JAR–25
Comments And Responses
On
NPA 25B, D, G-244 : Accelerate-Stop Distances And Related Performance Matters
February 1993

1 Background

NPA 25B, D, G-244 was drafted on the basis of a package of recommendations made to the Authorities, JAA and FAA, by an industry-led task force that had reviewed take-off safety issues related to rejected take-off performance. It had been intended that action by JAA should be fully harmonised with the FAA. However, delays in the internal US process, together with pressure within Europe to progress the subject, led to the NPA being published for consultation in March 1991 without there being any corresponding NPRM for FAR 25. Extensive comments were received and resulted in a revised version of the NPA, dated March 1992.

As FAA were still working on an equivalent NPRM, JAA took the decision to offer the latest version of the NPA to applicants as a voluntary alternative to the relevant paragraphs of JAR 25, but not to formally adopt the changes into the requirement code. Consultation was maintained with the FAA as they developed their NPRM and this resulted in further minor changes to the NPA. With the publication of NPRM 93-8, NPA 25B, D, G-244 was again issued for consultation as the February 1993 version. This joint circulation of both the NPA and the NPRM resulted in a large number of comments, which have led to a further extended period of review by JAA and FAA. This document details the comments received and the JAA responses.

2 Comments Received

The full list of respondents to the current round of consultation was as follows :–

Industry Associations :	*AEA* *AECMA* *AIA* *ATA* *GAMTA* *IATA*
Pilot Associations :	*ALPA* *GAPAN* *IFALPA* *New Zealand ALPA* *Norsk Flygerforbund*
Individual Manufacturers :	*BAe Airbus Division*
Individual Airlines :	*BA* *BMA* *Britannia*
Regulatory Authorities :	*BAZ* *CAA Denmark* *DGAC France* *FOCA* *Transport Canada*

3 Responses to Comments

3.1 General

The comments received ranged from 'no comment', through general comments of support (often with the proviso of ensuring JAA/FAA harmonisation), to detailed comments against specific proposals. A number of comments were received on the related operational aspects and retroactivity, referred to in the NPA but addressed in JAR-OPS Part 1. One commentator in particular made a very extensive submission to FAA on this aspect and copied it to JAA for information.

Given the extensive nature of the comments received, and a high degree of duplication between many of them, this document does not reproduce them in full. Instead, the comments are reviewed collectively against the individual proposals of the NPA. The related aspects covered in JAR-OPS are also addressed.

3.2 Discussion of Comments on Individual NPA Proposals

3.2.1 Definition of Take-off Decision Speed (NPA paragraph 2.1.1)

A number of comments were received on the proposal to introduce a definition of 'Take-off Decision Speed' into JAR 1. These invoked the philosophies behind the take-off go/no-go decision process and the treatment of pilot recognition and reaction delays. Some commentators pointed out that the emphasis of advice from manufacturers and modern crew training programmes was that the decision speed, V_1, was the point by which the pilot should have initiated actions to bring the aircraft to a halt in the event of a decision to reject the take-off. Others take the view that with as little as 1 second between the assumed engine failure speed, V_{EF}, and V_1, this is inadequate for the pilot to complete the recognition, analysis and response process, thus making 'decision speed' a misnomer.

JAA recognises that even with the benefit of effective crew training, a critical failure close to V_1 is a rare and unpredictable event for the line crew to deal with. Human factors considerations and the evidence of past RTO overrun accidents confirm that a safety margin based solely on a 1 second delay between engine failure and initiation of braking action is inadequate to cover the recognition and reaction process. However, the safety provided for by the requirements is a combination of the V_{EF} to V_1 delay time and the distance margin added to the certification demonstration of accelerate-stop distance to address operational contingencies. A balance needs to be achieved between the commercially penalising operational implications of performance margins and what it is reasonable to expect an adequately trained crew to achieve when faced with a critical, but rare, event. This balance needs to be achieved by a combination of performance scheduling and attention to the decision and reaction process in crew training. The training aspects are being emphasised through other initiatives, including the Take-off Safety Training Aid package produced by leading manufacturers, in consultation with FAA, as a further product of the task force recommendations. JAA concludes that it is right for the regulations to support and confirm the accepted training philosophies, with V_1 emphasised as the speed by which action should be initiated in an RTO, albeit with the additional margin of a distance safety factor.

In response to these comments this proposal of the NPA is further revised to delete reference to the term 'Take-off Decision Speed' but to amend the existing definition of the abbreviation 'V_1', emphasising the intended nature of this as a crew action speed. However, the recognised short duration of the delay time portion of the overall safety margin emphasises the need for the additional distance margin to be adequate. In particular, it should be used only to cover random operational contingencies. Significant predictable factors, such as alignment distance, need to be addressed separately and not treated as random events that are covered adequately by the general safety margins.

3.2.2 Definition of Screen Height. (NPA paragraph 2.1.1)

No comments were received on this aspect of the NPA. However, such a definition was not included in NPRM 93-8. While it is a commonly used term, it is not used in the requirements specifying the determination of take-off distance and only arose in the context of the NPA due to the proposed definition of Take-off Decision Speed. In seeking harmonisation with FARs, and given the changes discussed in the previous section, this proposal is deleted.

3.2.3 Definition of V_{EF}. (NPA paragraph 2.1.2)

One commentator proposed that the definition of V_{EF} should include the constraint that it must not be less than V_{MCG}. For large aeroplanes, certificated to JAR 25, this is adequately addressed by JAR 25.107(a)(1). The purpose of the definition in JAR 1 is to introduce a standard term that may then be used in various other JAR parts. These may include design codes for other categories of aircraft (e.g. small aeroplanes or rotorcraft) where the concept of V_{MCG} is either not used or is inappropriate. Thus, this proposed addition to the JAR 1 definition is not appropriate and the NPA proposal is adopted unchanged.

3.2.4 ACJ 25.101 (h)(3). (Not addressed in NPA)

The NPA did not propose any change to the ACJ to JAR 25.101(h)(3), which deals with the treatment of delay times between consecutive pilot actions in determining the accelerate-stop distance. However, commentators have pointed out that the wording of this ACJ is no longer consistent with the proposed derivation of this distance. JAA concurs and the adoption of these proposals will include a completely revised text for this ACJ which reflects the latest requirement standard.

3.2.5 JAR 25.101(i). (NPA paragraph 2.2.1)

A number of comments referred to this proposal. Points raised, other than endorsement of the proposal as written, were :–

- *the requirement should permit flexibility to allow for partial wear states to be determined and accounted for.*
- *this consideration had already been accounted for by AD action.*
- *the requirement should specify the 'least effective' wear state rather than fully worn.*
- *the inclusion of landing distances should be deleted.*

No specific proposals were made as to how partial wear states might be allowed for. Various methods might be envisaged, some, but not all, of which might be acceptable to the authorities. JAA, in consultation with FAA, is prepared to consider this as a follow-on rule making activity, but in the absence of more detailed proposals at this time, this aspect is considered to be beyond the scope of the present NPA.

A variation on the comment for allowing flexibility was that the performance should be based on all brakes worn to 90% of the permitted limit. This was on the basis that brake wear would be variable from one wheel to another and 90% was, statistically, an adequate means of accounting for a realistic worst case. JAA believes that the scheduled performance should be achievable throughout the permitted wear range and the worst case of all brakes fully worn should be accounted for. A further consideration is that if some individual brake units were worn beyond the level at which they could absorb their full share of the aircraft's energy (even though this was compensated for in energy terms by other brakes being less worn), then in a maximum kinetic energy RTO those brakes would wear out completely, and lose all braking effectiveness, before the aircraft came to a stop. (This is what happened in the DC-10 RTO incident at Dallas/Fort Worth.) This would reduce the overall braking force with a consequent increase in stopping distance. The asymmetry of braking force would also introduce aircraft controllability concerns.

Brake wear raises two causes of concern, as discussed in section 3.2.3 of the NPA. These relate to energy capacity and braking force. The ADs referred to by some commentators resulted from an overrun incident which involved inadequate residual energy capacity on some of the brakes and only this aspect was addressed. The question of reducing braking force achievable as brakes wear, which is a factor with some brake designs, also needs to be addressed, as covered in the NPA. Thus, JAA does not accept that existing ADs have fully addressed the concerns raised by brake wear.

The commentator who proposed changing the text to refer to the brake wear state that produced the least effective braking action did not provide any substantiation of brake designs where effectiveness increases with wear. On the evidence available to the authorities it is reasonable to accept that 'fully worn' is the worst case and the suggested amendment would be an unnecessary complication, requiring additional substantiation for each certification.

Comments on the proposal for landing distances also to be based on fully worn brakes included the view that this was an unnecessary consideration, without safety benefit, as this would never be a significant factor at landing energy levels. JAA believes that the principle of accounting for the full range of permitted operational conditions is equally applicable to the landing case. It is anticipated that the normal substantiation of brake performance by manufacturers identifies energy or wear thresholds beyond which braking effectiveness reduces and will not require undue additional effort.

The proposal is adopted without technical change. However, to maintain harmonisation with FAR 25 text, a minor wording change has been introduced; 'aircraft brake assemblies' has been amended to 'aeroplane wheel brake assemblies'.

3.2.6 <u>ACJ 25.101(i). (NPA paragraph 2.2.2)</u>

One commentator proposed that the final sentence be deleted on the basis that a flight test of the maximum kinetic energy RTO case is unnecessary if good correlation between flight tests and dynamometer tests exists. JAA does not agree. It is intended to permit flexibility between flight and rig tests in substantiating the effect of fully worn brakes over the range of operating conditions. However, the underpinning of this substantiation with one critical RTO test case at the limiting energy level and close to fully worn brakes is considered an essential element.

While JAA did not receive any comments on the earlier part of this proposed ACJ, in consultation with the FAA over the comments they also received, it was agreed to further amend the text. The text to be adopted is intended to provide the maximum flexibility for an applicant to show compliance with the requirement through a combination of aircraft and rig testing. The cross-reference to JAR 25.735(i) is amended to JAR 25.109(h) to reflect the relocation of this test requirement. Sections 3.2.9 and 3.2.15 below refer.

3.2.7 <u>JAR 25.105(c). (NPA paragraph 2.2.3)</u>

The proposed amendment to this sub-paragraph introduced the requirement for take-off performance data to be determined on wet as well as dry smooth runways. No critical comments were received on this point. However, comments were submitted that manufacturers should be permitted to determine and schedule additional wet take-off data for runways with either a grooved or porous friction course (PFC) surface. As more fully discussed against the proposed amendments to JAR 25.109, these commentators believed that existing knowledge of such surfaces justified a higher wet runway friction level than for smooth runways without further testing on individual aircraft.

JAA recognises that grooved or PFC surfaces offer significant safety benefits through maintaining a higher friction level when wet. Giving credit for this through improved aircraft performance would offer an incentive to airport operators to install and maintain such surfaces. A concern, however, is the need to establish standards for the construction and maintenance of such surfaces and the need for procedures and resources to monitor adherence to those standards. The FAA have produced guidance material on this in the form of Advisory Circular 150/5320-12B. There *is no equivalent European material and airfield standards are not yet a harmonised topic under JAA.*

Consequently, for the purposes of the performance requirements of JAR 25, JAA concurs with these comments and the adopted change to JAR 25.105(c) is further amended to permit the optional determination of additional data applicable to wet grooved or PFC surfaces. The need to ensure that individual runways are suitable to take credit for this alternative performance is addressed through the adoption of an addition to JAR 25.1533(a)(3) and an associated ACJ. It is intended that an operational approval will be granted for such data, when provided in the Flight Manual, to be used on particular runways.

3.2.8 JAR 25.107(a)(2) (Not addressed in NPA)

In commenting on the JAR 1 definition of V_1 along the lines now adopted by these amendments, one commentator proposed that JAR 25.107 should be amended to delete the words 'take-off decision speed'. JAA concurs that this proposal is consistent with the adopted amendment to JAR 1 and JAR 25.107(a)(2) is amended accordingly. The wording 'application of the first retarding means' has also been amended to reflect better the definition in JAR 1 and will now read 'initiation of the first action (e.g. applying brakes, reducing thrust, deploying speed brakes) to stop the aeroplane'.

3.2.9 JAR 25.109 (NPA paragraph 2.2.4)

A very wide range of comments were received in connection with the proposals to amend JAR 25.109. Various pilot associations were critical of the proposed changes to delay times and distance margins, recognising that taken in isolation this was a reduction in standards compared to those in place since the adoption of Change 5 (Amendment 25-42 to FAR 25). Others commented that they concurred with these aspects strictly on the basis that they were adopted only in conjunction with the full package of proposals from the Task Force. JAA concurs that this aspect of the proposals should not be adopted except as part of the wider package referred to. This is discussed in greater detail in section 3.3 below. However, as part of this overall package, JAA believes the changes will provide a beneficial harmonisation of standards applicable to existing, derivative and new aircraft types alike.

Several comments were opposed to the proposed methodology for wet runway braking accountability in JAR 25.109(b)(2), particularly the proposed 50% factoring of the dry runway braking force in the torque-limited case. The basis of the proposed methodology was that it would provide a simple but adequate approximation to wet runway braking performance without demanding a more complex analysis of braking system operation. Under some conditions and at some speeds, this approximation was expected to be conservative, whereas in other conditions or at other speeds it was likely to be optimistic. On balance, taking 50% of the dry braking capability for all conditions was considered acceptable. However, JAA accepts the lack of technical justification for assuming that the torque capability of a brake is significantly affected by a runway being wet.

This aspect of the NPA led to extensive further consideration and discussions with interested parties to seek an alternative methodology that would account realistically for the stopping capability on a wet surface while recognising the concerns expressed over the '½ dry' proposal of the NPA. As a result of this review the adopted methodology for wet runway accountability has been revised from that initially proposed. A reference wet surface is now defined for smooth runways, based on a maximium available tyre to ground μ, expressed as a function of speed. This is derived from data published by the Engineering Sciences Data Unit (ESDU) in their report No. 71026 which defined and categorised the characteristics of a wide range of runways. The datum standard being adopted represents the boundary between ESDU's categories B and C. The ESDU data also shows the effect of tyre wear, which becomes significant over the final stages of wear. The adopted standard is that quoted by ESDU for 2 mm of tread depth remaining. The maximum available μ is also a function of tyre pressure and the adopted *methodology requires the applicant to use the data applicable to the maximum certificated tyre pressure.*

The actual wheel braking capability of a particular aircraft type on a wet smooth surface is then taken to be that due to the maximum available μ, factored by the efficiency of the aircraft's anti-skid system and subject to the overriding limit of the maximum braking torque that has been demonstrated on a dry runway. This efficiency is a function of both system design and degree of tuning to the particular surface characteristics. System design has evolved greatly from the original 'ON/OFF' systems to the latest generation of high frequency modulating or adaptive systems. The early 'ON/OFF' systems were characterised by full release of brake pressure when an imminent skid was detected and a relatively slow frequency of response. This produced relatively long periods when little or no braking was being applied. The modulating, or adaptive, systems seek to limit the degree of brake pressure release to the minimum necessary to avoid skidding and, coupled with progressively higher response frequencies and enhanced control algorithms, are better able to detect and utilise the maximum available tyre to ground friction throughout the stop.

Two methods of determining the anti-skid efficiency to be assumed are provided for by the adopted change. The applicant may undertake the testing necessary, on a suitable wet surface, to establish an efficiency value. Alternatively, a suitably conservative default value, supported by limited test demonstrations on a wet runway, may be assumed. The default value depends on the system design and is 30% for 'ON/OFF' systems, 50% for early generation adaptive systems (defined as quasi-modulating for the purposes of this methodology) and 80% for the latest generation of adaptive systems (defined as fully modulating). Extensive ACJ guidance material has been introduced to assist with the application of this new methodology.

Despite the overwhelmingly critical nature of the comments received on the the NPA's proposed '½ dry' methodology, it is known that some manufacturers welcomed its simplicity and favoured its retention, at least as an option to the new methodology. JAA does not believe that giving 2 analytical methods, which could result in rather different results, would achieve the intended level of consistency. Manufacturers who favoured retaining the NPA proposal expressed concern over the potential complexity of determining anti-skid system efficiency under the adopted methodology. However, the option to use default efficiency values, supported by minimal, and largely qualitative, flight test demonstrations should provide for this concern, while retaining consistency in the requirements.

The option for applicants to schedule additional, enhanced, performance data for grooved or PFC runways, referred to in section 3.2.7 above, is covered in a new sub-paragraph (d) to JAR 25.109.

Comments varied widely on the proposal to permit credit for reverse thrust in the accelerate-stop distance determination on wet runways. Some commentators favoured wider credit for reverse, to include the dry runway case also. One commentator advocated that credit for reverse should be restricted to contaminated runways. A further comment was that the proposals lacked necessary guidance on the criteria for granting such credit. JAA continues to support the recommendations of the Task Force that reverse thrust credit was appropriate in the wet runway case, as part of the re-balancing of risks, but introducing this as a further change in the dry runway case is not warranted by other compensatory changes within this package. The need for associated guidance material is accepted and this has been added to the proposals in the form of a new ACJ to JAR 25.109(f).

3.2.10 ACJ 25.109(a) (Not addressed in NPA)

This ACJ is now related to both JAR 25.109(a) and (b), and the cross-reference in the title is amended accordingly. In reviewing other comments, particularly the need for guidance material on credit for reverse thrust, it was recognised that greater amplification of this aspect on tubopropeller types would be beneficial. The text has therefore been expanded in a manner intended to ensure consistency with that of the new ACJ to JAR 25.109(f).

3.2.11 ACJ 25.109(b). (NPA paragraph 2.2.5)

This ACJ provided guidance on the wet runway methodology proposed in the NPA. With the extensive change to this methodology in the adopted amendment, as discussed above, the introduction of the grooved or PFC runway option and the editorial re-arrangement, the necessary guidance material is now given in ACJs associated with JAR 25.109(c) and (d)(2).

3.2.12 JAR 25.113. (NPA paragraph 2.2.6)

As proposed in sub-paragraph JAR 25.113(c)(1), the treatment of take-off run on a wet runway, where the take-off distance was determined by the one-engine-inoperative continued take-off distance, accounted for 2 situations, depending upon the precise form of the curved flight path between lift-off and a height of 35 feet. If the end of the take-off distance (i.e. the achievement of a height of 15 feet) fell beyond the mid-point between lift-off and the achievement of a height of 35 feet, the take-off run would have been the distance up to this mid-point where a clearway was available. This would have permitted a small amount of clearway credit, as represented by the difference in horizontal distance between this mid-point and the point where a height of 15 feet was reached. Conversely, if the end of the take-off distance on a wet runway fell before the mid-point from lift-off to the achievement of a height of 35 feet, the take-off run would have been defined as equal to the take-off distance. One commentator disagreed with permitting any clearway credit on a wet runway, while 3 other commentators (including a major association of airframe manufacturers) believed this added complication was not worth the small benefit that might result in some cases.

JAA accepts these comments and the adopted change establishes the take-off run on a wet runway as the greater of the one-engine-inoperative distance to a height of 15 feet or 115% of the all-engines-operating distance up to the mid-point between lift-off and a height of 35 feet.

It was also noted that the existing requirement, and as perpetuated in the NPA, only defined take-off run for the situation where the take-off distance included a clearway, whereas operating regulations make reference to the take-off run regardless of the presence of clearway. It has always been taken as read that where there was no clearway, take-off run was equal to take-off distance, but this was not specifically stated. The adopted change will remove this anomaly.

Taking account of these points, an amended sub-paragraph JAR 25.113(a) and a new sub-paragraph JAR 25.113(b) are adopted as proposed in the NPA. A sub-paragraph JAR 25.113(c) is adopted which subsumes the technical content of the existing sub-paragraph JAR 25.113(b) for a dry runway, defines take-off run for a wet runway as discussed above and stipulates that, in the absence of clearway, the take-off run is equal to the take-off distance.

3. 2.13 ACJ 25.113(a)(2). (NPA paragraph 2.2.7)

The proposed change to this ACJ was purely editorial, consisting of changes to requirement cross-references as necessitated by other proposals in the NPA. One commentator proposed that paragraph (b) should not specify that the initial climb speed should not be less than V_2 *+ 10 knots. This is a technical consideration not raised in the NPA and is therefore beyond the scope of the present actions. The revisions to this ACJ are adopted as proposed.*

3.2.14 JAR 25.115. (NPA paragraph 2.2.8)

No comments were received on this proposal which is adopted without further change.

3.2.15 JAR 25.735. (NPA paragraph 2.2.9)

The proposed amendment to sub-paragraph JAR 25.735(f) would have required the design landing brake kinetic energy capacity rating to be determined with fully worn brakes. Comments were received that, unlike the RTO case, this requirement is not concerned with a limiting kinetic energy rating but is associated with equipment qualification testing. In particular, it related to the kinetic energy taken into account in demonstrating compliance with the TSO 100 landing stops specification. As such, it was stated that specifying fully worn brakes was inappropriate and confused the real purpose of this requirement.

JAA concurs with these comments and the adopted change is further amended to delete reference to brake condition in JAR 25.735(f). A new ACJ to this sub-paragraph is introduced to clarify that no specific brake condition is specified for this energy capacity rating determination (as opposed to the RTO rating which will continue to be required to be determined for the fully worn condition, as proposed in the NPA). For the landing rating, the applicant may select any convenient initial brake condition that is within the service range and satisfies the requirements of the brake qualification test specification.

One commentator proposed that sub-paragraph JAR 25.735(h) be further amended to permit the option of determining the RTO brake kinetic energy capacity at partially worn brake states. As discussed in Section 3.2.5 above, the scheduling of performance data varying with brake wear state would be a significant technical change that is beyond the scope of these proposals. Another commentator suggested changing the words 'rejected take-off' to 'most severe stop' in this sub-paragraph, citing aircraft that may have higher kinetic energy stopping conditions than in an RTO; for example, following a landing with the flaps fully retracted. This concern is being addressed as a separate regulatory activity involving the appropriate brakes specialists. It would be a significant change, meriting full consultation, and is not appropriate for adoption into the final rule based on the current NPA.

Some commentators proposed that the RTO brake kinetic energy rating on a dry runway, and other associated aspects of dry runway RTO performance, should permit account to be taken of reverse thrust. The need to account for worn brakes has been shown by service experience, even where that experience has related to aircraft having reverse thrust available that was not given credit in the certificated performance. There remain a number of operational variables that can affect RTO performance but which are not specifically addressed in the related requirements of JAR 25. JAA would be prepared to consider more detailed treatment of such variables and to include the availability and use of reverse thrust in that review. However, the inclusion of this change in this amendment package is not accepted and would adversely influence the intended balance of this package.

One commentator called for sub-paragraphs JAR 25.735(f) and (h) to be combined. However, as the former no longer specifies any particular brake wear state, while the latter retains the proposed specification of fully worn brakes, this combining of sub-paragraphs would not be appropriate.

In keeping with the adopted change to sub-paragraph JAR 25.735(f), sub-paragraph (h) is also further amended to cross-refer to the qualification testing of the applicable J-TSO. In both cases, however, the qualification 'or an acceptable equivalent' has been added. This is due to the fact that while JAA is developing a J-TSO to cover brake qualification testing, this work was not complete at the time of finalising the NPA 25B, D, G – 244 amendments to be adopted.

Several commentators suggested that the proposed new sub-paragraph JAR 25.735(i), which specifies a flight test demonstration of the maximum kinetic energy RTO, was misplaced in the Design and Construction requirements of JAR 25 sub-part D. JAA concurs and while the adopted change retains this new requirement, it has been re-located, as JAR 25.109(i), within the Flight requirements sub-part.

Finally, with the deletion from JAR 25.735 of the proposed new sub-paragraph (i), the re-labelling of the existing sub-paragraph (i) as sub-paragraph (j) is no longer necessary. The existing sub-paragraph (i) is therefore retained unchanged and no longer features as a part of these changes.

3.2.16 JAR 25.1533(a). (Not addressed in NPA)

The FAA's NPRM 93-8 included a proposal to amend FAR 25.1587(b) to include a reference to dry and wet runway surface conditions. This did not introduce any additional technical considerations, but simply consolidated other aspects of these proposals into sub-part G. This was not included in the NPA. One commentator on the NPRM agreed with the intent of this proposal but suggested it was inappropriately located in 25.1587(b) rather than in 25.1533(a). JAA and FAA concur with this comment and each requirement code will adopt a change to sub-paragraph 25.1533(a) to add 'runway surface conditions (dry and wet)' to the list of variables already specified therein. FAR 25.1587(b) will not be amended in this respect in the FAA's final rule.

Text has also been added to JAR 25.1533(a)(3) to address the establishment, at the option of the applicant, of wet runway take-off data applicable to grooved or PFC runways.

3.2 17 ACJ 25.1533(a)(3). (Not addressed in NPA)

This newly adopted ACJ elaborates on the need for operational approval for the use of wet runway data applicable to grooved or PFC surfaced runways. FAA AC 150/5320-12B is referenced as a source of guidance material on construction and maintenance standards for such surfaces.

3.2.18 JAR 25 X 1591. (NPA paragraph 2.2.10)

No comments were received on this proposal which is adopted without further change.

3.2 19 ACJ 25 X 1591. (NPA paragraph 2.2.11)

No comments were received on this proposal which is adopted without further change.

3.3 Discussion of Related Operational And Retroactive Aspects

It has been noted that the proposals contained in NPA 25B, D, G-244 were derived from a package of recommendations made to the Authorities by an industry-led Task Force that had reviewed the requirements associated with the rejected take-off (RTO) manoeuvre. This was also addressed in the Introduction to the NPA. JAR 25 contains design requirements to be complied with in the certification process for new aeroplane types. Its purpose is not to set the requirements for operation of aircraft, although, in the case of performance requirements, the distinction between design (airworthiness) and operating regulations is not always clear cut. JAR 25 also does not provide a means of retroactively applying new requirements to previously certificated designs. Given also the certification treatment of designs deemed to be derivatives of older models, rather than entirely new types, it can take a very considerable time before changes to design requirements are widely implemented throughout the air transport fleet. Where such retroactivity is deemed necessary, this can be achieved either through the operational requirements, applicable to whole classes of aircraft, or by Airworthiness Directives, applicable to specific aircraft models.

As the motivation for these proposals to amend the RTO requirements was a combination of concern over the continuing rate of RTO accidents amongst the in-service fleet and concern over inequitable treatment of competing aircraft designs in a highly commercially important area, a solution that applied across the air transport fleet was envisaged as essential by the Authorities and by the Task Force. For Europe, the solution for implementing the relevant operational and retroactive aspects was seen to be through the initial drafting of JAR-OPS. Since the last publication of NPA 25B, D, G-244, this has been achieved. The aspects involved are wet runway *accountability and runway alignment distance accountability; they are addressed by JAR-OPS 1.490.*

A number of comments were received endorsing the statements in the Introduction and Justification sections of the NPA to the effect that it should be seen as part of an indivisible package with these intended operational requirements. Such commentators stated that their support for the NPA was conditional upon the implementation of these operating requirements also, and urged the JAA to prevail upon the FAA to adopt a similarly complete package. JAA continues to concur with these comments.

It is a matter of concern to the JAA that the FAA have adopted a different view and no longer support retroactive application (other than brake energy aspects that were addressed by ADs) and runway alignment accountability. It is understood that the FAA position was based on a cost-benefit analysis that showed that these particular aspects, taken in isolation, could not be justified. In JAA's view, the package of proposals should have been considered in combination and would then have been found cost effective in safety terms.

In the case of new designs, these amendments to the requirements need to be compared with the standard of JAR 25 Change 5 (FAR 25 Amendment 42) that would otherwise have applied. They permit the calculation of RTO distances to revert to essentially the same standard as applied prior to Change 5/Amendment 42. Data suggested by manufacturers for the effect of this change was a reduction in RTO distance of around 300 feet or an increase in RTO-limited take-off weight of around 7 tonnes on a modern large twin turbo-jet aeroplane on a dry runway. Viewed globally, the introduction of wet runway accountability (in countries where this was not previously required) represents a useful enhancement in overall safety. However, the re-balancing of take-off performance on a wet runway using a 15 feet screen height, a lower V_1 and credit for reverse thrust, will often result in little or no reduction in take-off weight compared to a dry runway. The RTO-limited weight on a wet runway under these amendments is likely to be higher than on a dry runway in accordance with Change 5/Amendment 42. Thus, this aspect offers both safety and commercial benefits.

The lack of accountability for runway alignment distance is an historically established practice. However, its significance has increased with increasing fuselage lengths, and this factor can significantly impact the intended margins for all take-offs and RTOs. This concern has also been recognised recently by ICAO. An amendment to Annex 6 has introduced the need for runway alignment distance accountability as an ICAO Standard. (ICAO Annex 6 Part 1, Chapter 5, Paragraph 5.2.8.1 refers.) On the largest modern aeroplanes, this effect can amount to a distance of the same order as the benefit in RTO distances under these amendments compared to Change 5/Amendment 42. Thus, in situations where runway alignment within the scheduled runway length is a factor, this addition to the operating requirements can compensate well for the reduction in scheduled RTO distance compared to current requirements. JAA concurs with the comment that it cannot continue to be logical to give credit for distances of this magnitude for runway length that is already behind the aircraft at the start of the take-off roll as if it were still available ahead of the aircraft for the ensuing take-off or RTO. Furthermore, JAA sees no reason for member States failing to adopt the ICAO Standard on this topic.

For existing types, the illogicality of continuing to ignore alignment distance is equally applicable.

For operators who were not previously required to account for the effects of a wet runway surface, this aspect will be a newly imposed regulatory standard. However, given that the commercial impact on performance-limited take-off weights is generally small, the major concern has been over the costs of providing the data. The intention expressed at the Task Force, and still upheld by JAA, is that maximum use be made of existing wet runway data. A survey of manufacturers revealed that such data were available for virtually all the turbo-jet types back to, and including, the first generation types such as the B707 and DC-8. (The only exception of any significance appeared to be the Mercure and, possibly, some models of Caravelle. Neither of these types are believed to be still in commercial operation in Europe or North America). The data were produced in accordance with JAR 25 X 1591 and its associated AMJ, or the earlier

U.K. requirements of BCAR Section D. Even where compliance with such data has not been required, it has often been supplied to operators as advisory material and it is believed that many have used it on a voluntary basis. While such data will not have been derived to exactly the same standards as those now being adopted for JAR/FAR 25, JAA continues to believe it will offer a realistic means of meeting the safety intent of the retroactive operating requirement at a reasonable cost.

4 Conclusions

The proposals of NPA 25B, D, G-244 are further amended as discussed in this Comment and Responses document and as shown in the attachment. At this latest standard they are to be adopted into JAR 25 with effect from (TBD).