Comment-Response Document (CRD) to Notice of Proposed Amendment (NPA) 2011-09

for amending the Executive Director Decision 2003/02/RM of 17 October 2003 on certification specifications and acceptable means of compliance, for large aeroplanes ('CS-25')

'Incorporation of generic SC and AMC CRIs in CS-25'

Reactions to this CRD should be submitted via the CRT by clicking the 'add a general reaction' button.

Please <u>indicate clearly</u> the applicable paragraph.

Executive Summary

NPA 2011-09 proposed an upgrade of CS-25 by introducing generic CRIs (Certification Review Items) containing Special Conditions and/or Guidance Material, and Acceptable Means of Compliance.

The intent is to reflect the current certification practices and facilitate future certification projects.

Following the review of comments received, the Agency made some improvements and corrections to the CS-25 amendment proposal as explained in detail in the responses to comments provided hereafter. Furthermore, the proposal amending CS 25.1353 to address the subject of lithium-ion battery installation is withdrawn because of its lack of maturity and on-going developments.

Further to these changes, the final resulting text for CS-25 amendment addresses the following items: stalling speeds for structural design; design manoeuvre requirements; design dive speed; side stick controls; towbarless towing; steep approach and landing; protection of essential systems and equipment in Class E cargo compartments; removal of need for berths intended only for the carriage of medical patients to comply with CS 25.562; inclusion of engines at ground idle when assessing escape slide performance in wind; oxygen outlets in the galley work areas; fireproofness of engine cowlings; flight envelope protection; reduced and derated take-off thrust; go-around performance.

Explanatory Note

I. General

1. The purpose of the Notice of Proposed Amendment (NPA) 2011-09, dated 28 May 2011, was to propose an amendment to Decision 2003/02/RM of the Executive Director of the European Aviation Safety Agency of 17 October 2003 on certification specifications and acceptable means of compliance, for large aeroplanes ('CS-25')[1].

II. Consultation

2. The draft Executive Director Decision amending Decision 2003/02/RM was published on the website (http://easa.europa.eu/agency-measures/agency-decisions.php) on 31 May 2011.

   By the closing date of 31 August 2011, the European Aviation Safety Agency (hereafter referred to as the 'Agency') had received 82 comments from 15 national aviation authorities, professional organisations and private companies.

III. Publication of the CRD

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

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

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

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

   The Executive Director Decision on amendment to Decision 2003/02/RM will be issued at least two months after the publication of this CRD to allow for any possible reactions of stakeholders regarding possible misunderstandings of the comments received and answers provided.

5. Such reactions should be received by the Agency not later than **21 January 2013** and should be submitted using the Comment-Response Tool at http://hub.easa.europa.eu/crt.

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[1] As last amended by Decision 2012/008/R of the Executive Director of the Agency of 6 July 2012, 'CS-25 Amendment 12'.

IV. CRD table of comments, responses and resulting text

(General Comments)	-

comment	*36* comment by: *FAA* General comment: The FAA would like to suggest a future rulemaking or guidance project. We have noted subjective requirements for crew ability throughout 14 CFR part 25 and CS-25, such as section 25.101(h), "must be able to be consistently executed in service by crews of average skill." We would like to work together with EASA to identify and better define expected flightcrew skill and performance where referenced within our regulations.
response	Noted. This NPA does not propose any changes to CS 25.101(h). Nevertheless, the request for future development of this requirement is noted.

comment	*58* comment by: *UK CAA* Please be advised that the UK CAA have no comments to make on NPA 2011-09 'Incorporation of generic SC and AMC CRIs in CS-25'.
response	Noted.

comment	*60* comment by: *Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)* The Swedish Transport Agency, Civil Aviation Department is supporting Option 2 (*Amend CS25 by introducing generic CRIs*.)
response	Noted.

comment	*64* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.* Embraer appreciates the opportunity to send the attached comments for your consideration in NPA 2011-09 about Incorporation of generic SC and AMC CRIs in CS-25.
response	Noted.

comment	*84* comment by: *Swiss International Airlines / Bruno Pfister* SWISS Intl Air Lines takes note of the NPA 2011-09 without further commens.
response	Noted.

IV. Content of the draft decision - Design dive speed	p. 6

comment	*42* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 13 Design dive speed, Proposed AMC 25.335(b)(1)(ii). For failure of the high speed protection function, it is likely that the value of V_D/M_D will be

	greater than the value established with the function operating. In this case a reduction in V_C/M_C (and associated V_{MO}/M_{MO}) to maintain a safe operating margin to V_D/M_D may be more appropriate than a redefinition of loads at a higher V_D/M_D.
response	Partially accepted. See response to comment No 24.

IV. Content of the draft decision - Side stick controls p. 6-7

comment	*43* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 14 Side stick controls, CS 25.777 Cockpit controls. The content of proposed CS 25.777(i) appears to be missing from the NPA.
response	Not accepted. The proposed CS 25.777(i) is presented on page 18 of NPA 2011-09.

IV. Content of the draft decision - Towbarless towing p. 7-8

comment	*44* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 15 Towbarless towing, Proposed CS 25.745(d)(2). The proposed limitations, although valid, are not appropriate as AFM limitations (particularly the last paragraph if the documentation is the AFM)
response	Not accepted. The Agency assumes that your comment actually refers to the proposed AMC 25.745(d), last paragraph, i.e. sub-paragraph (d)(3). Sub-paragraph (d)(3) details the conditions under which the aeroplane manufacturer may accept a towbarless towing vehicle. Sub-paragraph (d)(2) introduces a limitation in the AFM for towbarless towing. Towbarless towing operations are restricted to the vehicle(s) accepted by the aeroplane manufacturer. The list of accepted vehicle(s) would be provided in the appropriate aeroplane manufacturer documentation, i.e. Instructions for Continued Airworthiness as described in Appendix H, paragraph H25.3(a)(4).

comment	*67* comment by: *Boeing* **Page: 7 of 45** **Paragraph 15. Towbarless towing** **<u>General comment:</u>** It appears that this material puts the airframe manufacturer in the position of approving tow vehicles. Boeing does not consider it appropriate to be in the position of approving this type of equipment; our approach for the past 15 years has been to provide the tow vehicle manufacturers and airlines with the criteria and guidance necessary for them to self-certify. Boeing created a tow vehicle assessment document specifically for this purpose and it has worked well as a means of allowing the tow vehicle manufacturers to qualify their equipment. Our recommendation is

	to continue with this approach. AMC 25.509, as currently proposed, would require that the airframe manufacturer perform an analysis of each vehicle and airplane combination, and then publish a list of acceptable combinations in the AMM and/or AFM. The analysis requirement would be an undue burden on Boeing, and maintaining the results in the AMM would be a similar problem. It invites questions, such as the requirement to re-do the analysis every time a small change is made to a tow vehicle. This responsibility clearly belongs to the tow vehicle equipment manufacturers, not to the airframe manufacturer. The NPA therefore needs to be revised to allow airframe manufacturers such as Boeing to continue with our current approach to towbarless towing. In addition, to maintain the appropriate maximum amount of harmonization with FAA requirements, any proposed new towbarless towing requirements should be harmonized with the FAA prior to implementation.
response	Partially accepted. This rulemaking proposal is consistent with the previous JAA interim policy (INT/POL 25/13 dated 01 June 2001) which was successfully applied over the past years. The origin of this policy dates back to February 1996 when the JAA D&F SG Ad-hoc Group on "Towbarless Towing" was in charge of investigating possible alternative means of compliance with the JAR-25 rule. This Group, in cooperation with the SAE Towbarless Towing Working Group, came to the conclusion that protection of the nose-wheel steering system can also be provided by means of precautions taken on the towbarless towing vehicle design and operation. For that reason the SAE has developed and published five ARP's (Aerospace Recommended Practices): two ARP's dedicated to the towbarless towing vehicle designer and three ARP's dedicated to the operation, maintenance/calibration and testing of the vehicle. The principle is that, if the nose wheel steering analysis results in Failure Condition(s) that can be classified as Major or less severe, each aeroplane manufacturer provides a Towing Assessment Criteria Document, specifically for his type of aircraft, to be used by the towbarless towing vehicle manufacturer for defining interface requirements of the Towing Oversteer Protection/Indication Systems (TOPIS). It is recognised that some manufacturers have chosen to stay closely involved in the qualification of the towbarless vehicles, their operation and the interface with the airframe; others have chosen to publish criteria and guidance enabling towbarless vehicle manufacturers to qualify their products. AMC 25.509 is revised to take into account that over the years different airframe manufacturers have adopted different (acceptable) approaches to towbarless towing. Nevertheless, the Agency does not agree that all responsibility for maintaining, publishing and updating acceptable towbarless vehicle and aircraft combinations lies with the towbarless vehicle manufacturers. Appendix H of CS-25, paragraph H25.3(a)(4), requires the airframe manufacturer to provide towing (including towbarless towing) instructions and limitations as part of the Instructions for Continued Airworthiness. The subject proposed text is amended to clarify this point. In addition, a statement should be present in the AFM Limitations Section, as specified in AMC 25.745(d). When the towing vehicle manufacturer has shown compliance to the SAE ARP's

	and the Towing Assessment Criteria Document, it releases a "Declaration Of Compliance" for the type and model of towbarless towing vehicle. The aeroplane manufacturer should then review and accept this declaration of compliance, and publish its acceptance of that towing vehicle in the appropriate aeroplane manufacturer maintenance documentation. When the towing vehicle type is published in the applicable aeroplane manufacturer documentation, this is considered by the Agency as the approval for the aeroplane operator to use that type of towbarless towing vehicle for its aeroplane. As for harmonisation with the FAA, the subject of towbarless towing has already been the subject of ARAC harmonisation discussions in the '90's, although it ended somewhat inconclusive. The Agency, however, believes the proposed text is acceptable to the FAA as well. In several places, "must" has been replaced by "should" in the proposed AMC 25.509.
comment	*68* comment by: *Boeing* **Page: 7 of 45** **Paragraph 15. Towbarless towing** **The proposed text states** *Consequently, if 'towbarless towing' devices are known to be used and/or have the approval of the manufacturer for ground manoeuvring of the aeroplane, some means must be provided within the design of the aeroplane that will give, at the very least, an equivalent level of protection to the steering system as that which is available from the more conventional tow bar towing arrangements.* **We suggest the following changes be made:** *Consequently, if 'towbarless towing' devices are known to be used ~~and/or have the approval of the manufacturer~~ for ground manoeuvring of the aeroplane, some means must be provided within the design of the aeroplane that will give, at the very least, an equivalent level of protection to the steering system as that which is available from the more conventional tow bar towing arrangements.* **<u>JUSTIFICATION</u>:** Towbarless towing devices are not approved by the aircraft manufacturer.
response	Not accepted. See response to comment No 67.

IV. Content of the draft decision - Steep approach and landing p. 8

comment	*45* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 16 Steep Approach and Landing, Proposed Appendix Q: 1. Section 25.1 Applicability. TCCA does not concur with permitting a screen height above 50 ft. CS 25.125(b)(2) requires that "A steady gliding approach, with a calibrated airspeed of not less than $1.3V_S$, must be maintained down to the 50 foot height". TCCA considers that an aircraft must be able to safely conduct an approach to landing using this

criteria for any glidepath.

2. Section 25.3 Steep Approach and Landing Distance. TCCA proposes an additional paragraph "(g) The measured landing distance data may be extrapolated to a maximum of 3000 feet above and 2000 feet below the test altitude without conducting additional verification tests.

3. Section 25.4 Climb: One-engine-inoperative. TCCA proposes an additional minimum control speed requirement in sub paragraph "(c) A climb speed of $V_{REF(SAL)}$ but not less than $1.1V_{MCL}$

4. Section 25.5 Safe operational and flight characteristics. TCCA proposes an additional demonstration condition (a)(4) "An approach path angle 1° steeper than the selected approach path angle, at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate" and associated condition that the flare must not be initiated above the screen height.

response	Not accepted. The Agency acknowledges the past attempts to harmonise the steep approach requirements, nevertheless, offers the standards applied to recent EASA certifications.

comment	*59* comment by: *Transport Canada Civil Aviation Standards Branch*

1. Section 25.1 Applicability and 25.2 Definitions. TCCA does not concur with permitting a screen height above 50 ft. CS 25.125(b)(2) requires that "A steady gliding approach, with a calibrated airspeed of not less than $1.3V_S$, must be maintained down to the 50 foot height". TCCA considers that an aircraft must be able to safely conduct an approach to landing using this criteria for any glidepath. Allowance of a screen height (and therefore, flare height) greater than 50 ft will result in an Increased probability of misjudging height:

- too high and loss of airspeed, possible stall warning, excessive pitch attitude,
- too low and heavy touchdown

2. Section 25.3 Steep Approach and Landing Distance. TCCA proposes an additional paragraph "(g) The measured landing distance data may be extrapolated to a maximum of 3000 feet above and 2000 feet below the test altitude without conducting additional verification tests. " At present there are insufficient data to show that the requirements can be met at substantially higher altitudes than those tested.

3. Section 25.4 Climb: One-engine-inoperative. TCCA proposes an additional minimum control speed requirement in sub paragraph (c) " A climb speed of VREF(SAL) but not less than 1.1VMCL". In a similar manner to the requirements for V2, there should be a safe margin between the climb speed with one engine inoperative and the minimum control speed.

4. Section 25.5 Safe operational and flight characteristics. TCCA proposes an additional demonstration condition (a)(4) "An approach path angle 1° steeper than the selected approach path angle, at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate" with the associated condition that "the flare must not be initiated above the screen height. " TCCA considers that it is essential to demonstrate the capability of arresting the rate of descent that might be obtained under typical operating conditions. Allowing the flare to be initiated above the screen height reduces the

	controllability demonstration requirement. An additional demonstration of a landing from an approach path angle 1° steeper than the selected approach path is considered to represent the effect of operational variables on the rate of descent at screen height.
response	Not accepted. The Agency acknowledges the past attempts to harmonise the steep approach requirements, nevertheless, offers the standards applied to recent EASA certifications.

IV. Content of the draft decision - Control surface awareness electronic/flight control systems p. 9

comment	*46* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 20 Control surface awareness electronic/flight control systems. Although this item is deferred, it appears to somewhat overlap the provisions of the last sub paragraph of proposed CS 25.143(k)
response	Accepted. The Agency recognises that there is an overlap between the proposed CS 25.143(k) and the ARAC Flight Controls Harmonization Working Group (FCHWG) proposal for a new paragraph CS 25.671(e). Moreover, the Agency's rulemaking task RMT.0049 (25.029) "Specific risk and standardised criteria for conducting aeroplane-level safety assessments of critical systems" is active and has in its Terms of Reference (dated 07 January 2011) the objective to amend CS/AMC 25.671 based on the FCHWG recommendations; this will include the FCHWG proposal for a new CS 25.671(e). The NPA is being drafted at the time of writing this CRD. Therefore, it is decided to withdraw the last paragraph of the proposed CS 25.143(k).

IV. Content of the draft decision - Stalling and scheduled operating speeds p. 11

comment	*47* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 23 Stalling and scheduled operating speeds. In addition to Airbus products, a number of other manufacturers have produced or are intending to produce aeroplanes with electronic flight control systems which provide high AOA protection. At present there are significant disagreements between authorities on the requirements for stalling and scheduled operating speeds, particularly with respect to the effects of icing. It is of the utmost importance to initiate and conclude harmonization activities on this subject.
response	Noted. The Agency concurs that there is a need for harmonisation.

IV. Content of the draft decision - Flight envelope protection p. 11

comment	*48* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 24 Flight envelope protection, Proposed CS 25 143(l). Although TCCA concurs with the intent, this requirement appears to be inconsistent or

	possible confusing with the provisions of CS 25.337(d).
response	Not accepted. The Agency believes that the proposed CS 25.143(l) requirement is compatible with CS 25.337(d) in that the latter recognises design features which may limit the manoeuvring load factor capability to below those specified in CS 25.337(b) & (c) and this proposal is intended to define the minimum standard of manoeuvre load factor capability which remains acceptable.

IV. Content of the draft decision - Reduced and derated take-off thrust p. 11-12

comment	*50* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 25 Reduced and derated take-off thrust, Proposed changes to AMC 25-13 Paragraph 5 a (4): (1)TCCA has concerns with respect to unlimited takeoff thrust reduction from the rated thrust due to ATTCS, derates and/or reduced thrust. Consequently TCCA proposes that the takeoff thrust setting should not be less than 60% of the rated takeoff thrust under any condition of ATTCS, derate and/or reduced thrust. . (2) Certification practice has been (or should have been) to require substantiation even at the 75% thrust level. As worded, it implies no additional substantiation is required for reduced thrust up to 75%. Hence the paragraph could be clarified by not mentioning the 75% level or ATTCS. In addition reference should be made to takeoff handling requirements as well as performance requirements as these may also be affected by changes in thrust pitching moment. Suggested text for consideration "Is lower than the takeoff thrust for the existing ambient conditions provided that compliance with the applicable performance and handling requirements is demonstrated as thoroughly as for an approved take-off rating". (3) Traditional practice has been to determine performance at a thrust setting (appropriate to altitude, bleed etc.) at a higher temperature than ambient temperature. As stated in the NPA, this results in conservatism when the associated takeoff reference speeds are used and because the actual thrust (at the ambient temperature) is higher than the thrust that would be obtained at the higher temperature. However it is conceivable with today's computational capabilities that performance could also be calculated using thrust (and operating speeds) for the assumed temperature thrust setting but at the actual ambient temperature. If this methodology was in fact used (and it does not appear to be prohibited), a significant amount of conservatism would be lost.
response	Accepted. Item 1: The Agency agrees with the proposal to limit the reduced thrust setting such that it should not be less than 60% of the full rated take-off thrust as this will harmonise with TCCA/FAA standards. However, this proposal remains applicable to reduced thrust operations not in combination with the use of derate. As for derated thrust, the current guidance is deemed sufficient. We revise AMC 25-13 sub-paragraph 5.a(4) to read: "(4) Is at least 60% of the maximum take-off thrust (no derate) for the existing ambient conditions, with no further reduction below 60% resulting from Automatic Take-off Thrust Control System (ATTCS) credit. Consequently, the amount of reduced thrust permitted is reduced when combined with the use of derated thrust so that the overall thrust reduction remains at least 60% of the maximum take-off thrust. For reduced thrust operations, compliance with the

applicable performance and handling requirements should be demonstrated as thoroughly as for an approved take-off rating."
Item 2: This comment has been accepted and addressed in the above revised proposal.
Item 3: The Agency accepts this comment, nevertheless, these proposals relate to the traditional assumed temperature method and do not encompass the suggested operations for which additional guidance may be required.

comment 51 comment by: *Transport Canada Civil Aviation Standards Branch*

Paragraph 25 Reduced and derated take-off thrust. TCCA has number of concerns about use of ATTCS, Derated Takeoff Thrust and Reduced Take-off Thrust that are not addressed in the proposed changes. These concerns are further explained in TCCA Flight Test Discussion Paper No. 34 (attached) and are repeated below:

1. The use of multiple derated thrust levels will inevitably lead to more and more take-off operations becoming take-off field length limited and remove the conservatism inherent in full take-off thrust operations. While the minimum requirements are still being met, this is a less safe operation than when there were only one or two derated thrust levels available. TCCA proposes that no more than 7 levels of derate should be permitted (resulting in 8 levels of take-off performance)
2. The potential use of multiple derated thrust levels, with or without the use of ATTCS, with or without reduced thrust, creates numerous performance options. Although this may lead to optimizing operational performance, the potential for crew errors in selecting the correct thrust configuration (in addition to the correct take-off configuration) will increase. Design precautions should be incorporated to reduce the possibility of crew error.
3. TCCA has significant concerns about the use of derated thrust on contaminated runways. With the availability of multiple derates, a takeoff thrust can be selected with little performance margin over the regulatory minimum. While this might be acceptable for dry and wet runway operations where there is no drag due to runway contamination displacement and impingement drag, the methodology for determining contamination drag is at best semi empiric. A small change in drag can result in a significant decrease in deceleration and increase in distance, especially with one engine inoperative. Presumably this is this same concern that leads to the prohibition of the use of Reduced thrust on contaminated runways in the FAA and EASA guidance material.

Because Derated thrust is considered a valid take-off thrust (with associated limitations and performance), V_{MCG} can be determined appropriate to this lower thrust. Under certain conditions, this allows a decrease in the minimum runway length required or an increase in take-off weight for a specific runway length, due to an associated reduction in minimum V_1. While this may be valid for a dry or wet runway, V_{MCG} is not determined on a contaminated runway. In particular, there is substantially reduced cornering friction produced on a low friction runway. Therefore V_{MCG} values used to determine minimum V_1 are probably not valid on a contaminated runway, particularly on a contaminated runway with an adverse crosswind.
To address the safety concern, TCCA has previously required that the AFM contain a Limitation prohibiting use of Derates on runways contaminated with standing water, slush or snow.
However, it is recognized that provided no performance increase is derived

	from the use of Derated thrust, the safety concerns are at least partially satisfied. As an alternative to an outright prohibition, the following AFM Limitation has been accepted "Derated thrust is not permitted on runways with standing water, slush or snow unless takeoff performance is adjusted using a method approved by the appropriate operating authority that addresses possible loss in conservatism and possible loss of controllability when operating on these runway surfaces". 4. For approval of derated thrust take-off, V_{MCG} and V_{MCA} should be verified for the derated thrust level. 5. For approval of reduced and derated thrust takeoff, the time delay between V_{EF} and V_1 should be verified
response	Noted. The Agency supports the intent of the above comments, however, they currently fall outside of the scope of this NPA and should await further harmonisation effort.

comment	*56* comment by: *GE Aviation* GE Aviation proposes that the AMC wording be changed from: e. A periodic take-off demonstration is conducted using the aeroplane's takeoff thrust setting without ARP ATTCS, if fitted, and the event is logged in the aeroplane's permanent records. An approved engine maintenance procedure or an approved engine condition monitoring programme may be used to extend the time interval between takeoff demonstrations. To e. A periodic take-off demonstration is conducted using the aeroplane's takeoff thrust setting without ARP ATTCS, if fitted, and the event is logged in the aeroplane's permanent records. **An approved engine maintenance procedure or an approved engine condition monitoring programme may be used to replace the programme of periodic takeoff demonstrations.** The rationale is that an appropriate condition monitoring program provides quantified margin between the engine's current condition and the published airworthiness limits. The engine health and thrust margin can be trended and accurate forecasts made to enable the engine to be removed before its performance becomes unacceptable (exceeds limits published in the instructions for continued airworthiness). This monitoring process is better controlled and gives more information than an individual demonstration to see whether the engine can / cannot make full takeoff thrust on that one occasion.
response	Not accepted. The Agency does not wish to provide a means which could be used to avoid the use of maximum take-off thrust as the norm and wishes to retain the current proposals.

IV. Content of the draft decision - Go-around performance p. 13

comment	*52* comment by: *Transport Canada Civil Aviation Standards Branch* Paragraph 26 Go-around performance, Proposed AMC 25.101(g) is very similar to TCCA guidance material.. EASA may also want to consider additional TCCA guidance "For each landing flap, associated steady VEF speed, 3 degree flight path and WAT, the horizontal and vertical distance from the point of sudden engine failure on a 3 deg approach to the point at which the approach climb configuration and speed is reached, should be determined. It is acceptable to

	provide the transition distances for the limiting WAT only.”
response	Noted. The Agency supports the intent of the above comments, however,, they currently fall outside of the scope of this NPA and should await further harmonisation effort.

V. Regulatory Impact Assessment p. 14-16

comment	*21* comment by: *FAA* Page 15, section 6.6 of Regulatory Impact Assessment Protection of Essential Systems and Equipment in Class E Cargo Compartments: In recent airplane programs, the FAA has included requirements for cockpit voice and flight data recorders. Therefore, we believe that the proposed change to CS-25 will result in a fully harmonized position with FAA practice.
response	Noted.

I. Draft Decision - SUBPART B — FLIGHT - CS 25.143 General p. 18

comment	*22* comment by: *FAA* Page 18; CS 25.143(k). The FAA recommends the following changes to the proposed standards: As currently written, the focus seems to be on demonstrating that turbulence does not produce any adverse pilot-in-the-loop control problems. The paragraph should be more focused on demonstrating precision control tasks (such as offset landings) can be performed without any pilot induced oscillation (PIO) tendencies both in and out of turbulent conditions. The FAA recommends incorporating the following wording currently used in FAA special conditions: "*It must be shown by flight tests that the use of side stick controllers does not produce unsuitable pilot-in-the-loop control characteristics when considering precision path control/tasks and turbulence.*" More specific requirements for flight control position annunciation (consistent with CS 25.1302 and § 25.1322) should be included. The proposed standard does not address the capability of the other pilot to contribute or override the controls. Dual pilot inputs should be addressed within these standards. The FAA recommends incorporating the following wording currently used in FAA special conditions: “*The electronic side stick controller coupling design must provide for corrective and/or overriding control inputs by either pilot with no unacceptable characteristics. Annunciation of controller status must not be confusing to the flightcrew*." Although these proposed standards for side stick controllers are based on standards that have been applied via certification review items and FAA special conditions on past programs, the FAA has found that these standards are not specific enough to ensure standardization in compliance across airplanes or for applicants or certification personnel to know when the standard has been met. The dependence on a finding of “suitability” for each provision does not provide a clear and unambiguous regulatory standard. The FAA would be interested in working together with EASA in a future rulemaking project to develop specific temporary and prolonged maximum force levels, as is done for non-side stick controllers in CS

25.143(j) and for the proposed loads requirements for side stick controllers in the proposed CS 25.397(d). We would also like to establish more specific minimum requirements for demonstration of pilot-in-the-loop control characteristics.

response Noted.
PIO evaluation: The FAA comment is noted. Whilst the Agency does not raise additional Special Conditions relating to PIO, it is a standard Agency's practice to require an applicant to assess PIO tendencies during the flight test campaign, not limited to side stick controllers. The Agency proposed text is intended to specifically require such an additional assessment in turbulence conditions for side stick controllers. Therefore, the intent of the FAA proposal is met with no additional burden to the applicant and the proposed text is unchanged.
Dual pilots input: Not accepted. This subject was not in the scope of the original CRI and may be discussed in a future dedicated rulemaking activity.
Rulemaking project to develop specific temporary and prolonged maximum force levels: Noted. The Agency agrees this is a subject to be investigated and treated through a rulemaking task.

comment *38* comment by: *Airbus*

Airbus recommends that the new CS 25.143(k) be complemented with the following AMC:

AMC 25.143(k)

Side stick controllers

CS 25.143(k) requires suitable annunciation to be provided to the flight crew when a flight condition exists in which near-full control authority (not pilot-commanded) is being used. Suitability of such a display must take into account that some pilot-demanded manoeuvres (e.g., rapid roll) are necessarily associated with intended full performance, which may saturate the surface. Therefore, simple alerting systems, which would function in both intended and unexpected control-limiting situations, must be properly balanced between needed crew-awareness and nuisance alerting. Nuisance alerting should be minimised. The term suitable indicates an appropriate balance between nuisance and necessary operation. Depending on the application, suitable annunciations may include cockpit control position, annunciator light, or surface position indicators. Furthermore, this requirement applies at limits of control authority, not necessarily at limits of any individual surface travel.

Justification:

The above AMC provides guidance material to set a "suitable" annunciation in case the control surfaces come close to their limits. This reflects what has been applied to Airbus programmes through CRIs.

response Not accepted.
The Agency has been aware that there is an overlap between the proposed CS 25.143(k) and the ARAC Flight Controls Harmonisation Working Group (FCHWG) proposal for a new paragraph CS 25.671(e).
Moreover, the Agency's rulemaking task RMT.0049 (25.029) "Specific risk and standardised criteria for conducting aeroplane-level safety assessments of critical systems" is active and has in its Terms Of Reference (dated 07 January

2011) the objective to amend CS/AMC 25.671 based on the FCHWG recommendations; this will include the FCHWG proposal for a new CS 25.671(e). The NPA is being drafted at the time of writing this CRD. Therefore, it is decided to withdraw the last paragraph of the proposed CS 25.143(k), and thus there is no more need for the AMC material proposed by Airbus.

comment *62* comment by: *Luftfahrt-Bundesamt*

No. 14.(1)c) and proposed new CS 25.143(k)

The last sentence of CS 25.143(k) „When a flight case exists where, without being commanded by the crew, control surfaces are coming so close to their limits that return to normal flight condition and/or continuing of safe flight needs a specific crew action, a suitable flight control position annunciation shall be provided to the crew, unless other existing indications are found adequate or sufficient to prompt that action." is not supported as it is not sufficiently clear. In particular:

- The term "flight case" is not defined and is not common to other CS paragraphs. It is not clear which cases are to be considered: normal operation in service, some or all certification flight test manoeuvres prescribed in CS-25 or any situation that may happen in flight in extraordinary conditions.
- The term "without being commanded by the crew" is not clear. Modern EFCS may involve one or several control surfaces to respond to any crew input on any single control. Thus, the crew is not necessarily commanding a single surface with a single input. Technically, even side stick controllers at neutral or released constitute a command by the crew. Therefore, the proposed requirement is not clear.
- It is not clear which control surfaces are to be addressed. Primary control surfaces or secondary control surfaces or both. There are aeroplane designs where an alert is triggered when any trim is commanded beyond a certain threshold, but for primary control surfaces such a feature is not common.
- The term "specific crew action" is not defined. It is not clear what "specific" relates to. A crew action can be anything from an instinctive action on primary or secondary flight controls to recover, a thrust or configuration change or a manipulation of the EFCS system control (if available) etc.
- The term "suitable flight control position annunciation" is not clear. Does it refer to the position of the control (e.g., stick, wheel, rudder pedal) or to the position of the flight control surfaces ?
- The means to provide the "flight control position annunciation" should be specified more clearly. Is an automatic display of that information required ? Should the information be presented in the primary field of view of the pilots? Is an alert consistent with the given alert and warning philosophy of the aeroplane sufficient ?

In summary of the above items, the safety objective and its intended applicability of this requirement are not clear. No associated AMC or IM was proposed. It seems impossible to imagine compliant design features. This requirement should be deleted from this NPA and referred back to a working group.

response Noted.

The Agency has been aware that there is an overlap between the proposed CS 25.143(k) and the ARAC Flight Controls Harmonisation Working Group (FCHWG) proposal for a new paragraph CS 25.671(e).

Moreover, the Agency's rulemaking task RMT.0049 (25.029) "Specific risk and standardised criteria for conducting aeroplane-level safety assessments of critical systems" is active and has in its Terms of Reference (dated 7 January 2011) the objective to amend CS/AMC 25.671 based on the FCHWG recommendations; this will include the FCHWG proposal for a new CS 25.671(e). The NPA is being drafted at the time of writing this CRD. Therefore, it is decided to withdraw the last paragraph of the proposed CS 25.143(k).

comment *69* comment by: *Boeing*

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Draft Decision
Subpart B - Flight
CS 25.143(k) - General

The proposed text states:
"25.143 ……
(k) …
When a flight case exists where, without being commanded by the crew, control surfaces are coming so close to their limits that return to normal flight condition and/or continuing of safe flight needs a specific crew action, a suitable flight control position annunciation shall be provided to the crew, unless other existing indications are found adequate or sufficient to prompt that action. "
The content of this paragraph was addressed by the (FAA/JAA) Flight Controls Harmonization Working Group (FCHWG) and is included in its recommendation for section 25.671. We maintain that it should not be included in section 25.143; instead, the FAA and EASA should incorporate the harmonized section 25.671 into the certification material.
JUSTIFICATION: We note the harmonized text agreed upon and recommended by the FCHWG was as follows:
Harmonized 25.671 Proposal Rule:
"(e) The system design must ensure that the flight crew is made suitably aware whenever the primary control means nears the limit of control authority."
Harmonized 25.671 Advisory Material:
"ENCLOSURE 2
11. EVALUATION OF CONTROL AUTHORITY AWARENESS – 25,671(e)
a. FAR/JAR 25.671(e) requires suitable annunciation to be provided to the flight crew when a flight condition exists in which near-full control authority (not pilot-commanded) is being used. Suitability of such a display must take into account that some pilot-demanded maneuvers (e.g., rapid roll) are necessarily associated with intended full performance, which may saturate the surface. Therefore, simple alerting systems, which would function in both intended and unexpected control-limiting situations, must be properly balanced between needed crew-awareness and nuisance alerting. Nuisance alerting should be minimized. The term suitable indicates an appropriate balance between nuisance and necessary operation.
b. Depending on the application, suitable annunciations may include cockpit control position, annunciator light, or surface position indicators. Furthermore, this requirement applies at limits of control authority, not necessarily at limits of any individual surface travel."

response Accepted.
The Agency recognises that there is an overlap between the proposed CS 25.143(k) and the ARAC Flight Controls Harmonisation Working Group (FCHWG) proposal for a new paragraph CS 25.671(e).
Moreover, the Agency's rulemaking task RMT.0049 (25.029) "Specific risk and standardised criteria for conducting aeroplane-level safety assessments of critical systems" is active and has in its Terms of Reference (dated 7 January

2011) the objective to amend CS/AMC 25.671 based on the FCHWG recommendations; this will include the FCHWG proposal for a new CS 25.671(e). The NPA is being drafted at the time of writing this CRD. Therefore, it is decided to withdraw the last paragraph of the proposed CS 25.143(k).

I. Draft Decision - SUBPART B — FLIGHT - CS 25.143 General p. 18

comment *23* comment by: *FAA*

Page 18; CS 25.143(l).

- The requirement should explicitly state the flight envelope to which it applies. We believe that the requirement should apply to the "*normal flight envelope*," (V_{MO}/M_{MO}).
- The text "in the absence of other limiting factors" should be clarified. We believe this is referring only to an aerodynamic limitation, so this phrase should be revised to say "*except as limited by reduced lift capability at high angle of attack*."
- The text "EFCS normal state" should be clarified. We suggest replacing "for the EFCS normal state" with "*with the EFCS functioning in its normal mode*."
- In a recent certification program, the FAA and EASA applied a special condition that included the requirements in the proposed paragraph CS 25.143(l). The special condition also included the text below. We believe this text should be added to the proposed paragraph CS 25.143(l).

  "Maximum reachable positive load factor wings level may be limited by flight control system characteristics or flight envelope protections (other than load factor protection) provided that 1) the required values are readily achievable in turns, and 2) wings level pitch up responsiveness is satisfactory."

  "Maximum achievable negative load factor may be limited by flight control system characteristics or flight envelope protections (other than load factor protection) provided that 1) pitch down responsiveness is satisfactory, and 2) from level flight, 0g is readily achievable or, alternatively, a satisfactory trajectory change is readily achievable at operational speeds."

response Partially accepted.

Comment proposing that the requirement should apply to the *normal flight envelope*, (V_{MO}/M_{MO}): Not accepted. Applicants for recent projects have extended the analysis to cover recovery initiated beyond V_{MO}/M_{MO}.

Comment on the text "in the absence of other limiting factors": Accepted

Comment on the text "EFCS normal state": Accepted

Comment on adoption of recent CRI additional text (flight system control characteristics): Accepted

comment *39* comment by: *Airbus*

Airbus recommends that the proposed CS 25.143(l) be modified and complemented as follows:

(l) Electronic flight control systems
For electronic flight control systems (EFCS) which embody a normal load factor limiting system and in the absence of aerodynamic limitation (lift capability at maximum angle of attack):
(1) The positive limiting load factor must not be less than:
(i) 2.5 g for the EFCS normal state with high lift devices retracted up to V_{MO}/M_{MO}. The positive limiting load factor may be gradually reduced down to 2.25 g above V_{MO}/M_{MO}.
(ii) 2.0 g for the EFCS normal state with the high lift devices extended.
(2) The negative limiting load factor must be equal to or more negative than:
(i) Minus 1.0 g for the EFCS normal state with high lift devices retracted;
(ii) 0 g for the EFCS normal state with high lift devices extended.

Maximum reachable positive load factor wings level may be limited by flight control system characteristics or flight envelope protections (other than load factor limitation), provided that:

- The required values are readily achievable in turn, and
- Wings level pitch up responsiveness is satisfactory.

Maximum reachable negative load factor may be limited by flight control system characteristics or flight envelope protections (other than load factor limitation), provided that:

- Pitch down responsiveness is satisfactory, and
- From level flight, 0 g is readily achievable, or at least a trajectory change of 5 degrees per second is readily achievable at operational speeds (from V_{LS} to Max speed - 10 kt. V_{LS} is the lowest speed that the crew may fly with auto thrust or auto pilot engaged. Max speed - 10 kt is intended to cover typical margin from V_{MO}/M_{MO} to cruise speeds and typical margin from V_{FE} to standard speed in high lift configurations.

Compliance demonstrations with the above requirements may be performed without ice accretion on the airframe.

Justification:

The above wording reflects the Special Conditions applied to latest Airbus programmes. It gives the possibility to limit, in a consistent way, the maximum reachable positive and negative load factors when limited by flight control system characteristics or flight envelope protections.

response Accepted.

comment *61* comment by: *Jean-Pierre Sarrato*

Attachment #1

Proposed CS 25.143 (l) is not fully in line with the latest standards (e.g. A350).
Experience has shown that it can be very difficult to comply literally with proposed 25.143 (l) 1) and 2), and that there is a need to specify
- which limiting factors are acceptable, and
- a minimum level of maneuvrability when such limiting factors are present
It is strongly suggested that proposed 25.143 (l) be amended to take into account the more advanced standard discussed in the frame of the latest projects (see A350 CRI B-06 at issue 2 attached).

response Accepted.

I. Draft Decision - SUBPART C — STRUCTURE - CS 25.335 Design airspeeds	p. 19-20

comment	*24* comment by: *FAA*
	Page 19; CS 25.335(b)(1). · The proposed amendment adds a dive speed requirement for airplanes equipped with a high speed protection system. To ensure that CS 25.335(b)(1)(ii) comprehensively addresses such airplanes, the FAA recommends incorporating the following wording currently used in FAA special conditions: *(C) The applicant must demonstrate that the speed margin, established under (A) and (B), will not be exceeded in inadvertent or gust induced upsets resulting in initiation of the dive from non-symmetric attitudes.* *(D) Any failure of the high speed protection system that would affect the design dive speed determination must be improbable.* *(E) Failures of the system must be annunciated to the pilots. Flight manual instructions must be provided that reduce the maximum operating speeds, V_{MO}/M_{MO}. The operating speed must be reduced to a value that maintains a speed margin between V_{MO}/M_{MO} and V_D/M_D that is consistent with showing compliance with CS 25.335(b)(1)(i) without the benefit of the high speed protection system.* · Clearly identify what high speed protection features must be present to qualify for the alternative design dive speed requirements. · A comma should be added in paragraph CS 25.335(b)(1)(ii)(A), as follows: "Twenty seconds after initiating the upset, manual recovery is made …."
response	Partially accepted. It is now recognised that the FAA position on this issue is different from the approach traditionally adopted by the Agency. The purpose of this NPA is to codify existing Generic CRI's, and, as such, the text proposed by the commentator is not adopted, but summarised (except for the need to consider unsymmetrical conditions) in the proposed AMC 25.335(b)(1)(ii) as an(other) acceptable means of compliance. Future harmonization activities may address this issue in more detail. A comma is added in CS 25.335(b)(1)(ii)(A). See also comment No 70

comment	*70* comment by: *Boeing*
	Page: 19 of 45 **Draft Decision** **Subpart C -- Structure** **CS 25.335 Design Airspeeds** While the intent of the NPA is to codify generic CRIs containing Special Conditions and/or guidance material for means of compliance, we suggest that the proposed design dive speed rule changes need further examination. Dive speed protection systems are not amenable to generic requirements as there are varying design approaches that need design specific requirements. The proposed rule changes seem focused on a particular approach, "hard" limiting, but do not adequately address other approaches. For example, the speed limit may be absolutely hard, with the system allowing no dive speed exceedance, regardless of control application, or the system may make over-

	speed very difficult through high deterrent control forces. As either approach is certifiable and quite different in design philosophy, a simple generic rule seems logically quite difficult. In addition, design of these systems requires a comprehensive multi-axis approach to upsets and the interaction of the flight control system. For example, demonstration requirements for section 25.253 may be affected by these systems. These considerations can be quite product-specific and not amenable to a generic approach. The proposed rule changes do not appear to consider these aspects. The NPA does not reflect the Boeing approach to these systems for both FAA and EASA certificated type designs and does not reflect the current certification practices for these systems. We therefore suggest that treatment of these systems continue to be covered by CRI, similar to the FAA Issue Paper approach, to allow for appropriate treatment of specific systems and varying design approaches. We are also concerned that the proposed rules introduce a regulatory bias in favor of a hard limiting system, and this approach diverges from the FAA treatment of these systems.. With regard to the specific proposed text, we find that the wording of paragraph 25.335(b)(1)(ii)(A) is not sufficiently general to cover the different design approaches to over-speed protection. The proposed wording directs that control application, up to full authority, is made to try and maintain a 7.5 degree flight path for 20 seconds. It is not clear how a control force deterrent system would comply with the proposed language, since the pilot action is limited by high deterrent forces, not by full control application. **JUSTIFICATION:** As indicated above, the NPA does not reflect the Boeing approach to these systems for both FAA and EASA certificated type designs and does not reflect the current certification practices for these systems. We therefore suggest that treatment of these systems continue to be covered by CRI to allow for appropriate treatment of specific systems and varying design approaches. We are also concerned that the proposed rule would introduce a regulatory bias in favor of a hard limiting system and this approach would not be harmonised with the FAA treatment of these systems.
response	Not accepted. The Agency does not believe the proposed text introduces a bias in favour of hard limiting systems. Also, the comprehensive multi-axis approach as mentioned by the commentator is not adopted by the Agency. It is also acknowledged that if the proposed wording is found to be inadequate for a particular protection system, there is a need for further discussion, and possibly a CRI will have to be raised.

comment	*74* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*
	Proposed CS 25.335(b)(1)(i) for aeroplanes not equipped with a high speed protection function requires that "the aeroplane is upset, flown for 20 seconds along a flight path 7·5º below the initial path". Proposed CS 25.335(b)(1)(ii)(A) for aeroplanes equipped with a high speed protection function requires that "Twenty seconds after initiating the upset manual recovery is made". In the first case it is required that the 20 seconds period starts after reaching a flight path 7·5º below the initial path, while on the other case it may be understood that the time starts counting from beginning of the maneuver and that the requirement that full authority is required only to maintain the maneuver (pitch angle) and not to initially achieve it. If this is not the intent, the text should be revised to prevent that slow maneuvers provide lower Vd for

	CS 25.335(b)(1)(ii)(A), by saying that "Twenty seconds after achieving the new flight path, manual recovery is made at a . . ."
response	Accepted.

I. Draft Decision - SUBPART C — STRUCTURE - CS 25.349 Rolling conditions p. 20-21

comment 6 comment by: *Airbus*

Reference to (a)(2) in subparagraphs (a)(5)(ii) and (a)(5)(iii) is not correct. Reference should be made to (a)(5)(i).

response Accepted.
This typographical error will be corrected.

comment 25 comment by: *FAA*

Page 20; CS 25.349(a).
The proposed amendment introduces additional requirements for airplanes equipped with electronic flight control systems (EFCS). For these airplanes, the roll maneuver is specified in terms of the cockpit control device, rather than aileron deflection, since the two might not be proportional. However, the FAA does not believe that separate requirements are necessary. We believe that the requirement should be revised as follows, which will cover both conventional airplanes and those equipped with EFCS without the need to add sub-paragraph (a)(5):
CS 25.349(a):
The following conditions, speeds, and ~~aileron deflections~~ *cockpit roll control motions* (except as the ~~deflections~~ *motions* may be limited by pilot effort) must be considered in combination with an airplane load factor of zero and of two-thirds of the positive maneuvering factor used in design. In determining the ~~required aileron deflections~~ *resulting control surface deflections*, the torsional flexibility of the wing must be considered in accordance with § 25.301(b):
1) (1) Conditions corresponding to steady rolling velocities must be investigated. In addition, conditions corresponding to maximum angular acceleration must be investigated for airplanes with engines or other weight concentrations outboard of the fuselage. For the angular acceleration conditions, zero rolling velocity may be assumed in the absence of a rational time history investigation of the maneuver.
2) (2) At V_A, a sudden ~~deflection of the aileron to the stop~~ *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) (3) At V_C, the ~~aileron deflection must be that required to produce~~ *cockpit roll control must be moved suddenly and maintained to achieve* a rate of roll not less than that obtained in sub-paragraph (a)(2) of this paragraph.
4) (4) At V_D, the ~~aileron deflection must be that required to produce~~ *cockpit roll control must be moved suddenly and maintained to achieve* a rate of roll not less than one third of that obtained in sub-paragraph (a)(2) of this paragraph.

response Not accepted.
Although the proposal from the commentator has a lot of merit, it is felt that it is beyond the scope of this NPA to change the design manoeuvre requirements for aircraft with conventional flight controls. For aeroplanes with electronic flight

controls, supplementary (compared to aircraft with conventional flight controls) requirements have been imposed, such as the consideration of a range of load factors and returning the cockpit roll control to neutral for V_A and V_C conditions. A merger of the text for both types of aircraft would impose more stringent requirements on aircraft with conventional flight controls. (Note: the text of the NPA is incorrectly only addressing the return to neutral condition for the V_A condition, not for the V_C condition. This will be corrected by adding the V_C condition in the final text.)

I. Draft Decision - SUBPART C — STRUCTURE - CS 25.351 Yaw manoeuvre conditions p. 21

comment	*5* comment by: *Airbus* **The proposed paragraph 25.351(e)** is new to Airbus and has not been in any of the Airbus Model Special Condition texts. It is unclear whether this text is replacing the usual SC text: "(e) It must be established that manoeuvre loads induced by the system itself (i.e. abrupt changes in orders made possible by electrical rather than mechanical combination of different inputs) are acceptably accounted for." The rationale behind this proposal, in particular the term "(with critical rate) to the maximum deflection", should be explained. Anyway Airbus considers that introduction of this requirement into CS-25 is premature, since a new task has recently been assigned to the ARAC Flight Controls Harmonization Working Group (U.S. Federal Register Vol. 76, No. 59, March 28, 2011, pages 17183-17185), in order to define use/misuse of rudder control and consider what standards (loads, manoeuvrability, etc.) can be developed to prevent unintended or inappropriate rudder usage. The result of this harmonization task should be considered before possibly amending CS 25.2351.
response	Partially accepted. The proposed new paragraph CS 25.351(e) was not directed by the activity conducted under the "rudder reversal" ARAC group. However, after considering the comments received on this proposal, it is accepted to withdraw it as the existing CS 25.351 provisions indeed fulfil the intent of the proposed CS 25.351(e). The content of proposed AMC 25.351(e) is, nevertheless, maintained under a new AMC 25.351 paragraph.

comment	*26* comment by: *FAA* Page 21; CS 25.351(e). EASA is proposing this new paragraph to clarify that, for airplanes equipped with electronic flight controls, "it must be assumed in subparagraph (a) of this paragraph that the cockpit rudder control is suddenly displaced (with critical rate) to the maximum deflection …." We see no reason to add this new paragraph. We believe that the objective (sudden displacement of the rudder control with critical rate to the maximum deflection) is already required by the existing CS 25 requirements. In addition, paragraphs (b), (c), and (d) are linked to paragraph (a). Paragraphs (b) and (c) specify maximum rudder deflection, but paragraph (d) specifies neutral rudder. Therefore, the proposed paragraph (e), which specifies maximum deflection of the rudder control, is in conflict with paragraph (d).

	The FAA recommends removing the proposed CS 25.351(e).
response	Accepted. The proposed paragraph CS 25.351(e) is withdrawn. The content of proposed AMC 25.351(e) is, nevertheless, maintained under a new AMC 25.351 paragraph.

comment	*80* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.* Part of the reason for FAA's Amendment 91 to 14 CFR 25.351, which is the basis for the existing requirements of CS 25.351, was to revise the requirement to base the loads case on rudder control input rather than surface deflection (regardless of the type of flight control system). To include a new CS 25.351(e) provides no benefit because electronic flight controls are already adequately addressed by paragraph (a), and this would introduce a lack of harmonization. In addition, the proposed paragraph (e) limits cockpit rudder control to control surface stops, while correctly stating before that "control surfaces does not bear a direct relationship to the motion of the cockpit control". There is no reason to prevent that the current CS 25.351 (a) (and 14 CFR 25.351(a)) limits apply to electronic control systems. Because the proposed change to CS 25.351 would introduce a regulatory difference with FAA without benefit, Embraer suggests that the proposed CS 25.351(e) be withdrawn.
response	Accepted. The proposed paragraph CS 25.351(e) is withdrawn. The content of proposed AMC 25.351(e) is, nevertheless, maintained under a new AMC 25.351 paragraph.

I. Draft Decision - SUBPART C — STRUCTURE - CS 25.397 Control system loads p. 21

comment	*27* comment by: *FAA* Page 21; CS 25.397(d). EASA is proposing this new subparagraph to define pilot forces for airplanes equipped with side stick controls. We agree with the criteria, but believe that clarification is needed in terms of how the rule should be applied. That is, either additional text in the rule or new advisory material should specify how the lower jam forces are applied and to which components.
response	Not accepted. The Agency believes the proposed text is sufficiently clear in terms of application of these forces.

I. Draft Decision - SUBPART D — DESIGN AND CONSTRUCTION - CS 25.745 Nose-wheel steering p. 22

comment	*37* comment by: *Airbus* CS 25.745(d)(2) would require:

	"(2) A flight crew alert is provided, before the start of taxiing, if damage may have occurred." Airbus wishes to highlight that this proposed requirement does not address the case where a "dead" aircraft (i.e. not powered) is towed, for instance from a gate to a maintenance area. In such a case, the on-board Oversteer Warning and indication System (OWS) is inactive, and a tractor OWS should be required to ensure safe operation. Airport regulations should include such a requirement.
response	Not accepted The proposed AMC 25.745(d) already provides a clear answer to this question. Paragraph (c) is copied below: "When protection is afforded by the flight crew alerting system, the damage detection means should be independent of the availability of aeroplane power supplies and should be active during ground manoeuvring operations effected by means independent of the aeroplane. If damage may have occurred, a latched signal should be provided to the flight crew alerting system."

I. Draft Decision - SUBPART D — DESIGN AND CONSTRUCTION - CS 25.785 Seats, berths, safety belts and harnesses p. 22

comment	*1* comment by: *Thomas Brinkmann, Bucher Leichtbau AG* <u>Comment:</u> Bucher Leichtbau AG supports the approach to implement an exemption for stetchers from specific paragraphs in the CS 25 regulations. However, we would like to propose a slightly different wording, since the term "Stretcher" should be mentioned in the headline of the paragraph. Furthermore under (b) the intro does not mention anything about the applicability of stretchers, but in the end (*However, stretchers* ....) stretchers are exempted from the previously applied requirements. That could lead to further confusions whether requirement CS 25.561 is still applicable or not, which is certainly the case without any doubt. Find in the following our proposal with the changes highlighted in yellow. <u>Proposal:</u> CS 25.785 Seats, stretchers, berths, safety belts and harnesses … (b) For each seat, stretcher, berth, safety belt, harness, and adjacent part the following apply: (1) Each seat, berth, safety belt, harness, and adjacent part of the aeroplane at each station designated as occupiable during takeoff and landing must be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertia forces specified in CS 25.561 and CS 25.562. (2) Stretchers intended only for the carriage of medical patients shall comply with CS 25.561, but need not to comply with the requirements of CS 25.562.
response	Partially accepted The Agency agrees to clarify that berths used for carriage of medical patients (including stretchers) do not need to comply with CS 25.562. However, we keep the sub-paragraph as simple as possible. The proposed paragraph is changed to:

"(b) Each seat, berth, safety belt, harness, and adjacent part of the aeroplane at each station designated as occupiable during take-off and landing must be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertia forces specified in CS 25.561 and CS 25.562. However, berths intended only for the carriage of medical patients (e.g. stretchers) do not need to comply with the requirements of CS 25.562."

comment *72* comment by: *Boeing*

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Draft Decision
Subpart D – Design and Construction
CS 25.810(a)(1)(iv) Emergency egress assist means and escape routes

The proposed text states:
"(iv) It must have the capability, in 46 km/hr (25-knot) winds directed from the most critical angle, simultaneously with any engine(s) running at ground idle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground."
Section IV, *Content of the draft decision*, provides useful background associated with this proposed change. Providing some additional clarification based on this background information to the proposed wording will clarify its intent. We suggest the following changes:
*"(iv) It must have the capability, in 46 km/hr (25-knot) winds directed from the most critical angle, ~~simultaneously with any engine(s) running at ground idle,~~ to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground. **If the erected assisting means is in the proximity to the intake of an engine(s), it must have the above capability simultaneously with the engine(s) running at ground idle.**"*

JUSTIFICATION: As noted in the NPA, the effect of the engine running at ground idle has only been considered for escape slides installed in proximity to an engine intake. Our suggested change is intended to clarify that this is how the new rule will be applied in the future.

response Not accepted.
The Agency does not see a benefit in the proposed rule change.

I. Draft Decision - SUBPART D — DESIGN AND CONSTRUCTION - CS 25.855 Cargo or baggage compartments p. 22-23

comment *14* comment by: *Airbus*

The effect of adding the proposed subparagraph (d) is to increment all subsequent subparagraphs by one letter.

This change in numbering is likely to introduce confusion in day-to-day activities of people working on several aircraft programmes with different certification bases, or working on a significant change under the Changed Product Rule.

It would be far easier to keep the current numbering of the existing

	subparagraphs and to add the new subparagraph at the end of CS 25.855: **CS 25.855 Cargo or baggage compartments** ... (k) Cockpit voice and flight data recorders, windows and systems or equipment within Class E cargo compartments shown to be essential for continued safe flight and landing according to CS 25.1309 must be adequately protected against fire. If protective covers are used they must meet the requirements of Appendix F, Part III.
response	Partially accepted. The Agency agrees that the proposed numbering changes could create burden for people dealing with certification bases or CPR. However, the Agency prefers to keep this specification before the existing sub-paragraph (d). Therefore, sub-paragraphs (c)(1) and (c)(2) are created.

comment	*28* comment by: *FAA* Page 22, CS 25.855 In the past 15 years that FAA has been addressing this issue, we have become concerned that adequate protection of systems and equipment outside but in the vicinity of the cargo compartment may not be adequately protected against the effects of fire within the cargo compartment. Main deck cargo compartment fires on freighter airplanes are contained through control of ventilation and by depressurizing the airplane to an altitude at which the reduced availability of oxygen limits the ability of the fire to be sustained at a level that threatens the airplane. Critical systems and equipment located in the *vicinity* of the main deck cargo compartment, as well as inside the cargo compartment, could be damaged by the fire (flame damage and/or heat damage) before the airplane can be depressurized adequately, and could also be damaged by residual heat after the fire has been suppressed via depressurization. On recent airplane programs FAA has added the phrase "or in the vicinity of, Class E cargo compartments" to our special conditions. FAA proposes the following change to amend CS 25.855(d): (d) Cockpit voice and flight data recorders, windows and systems or equipment within*, or in the vicinity of,* Class E cargo compartments shown to be essential for continued safe flight and landing according to CS 25.1309 must be adequately protected against fire. If protective covers are used they must meet the requirements of Appendix F, Part III.
response	Accepted. The proposed change clarifies the intent of the proposed rule.

comment	*73* comment by: *Boeing* **Page: 22 of 45** **Draft Decision** **Subpart D – Design and Construction** **CS 25.855 Cargo or baggage compartments** **EASA proposes to add a new paragraph (d), as below, and redesignate the remaining existing paragraphs:**

	"(d) Cockpit voice and flight data recorders, windows and systems or equipment within Class E cargo compartments shown to be essential for continued safe flight and landing according to CS 25.1309 must be adequately protected against fire. If protective covers are used they must meet the requirements of Appendix F, Part III." **Boeing suggests that the proposed text not be added as paragraph (d), but instead be added as new paragraph (k).** **JUSTIFICATION:** EASA's proposed text would fit best and more appropriately as a new paragraph (k). This change will avoid "renumbering" the remaining portion of the regulation [paragraphs (e) to (j)], thus keeping the paragraph designations consistent with the parallel FAA regulation. This will help to avoid confusion and additional "differences" between the EASA and FAA regulation.
response	Partially accepted. The Agency agrees that the proposed numbering changes could create burden for people dealing with certification bases or CPR. However, the Agency prefers to keep this specification before the existing sub-paragraph (d). Therefore, sub-paragraphs (c)(1) and (c)(2) are created.

I. Draft Decision - SUBPART E — POWERPLANT - CS 25.1193 Cowling and nacelle skin p. 24

comment	*15* comment by: *Airbus* We suggest the following wording: **CS 25.1193 Cowling and nacelle skin**... (e) Each aeroplane must –... (3) For cowlings and nacelle skins in areas subject to flame if a fire starts in an engine fire zone, (i) Have fire proof skin/cowlings in the complete concerned areas for in-flight operations; (ii) Have fireproof skin/cowlings for ground operations in the portions of the concerned areas where fire burning through the skin/cowlings can create additional hazards to the aircraft; and (iii) Have fire resistant skin/cowlings or skin/cowlings that comply with sub-paragraph (e)(1) of this paragraph for ground operations in the remaining portions of the concerned areas. (See AMC 25.1193(e)) Justification: The proposal is made to improve the clarity/legibility of the requirement which is in fact composed of several sub-requirements. It is considered that using additional bullets for enunciating the requirements to be met in details will improve the legibility/clarity of the paragraph.
response	Partially accepted. The Agency retains the proposal to arrange the rule in a bullet style. However, the wording is kept as close as possible to the original wording. The proposed rule is modified as follows : "(e) Each aeroplane must – … (3) Have cowlings and nacelle skins, in areas subject to flame if a fire starts in an engine fire zone, complying with the following: (i) For in-flight operations, cowlings and nacelle skins must be fireproof in the complete concerned areas and,

	(ii) For ground operations, cowlings and nacelle skins must be: (a) Fireproof in the portions of the concerned areas where a skin burn through would affect critical areas of the aeroplane, and (b) Fire-resistant or compliant with sub-paragraph (e)(1) of this paragraph in the remaining portions of the concerned areas. (see AMC 25.1193(e))"
comment	*29* comment by: *FAA* Page 24, CS 25.1193, and page 26 CS25J1193 The proposed rule text does not specify what is considered "in-flight." This is only provided as guidance in the advisory material. The FAA recommends EASA adopt the ARAC recommendation to include "minimum V1 to minimum touchdown speed" in the rule. The FAA recommends revising CS 25.1193(e)(3) on page 24 on the NPA and CS25J1193(e)(3) on page 27 per the ARAC recommendation: "For in-flight operations *from minimum V1 to minimum touchdown speed*, have fireproof skin in areas subject to flame if a fire starts in an engine fire zone; and, for ground operation, have fireproof skin protecting areas of the aeroplane critical during ground operation, and have skin that is either fire-resistant or complies with subparagraph (e)(1) of this paragraph in other areas."
response	Not accepted. The proposed rule already identifies the requirement severity dependence with flight and ground operation conditions. Clarification of the definition for flight and ground conditions is provided accordingly in the AMC.

I. Draft Decision - SUBPART F — EQUIPMENT - CS 25.1353 Electrical equipment and installations p. 25-26

comment	*4* comment by: *Airbus* **Paragraph 25.1353(c)(7)(ix)** sets a precedent as it is the first rule to specify the actual instructions that must be contained within the 25.1529 compliance material. To date, the only requirements that refer to 25.1529 are those that may generate Airworthiness Limitations (i.e. 25.571, 25.981 and 25.1309). For consistency, only rules that drive Limitations should include reference to 25.1529. Furthermore, if the maintenance instructions shall be considered as Limitations then reference to 25.1353 should be included in appendix H (however, this is not believed to be the case here). It has previously been accepted that the determination of all maintenance instructions that do not constitute Airworthiness Limitations shall be developed in accordance with Appendix H25.3. This typically is achieved by application of the MRB Process using MSG-3 logic. This would be the first Part 25 rule to require the TCH to override that process for an issue not related to Airworthiness Limitations. It is proposed that the text is reworded to highlight the need for the applicant to give due consideration to the need for scheduled maintenance. Secondly, the ICAs for the aircraft do not include instructions on how components shall be stored off-aircraft. The documentation that includes this information is typically not declared as an ICA. Thus, while the intention of the

	sentence is appropriate, the reference to ICA is not. A more generic statement is proposed. **Proposed text revision:** (ix) During development of the Instructions for Continued Airworthiness required by CS 25.1529, consideration must be given to the inclusion of maintenance instructions for measurements of battery capacity at appropriate intervals to ensure that batteries whose function is required for the safe operation of the aeroplane will perform their intended function as long as the batteries are installed in the aeroplane. Component storage instructions must also contain maintenance procedures for Li-Ion batteries 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 state of charge. **Justification:** The currently proposed wording introduces two issues that set a precedent with consequent potential for broader impact than is intended: 1. Overriding the MRB Process 2. Dictating that component storage instructions constitute ICAs
response	Noted. The Agency reviewed the comments received on this NPA and also considered the discussions presently occurring in the frame of standardisation bodies and recent industrial projects, including lithium batteries other than Li-Ion or Li-Polymer batteries. It has been concluded that the proposed amendment needs to be reviewed in the light of these developments; therefore, the CS 25.1353 amendment proposal is withdrawn. The Agency will make a new proposal once this item matures.

comment	*30* comment by: *FAA*
	Page 25, CS 25.1353(c)(7) The proposed requirements are limited to Lithium-Ion and Li-Ion Polymer battery installations. However, all Lithium batteries and battery systems that contain sensors, charger, protective circuits, etc., need to meet the same requirements. The means of compliance may differ for different Lithium chemistry. The FAA recommends that you revise the proposed requirements to cover all Lithium Batteries and/or Battery system installations for all Lithium Chemistries instead of just Li-Ion battery for only Li-Ion and Li-Ion Polymer battery installations. Page 25, CS 25.1353(c)(7)(ix) The FAA recommends that this proposed requirement not be limited to the batteries whose function is required for the safe operation of the airplane only. Many permanently installed Lithium battery and battery systems whose function is ***not required*** for the safe operation of the airplane pose the same safety concerns as those whose function is required for the safe operation of the airplane. The FAA recommends incorporating the following wording currently used in FAA special conditions: *The Instructions for Continued Airworthiness required by CS 25.1529 must contain maintenance requirements to assure that the lithium battery is sufficiently charged at appropriate intervals specified by the battery manufacturer to ensure that batteries whose function is required for safe operation of the airplane will not degrade below specified ampere-hour levels sufficient to power the equipment that are required for continued safe flight and landing. The Instructions for Continued Airworthiness must also contain procedures for the maintenance of lithium batteries in spares storage to prevent the replacement of*

	batteries whose function is required for safe operation of the airplane with batteries that have experienced degraded charge retention ability or other damage due to prolonged storage at a low state of charge. Replacement batteries must be of the same manufacturer and part number as approved by the FAA. Precautions should be included in the Instructions for Continued Airworthiness maintenance instructions to prevent mishandling of the lithium battery which could result in short-circuit or other unintentional damage that could result in personal injury or property damage. ***Note 1:*** *The term, "sufficiently charged'' means that the battery will retain enough of a charge, expressed in ampere-hours, to ensure that the battery cells will not be damaged. A battery cell may be damaged by lowering the charge below a point where there is a reduction in the ability to charge and retain a full charge. This reduction would be greater than the reduction that may result from normal operational degradation.* ***Note 2:*** *These special conditions are not intended to replace CS 25.1353(b) in the certification basis of the aircraft model being certified. These special conditions apply only to permanently installed rechargeable lithium batteries and lithium battery systems. The requirements of CS 25.1353(b) remain in effect for batteries and battery installations of the airplane model that do not use lithium batteries.*
response	Noted. The Agency reviewed the comments received on this NPA and also considered the discussions presently occurring in the frame of standardisation bodies and recent industrial projects, including lithium batteries other than Li-Ion or Li-Polymer batteries. It has been concluded that the proposed amendment needs to be reviewed in the light of these developments; therefore, the CS 25.1353 amendment proposal is withdrawn. The Agency will make a new proposal once this item matures.

comment	*55* comment by: *Garmin International*
	In regard to the proposed amendment to CS 25.1353(c) for the addition of a new subparagraph (7) addressing lithium-ion battery installations, Garmin views the requirement as excessive and should consider battery design, function, and aircraft installation details with specific regard to a warning/indication. Proposed CS 25.1353(c)(7)(vii) requires battery installations to have a system to automatically control the charging rate of the battery to prevent battery overheating or overcharging and also requires an additional warning system. This warning system can be one that senses an over-temperature condition or one that detects a battery failure. In both cases, the warning system must automatically disconnect the battery and would be interpreted by installers to require an indication to the crew. It is the 'AND' requirement of subparagraph (c)(7)(vii) for an additional warning system that Garmin considers potentially excessive specifically concerning the need for indication. The proposed requirement in (c)(7)(vii) gives no consideration for intended use or what functions are supported by the battery. Nor does the proposed requirement provide any alleviation in the event that installation/design aspects determine there is no need for a direct warning or indication to the crew. For main ship battery installations, it would be a reasonable expectation that the aircraft should have a warning or indication to alert the crew to an over-temperature or battery failure condition. However, it also would be reasonable

to assume the system safety process performed to satisfy the system safety objectives and requirements of CS 25.1309 would have driven a requirement to assess the need for an indication and ensure the indication is effective in limiting the effects of a failure even without the requirement levied in the proposed CS 25.1353(c)(7)(vii).

Other parts of the proposed rule use the phrase "whose function is required for safe operation"; Garmin considers this to be an important phrase and emphasizes the separate criteria recognized by EASA in addressing the criticality of the battery's intended function.

Some batteries are utilized for non-required or non-essential functions whose failure would not result in a hazard to the aircraft or occupants without a battery failure indication. This must be shown using the system safety process in complying with CS 25.1309 that includes common cause analysis and associated physical/functional isolation from required systems.

As part of RTCA/DO-311 test requirements associated with Lithium batteries, short circuit, overcharging (thermal runaway), explosion containment, and various other tests help determine the robustness of the battery design in containing flames, smoke, fumes, electrolytic fluid, and debris so as to not present a hazard to surrounding structure or systems. Additionally, the installer further considers location of the battery with respect to flammable fluid zones, and critical or essential wiring and systems when satisfying CS 25.1309.

As CS 25.1309(c) requires warning information be provided to alert the crew to unsafe operating conditions, it is anticipated that this requirement drives the need for an appropriate indication. But the way CS 25.1353(c)(7)(vii) reads currently, one would assume EASA has made the determination that all Lithium batteries will present an unsafe condition if they do not incorporate a charging rate system as well as a temperature or failure sensing system and a warning/indication to the crew.

It is in this regard, that Garmin considers EASA may be dictating design aspects not absolutely necessary for all batteries and battery installations and additional consideration is necessary to allow battery manufacturers and installers to determine need for warnings or indications.

Consequently, Garmin believes that EASA should consider modification of the proposed requirement and/or a clarifying statement allowing battery manufacturers and installers the ability to utilize the system safety process to determine the need for warnings and indications to the crew.

As such, Garmin proposes the following modification to CS 25.1353(c)(7)(vii) with additional clarification added to AMC 25.1353 as reflected below:

(vii) Battery installations must have a system to control the charging rate of the battery automatically so as to prevent battery overheating or overcharging with at least one of the following additional characteristics:

(A) A battery temperature sensing system with a means for automatically disconnecting the battery from its charging source in the event of an over-temperature condition, or

(B) A battery failure sensing system with a means for automatically disconnecting the battery from its charging source in the event of battery failure.

(See AMC 25.1353 (c)(7)(vii))

Proposed clarification for addition to AMC 25.1353:

CS 25.1353(c)(7)(vii) requires battery installations to have a separate system to:

Detect an over-temperature condition and to automatically disconnect the battery from its charging source, or

- *Detect a battery failure and to automatically disconnect the battery from its charging source.*

	In complying with CS 25.1309 for each installation, the installer must also evaluate the need for a separate indication to ensure the over-temperature or failure condition does not result in an unsafe operating condition. The evaluation for the need for indication must also evaluate the ability of the crew to take appropriate corrective action in a timely manner to prevent an unsafe condition.
response	Noted. The Agency reviewed the comments received on this NPA and also considered the discussions presently occurring in the frame of standardisation bodies and recent industrial projects, including lithium batteries other than Li-Ion or Li-Polymer batteries. It has been concluded that the proposed amendment needs to be reviewed in the light of these developments; therefore, the CS 25.1353 amendment proposal is withdrawn. The Agency will make a new proposal once this item becomes mature.

comment	*85* comment by: *AWComplianceGroup* CS 25.1353(c) Cessna requests clarification on why the specific chemistry is included in this rule. With a few edits and additions, this rule could provide reasonable minimum requirements for all battery types with the clear understanding that guidance or means of compliance CRIs may be required for new, unique requirements specific to a type. Rule making direction in the past has been to focus on performance based rules that are not specific to a design or technology; this rule making does not seem consistent with that direction.
response	Noted. The Agency reviewed the comments received on this NPA and also considered the discussions presently occurring in the frame of standardisation bodies and recent industrial projects, including lithium batteries other than Li-Ion or Li-Polymer batteries. It has been concluded that the proposed amendment needs to be reviewed in the light of these developments; therefore, the CS 25.1353 amendment proposal is withdrawn. The Agency will make a new proposal once this item becomes mature.

comment	*86* comment by: *AWComplianceGroup* CS 25.1353(c)(7)(ix) Use of the term "battery capacity" while generally understood would, in some domains, refer strictly to the potential energy storage quantity of the battery in question. Cessna suggests the use of the term "battery health" which would provide a more generally understood intent.
response	Noted. The Agency reviewed the comments received on this NPA and also considered the discussions presently occurring in the frame of standardisation bodies and recent industrial projects, including lithium batteries other than Li-Ion or Li-Polymer batteries. It has been concluded that the proposed amendment needs to be reviewed in the light of these developments; therefore, the CS 25.1353 amendment proposal is withdrawn. The Agency will make a new proposal once this item becomes mature.

I. Draft Decision - SUBPART J — APU INSTALLATIONS - CS 25J1193 APU compartment p. 27

comment	16	comment by: Airbus

We suggest the following wording:

CS 25J1193 APU compartment
...
(e) Each aeroplane must –
...
(3) For APU compartment skins in areas subject to flame if a fire starts in an engine fire zone,
(i) Have fire proof skin in the complete concerned areas for in-flight operations;
(ii) Have fireproof skin for ground operations in the portions of the concerned areas where fire burning through the skin can create additional hazards to the aircraft; and
(iii) Have fire resistant skin or a skin that complies with sub-paragraph (e)(1) of this paragraph for ground operations in the remaining portions of the concerned areas.
(See AMC 25.1193(e))

Justification:

The proposal is made to improve the clarity/legibility of the requirement consistently with the proposal made for CS 25.1193(e).

response

Partially accepted.
The Agency retains the proposal to arrange the rule in a bullet style. However, the wording is kept as close as possible to the original wording.
The proposed rule is modified as follows :
"(e) Each aeroplane must –
…
(3) Have APU compartment external skins, in areas subject to flame if a fire starts in an APU fire zone, complying with the following:
(i) For in-flight operations, APU compartment external skins must be fireproof in the complete concerned areas, and
(ii) For ground operations, APU compartment external skins must be :
(a) Fireproof in the portions of the concerned areas where a skin burn through would affect critical areas of the aeroplane, and
(b) Fire-resistant or compliant with sub-paragraph (e)(1) of this paragraph in the remaining portions of the concerned areas.
(see AMC 25.1193(e))".

I. Draft Decision - APPENDICES - Appendix Q	p. 28-32

comment	31	comment by: FAA

Page 29, (SAL) 25.3
An inconsistency exists between the proposed steep approach airworthiness requirements and the operating requirements. EU OPS 1.515(a) specifies a landing distance beginning at a height of 50 feet above the threshold. EU OPS 1.515(a)(3) conditionally allows the use of landing distance data based on a screen height of less than 50 feet, but there is no provision in the operating rules for a landing distance based on a screen height higher than 50 feet. Either remove the allowance for establishing a steep approach landing distance

	based on a screen height higher than 50 feet or amend the operating rules to allow it to be used. Page 30, SAL 25.5(a) Add criterion that the engines must remain above flight idle power or thrust when stabilized on the approach path for all three conditions specified in this paragraph. This criterion is used by the FAA to ensure adequate capability for a go-around or for down flight path adjustments. Page 30, SAL 25.5(a)(2) For condition (2), flare can be initiated at up to 150% of the screen height. Allowing the flare to be initiated higher than the screen height is done for flight test safety reasons. Add a criterion stating that if the flare is initiated above the screen height, it should be shown by analysis that there is sufficient pitch control to arrest the descent rate at this 2 degrees steeper approach path angle with flare initiated at the screen height, consistent with the criteria of paragraphs (ii) and (v). Page 30, SAL 25.5(a) The numbering of paragraphs shown is confusing. We recommend that you: • Designate the paragraph beginning with "For conditions (1), (2) and (3)" as paragraph (b). • Designate the paragraph beginning with "For conditions (1) and (3)" as paragraph (c). • Designate the paragraph beginning with "For conditions (2)" as paragraph (d). • Redesignate the remaining paragraphs accordingly.
response	Partially accepted. <u>Comment on (SAL) 25.3:</u> Noted. The Agency's Opinion on draft Commission Regulation on 'Air Operations - OPS' (see "Opinion No 04/2011 of the European Aviation Safety Agency of 1 June 2011 for a Commission Regulation establishing Implementing Rules for Air Operations" available on the Agency Website) provides the following provision for Landing distance calculation (see Annex IV – Part CAT, Subpart C — Aircraft performance and operating limitations, Section 1 Aeroplanes): "CAT.POL.A.230 Landing — dry runways (a) The landing mass of the aeroplane determined in accordance with CAT.POL.A.105 (a) for the estimated time of landing at the destination aerodrome and at any alternate aerodrome shall allow a full stop landing from 50 ft above the threshold: (1) for turbo-jet powered aeroplanes, within 60 % of the landing distance available (LDA); and (2) for turbo-propeller powered aeroplanes, within 70 % of the LDA. (b) For steep approach operations, the operator shall use the landing distance data factored in accordance with (a), based on a screen height of less than 60 ft, but not less than 35 ft, and shall comply with CAT.POL.A.245." Therefore, the proposed operational rule addresses the FAA comment through the provision of screen heights up to 60 ft. <u>Comment on SAL 25.5(a):</u> Not accepted. The Agency acknowledges the FAA proposal which is part of the proposed draft AC 25-7C. However, a past harmonisation effort failed and the Agency maintains the proposed CRI standard. The principle of this rulemaking task is to propose CRIs that are agreed with the industry; adding substantial new requirements would be out of the Terms of Reference of this rulemaking task. <u>Comment on SAL 25.5(a)(2):</u> Not accepted. The Agency acknowledges the FAA proposal which is part of the proposed draft AC 25-7C. However, a past

	harmonization effort failed and the Agency maintains the proposed CRI standard. The principle of this rulemaking task is to propose CRIs that are agreed with the industry; adding substantial new requirements would be out of the Terms of Reference of this rulemaking task. Comment on SAL 25.5(a): Paragraphs numbering: Accepted.

comment	*40* comment by: *Airbus* In paragraph (SAL) 25.2 Definitions, the reference to CS 25.143(g) for manoeuvring capability is wrong. The correct reference is CS 25.143(h).
response	Accepted.

I. Draft Decision - BOOK 2 AMC — SUBPART B - AMC 25.101(g) Go-around p. 33

comment	*32* comment by: *FAA* Page 33, AMC25.101(g) Safe go-around capability should be shown from any point in an approach prior to touchdown. Consideration should be given to including rejected landings, up to a defined point where a rejected landing is no longer possible (e.g., initiation of reverse thrust). A go-around may be initiated for many reasons after passing the decision height, including loss of visual reference, other vehicles on the runway, unexpected environmental conditions, aircraft related failures, etc. Rejected landings, i.e., a go-around after touchdown should also be safe using the manufacturer-recommended go-around procedures. The FAA recommends that EASA replace "from the decision height" with either *"from any point in the approach prior to touchdown"* or *"from any point in the approach and landing until a defined point is reached where a rejected landing is no longer recommended (e.g., at initiation of reverse thrust)."*
response	Not accepted. The Agency acknowledges the FAA proposal. The principle of this rulemaking task is to propose CRIs that are agreed with the industry; adding substantial new requirements would be out of the Terms of Reference of this rulemaking task.

comment	*63* comment by: *Luftfahrt-Bundesamt* Proposed new AMC 25.101(g): The detailed procedure includes the item "the landing gear selection to the 'up' position being made after a steady positive rate of climb is achieved." Usually, the landing gear is selected up upon a positive rate of climb, not necessarily a steady positive rate of climb. The addition of the word "steady" would imply that the gear up selection shall be made only once the climb rate has been reached and settled at a constant value after the transition into the climb phase. To delay the gear retraction compared to other situations (e.g. after take-off) would introduce some inconsistency in crew workflow and does not seem to make sense. It is proposed to delete the word "steady".
response	Not accepted. The proposed wording for gear retraction has been confirmed and deemed clear

enough in most recent CRIs. It does not mean that the rate of climb must stay constant (i.e. maintain a fixed value). It just means that the rate of climb has to be and remain positive.

I. Draft Decision - BOOK 2 AMC — SUBPART C - AMC 25.331(c)(2) Checked manoeuvre between VA and VD p. 34

comment

33 comment by: *FAA*

Page 34; AMC 25.331(c)(2).

The proposed new AMC includes the following: "The circular frequency of the movement of the cockpit control 'ω' shall be varied to establish the effect of the input period and amplitude on the resulting aeroplane loads."
The proposed AMC text conflicts with the rule, CS 25.331(c)(2). That is, the rule defines 'ω', but the AMC would require variation of the value of 'ω' to establish the effect on loads. If the AMC text is intended as a requirement, it should be put in CS 25.331(c)(2). Also, the AMC requires that applicants vary the 'ω' parameter to determine the effect on loads, but does not explicitly require that the most critical loads be applied. The AMC (or rule) should specify what the applicant is supposed to do once they determine the effect on loads.

response

Partially accepted.
The proposed AMC attempts to provide further guidance on the words "with active control system effects included, where appropriate" in CS 25.331(c)(2)(i), so it does not conflict with the rule. It is acknowledged that the wording of the proposed AMC needs further clarification, and this is included in the final proposal.

comment

71 comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.*

The proposed AMC for CS 25.331(c)(2) would require the applicant to determine the effect of the variation of the frequency of the pitch control input on aircraft loads. The existing CS 25.331(c)(2) specifies that the undamped natural frequency of the short period rigid mode (with some additional limitations on the input to be used) be used as the pitch control input to calculate loads, so the proposed AMC is requiring significantly more than the regulation. In addition to that fact that it is an undesirable regulatory practice for AMCs to require more than the regulation, the added work to generate these additional loads cases is considerable. Embraer does not see the technical justification to require this additional effort, and if EASA believes that is it necessary, then CS 25.331(c)(2) should be revised to specify the requirement for the control input survey (variation).

response

Not accepted.
See response to comment No 33.

I. Draft Decision - BOOK 2 AMC — SUBPART C - AMC 25.335(b)(1)(ii) Design Dive Speed — High speed protection function p. 34

comment

7 comment by: *Airbus*

Reference to CS 25.335(b)(2) is not correct. It should be CS 25.335(b)(1)(ii).

response	Accepted. The proposed AMC 25.335(b)(1)(ii) is amended accordingly.

comment	*54* comment by: *FAA* Page 34, ***AMC 25.335(b)(1)(ii)*** • In AMC 25.335(b)(1)(ii), it appears that the reference to CS 25.335(b)(2) is in error. It should be CS 25.335(b)(1)(ii). • AMC 25.335(b)(1)(ii) states that CS 25.335(b)(2) remains applicable for any failure condition. However, the rule does not specify such a failure requirement. Without such a requirement in the rule, the AMC appears to have no regulatory basis. On the other hand, CS 25.302 does specify that failure conditions must be evaluated and how they are to be evaluated. • The FAA does not believe there is any need for the establishment of a function-off structural design dive speed associated with loss of the high speed protection function for the determination of aeroelastic stability margins (§ 25.629). This is due to the fact that § 25.629 (b)(2) covers the failure case envelope, and is meant to address both cases: where there is a system that enables a reduced margin between Vc/Mc and Vd/Md, and where there is not. The FAA believes § 25.629 adequately covers the failure case since § 25.629(b)(2) ensures an adequate margin between Vc/Mc and the fail-safe aeroelastic stability clearance boundary by setting the clearance speed to the greater of, Vd / Md, or 1.15Vc / Mc+0.05. The provision for "... or 1.15Vc / Mc+0.05." was done specifically in FAA Amendment 25-77 to § 25.629 to cover the case where a high speed limiting/protection system is used to reduce the margin between Vc / Mc and Vd / Md, thus reducing the aeroelastic stability clearance margin for failure cases. (Please see the Preamble to Amendment 25-77 and NPRM 89-24 for the discussion of the allowance for high speed protection systems in setting the fail-safe clearance speeds. FAA AC 25.629-1A also acknowledges this in the "Background" section of the document.) This is also the reason why CS 25.302 does not apply either for the failure of high speed protection systems and compliance with § 25.629. The FAA also does not believe that a function-off structural design dive speed should be used for the determination of loads related to VD/MD. Our comments on the proposed changes to CS 25.335(b)(1) are intended to ensure that only one design dive speed is necessary
response	Partially accepted. The Agency does not agree that CS 25.629(b)(2) adequately addresses the failure conditions of high speed protection functions. As stated in CS 25.629(b)(3), failure conditions of certain systems must be treated in accordance with CS 25.302 and Appendix K, and this is the approach the Agency has traditionally taken for high speed protection functions. See also comment No 24. The proposed AMC 25.335(b)(1)(ii) will be amended to correct the reference (see comment No 7).

comment	*65* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.* Redefinition of design values (like Vd, Vs, Va) after failures may add much work

	without significant safety improvement. The following comments apply to high speed protection function inoperative: In order to be aligned with CS 25, K.25.2(c)(2)(i), there should be no need to compute loads above the Vc for continuation of flight. The remaining concern to aeroelastic stability could be addressed by the current CS 25.629(b)(2)(ii), which requires clearance up to 1.15*Vc after failures. The high speed protection function failure may increase the overspeed above Vc as others failures would do along recovery (e.g.: airbrake or elevator inoperative). Thus, there would be no need to change the approach. However, to be harmonised with FAA related recent Special Conditions, it could be required that: "Any failure of the high speed protection system that would result in an airspeed exceeding those determined [...] must be less than 10-5 per flight hour." And: "Failures of the system must be annunciated to the pilots. Flight manual instructions must be provided that reduce the maximum operating speeds, VMO/MMO. The operating speed must be reduced to a value that maintains a speed margin between VMO/MMO and VD/MD that is consistent with showing compliance with § 25.335(b) without the benefit of the high speed protection system." In order to be aligned with CS25, K.25.2(c)(2)(i), there should be no need to compute loads above the limited operating speed mentioned above. In summary, Embraer believes the proposed CS 25 regulations, together with the failure probability and annunciation requirements previously imposed as special conditions on high speed protection systems/functions are adequate, and the proposed revision to the AMC will induce a lack of harmonization with no attendant benefit in safety. Embraer suggests that the new AMC be to the failure probability and annunciation requirements.
response	Partially accepted. See comment No 24.

comment	*75* comment by: *Boeing* **Page: 34 of 45** **AMC – Subpart C** **AMC 25.335(b)(1)(ii) Design Dive Speed — High speed protection function** **The proposed text states:** *"… It implies that a specific value, which may be different from the VD/MD value in normal configuration, has to be associated with this failure condition for the definition of loads related to VD/MD as well as for the justification to CS 25.629. However, the strength and speed margin required will depend on the probability of this failure condition, according to the criteria of CS 25.302."* **We suggest the text be revised as follows:** *" … It implies that a specific value, which may be different from the VD/MD value in normal configuration, has to be associated with this failure condition for the definition of loads related to VD/MD ~~as well as for the justification to CS 25.629~~. However, the strength ~~and speed~~ margin required will depend on the probability of this failure condition, according to the criteria of CS 25.302."* **<u>JUSTIFICATION</u>:** The reference to CS 25.629 should be removed, as dive speed system failures are covered in current regulation through CS 25.629(b)(2)(ii).

response	Not accepted. See comment No 54.

I. Draft Decision - BOOK 2 AMC — SUBPART C - AMC 25.349(a) Rolling conditions p. 34-35

comment	*66* comment by: *Embraer - Indústria Brasileira de Aeronáutica - S.A.* The proposed AMC would require two separate conditions to be considered; one with the rudder held fixed and another with rudder input to minimize sideslip. Rudder input by the pilot is independent of whether the airplane has electronic flight control system, so it is not obvious why this AMC should be applicable only to those airplanes. In addition, this AMC imposes additional requirements outside that required by the regulation. If EASA believes that two rudder input cases should be considered, that requirement should be implemented in the regulation, not as AMC material.
response	Partially accepted. For aeroplanes with electronic flight controls it is felt that design manoeuvres require more attention and investigation, to make sure the resulting loads are of a reasonable magnitude so that the necessary level of safety is ensured. This is why for these aeroplanes two separate conditions are specified. It is acknowledged that these two conditions should be part of CS 25.349(a)(5), and they have been added to this subparagraph in the final text. Upon further review of the proposed AMC 25.349(a), it seems that most of the proposed text is now redundant with the proposed CS 25.349(a)(5). Therefore, most of the proposed text of AMC 25.349(a) has been withdrawn, and only the last paragraph has been maintained.

I. Draft Decision - BOOK 2 AMC — SUBPART C - AMC 25.509 Towbarless towing p. 35-36

comment	*8* comment by: *Airbus* Clarification is needed on the interpretation of this AMC: With this AMC now in place, if the design of the NLG is such that there is no physical "Tow point" on the nose landing gear (so 100% towbarless operations), it could be concluded that it is no longer mandatory to design the Auxiliary gear to a static load level of 0.15 Wt. Instead, the limit static loads due to towbarless towing are determined by the AMC investigation. Can EASA confirm this interpretation?
response	Noted. CS 25.509 provides a comprehensive set of load cases, for both main and auxiliary gear. In general, these load cases (with Ftow based on design ramp weight) provide a robust design and an acceptable level of safety related to towing operations. Today, the auxiliary gear is designed for these loads, and an investigation is conducted to ensure the towbarless towing loads remain within the structural capability of the gear. To base the set of load conditions of CS 25.509 entirely on Ftow as defined by towbarless towing operations, whilst at the same time maintaining the current level of safety, would require a more thorough investigation of the loads occurring during such operation than is normally conducted. In addition, more safeguards may be needed to prevent overload conditions (similar to shear pins used on regular towbars.)

comment	*9* comment by: *Airbus* **Paragraph (b):** In order to clarify the scope of the static loads, a note should be added that the limit static loads should not include loads resulting from an aircraft braking action
response	Not accepted. The Agency believes that this point is sufficiently clarified in paragraph (d) of the proposed AMC 25.509.

comment	*10* comment by: *Airbus* **Paragraph (b)(3):** Dispatch towing should be performed up to MTOW. **Justification:** Dispatch towing replaces typical taxiing operations prior to take off. Therefore, as the required investigation in line with AMC25.491 is limited to weights up to MTOW, these same weight criteria should be used for dispatch towing.
response	Not accepted. The definition of dispatch towing in the proposed AMC 25.509 is taken from several SAE papers on the subject of towbarless towing, and should, therefore, not be changed. Also, the Agency does not believe that the proposed AMC 25.509 replaces AMC 25.491 in the case of dispatch towing. Both AMC's have to be considered.

comment	*11* comment by: *Airbus* **Paragraph (b)(3):** ARP 5983 does not exist. We assume that ARP 5283 is the intended reference.
response	Accepted. This typographical error is corrected.

comment	*12* comment by: *Airbus* **Paragraph (c):** CS 25.509 is a static limit load requirement. Why to introduce here a fatigue requirement for towbarless towing while no equivalent specific CS-25 requirement exists for towbar towing? Reference to fatigue should be deleted. **Justification:** CS 25.571(a)(1)i and AMC 25.571(a),(b),(e) paragraph 1.2 perfectly address this topic, and there is no need to duplicate this information in AMC 25.509.
response	Not accepted. The Agency recognises the fact that CS 25.509 is a static load requirement, and

that AMC 25.571 also (briefly) mentions towing. It is felt, however, that it would be best to address the structural considerations related to towbarless towing in a comprehensive way in one AMC.

comment

13 comment by: *Airbus*

Paragraph (d):

It is stated that "appropriate steps to preclude aircraft braking during normal towbarless towing should be taken".
"Appropriate steps" implies much more than today's explicit warning that is incorporated in documentation.
We recommend that this sentence be changed as follows:
"For these reasons, appropriate information to preclude aircraft braking during normal towbarless towing should be provided in the applicable documentation."
Justification:
Bring the AMC in line with current practice.

response

Partially accepted.
The subject text is modified accordingly, albeit slightly different than proposed by the commentator.

comment

76 comment by: *Boeing*

Page: 35 of 45
AMC – Subpart C
AMC 25.509(a) Towbarless towing - *General*

The proposed text states:
"(a) General. Towbarless towing vehicles are generally considered as ground equipment and are as such not subject to direct approval by the (aircraft) certifying agencies. However, these vehicles should be qualified in accordance with the applicable SAE ARP documents and the static and dynamic (including fatigue) loads resulting from these qualification tests should be shared with the aircraft manufacturer to ensure that the nose landing gear and supporting structure is not being overloaded during towbarless towing operations with these vehicles."

We suggest revising the text as follows:
*"(a) General. Towbarless towing vehicles are generally considered as ground equipment and are as such not subject to direct approval by the (aircraft) certifying agencies. However, these vehicles should be qualified in accordance with the applicable SAE ARP documents **or aircraft manufacturer documents** ~~and the static and dynamic (including fatigue) loads resulting from these qualification tests should be shared with the aircraft manufacturer to ensure that the nose landing gear and supporting structure is not being overloaded during towbarless towing operations with these vehicles~~."*
JUSTIFICATION:
Re the deleted text: The aircraft manufacturer has no authority to ensure towbarless vehicles are qualified in accordance to the SAE documents. Likewise, the aircraft manufacturer has no authority to ensure loads from tow vehicle qualification tests are provided to the aircraft manufacturer to verify overloading does not occur. As written, the proposed AMC would require the aircraft manufacturer to be involved in the qualification testing and review of data for each towbarless towing vehicle. The Boeing approach has been to

	publish aircraft load limitations in the towbarless towing vehicle assessment document to allow the towbarless tow vehicle manufacturers to demonstrate their vehicles will not overload the aircraft. **Re the added text:** This added wording would clarify that it is acceptable for the aircraft manufacturer to publish aircraft load limitations in a towbarless towing vehicle assessment document to allow the towbarless tow vehicle manufacturers to demonstrate their vehicles will not overload the aircraft.
response	Partially accepted See comment No 67.

comment	*77* comment by: *Boeing* Page: 35 of 45 AMC – Subpart C AMC 25.509(b) Towbarless towing – *Limit static load cases* We suggest deleting the entire text in this proposed paragraph, and replacing it with the following**:** *"(b) Limit static load cases.* ***<u>The aircraft manufacturer may publish aircraft load limitations in a towbarless towing vehicle assessment document, to allow towbarless tow vehicle manufacturers to demonstrate their vehicles will not overload the aircraft</u>.****"* **<u>JUSTIFICATION</u>:** Rational analysis would require dynamic loads modeling including the interaction of the aircraft with the towbarless vehicle's braking system. The details of the towbarless vehicle's braking system and its behavior under various operational conditions would be unknown to the aircraft manufacturer. Each towbarless vehicle may require a loads evaluation and a separate aircraft certification activity as new or revised tow vehicles are used. Again, the Boeing approach has been to publish aircraft load limitations in the towbarless towing vehicle assessment document to allow the towbarless tow vehicle manufacturers to demonstrate that their vehicles will not overload the aircraft.
response	Partially accepted See comment No 67.

comment	*78* comment by: *Boeing* **Page: 36 of 45** **AMC – Subpart C** **AMC 25.509(c) Towbarless towing – *Fatigue evaluation*** We suggest deleting the entire text of proposed paragraph (c) "Fatigue evaluation," and replacing with: ***"<u>To be added later</u>."*** **<u>JUSTIFICATION</u>:** There is no definitive industry data for the frequency of occurrences for dispatch towing using towbarless vehicles.
response	Not accepted. A fatigue evaluation must be conducted as part of the investigations necessary to allow towbarless towing operations on a particular aircraft model, and if insufficient data are available, these will have to be collected during operational trials.

comment	79 comment by: *Boeing* **Page: 36 of 45** **AMC – Subpart C** **AMC 25.509(d) Towbarless towing -- *Other considerations*** We suggest deleting the entire text of paragraph (d), "Other considerations," and replacing it with: ***"To be added later."*** **JUSTIFICATION:** Aircraft braking during towbarless towing operations is a controversial issue. Boeing's position is that aircraft braking while being operated by a towbarless vehicle, even in emergency situations, may not only be harmful to the aircraft, but also to the towbarless vehicle and its operators. However, it is also recognized that aircraft braking may help avoid, or cause less damage, during some emergency situations. Therefore it is Boeing's opinion that the tow vehicle manufacturer, the aircraft operator, the tow vehicle operator, and the airport authorities are in a better position to determine appropriate procedures for using or not using aircraft braking during towbarless towing.
response	Partially accepted. The proposed text of AMC 25.509 has been clarified to recognise that aircraft braking may occur in emergency situations, although this is expected to be an obvious situation, and the necessary steps should be taken to subsequently inspect the aircraft including landing gear(s).

I. Draft Decision - BOOK 2 - AMC — SUBPART D - AMC 25.745(d) Nose-wheel steering p. 37-38

comment	53 comment by: *Transport Canada Civil Aviation Standards Branch* Page 37, Towbarless towing, AMC 25.745(d)(b)(4): The steering system is protected by shear sections installed on the nose landing gear. This proposal is not acceptable if it results in weakening the primary landing gear elements which must cater for all the load conditions of CS25.471 through 25.511.
response	Noted. The compliance with CS 25.745(d) does not lift the requirement of complying with structural loads specifications provided in CS 25.471 through CS 25.511.

comment	81 comment by: *Boeing* **Page: 37 of 45** **AMC – Subpart D** **AMC 25.745(d) Nose-wheel steering** **Proposed paragraph (d)(2) states:** *"(2) The Aeroplane Flight Manual, in the Section Limitations, should include a statement that:* *'Towbarless towing is prohibited, unless the towbarless towing operations are performed in compliance with the appropriate operational regulation using*

	towbarless towing vehicles that are designed and operated to preclude damage to the aeroplane nose wheel steering system, or which provide a reliable and unmistakable warning when damage to the steering system has occurred." **Please clarify the meaning of the words "the appropriate operational regulation" as used in the proposed text (highlighted above).** **JUSTIFICATION:** It is not clear what is meant by "appropriate operational regulation" in paragraph (d)(2). Clarification will ensure better comprehension and compliance.
response	Accepted. The applicable operational regulation depends on where and how the aeroplane is operated. In the EU, the current applicable regulation for commercial air transportation is Commission Regulation (EC) No 859/2008 of 20 August 2008 amending Council Regulation (EEC) No 3922/91 as regards common technical requirements and administrative procedures applicable to commercial transportation by aeroplane.

comment	82 comment by: *Boeing* **Page: 37 of 45** **AMC – Subpart D** **AMC 25.745(d)(3) Nose-wheel steering** **The proposed text in paragraph (d)(3) states:** *"(3) The acceptance by the aeroplane manufacturer of the applicable towbarless towing vehicles and its reliability of the oversteer protection and/or indication system as referred to in subparagraph (b) above should be based on the following: …"* **We suggest revising the text as follows:** *"(3) The ~~acceptance by the aeroplane manufacturer of the applicable towbarless towing vehicles~~ **Declaration of Compliance issued by the towbarless towing vehicle manufacturer** and its reliability of the oversteer protection and/or indication system as referred to in subparagraph (b) above should be based on the following: …"* **JUSTIFICATION:** It should be clarified that airplane manufacturers do not "accept" towbarless tow vehicles; rather, we receive a Declaration of Compliance from the vehicle manufacturers and publish a list of vehicles for which the vehicle manufacturers claim to meet this proposed regulation.
response	Not accepted. See response to comment No 67.

I. Draft Decision - BOOK 2 - AMC — SUBPART E - AMC 25.1193(e) Engine cowling, nacelle and APU compartment skin p. 39-42

comment	2 comment by: *BAE Systems Regional Aircraft* This AMC is intended to be published to coincide with the revised version of the 25.1193(e)(3) regulation now under discussion in this NPA. However, section (d) of the proposed AMC is actually referring to the wording of the rule which existed before the revision. Whilst the statements it makes are currently true (as of June 2011), they will not be true when this AMC is formally published and will therefore make no sense to future readers. This section of the AMC

	should be reworded to make it clear that it is discussing the previous wording of the rule (i.e. the version that existed before the NPA 2011-09 changes were applied). The text in section (e)(3)(ii)(A) of the AMC discusses angular "areas of concern" for fire burn-through (e.g. +/- 45 degrees). The datum plane for these relative angles is not defined. A simple diagram illustrating these angles relative to the engine installation would help to explain the meaning of the text. Otherwise confusion and mis-interpretation will ensue.
response	Accepted. Sub-paragraph (d) "Background" is reworked as follows: "CS 25.1193(e) and CS 25J1193(e) previously required the engine cowlings/nacelle skins and APU compartment external skins to be fireproof if a fire starts in the engine power or accessory sections or in the APU compartment. During past Type certification projects it has been found that having non-fireproof engine cowlings/nacelle skins in some locations under some operating conditions do not adversely affect safety. Consequently, in practice, not all cowlings/skins 'subject to flame if a fire starts in the engine power or accessory sections' have been required to be fireproof under all operating conditions and for instance some portions were approved as fire-resistant only for ground operating conditions.[…]" The definition of relative angles is improved with the introduction of a schematic.

comment	*17* comment by: *Airbus* We suggest the following text for paragraph (d) BACKGROUND: **(d) BACKGROUND** CS 25.1193(e) *and CS 25J1193(e) previously required the engine nacelle cowlings/skin and APU compartment skin* to be fire proof if a fire starts in the engine power or accessory sections or in the APU compartment. During past type-certification projects it has been found that having non-fireproof skins in some locations under some operating conditions does not adversely affect safety. Consequently, in practice, not all cowlings/skins 'subject to flame if a fire starts in the engine power or accessory sections' have been required to be fireproof under all operating conditions *and for instance some portions were approved as fire resistant only for ground operating conditions*. As it represented... *(last 3 sentences unchanged)* Justification: The proposal is made to improve the clarity and consistency of the background section which in fact refers to the previous CS25.1193(e)/CS25J1193(e) requirement, not the one proposed with this NPA which introduces the relaxation to the fireproof standard.
response	Accepted.

comment	*18* comment by: *Airbus* Attachment #2 We suggest the following text for paragraph (e) FIRE WITHSTANDING REQUIREMENTS, OPERATING CONDITIONS, AND POTENTIAL HAZARDS: **(e) FIRE WITHSTANDING REQUIREMENTS, OPERATING CONDITIONS,**

AND POTENTIAL HAZARDS

(1) General
The required level of ability to withstand the effects of fire varies with the potential hazard level associated with different flight and ground operating conditions, as follows:

(2) Flight Conditions
For the purpose of CS 25.1193(e) and CS 25J1193(e), Flight Conditions are defined as aircraft operations from minimum V1 speed until minimum touchdown speed. The complete cowlings, nacelle skin and APU compartment skin areas subject to flame if a fire starts in an engine or APU fire zone shall be demonstrated to be fireproof in these conditions.
For this demonstration:

- Credit from the external airflow on the skin/cowling can be considered;
- The engine/APU should be considered to be operative for the first five minutes, with the remaining ten minutes under windmilling conditions for the engine and stopped conditions for the APU;
- Historically a low external flow velocity representative of an aircraft final approach configuration has been used. Consistently the engine power was considered to be idle power. If a combination of higher engine power and higher airflow velocity is found to be more critical in terms of fire withstanding capability, it should be used for the demonstration. For the APU, airflow velocity and APU power conditions should be assessed in the same way as for the main engine.

(3) Ground Conditions
For the purpose of CS 25.1193(e) and CS 25J1193(e), Ground Conditions are defined as aircraft operations with a static or taxiing aircraft. For these conditions, the fire withstanding capability demonstration to be carried out for the cowlings, nacelle and APU compartment skin areas subject to flame if a fire starts in an engine or APU fire zone depends on the risk of creating further hazards to the aircraft if the fire burns through the cowling/skin as detailed hereafter.

(i) *Cowlings/skins areas where fireproof fire withstanding capability is required* -- The portions of engine/nacelle and APU compartment cowlings/skins located such that not containing the effects of the fire could result in further hazards to the aircraft should be demonstrated to be fireproof in ground conditions. Hazards to be considered include, but are not limited to events such as fuel tank explosions, damages to critical elements outside the fire zone or fuselage penetrations.
(A) Pod-mounted engines: For these engines a design is considered acceptable when the fireproof portion of the cowling/skin protects the pylon and other aircraft areas where further hazards can be created if they are exposed to flame. A 90° fireproof portion centred on the pylon centre line would typically be considered acceptable (see illustration below for under-wing mounted engine). More unique installation configurations may require a greater fireproof portion or an asymmetrical fireproof portion relative to the pylon centre line.

[INSERT ATTACHED FIGURE HERE]

(B) Turboprops and APUs and other non-pod mounted engines: Due to the wide variations in installation configurations each installation should be evaluated to determine if not containing the effects of a fire would cause a serious hazard such as the examples above. If so, the affected area of the fire zone skin should be fireproof.

For the fireproof demonstration in these ground conditions:

- No credit from external airflow on the skin/cowling should be considered in conjunction with the assumption that the aircraft may be static;
- The engine/APU should be considered to be operative for the first five minutes and stopped for the remaining ten minutes. For the APU, credit may be taken from automated shutdown function that would rapidly cut-off the APU in case of fire on the ground. If such function is implemented, the APU may be considered to be operative for a shorter time;
- The engine should be considered to be operated at ground idle power for the first five minutes of the demonstration. For the APU, the most critical APU power operating condition (in terms of effects in the cowling/skin fire withstanding capability) shoud be considered for the first five minutes of the demonstration (or for the time necessary for the automatic APU shutdown to activate).

(ii) *Cowlings/skins where fireproof fire withstanding capability is not required* -- For the remaining portions of the engine nacelle /APU compartment skin, it should be demonstrated that not containing the effects of the fire would not result in further hazards to the aircraft. This can be achieved by:

(A) Either demonstating that the concerned portions are fire resistant. This capability is considered to allow sufficient time to stop the aircraft if necessary and to evacuate it;

(B) Or demonstrating that the concerned portions are such that:

- The ability of the cowling/skin to withstand fire is at least equivalent to the capability of a 1mm (0.040 inch) thick aluminium sheet with no loads/vibrations nor back side cooling;
- It is substantiated that the lower fire withstanding capability will not lead to hazardous effects such as:
  - Upon burn through of the lower than 'fire-resistant' area, both the fire-resistant and/or fire-proof areas shall not have their fire withstanding capability affected.
  - Liberation of parts that would affect the evacuation procedure or reduce the efficiency of fire protection means.
  - Reduction in flammable fluid drainage capability such that fire severity would be increased (magnitude, residual presence, propagation to surrounding area).
  - Reduction in evacuation capability due to proximity to escape routes or due to the visibility of the fire hindering the ability of the passengers to evacuate the aeroplane in a rapid and orderly manner.

Note: There is some hazard involving passenger evacuation even in the absence of burn through due to such concerns as smoke and flaming liquids exiting from openings. Burn through of nacelle skin should not significantly increase these hazards.

  - Reduction in fire detection capability such that the flight crew would not be aware of the fire, especially in a situation involving taxiing prior to take-off.
  - ~~Reduction in fire extinguishing capability which could cause or aggravate one of the potential hazards listed above.~~

<u>Justification for the above proposed changes:</u>

The proposed modified text has been written with the following objectives:

- Clarify/highlight the conditions to be considered for the fire withstanding demonstration, in particular in terms of credit from the external airflow on the concerned skins. This was one of the key elements of the CRI

	applied on the previous type certification projects and in the JAA NPA 25E-266. • Clearly defined flight and ground conditions since they are now used in the rule. • Simplify the considerations to be taken into account for the definition of the 'critical' skin areas, again in line with the historical CRI and the NPA 25E-266. In particular these materials did not, to Airbus knowledge, include any considerations about coupling distance from the nacelle to the wing, airflow characteristics, fluid migration scheme, fire plume patterns. As mentioned in the proposed EASA text the CRI were nevertheless successfully used in the past. Therefore Airbus considers that the incorporation of these criteria is not necessary in the AMC text especially since they are incorporated without any indications about acceptable values/thresholds (or at least range of acceptable values). Airbus considers that the assessment of these characteristics is a very complex task which may, in the absence of agreed acceptable values/thresholds, lead to subjective conclusions. • Ensure that both Engine nacelle and APU skin are consistently mentioned throughout the text. • Delete the consideration about fire extinguishing in the very last sub-paragraph. Capability to extinguish the fire is not pertinent to this discussion. It shall be assumed that there is a fire that can burn though a portion if the cowlings/skins and it shall be demonstrated that there is no further hazards to the aircraft due to this burnthrough. It should be demonstrated independently of any extinguishing capability.
response	Partially accepted. Comment1 – part (e)(2) Partial agreement – The wording of proposed AMC has been amended with specific wording taking credit of external airflow. The Agency's AMC wording for the critical conditions is kept general since these conditions are intended to cover all possible situations and it is expected that the applicant substantiates them. A similar wording layout, as proposed, is used. Comment 2 – part (e)(3) Partial agreement – Ground definition is further detailed into the AMC in consideration of the comment. The proposed definition does not exhaustively cover the expected ground situations and, therefore, is not retained. Similar wording layout, as proposed, is used. Comment 3 – part(e)(3) – Engine/APU operation conditions are moved to the compliance sub-paragraph. Comment 4 – part (e)(3) – Pod mounted Engine – Partial agreement – the proposed AMC wording is detailed so that it allows to capture as many as possible of the various geometry configurations that could be encountered (i.e +/- 90°). The proposed wording is deemed too restrictive and, therefore, not retained. In addition, the proposed wording skips the analysis needed from the applicant to justify the compliance with the rule intent of the proposed fireproof portion. The Agency has clearly identified the similarity approach (comparison to previously certified configurations) and associated in-service experience. Agreement for the introduction of schematics and wording is also introduced to define the angular reference. Comment 4 – part (e)(3)- Other non-pod mounted engines - Partially accepted – Comments for the acceptable demonstration conditions are introduced into the AMC in a separate paragraph. No credit for external airflow is highlighted. Credit for the APU automatic shut-down was neither considered in the ARAC report nor in the CRI, therefore, it is not introduced as the general wording already states that engine/APU conditions have to be justified by the applicant. Comment 5 – part (e)(3) – Other nacelle areas – A generic wording for the

worst aircraft and engine/APU ground conditions is introduced to condition the reference to the minimum aluminium thickness.
Comment 6 – Not agreed - The proposed alternative is put at the same level as that of the "fire resistance" criteria. The latter warrantee a fire extinguishing agent efficiency over the first 5 min by maintaining the integrity of the volume/flow lines, therefore, the agent concentration/distribution in case the system is triggered. The alternative, that considers cowlings/nacelle skins burn through, shall offer the same level of capability.

comment

20 comment by: *Airbus*

Proposal:

In AMC 25.1193(f) SPECIFIC CONFIGURATION CONSIDERATIONS, add a sub-paragraph (5):

(5) Seals: Where seals are used as part of the external engine nacelle or APU compartment boundary, they should at least have the same ability to withstand the effect of fire as the surrounding skin.

Justification:

As for the latches, hinges, fittings, it seems valuable to explicitly state that the considerations of the updated CS 25.1193(e) also apply to seals when they are part of the external boundary of the engine/APU fire zone.

response

Accepted.

comment

34 comment by: *FAA*

Page 39; AMC 25.1193(e)
In general, the FAA wants to emphasize that the APU compartment needs to be maintained as fireproof and this policy only applies to the external skin. Any burnthough of the APU external skin should consider hazards associated with combustion products and possible outgassing and re-ingestion of toxic air into cabin air system.
Page 40; AMC 25.1193(e)(3)(ii)
The FAA suggests that EASA add "damage to flight control surfaces" to the last sentence:
"Serious hazards include, but are not limited to, events such as fuel tank explosion, hazardous spread of fire to flammable fluid sources outside the fire zone, *damage to flight control surfaces* or fuselage penetration."
Page 40; AMC 25.1193(e)(3)(ii)(B)
The FAA suggests that EASA include propfans since EASA has tasked a rulemaking project on this subject and addressing the fireproof-ness for this unique installation now may eliminate the need for a future revision: "Turboprops, *Propfans* and APUs and other non-pod-mounted engines"
Page 40; AMC 25.1193(e)(3)(iii)(B)
The FAA agrees that under specific conditions, it may be acceptable to have areas that are not at least "fire resistant" however, these conditions rarely occur and should be scrutinized for each design to assure these areas cannot pose any hazard to the airplane, its occupants, or ground personnel. The FAA recommends revising the paragraph to add emphasis that the conditions listed will be considered with careful and thorough attention.
Page 42; AMC 25.1193(f)(4)

	The FAA does not agree that hinges, fittings and latches only need to be as fire resistant as the surrounding skin. Burning through the skin may not pose a hazard to the airplane, whereas a fire that burns away the hinges, latches, etc. and releases the cowl panels could create a hazard such as damage to the wing or tail. In addition, if this is a pusher propfan design, the loss of the cowl could allow the cowl to be released into the blades, causing an uncontained failure of the blades. We suggest EASA revise the wording to require that the fire resistance of the fitting means should be a conditional finding that is determined based upon test and/or analysis.
response	Partially accepted. Comment 1: Accepted – The 25J1193 rule text is clarified to designate "APU compartment external skin". The toxicity aspect is considered for the burn through (item identified in AMC sub-paragraph (e)(3)(ii)). Comment2: Accepted Comment3: Not Accepted – When Propfan/Open Rotor definition, rules and associated interpretative materials are mature, the Agency may consider revision on existing proposed rule and interpretative material if identified during Propfan/Open Rotor rulemaking activities as affecting CS 25.1193/CS 25J1193. Comment4: Accepted – The Agency view is identical. Lower than "fire resistant" may be considered under specific conditions and after a thorough and detailed investigation. Comment5 – Accepted – The wording for latches/hinges has been modified accordingly to emphasise that the listed conditions will be carefully evaluated.

comment	*57* comment by: *GE Aviation* GE Aviation requests clarification of the issue regarding visibility of the fire hindering the ability of the passengers to evacuate in an orderly manner. Would smoke or visible flame issuing from a designed undercowl ventilation exit be considered to hinder the passengers ability to evacuate? Is there an expectation that the passengers should not be able to see flames?
response	Noted. In general, openings in a volume serving as fire containment are of relatively small dimensions and are subject to requirements intending to minimize hazards due to flammable vapours, flames, flammable fluids, fluid ingestion (e.g. CS 25.1191, CS 25.1187,…). It is recognised that flame and/or smoke could become visible since not explicitly banned by the existing rules. Nevertheless, the existing requirements on openings/drains in fire containment areas are also recognised to offer a certain level of mitigation with regard to the visual aspect. In some instances, designs such as flame arrestor, mitigating the flame propagation, are also minimising the flame external visibility. Not intended openings resulting from burn through may significantly affect the basic mitigation level and, therefore, shall be considered. Intense flames and heavy smoke in the direct path of evacuation may become unacceptable.

I. Draft Decision - BOOK 2 - AMC — SUBPART F - AMC 25.1447(c)(3) Equipment standards for oxygen dispensing units p. 43

comment	*83* comment by: *Boeing* **Page: 43 of 45** **AMC -- Subpart F** **AMC 25.1447(c)(3)**

	We suggest revising the proposed text as follows: *"AMC 25.1447(c)(3)* *Equipment standards for oxygen dispensing units* *If oxygen outlets are not provided in a dedicated area, called here remote area, the applicant shall demonstrate that oxygen dispensing outlets are within 'five feet/five seconds' reach of the remote area(s) and shall show that no visual obstruction exists between the potential oxygen users and the outlets, such as curtains or partitions* ***unless another method of indication (e.g., a light) is provided in the remote area****."* **JUSTIFICATION:** Our suggested revision allows for oxygen within the 5-feet/5-seconds that may be in a curtained-off area, by allowing an indication light. This is consistent with past approvals.
response	Accepted. The AMC has been updated.

I. Draft Decision - BOOK 2 - AMC — AMC — GENERAL ACCEPTABLE MEANS OF COMPLIANCE — AMC p. 45

comment	*35* comment by: *FAA* Page 45; AMC 25-13 The FAA recommends revising AMC 25-13 to include an assessment during failure effects. One example is an engine control commanding full fuel flow on one engine during the reduced-thrust take-off that could create an asymmetric thrust condition more severe than an engine failure at V1. This is important for evaluating engines that use the same controller for a wide range of similar "family plan" engines.
response	Not accepted. The Agency prefers to maintain the analysis of loss of thrust control failure conditions under CS 25.1309 safety analysis. The purpose of AMC 25-13 is not specifically to encompass consideration of failure conditions which are addressed through the application of CS 25.1309.

Appendix A - RESULTING TEXT

BOOK 1

SUBPART B — FLIGHT

Create a new CS 25.143(k) as follows:

CS 25.143 General

…

(k) Side stick controllers

In lieu of the maximum control forces provided in CS 25.143(d) for pitch and roll, and in lieu of specific pitch force requirements of CS 25.145(b) and CS 25.175(d), it must be shown that the temporary and maximum prolonged force levels for side stick controllers are suitable for all expected operating conditions and configurations, whether normal or non-normal.

It must be shown by flight tests that turbulence does not produce unsuitable pilot-in-the-loop control problems when considering precision path control/tasks.

Create a new CS 25.143(l) as follows:

CS 25.143 General

…

(l) Electronic flight control systems

For electronic flight control systems (EFCS) which embody a normal load factor limiting system and in the absence of aerodynamic limitation (lift capability at maximum angle of attack):

1) The positive limiting load factor must not be less than:

i) 2.5 g with the EFCS functioning in its normal mode and with high lift devices retracted up to V_{MO}/M_{MO}. The positive limiting load factor may be gradually reduced down to 2.25 g above V_{MO}/M_{MO}.;

ii) 2.0 g with the EFCS functioning in its normal mode and with the high lift devices extended.

2) The negative limiting load factor must be equal to or more negative than:

i) Minus 1.0 g with the EFCS functioning in its normal mode and with high lift devices retracted;

ii) 0 g with the EFCS functioning in its normal mode and with high lift devices extended.

Maximum reachable positive load factor wings level may be limited by flight control system characteristics or flight envelope protections (other than load factor limitation), provided that:

- The required values are readily achievable in turn, and
- Wings level pitch up responsiveness is satisfactory.

Maximum reachable negative load factor may be limited by flight control system characteristics or flight envelope protections (other than load factor limitation), provided that:

- Pitch down responsiveness is satisfactory, and

- From level flight, 0 g is readily achievable, or at least a trajectory change of 5 degrees per second is readily achievable at operational speeds (from V_{LS} to Max speed - 10 kt. V_{LS} is the lowest speed that the crew may fly with auto thrust or auto pilot engaged. Max speed - 10 kt is intended to cover typical margin from V_{MO}/M_{MO} to cruise speeds and typical margin from V_{FE} to standard speed in high lift configurations.

Compliance demonstrations with the above requirements may be performed without ice accretion on the airframe.

…

SUBPART C — STRUCTURE

Amend CS 25.331(c) as follows:

CS 25.331 Symmetric manoeuvring conditions

…

(c)(1) …

(See AMC 25.331(c)(1))

(c)(2) …

(See AMC 25.331(c)(2))

Amend CS 25.333(b) as follows:

CS 25.333 Flight manoeuvring envelope

…

(b) *Manoeuvring envelope*

(See AMC 25.333(b))

Amend CS 25.335(b)(1) as follows:

CS 25.335 Design airspeeds

…

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

(1) (i) For aeroplanes not equipped with a high speed protection function: From an initial condition of stabilised flight at V_C/M_C, the aeroplane is upset, flown for 20 seconds along a flight path 7.5º below the initial path, and then pulled up at a load factor of 1.5 g (0.5 g acceleration increment). The speed increase occurring in this manoeuvre may be calculated if reliable or conservative aerodynamic data issued. Power as specified in CS 25.175(b)(1)(iv) is assumed until the pull up is initiated, at which time power reduction and the use of pilot controlled drag devices may be assumed;

(ii) For aeroplanes equipped with a high speed protection function: In lieu of subparagraph (b)(1)(i), the speed increase above V_C/M_C resulting from the greater of the following manoeuvres must be established:

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

(B) From a speed below V_C/M_C, with power to maintain stabilised level flight at this speed, the aeroplane is upset so as to accelerate through V_C/M_C at a flight path 15° below the initial path (or at the steepest nose down attitude that the system will permit with full control authority if less than 15°). Pilot controls may be in neutral position after reaching V_C/M_C and before recovery is initiated. Recovery may be initiated 3 seconds after operation of high speed, attitude or other alerting system by application of a load factor of 1.5 g (0.5 g acceleration increment), or such greater load factor that is automatically applied by the system with the pilot's pitch control neutral. Power may be reduced simultaneously. All other means of decelerating the aeroplane, the use of which is authorised up to the highest speed reached in the manoeuvre, may be used. The interval between successive pilot actions must not be less than 1 second (See AMC 25.335(b)(1)(ii)).

…

Amend CS 25.349(a) as follows:

CS 25.349 Rolling conditions

…

(a) *Manoeuvring*. The following conditions, speeds, ~~and~~ aileron deflections and cockpit roll control motions (except as the deflections and the motions may be limited by pilot effort) must be considered in combination with an aeroplane load factor of zero and of two-thirds of the positive manoeuvring factor used in design. For aeroplanes equipped with electronic flight controls, where the motion of the control surfaces does not bear a direct relationship to the motion of the cockpit control devices, these conditions must be considered in combination with an aeroplane load factor ranging from zero to two thirds of the positive manoeuvring factor used in design. In determining the required or resulting aileron deflections, the torsional flexibility of the wing must be considered in accordance with CS 25.301 (b):

(1) Conditions corresponding to steady rolling velocities must be investigated. In addition, conditions corresponding to maximum angular acceleration must be investigated for aeroplanes with engines or other weight concentrations outboard of the fuselage, and for aeroplanes equipped with electronic flight controls, where the motion of the control surfaces does not bear a direct relationship to the motion of the cockpit control devices. For the angular acceleration conditions, zero rolling velocity may be assumed in the absence of a rational time history investigation of the manoeuvre.

…

(5) For aeroplanes equipped with electronic flight controls, where the motion of the control surfaces does not bear a direct relationship to the motion of the cockpit control devices, in lieu of subparagraphs (a)(2), (a)(3) and (a)(4) the following applies:

(i) At V_A, 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.

(ii) At V_C, the cockpit roll control must be moved suddenly and maintained so as to achieve a roll rate not less than that obtained in subparagraph (a)(5)(i) of this paragraph. The return of cockpit control to neutral is initiated suddenly when steady roll rate is reached.

(iii) At V_D, 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 subparagraph (a)(5)(i) of this paragraph.

The conditions specified in this sub-paragraph must be investigated with yaw control held steady, and, as a separate condition, with corrective yaw control action to reduce sideslip as far as possible.

(See AMC 25.349(a))

…

Amend CS 25.351 as follows:

CS 25.351 Yaw manoeuvre conditions

(see AMC 25.351)

Create a new CS 25.397 (d) as follows:

CS 25.397 Control system loads

…

(d) For aeroplanes equipped with side stick controls, designed for forces to be applied by one wrist and not by arms, the limit pilot forces are as follows:

(1) For all components between and including the handle and its control stops:

PITCH		ROLL	
Nose up	890 N (200 lbf)	Nose left	445 N (100 lbf)
Nose down	890 N (200 lbf)	Nose right	445 N (100 lbf)

(2) For all other components of the side stick control assembly, but excluding the internal components of the electrical sensor assemblies, to avoid damage as a result of an in-flight jam:

PITCH		ROLL	
Nose up	556 N (125 lbf)	Nose left	222 N (50 lbf)
Nose down	556 N (125 lbf)	Nose right	222 N (50 lbf)

Amend CS 25.509 as follows:

CS 25.509 Towing loads

(See AMC 25.509)

…

SUBPART D — DESIGN AND CONSTRUCTION

Amend CS 25.745(d) as follows:

CS 25.745 Nose-wheel steering

…

(d) ~~The design of the attachment for towing the aeroplane on the ground must be such as to preclude damage to the steering system.~~

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).

(See AMC 25.745(d))

Create a new CS 25.777(i) as follows:

CS 25.777 Cockpit controls

…

(i) Pitch and roll control forces and displacement sensitivity shall be compatible, so that normal inputs on one control axis will not cause significant unintentional inputs on the other.

Amend CS 25.785(b) as follows:

CS 25.785 Seats, berths, safety belts and harnesses

…

(b) Each seat, berth, safety belt, harness, and adjacent part of the aeroplane at each station designated as occupiable during take-off and landing must be designed so that a person making proper use of these facilities will not suffer serious injury in an emergency landing as a result of the inertia forces specified in CS 25.561 and CS 25.562. However, berths intended only for the carriage of medical patients (e.g. stretchers) need not comply with the requirements of CS 25.562.

Amend CS 25.810(a)(1)(iv) as follows:

CS 25.810 Emergency egress assist means and escape routes

…

(a) …

(1) …

(iv) It must have the capability, in 46 km/hr (25-knot) winds directed from the most critical angle, simultaneously with any engine(s) running at ground idle, to deploy and, with the assistance of only one person, to remain usable after full deployment to evacuate occupants safely to the ground.

…

Amend CS 25.855 as follows:

CS 25.855 Cargo or baggage compartments

…

(c) (1) Ceiling and sidewall liner panels of Class C cargo or baggage compartments, and ceiling and sidewall liner panels in Class F cargo or baggage compartments, if installed to meet the requirements of subparagraph (b)(2) of this paragraph, must meet the test requirements of Part III of Appendix F or other approved equivalent methods.

(2) Cockpit voice and flight data recorder systems, windows and systems or equipment within, or in the vicinity of, Class E cargo compartments shown to be essential for continued safe flight and landing according to CS 25.1309 must be adequately protected against fire. If protective covers are used they must meet the requirements of Appendix F, Part III.

SUBPART E — POWERPLANT

Amend CS 25.1193(e)(3) as follows:

CS 25.1193 Cowling and nacelle skin

…

(e) Each aeroplane must -

…

(3) ~~Have fireproof skin in areas subject to flame if a fire starts in the engine power or accessory sections.~~ Have cowlings and nacelles skins, in areas subject to flame if a fire starts in an engine fire zone, complying with the following:

(i) For in-flight operations, cowlings and nacelles skins must be fireproof in the complete concerned areas and,

(ii) For ground operations, cowlings and nacelles skins must be:

(a) Fireproof in the portions of the concerned areas where a skin burn through would affect critical areas of the aeroplane, and

(b) Fire-resistant or compliant with sub-paragraph (e)(1) of this paragraph in the remaining portions of the concerned areas.

(See AMC 25.1193(e))

SUBPART F — EQUIPMENT

Amend CS 25.1447 (c)(3) as follows:

CS 25.1447 Equipment standards for oxygen dispensing units

…

(c) …

(See AMC 25.1447 (c)(3))

…

SUBPART J — AUXILIARY POWER UNIT INSTALLATIONS

Amend CS 25J1193 as follows:

CS 25J1193 APU compartment

…

(e) Each aeroplane must:

…

(3) ~~Have fireproof skin in areas subject to flame if a fire starts in the APU compartment.~~ Have APU compartment external skins, in areas subject to flame if a fire starts in an APU fire zone, complying with the following:

(i) For in-flight operations, APU compartment external skins must be fireproof in the complete concerned areas, and

(ii) For ground operations, APU compartment external skins must be :

(a) Fireproof in the portions of the concerned areas where a skin burn through would affect critical areas of the aeroplane, and

(b) Fire-resistant or compliant with sub-paragraph (e)(1) of this paragraph in the remaining portions of the concerned areas.

(See AMC 25.1193(e))

APPENDICES

Create a new Appendix Q as follows:

Appendix Q

Additional airworthiness requirements for approval of a Steep Approach Landing (SAL) capability

(SAL) 25.1 Applicability

This Appendix contains airworthiness requirements that enable an aeroplane to obtain approval for a steep approach landing capability using an approach path angle greater than or equal to 4.5° (a gradient of 7.9 %).

The requirements of this appendix cover only CS-25 Subparts B and G and they apply in lieu of CS 25.121(d). They also apply in lieu of CS 25.125 if a reduced landing distance is sought, or if the landing procedure (speed, configuration, etc.) differs significantly from normal operation, or if the screen height is greater than 50 ft. Additional requirements may apply with respect to aeroplane systems or equipment or other relevant items such as autopilot, flight guidance or GPWS. It is likely that the GPWS mode 1 (sink rate) envelope will need modification to prevent nuisance alerts. Also, the structural implications of the increased probability of high rates of descent at touchdown must be considered.

If a steep approach approval is required for flight in icing conditions, substantiation must be provided accordingly for the steep approach condition.

An applicant may choose to schedule information for an all-engines approach or for an approach with one engine inoperative. If an all-engines approach is scheduled, it is assumed that a diversion is required if an engine failure occurs prior to the decision to land.

(SAL) 25.2 Definitions

For the purposes of this Appendix:

— Steep Approach Landing: An approach to land made using a glide path angle greater than or equal to 4.5°, as selected by the applicant.

— Screen Height: The reference height above the runway surface from which the landing distance is measured. The screen height is a height selected by the applicant, at 50 ft or another value from 35 to 60 ft.

— $V_{REF(SAL)}$ is the calibrated airspeed selected by the applicant used during the stabilised approach at the selected approach path angle and maintained down to the screen height defined above. $V_{REF(SAL)}$ may not be less than 1.23 V_{SR}, V_{MCL}, or a speed that provides the manoeuvring capability specified in CS 25.143(h), whichever is greater and may be different to the V_{REF} used for standard approaches.

— $V_{REF(SAL)-1}$ is the calibrated airspeed selected by the applicant used during the stabilised one-engine-inoperative approach at the selected approach path angle and maintained down to the screen height defined above. $V_{REF(SAL)-1}$ may not be less than $V_{REF(SAL)}$.

(SAL) 25.3 Steep Approach Landing Distance (Applicable only if a reduced landing distance is sought, or if the landing procedure (speed, configuration, etc.) differs significantly from normal operation, or if the screen height is greater than 50 ft.)

(a) The steep approach landing distance is the horizontal distance necessary to land and to come to a complete stop from the landing screen height and must be determined (for standard temperatures, at each weight, altitude and wind within the operational limits established by the applicant for the aeroplane) as follows:

(1) The aeroplane must be in the all-engines-operating or one-engine-inoperative steep approach landing configuration, as applicable.

(2) A stabilised approach, with a calibrated airspeed of $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate, and at the selected approach angle must be maintained down to the screen height.

(3) Changes in configuration, power or thrust, and speed must be made in accordance with the established procedures for service operation (see AMC 25.125(b)(3)).

(4) The landing must be made without excessive vertical acceleration, tendency to bounce, nose over or ground loop and with a vertical touchdown velocity not greater than 6 ft/sec.

(5) The landings may not require exceptional piloting skill or alertness.

(b) The landing distance must be determined on a level, smooth, dry, hard-surfaced runway (see AMC 25.125(c)). In addition -

(1) The pressures on the wheel braking systems may not exceed those specified by the brake manufacturer.

(2) The brakes may not be used so as to cause excessive wear of brakes or tyres (see AMC 25.125(c)(2)).

(3) Means other than wheel brakes may be used if that means

(i) Is safe and reliable;

(ii) Is used so that consistent results can be expected in service; and

(iii) Is such that exceptional skill is not required to control the aeroplane.

(c) Reserved.

(d) Reserved.

(e) The landing distance data must include correction factors for not more than 50 % of the nominal wind components along the landing path opposite to the direction of landing, and not less than 150 % of the nominal wind components along the landing path in the direction of landing.

(f) If any device is used that depends on the operation of any engine, and if the landing distance would be noticeably increased when a landing is made with that engine assumed to fail during the final stages of an all-engines-operating steep approach, the steep approach landing distance must be determined with that engine inoperative unless the use of compensating means will result in a landing distance not more than that with each engine operating.

(SAL) 25.4 Climb: One-engine-inoperative

In a configuration corresponding to the normal all-engines-operating procedure in which V_{SR} for this configuration does not exceed 110 % of the V_{SR} for the related all-engines-operating steep approach landing configuration, the steady gradient of climb may not be less than 2.1 % for two-engined aeroplanes, 2.4 % for three-engined aeroplanes, and 2.7 % for four-engined aeroplanes, with:

(a) The critical engine inoperative, the remaining engines at the go-around power or thrust setting;

(b) The maximum landing weight;

(c) A climb speed of $V_{REF(SAL)}$; and

(d) The landing gear retracted.

(SAL) 25.5 Safe operational and flight characteristics

(a) It must be demonstrated that it is possible to complete a stabilised approach in calm air down to the commencement of the landing flare, followed by a touchdown and landing without displaying any hazardous characteristics for the following conditions (see AMC to Appendix Q, (SAL) 25.5):

(1) The selected approach path angle at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate;

(2) An approach path angle 2° steeper than the selected approach path angle, at $V_{REF(SAL)}$ or $V_{REF(SAL)-1}$ as appropriate; and

(3) The selected approach path angle at $V_{REF(SAL)}$ minus 5 knots or $V_{REF(SAL)-1}$ minus 5 knots as appropriate.

(b) For conditions (1), (2) and (3):

(i) The demonstration must be conducted at the most critical weight and centre of gravity, either with all-engines-operating or with the critical engine inoperative, as appropriate;

(ii) The rate of descent must be reduced to 3 feet per second or less before touchdown;

(iii) Below a height of 200 ft no action shall be taken to increase power or thrust apart from those small changes which are necessary to maintain an accurate approach;

(iv) No nose depression by use of longitudinal control shall be made after initiating the flare other than those small changes necessary to maintain a continuous and consistent flare flight path; and

(v) The flare, touchdown and landing may not require exceptional piloting skill or alertness.

(c) For conditions (1) and (3), the flare must not be initiated above the screen height.

(d) For condition (2), it must be possible to achieve an approach path angle 2° steeper than the selected approach path angle in all configurations which exist down to the initiation of the flare, which must not occur above 150 % of the screen height. The flare technique used must be substantially unchanged from that recommended for use at the selected approach path angle.

(e) All-engines-operating steep approach. It must be demonstrated that the aeroplane can safely transition from the all-engines-operating steep landing approach to the one-engine-inoperative approach climb configuration with one engine having been made inoperative for the following conditions:

(1) The selected steep approach angle;

(2) An approach speed of $V_{REF(SAL)}$;

(3) The most critical weight and centre of gravity; and

(4 For propeller-powered aeroplanes, the propeller of the inoperative engine shall be at the position it automatically assumes following an engine failure at high power.

(f) In addition, for propeller-powered aeroplanes, it must be demonstrated that controllability is maintained following an engine failure at approach power and with the propeller at the position it automatically assumes.

(g) The height loss during the manoeuvre required by subparagraph (SAL) 25.5(e) must be determined.

(h) It must be demonstrated that the aeroplane is safely controllable during a landing with one engine having been made inoperative during the final stages of an all-engines-operating steep approach for the following conditions:

(1) The selected steep approach angle;

(2) An approach speed of $V_{REF(SAL)}$;

(3) The most critical weight and centre of gravity; and

(4) For propeller-powered aeroplanes, the propeller of the inoperative engine shall be at the position it automatically assumes following an engine failure at approach power.

(i) One-engine-inoperative steep approach. It must be demonstrated that the aeroplane can safely transition from the one-engine-inoperative steep landing approach to the approach climb configuration for the following conditions:

(1) The selected steep approach angle;

(2) An approach speed of $V_{REF(SAL)-1}$;

(3) The most critical weight and centre of gravity; and

(4) For propeller-powered aeroplanes the propeller of the inoperative engine may be feathered.

(SAL) 25.6 Aeroplane Flight Manual

The AFM supplement for steep approach landing shall include the following:

(a) The steep approach landing distance determined in accordance with paragraph (SAL) 25.3 of this Appendix for the selected screen height and aeroplane configuration. The landing distance data may additionally include correction factors for runway slope and temperature other than standard, within the operational limits of the aeroplane, and may provide the required landing field length including the appropriate factors for operational variations prescribed in the relevant operating regulation.

(b) The more limiting of the landing weight, altitude and temperature (WAT) limits derived in accordance with:

(1) CS 25.119, and

(2) The one-engine-inoperative approach climb requirement of paragraph (SAL) 25.4 of this Appendix.

(c) Appropriate limitations and detailed normal, non-normal and emergency procedures. Where an aeroplane is not approved for deliberate one-engine-inoperative steep approach landings, this limitation shall be stated.

(d) A statement that the presentation of the steep approach limitations, procedures and performance reflects the capability of the aeroplane to perform steep approach landings but that it does not constitute operational approval.

(e) A statement of headwind and crosswind limitations if they are different from those for non-steep approaches. The tailwind limitation is 5 knots, unless test evidence shows that more than 5 knots is acceptable.

(f) The reference steep approach glide slope angle and the screen height used for determination of the landing distance must be specified.

(g) The height loss during a go-around from the all-engines-operating steep landing approach to the approach climb configuration with one engine made inoperative, determined in accordance with (SAL) 25.5(g).

BOOK 2

AMC — SUBPART B

Amend AMC 25.21(g) as follows:

AMC 25.21(g) Performance and handling characteristics in icing conditions contained in Appendix C to CS-25

…

4.7 …

h. Installed thrust. This includes operation of ice protection systems when establishing acceptable power or thrust setting procedures, control, stability, lapse rates, rotor speed margins, temperature margins, ~~Automatic Reserve Power (ARP)~~ Automatic Take-Off Thrust Control System (ATTCS) operation, and power or thrust lever angle functions.

…

Create a new AMC 25.101(g) as follows:

AMC 25.101(g)

Go-around

In showing compliance with CS 25.101(g), it should be shown at the landing weight, altitude and temperature (WAT) limit, by test or calculation, that a safe go-around can be made from the minimum decision height with:

— the critical engine inoperative and, where applicable, the propeller feathered,

— a configuration and a speed initially set for landing and then in accordance with the go-around procedures, using actual time delays and, except for movements of the primary flying controls, not less than 1 second between successive crew actions,

— the power available,

— the landing gear selection to the 'up' position being made after a steady positive rate of climb is achieved.

It should be noted that for Category 3 operation the system will ensure the aircraft is over the runway, so any go-around will be safe with the aircraft rolling on the runway during the manoeuvre. Hence AMC 25.101(g) is only relevant or necessary for decision heights down to Category 2 operations.

AMC — SUBPART C

Create a new AMC 25.331(c)(1) as follows:

AMC 25.331(c)(1)

Maximum pitch control displacement at V_A

The physical limitations of the aircraft from the cockpit pitch control device to the control surface deflection, such as control stops position, maximum power and displacement rate of the servo controls, and control law limiters, may be taken into account.

Create a new AMC 25.331(c)(2) as follows:

AMC 25.331(c)(2)

Checked manoeuvre between V_A and V_D

The physical limitations of the aircraft from the cockpit pitch control device to the control surface deflection, such as control stops position, maximum power and displacement rate of the servo controls, and control law limiters, may be taken into account.

For aeroplanes equipped with electronic flight controls, where the motion of the control surfaces does not bear a direct relationship to the motion of the cockpit control devices, the circular frequency of the movement of the cockpit control 'ω' shall be varied by a reasonable amount to establish the effect of the input period and amplitude on the resulting aeroplane loads. This variation is intended to verify that there is no large and rapid increase in aeroplane loads.

Create a new AMC 25.333(b) as follows:

AMC 25.333(b)

Manoeuvring envelope

For calculation of structural design speeds, the stalling speeds V_{s0} and V_{s1} should be taken to be the 1-g stalling speeds in the appropriate flap configuration. This structural interpretation of stalling speed should be used in connection with the paragraphs CS 25.333(b), CS 25.335, CS 25.335(c)(d)(e), CS 25.479(a), and CS 25.481(a)(1).

Create a new AMC 25.335(b)(1) as follows:

AMC 25.335(b)(1)(ii)

Design Dive Speed — High speed protection function

In any failure condition affecting the high speed protection function, the conditions as defined in CS 25.335(b)(1)(ii) still remain applicable.

It implies that a specific value, which may be different from the V_D/M_D value in normal configuration, has to be associated with this failure condition for the definition of loads related to V_D/M_D as well as for the justification to CS 25.629. However, the strength and speed margin required will depend on the probability of this failure condition, according to the criteria of CS 25.302.

Alternatively, the operating speed V_{MO}/M_{MO} may be reduced to a value that maintains a speed margin between V_{MO}/M_{MO} and V_D/M_D that is consistent with showing compliance with CS 25.335(b)(1)(ii) without the benefit of the high speed protection system, provided that:

(a) Any failure of the high speed protection system that would affect the design dive speed determination is shown to be Remote;

(b) Failures of the system must be announced to the pilots, and:

(c) Aeroplane flight manual instructions should be provided that reduce the maximum operating speeds, V_{MO}/M_{MO}.

Create a new AMC 25.349(a) as follows:

AMC 25.349(a)

Rolling conditions

The physical limitations of the aircraft from the cockpit roll control device to the control surface deflection, such as control stops position, maximum power and displacement rate of the servo controls, and control law limiters, may be taken into account.

Create a new AMC 25.351 as follows:

AMC 25.351

Yaw manoeuvre conditions

The physical limitations of the aircraft from the cockpit yaw control device to the control surface deflection, such as control stops position, maximum power and displacement rate of the servo controls, and control law limiters, may be taken into account.

Create a new AMC 25.509 as follows:

AMC 25.509

Towbarless towing

(a) General

Towbarless towing vehicles are generally considered as ground equipment and are as such not subject to direct approval by the (aircraft) certifying agencies. However, these vehicles should be qualified in accordance with the applicable SAE ARP documents. It should be ensured that the nose landing gear and supporting structure is not being overloaded (by static and dynamic (including fatigue) loads) during towbarless towing operations with these vehicles. This should be ensured by the aircraft manufacturer, either by specific investigations as described in subparagraphs (b) and (c) below, or alternatively, by publishing aircraft load limitations in a towbarless towing vehicle assessment document, to allow towbarless towing vehicle manufacturers to demonstrate their vehicles will not overload the aircraft.

(b) Limit static load cases

For the limit static load cases, the investigation may be conducted by rational analysis supported by test evidence. The investigation should take into account the influence on the towing loads of the tractive force of the towing vehicle including consideration of its weight and pavement roughness.

Furthermore, the investigation should include, but may not be limited to, the following towbarless towing operation scenarios:

(1) P ushback towing: Moving a fully loaded aircraft (up to Maximum Ramp Weight (MRW)) from the parking position to the taxiway. Movement includes: pushback with turn, a stop, and short tow forward to align aircraft and nose wheels. Engines may or may not be operating. Aeroplane movement is similar to a conventional pushback operation with a towbar.

(2) Maintenance towing: The movement of an aeroplane for maintenance/remote parking purposes (e.g. from the gate to a maintenance hangar). Aircraft is typically unloaded with minimal fuel load.

(3) Dispatch (operational) towing: Towing a revenue aircraft (loaded with passengers, fuel, and cargo up to Maximum Ramp Weight (MRW)) from the terminal gate/remote parking area to a location near the active runway. The movement may cover several kilometres with speeds according to SAE ARP 5283 technical standards, with several starts, stops and turns. Replaces typical taxiing operations prior to take-off.

Operations that are explicitly prohibited need not to be addressed.

(c) Fatigue evaluation

Fatigue evaluation of the impact of towbarless towing on the airframe should be conducted under the provision of CS 25.571 and CS 25.1529.

Specifically, the contribution of the towbarless towing operational loads to the fatigue load spectra for the nose landing gear and its support structure needs to be evaluated. The impact of the towbarless towing on the certified life limits of the landing gear and supporting structure needs to be determined.

The fatigue spectra used in the evaluation should consist of typical service loads encountered during towbarless towing operations, which cover the loading scenarios noted above for static considerations. Furthermore, the spectra should be based on measured statistical data derived from simulated service operation or from applicable industry studies.

(d) Other considerations

Specific combinations of towbarless towing vehicle(s) and aircraft that have been assessed as described above and have been found to be acceptable, along with any applicable towing instructions and/or limitations should be specified in the Instructions for Continued Airworthiness as described in Appendix H, paragraph H25.3(a)(4) and in the Aeroplane Flight Manual as specified in AMC 25.745(d)..

Aircraft braking, while the aircraft is under tow, may result in loads exceeding the aircraft's design load and may result in structural damage and/or nose gear collapse. For these reasons, the aircraft manufacturer should ensure that the appropriate information is provided in the Aeroplane Maintenance Manual and in the Aeroplane Flight Manual to preclude aircraft braking during normal towbarless towing. Appropriate information should also be provided in the

Instructions for Continued Airworthiness to inspect the affected structure should aircraft braking occur, for example in an emergency situation.

AMC — SUBPART D

Create a new AMC 25.745(d) as follows:

AMC 25.745(d)

Nose-wheel steering

CS 25.745(d) provides for the two following options:

1. A 'no damage' situation exists, because damage is precluded.

2. Damage can occur, but indication to the flight crew is provided.

(a) General consideration to CS 25.745(d)(1) and (2)

Some damage may occur during ground manoeuvring activities that can be considered acceptable and judged to be normal wear and tear. It is not intended that such damage needs necessarily to be precluded or that it should initiate a flight crew alert.

(b) To comply with CS 25.745(d)(1) the following applies:

The aeroplane may be designed in such a way that under all ground manoeuvring operations by any towing means no damage affecting the steering system can occur.

Examples are:

(1) The steering system is designed sufficiently strong to resist any applied towing input.

(2) The steering system is designed to allow 360 degrees rotation.

(3) The steering system is disconnected either automatically or by operational procedure.

(4) The steering system is protected by shear sections installed on the nose landing gear.

(c) To comply with CS 25.745(d)(2) the following applies:

When protection is afforded by the flight crew alerting system, the damage detection means should be independent of the availability of aeroplane power supplies and should be active during ground manoeuvring operations effected by means independent of the aeroplane. If damage may have occurred, a latched signal should be provided to the flight crew alerting system.

(d) Alternative Acceptable Means of Compliance to CS 25.745(d)(1) and (2):

In the case where the aeroplane design does not comply with CS 25.745(d)(1) and (d)(2) the following applies:

(1) The Aeroplane Flight Manual, in the Section Limitations, should include a statement that '*Towbarless towing is prohibited*', or

(2) The Aeroplane Flight Manual, in the Section Limitations, should include a statement that:

'*Towbarless towing is prohibited, unless the towbarless towing operations are performed in compliance with the appropriate operational regulation using towbarless towing vehicles that are designed and operated to preclude damage to the aeroplane nose wheel steering system, or which provide a reliable and unmistakable warning when damage to the steering system has occurred.*

Towbarless towing vehicles that are specifically accepted for this type of aeroplane are listed in the [appropriate maintenance documentation]provided by the aeroplane manufacturer.'

'Appropriate maintenance documentation' means Instructions for Continued Airworthiness as described in Appendix H, paragraph H25.3(a)(4) of CS-25.

(3) The acceptance by the aeroplane manufacturer of the applicable towbarless towing vehicles and its reliability of the oversteer protection and/or indication system as referred to in sub-paragraph ((d)(2)) above should be based on the following:

(i). The aeroplane Nose Wheel Steering Failure Analysis should include the effects of possible damage caused by towbarless towing operations.

(ii). If the Nose Wheel Steering Failure Analysis shows that damage to the steering system by the use of towbarless towing may result in a Failure Condition that can be classified as Hazardous or Catastrophic (refer to CS 25.1309), the acceptance of a towing vehicle oversteer protection and/or indication system should be based on an aeroplane safety analysis, encompassing the reliability of that vehicle system, in order to meet the aeroplane safety objectives.

(iii). If the Nose Wheel Steering Failure Analysis shows that damage to the steering system by the use of towbarless towing may result in a Failure Condition that can be classified as Major or less severe, the aeroplane manufacturer can accept the design of the towing vehicle oversteer indication — and/or protection system based on a 'Declaration of Compliance', issued by the towbarless towing vehicle manufacturer. This declaration will state that the vehicle design complies with the applicable standards (SAE ARPs, Aeroplane Towing Assessment Criteria Document) and that it is designed and built under ISO 9001 quality standards or equivalent.

Such a declaration must be made regarding all Towbarless Towing Vehicles to be used for ground manoeuvring of CS-25 certificated aeroplanes.

AMC — SUBPART E

Create a new AMC 25.1193 (e) as follows:

AMC 25.1193(e)

Engine cowling and nacelle skin, APU compartment external skin

(a) PURPOSE

This AMC provides guidance for showing compliance with the certification specifications relating to fire withstanding capability of engine cowlings and nacelles skins, and APU compartment external skins, in areas subject to flame if a fire starts in an engine or APU fire zone, in consideration of potential hazard levels associated to operating conditions (flight/ground).

(b) RELATED CERTIFICATION SPECIFICATIONS

CS 25.1193(e), CS 25J1193(e)

(c) APPLICABILITY

This AMC is applicable to engine cowlings and nacelles, and APU compartment external skins (fixed and/or removable).

(d) BACKGROUND

CS 25.1193(e) and CS 25J1193(e) previously required the engine cowlings/nacelle skins and APU compartment external skins to be fireproof if a fire starts in the engine power or accessory sections or in the APU compartment. During past Type certification projects it has been found that having non-fireproof engine cowlings/nacelle skins in some locations under some operating conditions do not adversely affect safety. Consequently, in practice, not all cowlings/skins 'subject to flame if a fire starts in the engine power or accessory sections' have been required to be fireproof under all operating conditions and for instance some portions were approved as fire-resistant only for ground operating conditions. As it represented a rule relaxation, such non-fireproof cowlings/skins were formally found to be 'equivalently safe' to comply with the rule. Over time, however, these equivalent safety findings became inherent within traditionally accepted design practices. Certification Review Item (CRI) released to cover the relaxation included also interpretations for zone definitions and operating conditions to be considered for fireproofness or fire-resistance compliance demonstration.

(e) FIRE WITHSTANDING REQUIREMENTS, OPERATING CONDITIONS AND POTENTIAL HAZARDS

(1) General

The required level of ability to withstand the effects of fire varies with the potential hazard level associated with different flight and ground operating conditions, as follows:

(2) Flight Conditions

For the purpose of CS 25.1193(e) and CS 25J1193(e), flight conditions are defined as aeroplane operation from airspeed above minimum V1 until minimum touchdown speed in approved normal or abnormal operations. Cowling and skin in areas subject to flame if a fire starts in an engine or APU fire zone must be demonstrated to be fireproof.

For demonstrating the fireproof capabilities of the cowling/skin, the following applies:

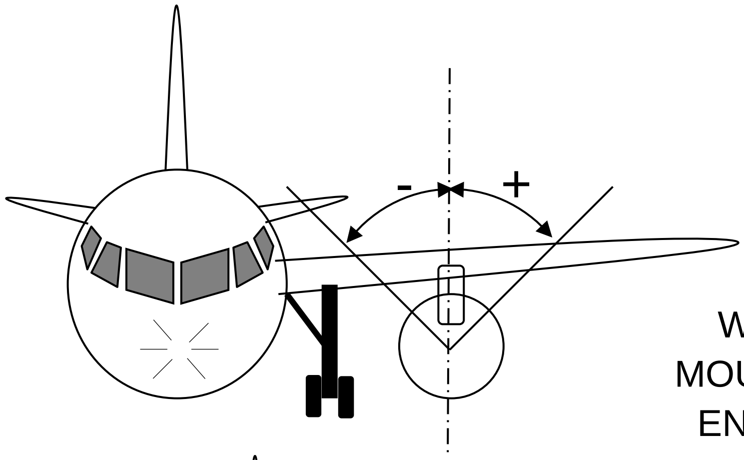
- Credit from the external airflow on the cowling/skin can be considered
- The airflow levels and the engine/APU powers should be consistent with the operating conditions. These parameters should be examined and the most critical ones should be determined.
- The engine/APU should be considered to be operative for the first 5 minutes, and during the remaining 10 minutes under windmilling conditions for engine and stopped conditions for the APU.

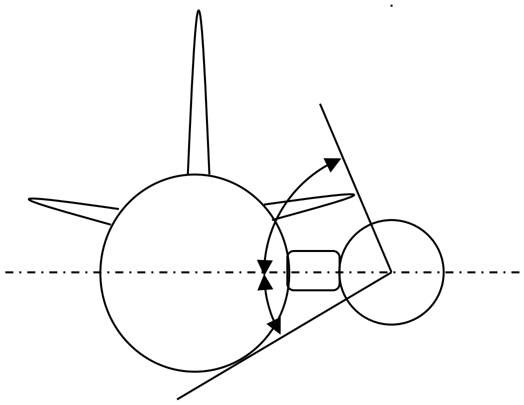
(3) Ground conditions

For the purpose of CS 25.1193(e) and CS 25J1193(e), ground conditions are defined as aircraft operation not covered by the flight conditions provided in sub-paragraph (e)(2) of this AMC. It includes static, taxiing, take-off roll and landing roll.

(i) *Areas where fireproof skins are required* — The portion of cowling and skin in areas subject to flame if a fire starts in an engine or APU fire zone, and located so that not containing the effects of the fire could result in serious hazards to the aircraft, injuries to crew, passengers or ground personnel, must be fireproof under all conditions. Serious hazards include, but are not limited to, events such as fuel tank explosion, hazardous spread of fire to flammable fluid sources outside the fire zone, fuselage penetration and flight control surface damages.

(A) *Pod-mounted engines:* The portion of the nacelle/cowling skin, which is required to be fireproof on ground, varies by installation. A design is considered acceptable when it is demonstrated that the fireproof area protects the pylon strut and other portions of the aircraft considered to be put at a serious hazard risk if burn through occurs. Factors to consider within the analysis and to use when substantiating the design are: the engine location — wing or aft fuselage mounted, the coupling distance of the nacelle to the wing, the airflow characteristics, the fluid migration scheme and the fire plume patterns. After the initial analysis, similarity demonstration and in-service experience may be used as appropriate. Analyses have demonstrated that the typical area of concern ranges from 90° (± 45°) to 180° (± 90°) and is centred on the pylon centre line. This area may increase or decrease depending on the analysis results. For example, most wing mounted engines not closely coupled to the wing have been found acceptable with a ± 45° protection while more closely coupled installations and those with other unique design features have required ± 90° protection. The symmetry of the protection may also vary. Wing mounted engines usually have symmetrical protection while aft mounted engines may have non-symmetrical protection in order to cover more of the inboard area.





(B) *Turbo-propellers, APUs and other non-pod-mounted engines*: Due to the wide variations in installation configurations, each installation should be evaluated to determine if not containing the effects of a fire would cause a serious hazard such as the examples above. If so, the affected area of the fire zone skin should be fireproof.

(C) *For the purpose of the demonstration*:

- No credit from external airflow on the cowling/skin should be considered in conjunction with the assumption that the aircraft may be static,
- The engine/APU should be considered to be operative for the first 5 minutes and stopped for the remaining 10 minutes,
- Engine/APU operation — Requirements for ability of cowling/skin in areas subject to flame if a fire starts in an engine or APU fire zone to withstand the effects of fire in ground operating conditions apply with either the engine operating or not operating, whichever is the more critical. The Engine/APU operating conditions shall be justified by the applicant.

(ii) *Other areas*: For the remaining portions of cowling/skin in areas subject to flame, if a fire starts in an engine or APU fire zone, the degree of fire resistance can be lower than 'fireproof' due to less serious or less probable hazard to the aircraft, crew, passengers and ground personnel under the critical operating conditions. Any burn through of the APU compartment external skin should consider hazards associated with combustion product and possible outgassing and re-ingestion of toxic air into cabin air system.

(A) Fire-resistant cowlings/skins provide adequate fire protection for those areas as they provide sufficient time to stop the aeroplane and evacuate it.

(B) A lower than 'fire-resistant' degree of fire protection may be considered; the following conditions should then be analysed and submitted to the Agency for approval:

— Cowling/skin should have the ability to withstand fire at least equivalent to the ability of a 1 mm (0.040 inch) aluminium sheet in the worst aircraft and engine/APU ground conditions anticipated;

— Applicants must substantiate that this lower fire protection level will not lead to hazardous effects including but not limited to:

- Upon burn through of the lower than 'fire-resistant' area, both the fire-resistant and/or fire-proof areas shall not have their fire withstanding capability affected,
- Liberation of parts that would affect the aeroplane evacuation procedure or reduce the efficiency of fire protection means,
- Reduction in flammable fluid drainage capability such that fire severity would be increased (magnitude, residual presence, propagation to surrounding area),
- Reduction in aeroplane evacuation capability due to proximity to evacuation paths or due to the visibility of the fire hindering the ability of the passengers to evacuate the aeroplane in a rapid and orderly manner,

Note: There is some hazard involving aeroplane evacuation even in the absence of burn through due to such concerns as smoke and flaming liquids exiting from openings. Burn through of nacelle skin should not significantly increase these hazards.

- Reduction in fire detection capability such that the flight crew would not be aware of the fire, especially in a situation involving taxiing prior to take-off,
- Reduction in fire extinguishing capability which could cause or aggravate one of the potential hazards listed above.
- Flammable fluid and/or fire spreading on the aeroplane evacuation path

(f) SPECIFIC CONFIGURATION CONSIDERATIONS

(1) *Multiple skin layers*: For some specific fire zones, a fire originating in that zone will have to pass through several layers of cowling or skin before burning through the external skin. This may be the case, for example, for the core zone of some turbofan installations. In such cases, credit may be taken for multiple layers, having regard to the location of the fire source and the likely direction of propagation from

that location, providing burn through of the inner layer does not produce other hazardous effects and it does not invalidate other certification specifications such as fire extinguishing capability. The corresponding compliance substantiation should take into account particular geometrical configuration with respect to the risk of flame propagation, as well as critical systems or structures.

(2) *Inlet skins*: For external inlet skins, which enclose fire zones, the guidance provided above for multiple skin layers applies. Inlet ducts should meet CS 25.1103/CS 25J1103 specifications.

(3) *Openings*: The following considerations are applicable to openings in a fire zone skin whether the openings are of fixed size, variable or controllable size, or normally closed, such as access or inspection doors, or pressure relief doors.

(i) Openings should be located such that flame exiting the opening would not enter any other region where it could cause a hazard in flight or a serious hazard on the ground as per sub-paragraph (e)(3). Exception is made for covered openings which meet the same criteria for ability to withstand the effects of fire as the surrounding cowl skin, and which are not expected to become open under fire conditions. Since pressure relief doors may open during some fire conditions, they should be located such that flames exiting the door will not cause a hazard. However, doors that will remain closed during most fire conditions, or will tend to re-close following initial opening, have traditionally been assumed to be closed for the purposes of evaluating fire detection and extinguishing.

(ii) Openings should have the same ability to withstand the effects of fire as the adjacent skin with respect to becoming enlarged under fire conditions. Some enlargement, such as burning away of louvers or doublers surrounding the opening or gapping of covered openings, is acceptable provided that the hazard is not significantly increased by a reduction in fire extinguishing or detection capability, increased airflow causing increase in fire size or intensity, or increase in probability of a hazardous spread of fire to other regions.

(4) *Hinges, Fittings and Latches*: These attaching means maintaining the nacelle/cowlings between them or to the aircraft/engine/APU structure may need to have a greater ability to withstand the effect of fire than the surrounding skin. Loss of attaching means may create more severe hazards such as cowling liberation in comparison to a skin burn through. The applicant must justify the required level of fire withstanding capability by test and/or analysis.

(5) *Seals* : Where seals are used part of the external engine nacelle/cowling or APU compartment boundaries, they should at least have the same ability to withstand fire as the surrounding cowling/skin.

(g) COMPLIANCE DEMONSTRATION

Compliance should be substantiated per CS 25.1207. Substantiation involving airflow patterns may include analytical methods such as Computational Fluid Dynamics, test methods or other flow visualisation methods or a combination of these methods. Fire testing should be accomplished according to the guidance of ISO 2685 with considerations of applications of representative conditions (airflow, loads, vibrations) and establishment of appropriate pass/fail criteria (burn through, elongation, dislocation).

AMC — SUBPART F

Create a new AMC 25.1447(c)(3) as follows:

AMC 25.1447(c)(3)

Equipment standards for oxygen dispensing units

If oxygen outlets are not provided in a dedicated area, called here remote area, the applicant shall demonstrate that oxygen dispensing outlets are within 'five feet/five seconds' reach of the remote area(s) and shall show that no visual obstruction exists between the potential oxygen users and the outlets, such as curtains or partitions, unless another method of indication (e.g. a light) is provided in the remote area.

AMC — APPENDICES

Create a new AMC to Appendix Q as follows:

AMC to Appendix Q

(SAL) 25.5 Safe operational and flight characteristics

(a) For the approach demonstrations required by (SAL) 25.5(a), due account should be taken of:

(1) The systems' aspects of the power/thrust levers being at idle (e.g. arming of ground lift dump);

(2) The most adverse flight idle power/thrust (e.g. effects of engine bleeds or FADEC idle power/thrust control); and

(3) The effects on controllability from the use of auxiliary drag devices such as flight spoilers (e.g. increased stall warning and stall speeds, loss of manoeuvrability).

(b) For the flare, touchdown and landing demonstrations required by (SAL) 25.5(a), there should not be any occurrence of:

(1) Stall warning;

(2) Tail strike; or

(3) Any other characteristic that would interfere with the completion of the landing (e.g. automatic thrust increase).

(c) For the go-around demonstrations required by (SAL) 25.5(e) and (i), due account should be taken of time delays associated with automatic or manual retraction of auxiliary drag devices.

GENERAL

ACCEPTABLE MEANS OF COMPLIANCE — AMC

Amend AMC 25-13 as follows:

5 *Reduced Thrust:* (Acceptable Means of Compliance)

…

a. The reduced take-off thrust setting –

…

(4) Is at least 60~~75~~% of the maximum take-off thrust (no derate) ~~or derated take-off thrust if such is the performance basis, for the existing ambient conditions,~~ for the existing ambient conditions,with no further reduction below 60~~75~~% resulting from ~~ARP~~ Automatic Take-off Thrust Control System (ATTCS) credit. Consequently the amount of reduced thrust permitted is reduced when combined with the use of derated thrust so that the overall thrust reduction remains at least 60% of the maximum take-off thrust. For reduced thrust operations, compliance with the applicable performance and handling requirements should be demonstrated as thoroughly as for an approved take-off rating.

…

(6) Enables compliance with CS-25 Appendix I in the event of an engine failure during take-off, for aeroplanes equipped with an ~~Automatic Reserve Performance system~~ ATTCS.

…

b. Relevant speeds (VEF, VMC, VR, and V2) used for reduced thrust take-offs are not less than those which will comply with the required airworthiness controllability criteria when using the take-off thrust (or derated take-off thrust, if such is the performance basis) for the ambient conditions, including the effects of an ~~Automatic Reserve Performance (ARP) system~~ ATTCS. It should be noted, as stated in paragraph c. below, that in determining the take-off weight limits, credit can be given for an operable ~~ARP system~~ ATTCS.

c. The aeroplane complies with all applicable performance requirements, including the criteria in paragraphs a. and b. above, within the range of approved take-off weights, with the operating engines at the thrust available for the reduced thrust setting selected for take-off. However, the thrust settings used to show compliance with the take-off flight path requirements of CS 25.115 and the final take-off climb performance requirements of CS 25.121(c) should not be greater than that established by the initial thrust setting. In determining the take-off weight limits, credit can be given for an operable ~~ARP system~~ ATTCS.

…

e. A periodic take-off demonstration is conducted using the aeroplane's take-off thrust setting without ~~ARP~~ ATTCS, if fitted, and the event is logged in the aeroplane's permanent records. An approved engine maintenance procedure or an approved engine condition monitoring programme may be used to extend the time interval between take-off demonstrations.

f. The AFM states, as a limitation, that take-offs utilising reduced take-off thrust settings –

…

(4) Are authorised for aeroplanes equipped with an ~~ARP System~~ ATTCS, whether operating or not.

…

Appendix B - Attachments

CRI_B-06_Issue-02(closed).pdf
Attachment #1 to comment #61

NPA2011-09_comment18_figure.pdf

Attachment #2 to comment #18