will interface must be presented. Where applicable, use of TSO and Advisory Circular approval is recommended.

5. Alerts and Terrain Display

Compliance to JAR 25.1322 should be shown. An acceptable means of compliance is provided in AMJ 25.1322.

a. Terrain Alerting

An aural alert should be proposed to warn the pilot of approaching terrain other than the basic GPWS.
This alert shall annunciate prior to the basic GPWS "pull up" warnings when the aircraft relative to the display approaches the target terrain. It is understood that two levels of alerts for the two different alerting regions are proposed. One alerting region is for warnings, which will be red and the other alerting region for cautions, which will be yellow.

The EGPWS must be demonstrated to perform its intended function when the aircraft is operated in normal conditions.

The predictive algorithm should be designed to take into account the crew workload and should not rely on exceptional piloting skill or alertness. In particular, various parameters affecting the recovery manoeuvre (load factor, pilot's reaction time, go-around procedure, ...) will be evaluated during simulator and flight tests.

Areas of operations where no satisfactory Terrain Data are available, to the extent that the EGPWS will be unreliable or potentially misleading, must be identified to the flight crew (Irrespective of terrain display selection). Suitable flight crew procedures to deal with this situation must be developed and included in the AFM.

b. Alerting Design

The alerting system design for the EGPWS must include a rationale for the alert level and alerting nomenclature and desired flight crew response to the alert. It must also be ensured that the escape algorithms are compatible with the aircraft performance.
The EGPWS alerts must be shown to be distinct and non confusing, especially with basic GPWS modes.
In addition, it should be demonstrated that during turns performed according to normal procedures, the EGPWS will not create hazardous situation by enunciating undesirable pull up.

c. Nuisance alerts

It must be shown by flight and/or simulation that the alerting algorithm will minimise caution or warning alerts when the airplane is operated normally. (Demonstration of a 10^{-4} objective would be acceptable)

d. Display Inoperative Condition.

If there is a failure mode in which the display may be inoperative, but the EGPWS is operative, or vice versa, an annunciation must be provided to the flight crew of the failure mode. This annunciation must be clear, unambiguous and distinguishable from other failure annunciations.

6. Proof of concept

The applicant must show that the algorithms, used in conjunction with the terrain database, performs its intended functions, i.e. provides alerts only when necessary.

One acceptable method would be to flight test a number of approaches and departures, particularly for runways situated in significant terrain. As an alternative, simulation and/or analysis may be used. Regardless of the method, the demonstration should include the effects of inherent terrain data base errors (i.e. should use the database as it is envisioned for the final product), and anticipated altitude/position errors. Airports with significant terrain, for this purpose, are defined as airports with terrain that is more than 1000 feet above runway elevation within 10 nautical miles of the runway. Given this definition, 1134 (about 24%) of the 4814 airports world-wide with runways 3500 ft and longer are situated in significant terrain. Successfully demonstrating 500 or more significant approaches or departures for at least 250 different airports situated in significant terrain (given anticipated position/altitude errors) should assure that the system is robust enough to avoid an unacceptable high rate of unwanted alerts for normal flight operations.

Data exists for approximately 300 turbine-powered aircraft accidents and incidents involving CFIT which have occurred world-wide over the course of the last 25 years. Validation of system performance against these accidents/incidents scenarios is the best predictor of effectiveness in avoiding future accidents. Consequently, the applicant should demonstrate that the system provides timely alerts for a representative sample of these accidents/incidents scenarios. Roughly, 100 cases should be examined at a minimum. One criterion to establish adequate alerting times would be that the system exceeds the current alert times of mode 2 (excessive closure rate to terrain) and mode 4 (unsafe terrain clearance) of the basic GPWS (as defined in TSO C92c).
Simulation is the most practical and effective means to provide this demonstration. Alternative methods that provide equivalent demonstration of effectiveness would be acceptable.

7. Displays/Human Factors

The display of the terrain should meet the guidelines provided in AMJ 25-11. The justification for the design of the displayed information should be documented. The justifications should include a discussion on the use of colour and for the coding of the information. If the EGPWS share display space with the weather radar display, the potential for confusion with this display should be minimised.

a. Human Factors.

Human factors support should be provided for decisions regarding display presentation. Evaluation by a representative pilot population should verify that the display as presented does not have human factors that would trap or have pitfalls, such as display perceptual, or interpretative problems.
There should be also an unambiguous annunciation that the selection of the displays is in the terrain mode rather than any other mode.

b. Flight Crew Use of the EGPWS System

The use of the EGPWS system as an integrated part of the current flight deck must be demonstrated. The use of EGPWS must be shown to be compatible with the operation of the current technology navigation system including paper charts, traffic alert and collision avoidance (TCAS) and weather avoidance systems (Predictive Windshear) .
In addition, methods for flight crew error detection and proposed recovery strategies should be described.

c Terrain Display

It must be demonstrated that the EGPWS can achieve the following set of minimum design goals :

- The terrain display should be manually selectable by the flight crew. This does not preclude an automatic pop-up mode.

- The system should have a simple means that can be used to de-select the terrain display after an automatic "pop up".

- The terrain display should be accurate enough to allow the flight crew to readily determine whether the terrain of interest presents an impending threat to the airplane .

- The terrain display should be clear, unambiguous, and readily usable by the flight crew during day and night operations under all ambient lighting conditions expected in service.

- The terrain display should complement and be compatible with the terrain alerting function of the EGPWS.

8. Recording (DFDR)

With respect to the requirements of JAR 25.1459 (e), the enhanced features of the EGPWS are considered to be a novel and unique characteristic requiring specific accident recording considerations. This aspect can be satisfied by recording the following parameters :

- Selection of terrain display mode including pop-up status,
- Terrain alerts, both cautions and warnings.
- ON/OFF position.

9 Airplane Flight Manual Supplement

An evaluation should be made to determine the limitations that the system will provide and how the system will affect operation.

Boeing should propose procedures and limitations to be included in the Limitations Section of the AFMS taking into account the above requirements .

10 MMEL

Considerations should be given to MMEL aspects .

11 In service experience follow-up

With the aim to follow-up the in service experience, it is requested that the applicant together with the vendor and the operators put in place the adequate means in order to collect the crews reports (e.g. undue warnings,...), analyse the data, and propose as deemed necessary changes to the design and/or procedures .

EQUIVALENT SAFETY FINDING	**F-17/MAX: Leading Edge FLAPS TRANSIT - flight crew indication**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.1322(a)(1)(i)**
ADVISORY MATERIAL:	

STATEMENT OF ISSUE

The LE FLAPS TRANSIT indication is located on the engine display immediately below the trailing edge flap position indicator and illuminates during leading edge device transit (LE not in commanded position) and extinguishes when the leading edge devices are in their commanded position. The LE FLAPS TRANSIT indication remains illuminated in the event of a leading edge failure to reach commanded position. On the 737-700, -800, and -900/-900ER (hereafter referred to as 737 NG), this indication is a dedicated amber light on the forward panel. On the 737 MAX, this indication is an emulated amber light on the forward engine display. The functional behavior of the indication is unchanged from the model 737 NG.

EASA POSITION

Indication features, functions and operation of the high lift leading edge flaps in the 737 airplane provide the compensating factors for an equivalent level of safety:

1. The color amber used for the LE FLAPS TRANSIT indication implies a flight envelope limitation that must be complied with until the indication extinguishes.
2. For a leading edge device failure when the airplane is decelerating, there are multiple layers of low speed awareness provided (low airspeed amber band, AIRSPEED LOW voice alert, lower barber pole displays, and eventually stick shaker) that are still in effect.
3. The LE FLAPS TRANSIT indication has an established meaning to flight crews on the 737.
4. LE DEVICES indicator on the overhead panel provides specific position information for the leading edge devices.
5. Operating procedures specifying that flight crews confirm LE FLAPS TRANSIT is extinguished when devices are in commanded position.

Sufficient information is provided for the flight crew to identify non-normal conditions of the leading edge flaps and for them to determine the appropriate actions in the associated non-normal checklist. Appropriate use of the color amber to imply an operational limit or caution condition applies to the airplane while the indication is provided. Additional situational information based upon actual leading edge position helps protect low airspeed should the leading edges fail to extend to the commanded position when the airplane is slowing during approach. 737 pilots interact with the amber LE FLAPS TRANSIT and green LE FLAPS EXT indication during every flight and there is sufficient and appropriate flight crew training regarding these indications. Normal operational procedures and checklists are in place that will assure the flight crew detects the non-normal conditions which for which this crew alert annunciates.

On these grounds, and although an alternative way of certifying the system may have been preferable, EASA supports the FAA position that the system is acceptable as designed.

The ESF has been subject to public consultation from 18 January 2017 to 8 February 2017. No comment was received.

SPECIAL CONDITIONS	**F-27/PTC: GNSS Landing System (GLS) - Airworthiness Approval for Category I Approach Operations**
APPLICABILITY:	Boeing 737-700/-8/–9
REQUIREMENTS:	JAR 25.1301, 25.1309, 25.1322, 25.1329, 25.1335, 25.1431, 25.1459, 25.1581, JAR-AWO, JAR-AWO, NPA AWO-9
ADVISORY MATERIAL:	AMJ 25-11, AMJ 25.1309, AMJ 25.1322, ACJ 25.1329, JAA (OPS) TGL No. 23, FAA AC 120-29A

1.1 GLS as an ILS Look-alike approach and landing system

NPA AWO-9 enables the certification of MLS as an ILS look-alike function. The scope of the NPA covers the approval of Autoland (with and without rollout), Category II and III operations and Takeoff guidance and makes changes to JAR-AWO Subparts 1, 2, 3, and 4 respectively. For ILS look-alike, the assumption is that the multi-mode receiver output has the same characteristics and behaviour (including failure modes) of the equivalent ILS signal, and therefore the autopilot control laws and monitoring are unaffected. It also assumes that in respect of the MLS ground facility model, the MLS quality is equal to or better than that of ILS and requires no further substantiation.

The NPA contains criteria for integration of an additional landing system aid (in this case MLS) into the flight deck annunciations and displays. It also introduces a new ACJ AWO-1 that defines criteria for the re-certification of the all weather operations function following the installation of new or modified navigation receivers providing ILS/MLS capability.

The EASA consider that the concepts described in this NPA may also be applied to the introduction of GLS, albeit with special considerations for Category I approach operations and automatic landing.

1.2 Category I Approach

The EASA has no specific criteria for Category I within JAR-AWO. However, through the EASA/FAA harmonisation process, the Harmonisation Working Group saw the need to include Category I criteria and this has been documented in paragraph 5.1.3 and Appendix 2 of AC 120-29A dated August 12, 2002. The EASA eventually plans to introduce a new subpart to JAR-AWO to address Category I operations that will be based on this material. For this programme the EASA intends to apply the relevant criteria from AC 120-29A, specifically Category I performance and performance demonstration criteria.

1.3 Autoland

The use of the autoland system on ILS Category I facilities or on Category II/III facilities when Low Visibility Procedures (LVP) are not in force, are conducted for a number of reasons:

- For crew qualification purposes - initial and recurrent training and checking as well as maintaining recency
- Operational demonstration and in-service proving
- System verification including scheduled maintenance and corrective maintenance
- Crew workload, in particular during marginal conditions

JAA Leaflet No. 23 (to be superseded by JAR-OPS 1 IEM material) provides guidance as to the potential risks and the operational procedures to ensure the safety of the autoland under these conditions. In particular, flight crews are to be alert to potential ILS beam disturbances due to the absence of protection, ground station switchover times not in accordance with Category III requirements and irregularities with the pre-threshold terrain. Sudden and unexpected flight control movements may occur at low altitude or during the landing and rollout. Nevertheless, on a good quality ILS beam and assuming a satisfactory operational assessment, the landing performance is considered to be acceptable and supports the operational procedures mentioned above.

The clearance to use the autoland system on an ILS Category I facility or on a Category II/III facility when LVPs are not in force is subject to the same limitations applied during the original autoland performance compliance demonstration e.g., wind limits (head, cross and tail), runway elevation, one-engine inoperative, autothrottle inoperative, glidepath angle, runway slope and profile.

At this time Boeing is not seeking approval for autoland to support Category III operations based on GLS, but is requesting approval to allow automatic landings to be conducted following a GLS approach in Category I or better weather conditions. This application will require a demonstration to show both a safe autoland or adequate pilot cues to support visual recognition and subsequent recovery action in making a manual landing or go-around as appropriate.

Compliance with JAR-AWO ACJ AWO 131, including a statistical analysis and flight test validation of such, is not considered necessary given that:

- The autoland function is already approved on the Boeing 737NG
- The GLS is being approved for ILS look-alike operations
- An operational assessment is required for each facility/runway
- Operations are limited to Category I weather minima or better
- Flight crews have responsibility for monitoring performance.

It should be noted that this airworthiness approval does not constitute a general clearance for use of the autoland system on a GBAS ground station in Category II or III weather conditions. This will require a demonstration of compliance against ACJ AWO-131 with a signal-in-space model representative of a Performance Type 2 or Performance Type 3 facility. However, a statement of demonstrated performance may be included in the Normal Procedures of the Airplane Flight Manual (AFM) to support subsequent operational approval under the conditions set out in JAA Leaflet No. 23.

1.4 GBAS

The GLS service, provided by a GBAS, is different from ILS in its operation and may provide many improvements over ILS (e.g., signal quality, reduced low visibility sensitive areas). However, the GLS is a new and evolving system and different evaluation and assessment methods need to be considered for:

- Ground station issues e.g., airborne system response to ground station failure modes
- Runway characteristics e.g., short and long, ground profile
- Novel displays e.g., distance to threshold as an alternative to display of DME
- MMR characteristics e.g., GLS conversion algorithm for ILS look-alike

1.5 Future Applicability to Category III Approach

The EASA want to state clearly that this CRI does not constitute a precedent for future Category III applications on the GLS system for Boeing 737NG and other types.

2. ASSUMPTIONS FOR THE AIRWORTHINESS APPROVAL

In conducting the airworthiness approval, certain assumptions have to be made concerning the infrastructure and operating environment. Para 6.1 of Appendix 2 to AC 120-29A states that:

“The certification plan should describe how any non-aircraft elements of the approach system relate to the aircraft system from a performance, integrity and availability perspective.”

The assumptions for the airworthiness approval are considered to include the following ground service aspects:

• The GBAS ground station shall be compliant with ICAO Annex 10 SARPS for Category I operations

• Operational use of the GLS to be based on instrument procedures that are shown to be equivalent to ILS e.g., protection surfaces or appropriate GLS instrument approach procedure criteria, as and when developed

• Appropriate charting of the GLS procedure

• Promulgation of Air Traffic Services procedures covering GLS operations

• Assessment of the compatibility of the operating environment including consideration of the potential effects of multi-path on the GLS signal-in-space (airframe, ground bounce, buildings, parked aircraft)

• Approval of the Air Traffic Service in accordance with national requirements.

3. AIRWORTHINESS ASSESSMENT

The EASA will assess the Boeing GLS function against the following airworthiness requirements:

3.1 Category I Approach

3.1.1FAA AC 120-29A paragraph 5.1.3 - Airborne System Requirements and Appendix 2 – Airborne Systems for Category I. This Advisory Circular addresses the equipment and installation criteria as well as defining the applicable performance, integrity and availability requirements for Category I operations.

3.1.2 ILS Look-alike equivalence - Principles of ACJ AWO-1 in JAA NPA AWO-9

Para 6.1 certification process
Para 6.2 equipment approval
Para 6.3 aircraft installation approval
Para 8.1 impact assessment
Para 8.2 failure analysis:
– impact on MUH
– consideration of failures from the antenna through to the EDFCS
Para 8.4 antenna location (navigation reference point)
Para 8.5 flight testing based on AC 120-29A Appendix 2 performance demonstration
Para 8.6 documentation

3.1.3The acceptability of the cockpit display and alerting systems to support the operation.

3.1.4The EASA recommends that a Deviation Alerting system similar to that required of Category II operations based on ILS (refer to JAR AWO 236) be provided for GLS. The applicant should provide rationale for a different alerting profile than that identified in JAR-AWO 236.

3.1.5 The (different) GBAS signal-in-space service volume should not introduce any inappropriate aeroplane system behaviour when conducting an ILS-like operation e.g. capture.

3.1.6The effects on the airborne system due to failures of the GBAS ground station should be investigated, taking into account the Standards and Recommended Practices of ICAO Annex 10.

The validation of the effects of ground station failures on the airborne system should include the effects of SIS Failure Flag (i.e. an alert) and Position Error < Alert Limit (i.e. bias error). It should also highlight any anomalous signal detection and rejection, and alerting provided. Although assuming ILS look-alike signal characteristics, consideration should be given to the differences between ILS and GBAS signal-in-space, including input signal deflection magnitude, rate, signal interruptions and whether these might render the existing EDFCS fault detection and rejection mechanisms inadequate. Where the position error is less that the alert limit, effect on normal performance should be assessed.

3.1.7Normal performance and failure demonstrations should use analysis, simulation or flight test, as appropriate.

3.1.8To satisfy the requirements of JAR 25.1459 (e), use of the GLS concept is considered to be a novel and unique characteristic requiring specific accident recording considerations. As a minimum, the applicant should consider recording of the following parameters:

a) GLS DDM deviations (lateral and vertical)
b) GLS channel tuning (to differentiate DDM from ILS, MLS or GLS).

For MMR equipment qualification, the applicant should consider the applicability of:

•EUROCAE ED-88, MOPS for MMR including ILS, MLS and GPS for Supplemental means of Navigation, i.e. partitioning requirements
•FAA TSO C-161, Ground Based Augmentation System Positioning and Navigation Equipment. (RTCA DO-253A – MOPS for GPS LAAS Airborne Equipment)
•FAA TSO C-162, Ground Based Augmentation System Very High Frequency Data Broadcast Equipment (RTCA DO-253A)
•RTCA DO-246B, GNSS Based Precision Approach LAAS – Signal-In-Space Interface Control Document (ICD).

The environmental and software qualification of the GLS function of the MMR shall be compliant to RTCA DO-160D/EUROCAE ED-14D and RTCA DO-178B/EUROCAE ED-12B respectively. Where ASICs and PLDs are used, compliance with Boeing Design Assurance Guideline for PLDs and ASICs (Document number D6-81999) should be demonstrated.

3.2 Autoland

The projected change in landing and rollout performance (as applicable) when conducting operations based on GLS when compared to demonstrated performance based on ILS should be assessed.

The impact of failures of the GBAS ground station on the flare, landing and rollout functions within the GLS should be assessed (see paragraph 3.1.6 and 3.1.7 above).

3.3 Flight Test and Simulator Demonstration Programme

The flight test and simulator demonstration programme supporting this approval should be submitted to the EASA for agreement. Within the Limitations already defined for the autoland system on the Boeing 737NG for an ILS facility, the GLS programme should address the following (as applicable):
• Demonstration of acceptable (safe) autoland performance
•Adequacy of pilot recognition of GBAS failure modes and demonstration of either a manual landing or a safe go-around from any point on the approach to touchdown
• Aeroplane configurations, weight, cg, flap configurations
• Number of ground facilities
• Variation in runway profiles e.g., lengths, slopes etc.
• Range of approach gradients
• Range of environmental conditions i.e. head, cross and tail winds

- Aerodrome elevation i.e. high altitude autoland
- Variation in performance due to day-to-day variations in the satellite constellation

The applicant should provide an assessment of the rationale that the programme proposed is appropriate for the EASA to grant the application as submitted.

4. AIRPLANE FLIGHT MANUAL

Boeing should submit for approval by the EASA Boeing 737 Team, Airplane Flight Manual (AFM) Pages applicable to the addition of the GLS function on the 737NG.

Where applicable, for aircraft equipped with Head-up Guidance (HGS) Boeing should make clear in the AFM that the use of the Head-up Guidance (HGS) with GLS has not been demonstrated and is subject to a separate approval programme and AFM entry.

EASA public comments phase was completed 28 May 2005. No adverse comments have been received.

SPECIAL CONDITION	F-29: Lithium - Ion Batteries
APPLICABILITY:	Boeing 737 -600/-700/-800/–900 and -900ER
REQUIREMENTS:	JAR 25.601, 25.863, 25.1309, 25.1353(c), and 25.1529
ADVISORY MATERIAL:	N/A

SPECIAL CONDITION

Lithium-ion 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-ion battery installation must be designed to preclude explosion in the event of those failures.

(2) Li-ion 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-ion 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-ion battery installations must meet the requirements of JAR 25.863(a) through (d).

(5) No corrosive fluids or gasses that may escape from any Li-ion battery may damage surrounding aeroplane structures or adjacent essential equipment.

(6) Each Li-ion 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-ion 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-ion 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 SOC of the batteries have fallen below levels considered acceptable for dispatch of the aeroplane.

(9) The Instructions for Continued Airworthiness must contain maintenance requirements for measurements of battery capacity at appropriate intervals to ensure that batteries whose function is required for safe operation of the aeroplane will perform their intended function as long as the batteries are installed in the aeroplane. The Instructions for Continued Airworthiness must also contain maintenance procedures for Li-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.

Compliance with the requirements of this Special Condition must be shown by test or, with the concurrence of EASA, by analysis.

Special Condition	**F-30:** Data Link Services for the Single European Sky
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR/FAR 25.1301, 25.1307, 25.1309, 25.1321, 25.1322, 25.1431, 25.1459, 25.1581, 25.1585, Commission Regulation (EC) No 29/2009
ADVISORY MATERIAL:	EUROCAE ED-120, ED-78A, ED-110B, ED-92A (Radio VDL/M2), ICAO Annex 10 Vol II & III, ICAO Doc 9776, ARINC Specification 631-5

SPECIAL CONDITION

A system capable of providing Data Link Services that complies with the safety, performance and interoperability standards as detailed in the Appendix 1 must be provided if operations are to be conducted within the airspace as defined by the Commission Regulation (EC) No 29/2009.

1. The following Data link services must be provided:

1.1. Data Link Initiation Capability (DLIC), to enable the exchange of the necessary information for the establishment of Data Link communications between ground and aircraft systems.

1.2. ATC Communication Management (ACM), to provide automated assistance to flight crews and air traffic controllers for conducting the transfer of ATC communications (voice and data).

1.3. ATC Clearances (ACL), to provide flight crews and air traffic controllers with the ability to conduct operational exchanges.

1.4. ATC Microphone Check (AMC), to provide air traffic controllers with the capability to send an instruction to several Data Link equipped aircraft, at the same time, in order to instruct flight crews to verify that their voice communication equipment is not blocking a given voice channel.

SPECIAL CONDITION	**F-31 PTC: Security protection of aircraft systems and networks**
APPLICABILITY:	Boeing B737-600/-700/-800/-900/-900ER/-8
REQUIREMENTS:	25.1309
ADVISORY MATERIAL:	EUROCAE ED-202

SPECIAL CONDITIONS
a) The applicant shall ensure security protection of the systems and networks of the aircraft from any remote or local access by unauthorized sources if corruption of these systems and networks (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, including those possibly caused by maintenance activity or by any unprotected connecting equipment/devices inside or outside the A/C, are identified, assessed and risk mitigation strategies are implemented to protect the aircraft systems from all adverse impacts on safety, and
c) Appropriate procedures shall be established to ensure that the approved security protection of the aircraft's systems and networks is maintained following future changes to the Type Certificated design.

GENERIC I.M.
Aircraft systems and networks covered by 25.1309 should be assessed against potential failure caused by information security threats in order to evaluate their vulnerabilities to these threats. To
do so an acceptable means is to perform a Particular Risk Analysis, called in the rest of this AMC "Network Security Assessment", that is described in section I.
As a result of this assessment, either the aircraft systems have no known vulnerabilities, or the vulnerabilities cannot be exploited by any security threat to create a Hazard of a Failure Condition that has an effect deemed unacceptable against CS 25.1309.
When vulnerabilities exist and protection mechanisms are needed to fulfil this requirement, validation and verifications of these security protection mechanisms, as described in section II, should demonstrate that the implemented mechanisms provide the expected protection against information security threats.
When required, Instruction for Continued Airworthiness as described in section III should be developed to maintain the security efficiency after the entry into service of the Aircraft.

I. AIRCRAFT SYSTEMS AND NETWORK SECURITY ASSESSMENT
As recommended in ED-79A/ARP-4754A and ED-135/ARP-4761, a Particular Risk Analysis is required when risks, as those events or influences which are outside the system(s) and item(s) concerned, but which may violate failure independence claims, may be encountered. Having identified the appropriate risks with respect to the design under consideration, each risk should be the subject of a specific study to examine and document the simultaneous or cascading effect(s) of each risk. The objective is to ensure that any safety related effects are either eliminated or the risk is shown to be acceptable.
In this context, the applicant should develop an analysis, similar to the Particular Risk Analysis dedicated to Aircraft Systems and Network Information Security, hereafter referred to as the Network Security Assessment. It should include:
1. identification and detailed definition or the information security threats, risks and vulnerabilities
2. identification of the impacted assets
3. review of the consequences on safety of the information security threat on the affected items
    Note: the following documentation should be used as input, when appropriate: FHA, FMEA or PSSA
4. review of the potential effect of the information security threats on the aircraft safety
5. Determination if the consequences are acceptable.
    a. If yes, preparation of justification for certification
    b. If no,

i. implementation, description and justification of a protection mechanism(s),
ii. Identification of the vulnerabilities associated with incorrect operation or loss of the protection mechanisms

6. Definition of the Security Level for all implemented protection mechanism. This security level determination should encompass:
   a. the effectiveness of the protection mechanism,
   b. the likelihood of the information security thread to occur and,
   c. the acceptability of the risk, depending on its effect to the safety.
   When a system and network security rule violation may, as a result of this assessment, generate an unsafe condition, this violation should be reported timely to the crew or maintenance operators. Guidance can be found in AMC 25.1309 § 9(5) Crew and Maintenance Actions (i), (ii) and (iii).

The applicant should gain the agreement of the EASA for those assigned protection levels and their network security protection plan(s).
Guidance for performing security risk assessments for airworthiness on Aircraft Systems and Network, and for Security Level determination can be found in document EUROCAE ED-202/ RTCA DO-326.
This Network Security Assessment should be performed for any design change which may have an effect on the Aircraft Systems and Network Security.

II. VALIDATION AND VERIFICATION OF THE AIRCRAFT SYSTEMS AND NETWORK SECURITY PROTECTION
When vulnerabilities have been identified during the Network Security Assessment, and when these vulnerabilities require the implementation of protection mechanisms, security verifications should demonstrate that Aircraft safety is not lowered by information security threats.

These security verifications should
d. establish the correct functioning of security technical features, and
e. verify the absence of unintended functionality, and
f. verify the absence of new vulnerabilities introduced by the protection mechanism.

These verifications should be performed as much as possible by security testing. Security testing addresses the aircraft system from the perspective of a potential adversary, using network access or other vulnerabilities identified in the Network Security Assessment, potentially including:
d. Network access;
e. Logical remote access where enabled; and
f. Forged data (such as malware, coherently corrupted data tables, configuration files).

In case that these verifications cannot be established through functional testing, they may be done by combinations of analysis, (security oriented) robustness testing, inspection and review.

III. INSTRUCTION AND INFORMATION FOR CONTINUED AIRWORTHINESS
The applicant should identify the network security assets and protection mechanism to be addressed by the ICA of the aircraft (for example: physical and operational security, auditing and monitoring of the security efficiency, key management procedures that are used as assumptions in the security assurance process) and develop the appropriate procedure to maintain the security efficiency after the aircraft enters commercial service.

When an in-service occurrence is reported, the applicant should consider the possibility to be originated by a system and network security rule violation and should take any required corrective action accordingly. When a system and network security rule violation has

generated an unsafe condition, then information about occurrence, investigation results and recovery actions will be reported to the Agency in accordance with Part 21A.3.
The Applicant should also assess the impact of new threats not foreseen during previous Network Security Assessment, on the aircraft systems and networks. In case the assessment would identify an unacceptable hazard of Failure Condition, the Applicant should notify the Operators of the need to update the protection means.

EQUIVALENT SAFETY FINDING	**F-40/MAX: First aid portable pulse oxygen system**
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	**CS 25.1443(d)**
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

Boeing is proposing to install portable pulse oxygen bottles (PPOS) on the 737 in order to allow customers more choices when configuring their airplanes and support commonality within their fleet. These bottles do not meet the oxygen delivery requirements of CS 25.1443(d) (and 14 CFR 25.1443(d).

EASA POSITION

The ESF CRI raised on that topic for the B787 aircraft applies (CRI F-30), aligned on the FAA IP ES-20.

The design has been accepted as equivalently safe considering:
a test was passed demonstrating that the PPOS oxygen delivery provided an equivalent physiological effect to a person as indicated by their SaO2 level when subjected to a hypoxic condition induced by a combination of exercise and reduced partial pressure of oxygen brought about by increase altitude in an altitude chamber.

SPECIAL CONDITION	**F-GEN10 PTC: Non-rechargeable Lithium Batteries Installations**
APPLICABILITY:	Boeing B717, B727, B737, B747, B757, B767, B777, DC-10, MD11, DC-9, MD80
REQUIREMENTS:	CS 25.601, 25.863, 25.869, 25.1301, 25.1309, 25.1353(c), 25.1529, 25.1360 (b)
ADVISORY MATERIAL:	-

Applicability limited to Boeing installation of Honeywell CVR/FDR.

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.

6. Have provisions to prevent any hazardous effect on 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. Be capable of automatically controlling the discharge rate of each cell to prevent overheating, back charging, charge imbalance, and uncontrollable temperature and pressure.

8. Have a means to be automatically disconnected from its discharging circuit in the event of an over-temperature condition, cell failure or battery failure.

9. 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, battery charger 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 to all non-rechargeable lithium battery installations in lieu of CS 25.863 and 25.1353(b)(1) through (b)(4). Section 25.1353(b)(1) through (b)(4) will remain in effect for other battery installations.

SPECIAL CONDITION	**F-GEN11 PTC: Non-rechargeable Lithium Batteries Installations**
APPLICABILITY:	Boeing B717, B727, B737, B747, B757, B767, B777, B787, DC-10, MD11, DC-9, MD80
REQUIREMENTS:	CS 25.601, 25.863, 25.1353(c)
ADVISORY MATERIAL:	-

Applicability for all non-rechargeable Lithium batteries installations/relocations.

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 to all non-rechargeable lithium battery installations in lieu of 25.1353(c)(1) through (c)(4). Section 25.1353(c)(1) through (c)(4) will remain in effect for other battery installations.

EQUIVALENT SAFETY FINDING	G-GEN01 Instructions for Continued Airworthiness
APPLICABILITY:	Boeing B787-8/-9, B747-8/-8F, 737-600/-700-700C/-800/-900/-900ER, 737-7/-8/-9, 767-200/-300/-300F/-400ER/-2C, 777-200/-300/-300ER/-200LR and 777F
REQUIREMENTS:	CS 25.1529, CS25 Appendix H
ADVISORY MATERIAL:	N/A

EASA Statement of Issue:

Boeing has developed a specific set of documentation that is not literally in compliance with the certification requirements.
The Airworthiness Limitations Section (ALS) is not provided as part of the "principal manual" as requested by H25.4(b) of CS 25 Appendix H.

FAA Issue Paper ELOS G-8 - Background (Jan 22, 2009) of Issue:

Section 25.1529 states that the applicant must prepare ICA in accordance with appendix H to part 25.
App H section H25.2 states:

(b) The instructions for continued airworthiness must be in form of a manual or manuals as appropriate for the quantity of data to be provided
(c) The format of the manual or manuals must provide for a practical arrangement

App H section H25.4 ALS states in pertinent part:
(b) If the instructions for continued airworthiness consist of multiple documents, the section required by this paragraph (i.e. ALS) must be included in the principal manual (underline added for emphasis)

Boeing has proposed to provide al operators of Boeing airplanes with all required ICA documents, but the ALS will not be part of the "principal manual" as required by the rule. The ICA document (i.e. many electronic files) would be contained within a single electronic repository available wia the internet at www.myboeingfleet.com (MBF).Airline customers would be able to download this information and customize it to fit the structure of their specific general maintenance manual.

The ALS data would be contained within Section 9 of the MPD document for each model (…).

FAA Issue Paper ELOS G-8 - FAA position (Jan 22, 2009) of Issue:

The FAA request that Boeing provide an applicant's position justifying how the proposed format of the ALSprovides an equivalent level of safety to the requirements of 25.1529 in accordance wiy the provisions of 21.21(b). (…).

FAA Issue Paper ELOS G-8 - FAA Conclusion (March 27, 2013):

The FAA concurs that the Boeing's proposed format of the ICAs provides an ELOS to the ICA ALS format / structure related requirements listed below. All other requirements of the regulations listed remain applicable:

- 25.1529 ICA amendment 25-123
- 25.1729 ICA: EWIS , amendment 25-123
- Part 25 appendix H, amendments 25-102, 25-123, 25-132

To utilize the provisions of this ELOS, the following conditions apply:

- The MPD Section 9 document must be titled "Airworthiness Limitations and Certification Maintenance Requirements" (ref D011Z009-03 (787), D011U721-02 (747), D626A001-9 (737), D62T001-9 (767), D622W001-9 (777)

- The sub-document contents referenced in MPD section 9(ref D*******-*-01 through -04) must be recognized as ICA
- The title for documents ref D011Z009-03-04 (787), D011U721-02-04 (747), D626A001-9-04 (737), D62T001-9-04 (767), D622W001-9-04 (777) must be "Special Compliance Items / Airworthiness Limitations" Note: the FAA understands that MBF system software revisions will be required to update these titles for certain airplane models. These updates are to be accomplished as soon as practicable, but no later than one year (…)
- The MPD section 9 document and all the related sub-documents must be complete at issuance of the type certificate, or prior to delivery for the first airplane or issuance of a standard certificate of airworthiness, whichever occurs later.
- Access to these documents must be provided to the FAA
- Access to these documents must be provided to the airline customers and modifiers, provided the parties requesting access agree to Boeing's conditions for access and proper contracts are in place.

This finding of equivalent safety may also be applied to future derivatives of the model series identified above by listing the associated ELOS summary memorandum in the relevant sections of each model type certificate data sheet.

(…)

EASA Position: (Issue 1, 24 March 2014)

EASA acknowledges Boeing Position expressed in the FAA Issue Paper ELOS G-8 as subject "*Inclusion of Airworthiness Limitations with the Boeing ICA Manuals*", closed at stage 4 March 27, 2013 (see Appendix A) and concurs with Boeing and FAA's Position.
As that FAA Issue Paper ELOS G-8 is accepted and adopted by EASA, this CRI can be closed

SPECIAL CONDITION	H-01: Enhanced airworthiness programme for aeroplane systems – ICA on EWIS
APPLICABILITY:	Boeing B717, B727, B737, B747, B757, B767, B777, DC-10, MD11, DC-8, DC-9, MD80, MD90 (all FAR26.11 affected models)
REQUIREMENTS:	Part 21A.16B(a)(3), 21A.3B(c)(1), CS25.1529 & Appendix H
ADVISORY MATERIAL:	AMC 25 Subpart H

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.

Special Condition H-01 continued

(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.

EQUIVALENT SAFETY FINDING	J-03/MAX: APU Engine mounts
APPLICABILITY:	Boeing B737-7/-8/-9
REQUIREMENTS:	CS 25.865
ADVISORY MATERIAL:	-

STATEMENT OF ISSUE

The APU mount attach points would normally be covered by TSO C-77b and CS-APU for a new APU, but the 131-9[B] was approved in the early 1990s to TSO C-77a and JAR-APU at amendment 2, which did not have a rule about fire proof engine mounts. So for the 737-8 the APU attach points as well as the aircraft side APU engine mounts are being addressed under 25.865.

There is one APU mount attach point on the 131-9[B] APU as installed in the 737-800 and as will be installed in the 737-8. The left forward mount point uses a slotted link so that it does not normally carry any load. It is intended to limit the deflection of the APU in the event of a failure of one of the primary mount paths. The fourth attach point is not required for any mount or load regulation compliance. It was added during development of the 737-700 for an added level of safety due to the tight fit of the 131-9[B] APU into the space.
This fourth mount also attaches to the aluminum APU load compressor scroll case. It is very closely surrounded by the external pipe work on the APU. With the current APU configuration it is not possible to install insulation to shield this attach point from a fire.
This Finding is only concerned with the APU left forward mount attachment point.

The 737-700 IP A-06 and the 777-200 IP A-10 for the main engine mounts allowed: "The failsafe features of the design may be taken into account if it can be shown that a foreseeable fire condition could not affect the integrity of the alternate load paths when those paths are not fireproof (i.e. not made of steel)." In the 737-8 case the failsafe feature / alternate load path is not relied upon in the event of fire. The primary elements are being shown to be fireproof. However the left forward mount APU engine mount at the APU case will not be shown to be fire proof.
Therefore, Boeing cannot demonstrate the Model 737-8, 737-9 and 737-7 (737 MAX) airplanes directly comply with the requirements of CS 25.865 for the auxiliary power unit (APU) installation.

EASA POSITION

EASA accepted the design to be equivalently safe to that intended by CS 25.865 with respect to the APU mount system ability to withstand the effects of fire in the APU fire zone based on the following compensating factors:

1) All of the primary mounts will be shown to be fireproof.
2) The left forward mount point is not within the engine rotor failure or combustor burn through threat area.
3) The APU gearbox has been shown to withstand a fire for 15 minutes without spilling the oil from the sump. The left forward mount is slotted and unable to carry any load unless at least one of the primary mounts is already failed.

The presence of the displacement limiter is a compensating feature that provides an additional level of safety beyond the requirements of the regulation 25.865.
Boeing have shown that the design as described in this IP is more capable and protects against more threats and is therefore a greater level of safety than a fully compliant design as is found on every other APU equipped jet transport we know of yet in service.

List of compensating Features:
Automatic APU shutdown upon detecting a fire in the compartment reduces the probability of a long fire exposure.

The deflection limiter is shown to be capable of supporting the required loads to maintain the APU in position with a fire elsewhere in the compartment.
Full containment of all rotors for a tri-hub burst of any APU stage.
The presence of the deflection limiter allows us to retain the APU in position for all rotor burst scenarios rather than address potential damage to structure and flight home.

REVERSION:	**J-04: APU Fuel Shut Off Valve Indication**
APPLICABILITY:	Boeing B737-600/-700/-800
REQUIREMENTS:	JAR 25A1141(f)(2)
ADVISORY MATERIAL:	N/A

A reversion may be granted from JAR 25A1141(f)(2) to FAR 25.1141 Amendment 11 which does not require a valve position indicator. This is agreed for the APU fuel valve on the basis of it not being significantly modified from the 737-100 and having an acceptable service history. The remainder of JAR 25A1141 at Change 13 must be satisfied.

-- END --