European Aviation Safety Agency

Notice of Proposed Amendment 2016-11

Review of aeroplane performance requirements for commercial air transport operations

RMT.0296 (OPS.008(a)) — 30.9.2016

EXECUTIVE SUMMARY

This Notice of Proposed Amendment (NPA) addresses a number of issues related to aeroplane performance requirements for commercial air transport (CAT) operations.

In particular, the NPA addresses two safety recommendations (SRs), and it is linked with Actions 3.7.1, 3.7.2 and 3.7.3 of the European Action Plan for the Prevention of Runway Excursions (EAPPRE).

It also provides for alignment with the International Civil Aviation Organization (ICAO) State Letters 2016/12 and 2016/29.

The NPA proposes standards for runway surface condition reporting, airworthiness standards for landing performance computation at time of arrival, an in-flight assessment of landing performance at time of arrival as well as a reduced required landing distance for business aviation operations with performance class A aeroplanes and for performance class B aeroplane operations.

The proposed changes are expected to increase the current level of safety in relation to aeroplane performance, to improve harmonisation with the corresponding Federal Aviation Administration (FAA) rules, to ensure alignment with (ICAO), and to allow for flexibility and proportionality for certain CAT operations.

Applicability	
Affected regulations and decisions:	— Annex I (Definitions); — Annex II (Part-ARO); — Annex IV (Part-CAT); to Regulation (EU) No 965/2012; — ED Decision 2003/002/RM (CS-25); — ED Decision 2012/015/R (Definitions); — ED Decision 2014/017/R (Part-ORO); — ED Decision 2014/015/R (Part-CAT)
Affected stakeholders:	CAT aeroplane operators; flight crew; national aviation authorities (NAAs); aircraft manufacturers
Driver/origin:	Safety/proportionality
Reference:	— EAPPRE; — SR UNKG-2008-076; — SR NORW-2011-011; — ICAO Annex 6, Part I

Process map	
Terms of Reference (ToR), Issue 1:	9.6.2015
Concept paper (CP):	No
Rulemaking group (RMG):	Yes
Regulatory impact assessment (RIA) type:	Full
Technical consultation during NPA drafting:	No
NPA consultation duration:	3 months
Review group (RG):	Yes
Focused consultation:	TBD
Opinion expected publication date:	2017/Q3
Decision expected publication date:	2018/Q3

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1. Procedural information

1.1. The rule development procedure

The European Aviation Safety Agency (EASA) developed this NPA in line with Regulation (EC) No 216/2008[1] (the EASA Basic Regulation) and the Rulemaking Procedure[2].

This rulemaking activity is included in the EASA 5-year Rulemaking Programme under RMT.0296 (former task number: OPS.008(A)).

The text of this NPA has been developed by EASA based on the input of RMG RMT.0296 (OPS.008(A)). It is hereby submitted to all interested parties[3] for consultation.

The process map on the title page contains the major milestones of this rulemaking activity to date and provides an outlook of the timescales of the next steps.

1.2. The structure of this NPA and related documents

Chapter 1 of this NPA contains the procedural information related to this task. Chapter 2 (Explanatory Note) explains the core technical content. Chapter 3 contains the proposed text for the new requirements, CS and AMC/GM. Chapter 4 contains the RIA showing which options were considered and what impacts were identified, thereby providing the detailed justification for this NPA.

1.3. How to comment on this NPA

Please submit your comments using the automated **Comment-Response Tool (CRT)** available at http://hub.easa.europa.eu/crt/[4].

The deadline for the submission of comments is **9 January 2017**.

1.4. The next steps in the procedure

Following the closing of the NPA public consultation period, EASA will review all the comments received. For this purpose, an RG will be established and one or more group meetings will be held if required. Depending on the number and nature of the comments received, a focused consultation in the form of a workshop with selected stakeholders may be also organised.

The outcome of the NPA public consultation and eventual focused consultation will be reflected in the respective comment-response document (CRD).

EASA will publish the CRD with the Opinion.

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1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

2 EASA is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material.

3 In accordance with Article 52 of the Basic Regulation and Articles 6(3) and 7 of the Rulemaking Procedure.

4 In case of technical problems, please contact the CRT webmaster (crt@easa.europa.eu).

The Opinion contains proposed changes to European Union (EU) regulations (implementing rules (IRs)) and is submitted to the European Commission to be used as a technical basis in order to prepare a legislative proposal.

The Decision(s) containing certification specifications (CS), acceptable means of compliance (AMC) and guidance material (GM) will be published by EASA when the related IRs are adopted by the European Commission.

2. Explanatory Note

2.1. Overview of the issues to be addressed

The main issues this NPA addresses are the following:

— standards for runway surface condition assessment and reporting;

— airworthiness standards for landing performance computation at time of arrival;

— in-flight assessment of landing performance at time of arrival;

— crosswind limitations;

— reduced required landing distance for business aviation operations with performance class A aeroplanes and for performance class B aeroplane operations; and

— miscellaneous amendments to improve technical accuracy, clarity and consistency.

The reasons for addressing these issues are essentially the implementation of amendments to ICAO Annex 6, Part I, and to ICAO Annex 8, certain SRs addressed to EASA, harmonisation with the FAA, proportionality, technical improvements and clarifications of the rules on aeroplane performance.

For a more detailed analysis of the issues addressed by this proposal, please refer to the RIA Section 4.1. — Issues to be addressed.

2.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2 of this NPA.

The general objective of this proposal is to maintain a uniform and high level of safety with cost-efficient rules.

The specific objectives of this proposal are to:

— reduce the number of accidents and serious incidents where aeroplane performance is a causal factor;

— provide improved clarity, technical accuracy, flexibility or a combination of these benefits for the EU operational requirements on aeroplane performance for CAT operations; and

— contribute to the harmonisation of FAA and EU operational requirements on aeroplane performance for CAT operations.

2.3. Summary of the RIA

For two of the issues addressed by this NPA, namely:

— miscellaneous amendments to improve technical accuracy, clarity and consistency; and

— crosswind limitations,

a RIA is not considered necessary.

The other two issues, namely:

— implementation of ICAO amendments (which includes standards for runway surface condition assessment and reporting, airworthiness standards for landing performance computation at time of arrival, and in-flight assessment of landing performance at time of arrival); and

— reduced required landing distance for performance class A and B aeroplane operations,

which have different starting points and drivers, have been considered under two separate RIAs.

Implementation of ICAO amendments

Along with the baseline option (Option 0 — No changes), another option was considered:

— implement the ICAO amendments.

The impacts of the two options are analysed in detail in Chapter 4 below. Option 1 has been selected as the most appropriate one for the following reasons:

— it is expected to provide the highest safety benefit;

— it allows full alignment of the EU rules with the adopted ICAO Standards and Recommended Practices (SARPs); and

— it achieves a higher degree of harmonisation between EU and US rules.

Reduced required landing distance for performance class A and B aeroplane operations

Along with the baseline option (Option 0 'No changes'), another option was considered:

— introduce the possibility of using a landing factor of 80 % of the landing distance available (LDA) for performance class A and B aeroplanes under defined conditions and with the approval of the competent authority (CA).

The impacts of the two options are analysed in detail in Chapter 4 below. Option 1 has been selected as the most appropriate one because while it maintains the same level of safety as with the current rules, it is expected to achieve the following additional benefits:

— to have a medium positive social impact;

— to have a medium positive economic impact;

— to render EU rules more proportionate; and

— to achieve a higher degree of harmonisation between EU and US rules.

SRs addressed by this NPA

EASA committed to consider the following SRs in this RMT:

EAPPRE, Ref. 3.7.1	*Establish and implement one consistent method of contaminated runway surface condition assessment and reporting by the aerodrome operator for use by aircraft operators. Ensure the relation of this report to aircraft performance as published by aircraft manufacturers.*
EASA reply	The SR has been agreed and addressed through the changes of:

	— CAT.OP.MPA.311 on runway surface condition assessment; and — CS 25.1591 and CS 25.1592 on performance data published by the manufacturers. It should be noted that the requirements applicable to aerodrome operators to implement one consistent method for runway surface condition assessment and reporting will be developed through a future rulemaking task in the 'Aerodromes (ADR)' context.
EAPPRE Ref. 3.7.2	*Establish and implement one consistent method of calculation of crosswind limits for use by aircraft manufacturers and aircraft operators.*
EASA reply	The development of a standardised methodology for the calculation of crosswind limits is at the level of flight testing and cannot be addressed in the context of operational rules for aeroplane performance. The SR is, therefore, considered to be beyond the scope of this NPA. Furthermore, it was recognised that the issue is currently being addressed by the Flight Test Harmonization Working Group (FTHWG), where EASA is represented and which is considered to be the most appropriate body to deliberate on the issue.
EAPPRE Ref. 3.7.3	*It is recommended that aircraft operators always conduct an in-flight assessment of the landing performance prior to landing. Note: Apply an appropriate margin to the results.*
EASA reply	The SR has been agreed and addressed through the proposed new requirement of CAT.OP.MPA.303 for in-flight check of the landing distance at the time of arrival.
SR UNKG-2008-076	*The European Aviation Safety Agency should require operators to ensure that flight crews are provided with guidance material on aircraft performance when operating on a runway that is notified as 'may be slippery when wet', or has sections thereof notified as 'may be slippery when wet'.*
EASA reply	The SR has been agreed and addressed through the proposed amendments of: — Annex I (Definitions) to Regulation (EU) No 965/2012[5] (hereinafter referred to as the 'Air OPS Regulation') on the runway surface condition and contaminant descriptors;

[5] Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1).

	— CAT.OP.MPA.311 on runway surface condition assessment; — CAT.OP.MPA.303 on in-flight check of the landing distance at the time of arrival; and — CS 25.1591, CS 25.1592
SR NORW-2011-011	*The Accident Investigation Board Norway (AIBN) recommends that FAA, EASA and the Civil Aviation Authority (CAA) Norway evaluate the airlines' crosswind limits in relation to friction values and consider whether they should be subject to separate approval by the authorities.*
EASA reply	The SR has been accepted and the following assessment has been done: — Operational crosswind limits are either based on manufacturer's approved data or on manufacturer's advisory data provided in other documents; thus, an additional approval by the CA is not considered necessary. — Guidance to operators is necessary on how to use the information available from manufacturers to establish operational crosswind limits in the operations manual (OM) and to relate such limits to the runway surface conditions. The SR has been then addressed by the proposed amendments of: GM1 ORO.MLR.100 Operations manual — general CROSSWIND LIMITATIONS IN THE OPERATIONS MANUAL.

2.4. Overview of the proposed amendments

2.4.1. Annex I (Definitions) to the Air OPS Regulation

The definitions of dry, wet and contaminated runway are amended in accordance with the definitions introduced in ICAO Annex 6 and Annex 14.

Procedural information that was previously contained in the definitions of dry and contaminated runway is moved to the related GM. For 'contaminated runways', it is further specified that being the runway condition reported by runway thirds, a 'significant portion of the runway' in this context refers to one third of the runway and not to the entire length.

The definition of 'damp runway' is deleted as this condition is now included in the definition of 'wet runway'.

The following new definitions are added to support the proposed runway surface condition assessment and reporting system:

— 'runway condition assessment matrix (RCAM)';

— 'runway condition report (RCR)';

— 'runway condition code (RWYCC)'; and

— ‘runway surface condition(s)’.

The definitions of the runway surface descriptors are added as well.

Furthermore, a definition of ‘slippery wet runway’ is added in accordance with ICAO Annex 14.

2.4.2. Annex II (Part-ARO) to the Air OPS Regulation

Appendix II

Note 20 to the OPERATIONS SPECIFICATIONS form (EASA FORM 139, Issue 1) is amended to include under the listed items the approval for reduced required landing distance operations to be consistent with the proposed new rules CAT.POL.A.255 and CAT.POL.A.355 regulating such operations.

2.4.3. Annex III (Part-ORO) to the Air OPS Regulation

GM2 ORO.GEN.130(b) Changes related to an AOC holder

The list of changes requiring prior approval is amended to include reduced required landing distance operations to be consistent with the proposed new rules CAT.POL.A.255 and CAT.POL.A.355 regulating such operations.

GM1 ORO.MLR.100 Operations manual — general

Guidance is proposed to operators on how to establish crosswind limits in the OM to clarify that the primary source should be the manufacturer’s information and that then, further restrictions may be applied based on the consideration of operational experience and operating-environment factors, including runway surface condition.

2.4.4. Annex IV (Part-CAT) to the Air OPS Regulation

CAT.OP.MPA.300 Approach and landing conditions

A requirement for a specific in-flight assessment of the landing distance at the time of arrival is proposed in accordance with ICAO Annex 6.

For clarity reasons, the following amendments are also proposed:

— The rule previously applicable to both aeroplanes and helicopters is split in two different requirements. The new requirement CAT.OP.MPA.301 for helicopters has no content changes compared to the current rule.

— The details of the in-flight assessment of the landing distance at the time of arrival are contained in a new dedicated rule because the current CAT.OP.MPA.300 serves also other purposes than checking the landing distances, such as checking the weather minima. In this regard, it should be noted that said rule is being revised under the ongoing RMT.0379 — All-weather operations (AWO) (check of the operating minima and other consistency changes). However, the proposal of RMT.0379 is not presented in this NPA, since the related NPA has not been published yet. Further coordination in this respect will be ensured in the future.

AMC1 CAT.OP.MPA.300 Approach and landing conditions

— The helicopter-related AMC is separated from the aeroplane-related AMC for clarity reasons without any content changes.

— The aeroplane-related AMC is amended to specify that the commander should make during the approach preparation a decision on the worst runway condition that may be accepted for safe landing, should the meteorological conditions lead to a degradation of the runway condition.

CAT.OP.MPA.303 In-flight check of the landing distance at the time of arrival — aeroplanes

A new requirement is proposed for an in-flight check of the landing distance at the time of arrival in accordance with ICAO Annex 6 and the Takeoff and Landing Performance Assessment Aviation Rulemaking Committee (TALPA ARC) recommendations.

A different approach is taken for various categories of aeroplanes as follows:

— performance class A aeroplanes:

the TALPA ARC recommendations require the application of a 15% factor to the landing distance determined in accordance with performance data for the landing distance at the time of arrival.

— performance class B aeroplanes:

in consideration of the fact that in many cases, data from the manufacturer may not be available for this category of aeroplanes as no relevant airworthiness standards may exist, the proposed new rule allows, as a minimum, to ensure that the landing distance calculated at the time of landing, based on the actual conditions, is at least in accordance with the criteria applicable at dispatch; and

— performance class C aeroplanes:

in consideration of the fact that in many cases, data from the manufacturer may not be available for this category of aeroplanes as no relevant airworthiness standards may exist, the proposed new rule allows, as a minimum, to ensure that the landing distance calculated at the time of landing, based on the actual conditions, is at least in accordance with the criteria applicable at dispatch.

AMC1 CAT.OP.MPA.303(a);(b)(1);(c)(1) In-flight check of the landing distance at the time of arrival — aeroplanes

A new AMC is proposed, based on the FAA Advisory Circular (AC) 25-32, for the use of corrective factors for the in-flight check of the landing distance at the time of arrival when no manufacturer's data are provided in the AFM for performance class A aeroplanes.

GM1 CAT.OP.MPA.303 In-flight check of the landing distance at the time of arrival — aeroplanes

Guidance is proposed mainly to explain the following:

— when during the approach, the in-flight check of the landing distance should be performed;

— what information should be considered;

— the autobrake usage; and

— when the assessment may be limited only to confirmation of the dispatch calculation.

CAT.OP.MPA.311 Runway braking action reporting

A new requirement is proposed in accordance with ICAO Annex 6 for the commander to report the braking action experienced during landing if it is not as good as expected from previous reports.

AMC1 CAT.OP.MPA.311 Runway braking action reporting

A new AMC is proposed to implement the requirement on runway braking action reporting based on amendments of ICAO documents. The background is the following:

The core of the ICAO amendments is the RCAM. Its structure adheres to the previous ICAO runway codes used in the SNOWTAM format and includes seven runway condition levels associated with codes from 0 (for less than poor braking action) to 6 (for dry), where each runway condition code (except 0) is matched with a corresponding aeroplane deceleration performance level. A version of the RCAM derived from the TALPA ARC proposals is available in ICAO Doc 9981 'PANS — Aerodromes'.

Different criteria of runway condition reporting can be used as entry points for the determination of the applicable aeroplane performance level. These reporting criteria are:

— primary observations of contaminant type and depth, as well as of temperature;

— pilot advisory report of braking action; and

— runway friction measurements (Mu (μ)).

The last two types of report should be used only for downgrading a braking action category of a runway, which is basically identified via contaminant type and depth. Runway condition codes are to be reported for each third of the runway when more than 25 % of one third of the runway surface is contaminated. If a friction measurement or reports from pilots of preceding aeroplanes (air reports (AIREPs)) indicate that the friction levels have dropped below those expected for the type of contaminant on the runway, the aerodrome should consider this information in reporting the relevant condition code in line with the observed friction or braking action.

The TALPA ARC recommended that friction values should no longer be transmitted to pilots, but restricted to use by the aerodrome in consolidating the runway condition assessment, mainly to downgrade a runway condition assessment from descriptive characteristics. Furthermore, an ICAO SARP recommends not to consider friction readings in winter conditions, except on hard contaminants (i.e. compacted snow and ice).

It should be noted that the RCAM provides a recommendation for the performance classification of runways that are reported as 'slippery wet' due to rubber contamination or otherwise degraded runway friction. The concept of reporting runways as 'slippery wet', when the measured friction drops below the maintenance threshold, was previously recommended for enforcement by the States in ICAO Annex 14, but no associated aeroplane performance was so far available to allow flight crew to take this information into account in their performance assessment at the time of arrival.

CAT.POL.A.105 General

Paragraph (d) on damp runways is deleted for consistency with the changes introduced in the definitions, and the following (e) is renumbered as (d) accordingly.

CAT.POL.A.200 General

A new paragraph is proposed for performance data necessary for the landing distance assessment at the time of arrival.

AMC1 CAT.POL.A.200 General

An amendment to the AMC on wet and contaminated runway data is proposed to reflect the new ICAO methodology of reporting runway surface condition based on the RWYCC and RCAM.

GM1 CAT.POL.A.200 General

A new GM is proposed to specify the applicable standards for the assessment of the landing distance at the time of arrival.

CAT.POL.A.215 En-route — one-engine-inoperative (OEI)

Further to taking into account proposal 6 of the Joint Aviation Authorities (JAA) NPA-OPS 47, rule references are corrected and some text clarifications introduced.

Moreover, a new paragraph is added as the current rule was assuming the availability of en route OEI net flight path data for performance class A aeroplanes. However, this is not always the case. Most notably, airworthiness standards applicable to commuter category aeroplanes (CS-23 or equivalent) do not require this information to be provided in the AFM. To address this disparity, it is necessary to specify the appropriate margin that should be applied to the OEI gross en-route flight path data for performance class A aeroplanes. Accordingly, the OEI net flight path margins specified in CS-25 for two-, three- and four-engined aeroplanes are added.

CAT.POL.A.220 En-route — aeroplanes with three or more engines, two engines inoperative

Further to the proposal of the JAA NPA-OPS 47, the following changes are introduced:

— the use of ‘long range cruising speed’ is replaced with ‘cruising power’, thus harmonising with the corresponding Federal Aviation Regulation (FAR) 121 requirement. This change would allow more flexibility to operators who would be able to substantiate the use of a speed other than the long-range cruising speed to comply with the rule; and

— text clarifications are introduced and rule references added; it should be noted that the reference to CAT.POL.A.235 is restricted to wet runways only compared to the JAA proposal.

CAT.POL.A.230 Landing — dry runways

The rule is amended to include the existence of reduced required landing distance operations as per proposed new CAT.POL.A.255.

Furthermore, paragraph (f) on alternates is proposed to be deleted for the following reasons:

— the original intent of this requirement was to cater for a rare and unique set of circumstances, which is better addressed by an exemption or a derogation than a general rule; and

— this paragraph is partly superseded regarding the in-flight check part by the proposed new CAT.OP.MPA.303.

It is, however, considered that alleviation for alternates is necessary for operations on contaminated runways; in this regard, a proposal is made.

AMC1 CAT.POL.A.230 Landing — dry runways

Rule references are corrected.

GM1 CAT.POL.A.230 Landing — dry runways

The possibility of a landing factor of 80 % is mentioned in consistence with the change proposed in CAT.POL.A.255.

CAT.POL.A.235 Landing — wet and contaminated runways

A new paragraph is added to allow flexibility on the use of alternates when dispatching on contaminated runways.

CAT.POL.A.250 Approval of short landing operations

Further to the new type of operations introduced into CAT.POL.A.255, in CAT.POL.A.250, it is specified that short landing operations cannot be conducted in combination with reduced required landing distance operations.

CAT.POL.A.255 Approval of reduced required landing distance operations

A new requirement is proposed for reduced required landing distance operations of performance class A aeroplanes. These operations are only allowed for non-scheduled on-demand CAT operations of aeroplanes having a maximum certified take-off mass (MCTOM) of 45 360 kg or less and a maximum operational passenger seating configuration (MOPSC) of 19, and require a prior approval by the CA.

The rule allows the use of a landing factor of 80 % of the LDA, which in turn reduces the required landing distance.

The intent of this proposed new requirement is to achieve proportionality of the rules for business aviation operations and harmonisation with the corresponding US requirement, under a set of conditions that, as explained in Chapter 4 (RIA) of this NPA, attain a level of safety equivalent to that intended by CAT.POL.A.230.

The proposed mitigating measures are developed in the following four main areas:

— operational conditions;

— flight crew;

— aerodrome conditions, and

— aeroplane characteristics and performance.

Particularly as regards the assessment of aerodrome conditions, it should be noted that when the runway is forecast to be wet, a further check of the landing distance is required for the following reason: the landing distance calculated in accordance with CAT.POL.A.230 for dry runways at dispatch needs to be increased by 1.15 for the case of a wet runway (as per CAT.POL.A.235). This distance is obtained as follows:

$$\text{Wet LD} = 1.15 \times 1.25 \times \text{ALD}$$

where:

— 'Wet LD' is the required landing distance for wet runways;

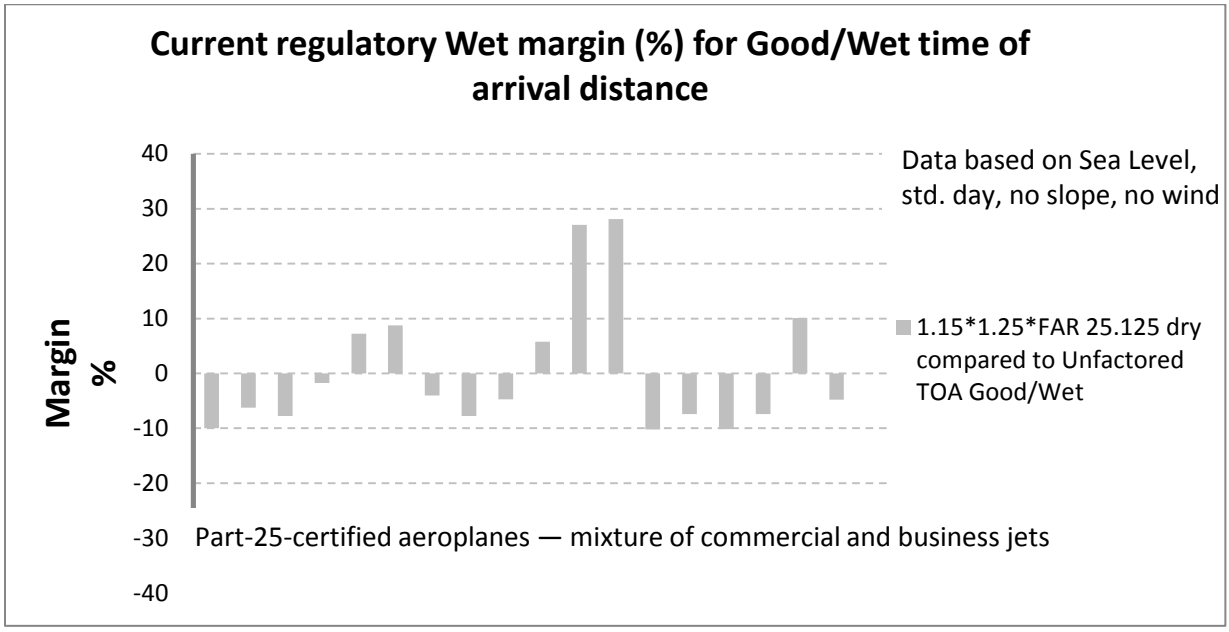
— '1.15' is the factor of the wet check required by CAT.POL.A.235;

— '1.25' is the factor resulting from the use of 80 % of the LDA; and

— 'ALD' is the actual landing distance for the type resulting from AFM data in accordance with CS 25.125 or equivalent (FAR 25.125).

However, a comparison with the landing distance required by CAT.OP.MPA.303 was performed for a number of performance class A aeroplane types showing that the distance based on CAT.OP.MPA.303 may be higher or lower than Wet LD figures depending on the aeroplane type, number of operative reversers and other assumptions made during the certification of the aeroplane.

Figure 1 — Wet margin for large jet aeroplanes



These differences for certain aeroplane types may lead to the situation where the Wet LD for reduced required landing distance operations is systematically shorter of the one calculated in-flight due to the use of the 80 % landing factor.

To avoid this situation, a requirement is proposed to compare at the time of dispatch the Wet LD with the distance calculated in accordance with CAT.OP.MPA.303, and use the longer of the two.

Notwithstanding the above reasoning, the requirement of CAT.OP.MPA.303 to check again the landing distance in-flight against the latest information available at the time of arrival remains valid.

GM1 CAT.POL.A.255(b)(1) Approval of reduced required landing distance operations

Guidance is provided to clarify that charter operations are not eligible for reduced required landing distance operations.

GM2 CAT.POL.A.255(b)(1) Approval of reduced required landing distance operations

Guidance is proposed on how to determine for these operations a level of safety equivalent to that attained by the current rules. It is highlighted that all the conditions established have to be adhered to as it is the combination that achieves the intended level of safety. Criteria for the risk assessment are also listed.

AMC1 CAT.POL.A.255(b)(2)(iii) Approval of reduced required landing distance operations

An AMC is proposed on qualification, training, and checking of the flight crew. Details of the various phases as well as equivalence criteria to account for previous experience are also provided.

GM1 CAT.POL.A.255(b)(2)(iii) Approval of reduced required landing distance operations

Flight data monitoring is recommended as a possible method to monitor these operations.

GM1 CAT.POL.A.255(b)(2)(iv) Approval of reduced required landing distance operations

Guidance is provided to explain the intent of an aerodrome landing analysis programme (ALAP).

GM2 CAT.POL.A.255(b)(2)(iv) Approval of reduced required landing distance operations

Guidance is provided on adverse weather conditions that have to be considered for these operations, especially in relation to wind.

AMC1 CAT.POL.A.255(b)(2)(v) Approval of reduced required landing distance operations

Guidance on equipment and minimum equipment list (MEL) usage is provided.

AMC1 CAT.POL.A.255(b)(2)(viii) Approval of reduced required landing distance operations

An AMC on how to account additional aerodrome conditions is proposed.

CAT.POL.A.330 Landing — dry runways

The rule is amended to include the existence of reduced required landing distance operations as proposed in CAT.POL.A.355.

AMC1 CAT.POL.A.330 Landing — dry runways

Rule references are corrected.

GM1 CAT.POL.A.330 Landing — dry runways

The possibility of a landing factor of 80 % is mentioned in consistence with the change proposed in CAT.POL.A.355.

CAT.POL.A.350 Approval of short landing operations

Further to the new type of operations introduced into CAT.POL.A.355, in CAT.POL.A.350, it is specified that short landing operations cannot be conducted in combination with reduced required landing distance operations.

CAT.POL.A.355 Approval of reduced required landing distance operations

A new requirement is proposed for reduced required landing distance operations of performance class B aeroplanes. These operations are allowed for specific runways at aerodromes where a public interest and operational necessity have been determined by the state of the aerodrome, and require a prior approval by the CA.

The rule allows the use of a landing factor of 80 % of the LDA which in turn reduces the required landing distance.

The intent of the rule is to achieve proportionality of the rules for small CAT operators under a set of conditions that, as explained in Chapter 4 (RIA) of this NPA, are considered to attain a level of safety equivalent to that intended by CAT.POL.A.230.

The proposed mitigating measures are developed in the following four main areas:

— operational conditions,

— flight crew,

— aerodrome conditions, and

— aeroplane characteristics and performance.

Compared to the corresponding rule for performance class A aeroplanes, requirements on training are simplified; however, further limitations are proposed on the control of the touchdown area, and operations are restricted to visual meteorological conditions (VMC) only.

GM1 CAT.POL.A.355(b) Approval of reduced required landing distance operations

Guidance is proposed on how to determine for these operations a level of safety equivalent to that attained by the current rules. It is highlighted that all the conditions established have to be adhered to as it is the combination that achieves the intended level of safety. Criteria for the risk assessment are also listed.

AMC1 CAT.POL.A.355(b)(3) Approval of reduced required landing distance operations

An AMC on how to control the touchdown area is proposed.

AMC1 CAT.POL.A.355(b)(4) and (b)(5) Approval of reduced required landing distance operations

An AMC is proposed on experience, training, and recency of the flight crew.

GM1 CAT.POL.A.355(b)(6) Approval of reduced required landing distance operations

Guidance is proposed:

— to explain the intent of an aerodrome landing analysis program (ALAP); and

— on adverse weather conditions that have to be considered for these operations, especially in relation to wind.

GM1 CAT.POL.A.355(b)(7)(i) Approval of reduced required landing distance operations

Guidance on equipment and MEL usage is proposed.

GM1 CAT.POL.A.355(b)(7)(ii) Approval of reduced required landing distance operations

Guidance on the use of deceleration devices is proposed.

AMC1 CAT.POL.A.355(b)(8) Approval of reduced required landing distance operations

An AMC on maintenance instructions and operational procedures to enhance the efficiency of deceleration devices is proposed.

AMC1 CAT.POL.A.355(b)(10) Approval of reduced required landing distance operations

An AMC on how to account additional aerodrome conditions is proposed.

CAT.POL.A.415 En-route — OEI

The changes introduced into CAT.POL.A.215 and CAT.POL.A.220 in accordance with JAA NPA-OPS 47 are also introduced here for consistency, as applicable to performance class C aeroplanes.

CAT.POL.A.420 En-route — aeroplanes with three or more engines, two engines inoperative

The changes introduced in CAT.POL.A.215 and CAT.POL.A.220 in accordance with JAA NPA-OPS 47 are also introduced here for consistency, as applicable to performance class C aeroplanes.

2.4.5. CS-25

CS 25.1591

The applicability of this provision is restricted to take-off performance information only as a new standard is introduced for landing performance information.

AMC 25.1591

Information and explanatory material is amended in accordance with the TALPA ARC recommendations and FAA AC 25-31, taking into account ICAO standards for runway condition codes and contaminant descriptors. Definitions and terminology used throughout the entire text are amended accordingly.

Information related to landing is deleted and moved, appropriately amended, to new AMC 25.1592.

In addition to the main changes, further improvements or clarifications are the following:

— Paragraph 7.1 ‘Contaminant Drag — Standing Water, Slush, Wet Snow’ is updated to provide for the option of using 100 % of drag accountability during acceleration, as an alternative to demonstration of conservatism considering 50 % for the entire accelerate and stop distance (ASD);

— Paragraph 7.3.4 is added to provide limitations on upgrades for specially prepared winter runway surfaces in accordance with ICAO; and

— In paragraph 8.3, references to other CS-25 provisions are added, as well as a clarification on crosswind.

CS 25.1592

A new standard is introduced for landing performance information, including performance data for the time of arrival, in accordance with ICAO Annex 8.

AMC 25.1592

Information and explanatory material is amended in accordance with the TALPA ARC recommendations and FAA AC 25-32, taking into account ICAO standards for runway condition codes and contaminant descriptors. ICAO definitions and terminology are introduced accordingly throughout the entire text.

3. Proposed amendments

The text of the amendment is arranged to show deleted text, new or amended text as shown below:

(a) deleted text is marked with ~~strike through~~;

(b) new or amended text is highlighted in grey;

(c) an ellipsis (…) indicates that the rest of the text is unchanged.

3.1. Draft Regulation (draft EASA Opinion)

3.1.1. Definitions

1. Definitions is amended as follows:

Definitions for terms used in Annexes II to VIII

For the purpose of this Regulation, the following definitions shall apply:

(…)

(25) 'contaminated runway' means a runway of which a significant portion of the runway surface area (whether in isolated areas or not) within the length and width being used is covered by one or more of the substances listed under the runway surface condition descriptors.~~more than 25 % of the runway surface area within the required length and width being used is covered by the following:~~

~~(a) surface water more than 3 mm (0,125 in) deep, or by slush, or loose snow, equivalent to more than 3 mm (0,125 in) of water;~~

~~(b) snow which has been compressed into a solid mass which resists further compression and will hold together or break into lumps if picked up (compacted snow); or~~

~~(c) ice, including wet ice;~~

(…)

~~(32) 'damp runway' means a runway where the surface is not dry, but when the moisture on it does not give it a shiny appearance;~~

(…)

(42) 'dry runway' means a runway ~~which is neither wet nor contaminated, and includes those paved runways which have been specially prepared with grooves or porous pavement and maintained to retain 'effectively dry' braking action even when moisture is present;~~whose surface is free of visible moisture and not contaminated within the area intended to be used.

(…)

(103a) 'Runway condition assessment matrix (RCAM)' means a matrix allowing the assessment of the runway condition code, using associated procedures, from a set of observed runway surface condition(s) and pilot report of braking action.

(103b) 'Runway condition code (RWYCC)' means a number describing the runway surface condition to be used in the runway condition report.

Note: the purpose of the runway condition code is to permit an operational aeroplane performance calculation by the flight crew.

(103c) 'Runway condition report (RCR)' means a comprehensive standardised report relating to runway surface conditions and their effect on the aeroplane landing and take-off performance.

(103d) 'Runway surface condition(s)' means a description of the condition(s) of the runway surface used in the runway condition report which establishes the basis for the determination of the runway condition code for aeroplane performance purposes.

Note 1: the runway surface conditions used in the runway condition report establish the performance requirements among the aerodrome operator, aeroplane manufacturer and aeroplane operator.

Note 2: aircraft de-icing chemicals and other contaminants are also reported but are not included in the list of runway surface condition descriptors because their effect on runway surface friction characteristics and the runway condition code cannot be evaluated in a standardised manner.

(103e) 'Runway surface condition descriptors' means one of the following elements on the surface of the runway (note: the descriptions under (a) to (h) below are used solely in the context of the runway condition report and are not intended to supersede or replace any existing World Meteorological Organization (WMO) definitions):

(a) 'Compacted snow': snow that has been compacted into a solid mass such that aeroplane tires, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface.

(b) 'Dry snow': snow from which a snowball cannot readily be made.

(c) 'Frost': ice crystals formed from airborne moisture on a surface whose temperature is below freezing; frost differs from ice in that the frost crystals grow independently and, therefore, have a more granular texture.

Note 1: below freezing refers to air temperature equal to or lower than the freezing point of water (0 °C).

Note 2: under certain conditions, frost can cause the surface to become very slippery, and it is then reported appropriately as 'reduced braking action'.

(d) 'Ice': water that has frozen or compacted snow that has transitioned into ice, in cold and dry conditions.

(e) 'Slush': snow that is so water-saturated that water will drain from it when a handful is picked up or will splatter if stepped on forcefully.

(f) 'Standing water': water of depth greater than 3 mm.

Note: running water of depth greater than 3 mm is reported as 'standing water' by convention.

(g) 'Wet ice': ice with water on top of it or ice that is melting.

Note: freezing precipitation can lead to runway conditions associated with wet ice from an aeroplane performance point of view. Wet ice can cause the surface to become very slippery. It is then reported appropriately as 'reduced braking action'.

(h) 'Wet snow': snow that contains enough water to be able to make a well-compacted, solid snowball, but water will not squeeze out.

(…)

(107a) 'Slippery wet runway' means a wet runway where the surface friction characteristics of a significant portion of the runway have been determined to be degraded

(…)

(128) 'Wet runway' means a runway ~~of which the surface is covered with water, or equivalent, less than specified by the 'contaminated runway' definition or when there is sufficient moisture on the runway surface to cause it to appear reflective, but without significant areas of standing water~~whose surface is covered by any visible dampness or water up to and including 3 mm deep within the intended area of use.

3.1.2. Part-ARO

1. Appendix II is amended as follows:

APPENDIX II

(…)

20. Other approvals or data can be entered here, using one line (or one multi-line block) per authorisation (e.g. short landing operations, steep approach operations, reduced required landing distance operations, helicopter operations to/from a public interest site, helicopter operations over a hostile environment located outside a congested area, helicopter operations without a safe forced landing capability, operations with increased bank angles, maximum distance from an adequate aerodrome for two-engined aeroplanes without an ETOPS approval, aircraft used for non-commercial operations).

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3.1.3. Part-CAT

1. CAT.OP.MPA.300 is amended as follows:

CAT.OP.MPA.300 Approach and landing conditions — aeroplanes

~~Before commencing an~~During the approach to land, the commander shall be satisfied that, according to the information available to him/her, the weather at the aerodrome and the condition of the runway ~~or FATO~~ intended to be used should not prevent a safe approach, landing or missed approach, having regard to the performance information contained in the operations manual. A landing distance assessment shall be done in accordance with CAT.OP.MPA.303.

2. New CAT.OP.MPA.301 is added:

CAT.OP.MPA.301 Approach and landing conditions — helicopters

Before commencing an approach to land, the commander shall be satisfied that according to the information available to him or her, the weather at the aerodrome and the condition of the runway or final approach and take-off area (FATO) intended to be used should not prevent a safe approach, landing or missed approach, having regard to the performance information contained in the operations manual (OM).

3. New CAT.OP.MPA.303 is added:

CAT.OP.MPA.303 In-flight check of the landing distance at the time of arrival — aeroplanes

(a) For performance class A aeroplanes, no approach to land shall be continued unless the landing distance available (LDA) is at least 115 % of the landing distance at the estimated time of landing on the intended runway, determined in accordance with the approved landing distance data at the time of arrival for landing distance assessment.

(b) For performance class B aeroplanes, no approach to land shall be continued unless:

(1) the LDA is at least 115 % of the landing distance at the estimated time of landing on the intended runway, determined in accordance with the approved landing distance data at the time of arrival for landing distance assessment; or

(2) if approved landing distance data at the time of arrival for landing distance assessment are not available, the LDA at the estimated time of landing on the intended runway is checked to be at least the required landing distance determined in accordance with CAT.POL.A.330 or CAT.POL.A.335, as applicable.

(c) For performance class C aeroplanes, no approach to land shall be continued unless:

(1) the LDA is at least 115 % of the landing distance at the estimated time of landing on the intended runway, determined in accordance with the approved landing distance data at the time of arrival for landing distance assessment; or

(2) if approved landing distance data at the time of arrival for landing distance assessment are not available, the LDA at the estimated time of landing on the intended runway is checked to be at least the required landing distance determined in accordance with CAT.POL.A.430 or CAT.POL.A.435, as applicable.

4. New CAT.OP.MPA.311 is added:

CAT.OP.MPA.311 Runway braking action reporting

Whenever the runway braking action encountered during the landing roll is not as good as reported, the knowledge of which the commander considers to be safety relevant, he or she shall notify the air traffic services (ATS) as soon as practicable.

5. CAT.POL.A.105 is amended as follows:

CAT.POL.A.105 General

(…)

(d) ~~For performance purposes, a damp runway, other than a grass runway, may be considered to be dry.~~

~~(e)~~ The operator shall take account of charting accuracy when assessing the take-off requirements of the applicable chapters.

6. CAT.POL.A.200 is amended as follows:

CAT.POL.A.200 General

(a) The approved performance data in the AFM shall be supplemented as necessary with other data if the approved performance data in the AFM is insufficient in respect of items such as:

(1) accounting for reasonably expected adverse operating conditions such as take-off and landing on contaminated runways; and

(2) consideration of engine failure in all flight phases.

(b) For wet and contaminated runways, performance data determined in accordance with applicable standards on certification of large aeroplanes or equivalent shall be used.

(c) For the landing distance assessment at the time of arrival, data determined in accordance with applicable standards on certification of large aeroplanes, or equivalent, shall be used.

(d) The use of other data referred to in (a) and equivalent requirements referred to in (b) and (c) above shall be specified in the operations manual.

7. CAT.POL.A.215 is amended as follows:

CAT.POL.A.215 En-route — one-engine-inoperative (OEI)

(…)

(c) The net flight path shall permit the aeroplane to continue flight from the cruising altitude to an aerodrome where a landing can be made in accordance with CAT.POL.A.22~~5~~30 or CAT.POL.A.23~~0~~5, as appropriate. The net flight path shall clear vertically, by at least 2 000 ft, all terrain and obstructions along the route within 9.3 km (5 NM) on either side of the intended track in accordance with the following:

(1) the engine is assumed to fail at the most critical point along the route;

(2) account is taken of the effects of winds on the flight path;

(3) fuel jettisoning is permitted to an extent consistent with reaching the aerodrome where the aeroplane is assumed to land after engine failure with the required fuel reservesas per CAT.OP.MPA.150, appropriate for an alternate aerodrome, if a safe procedure is used; ~~and~~

(4) the aerodrome where the aeroplane is assumed to land after engine failure shall meet the following criteria:

(i) the performance requirements at the expected landing mass are met; and

(ii) weather reports and/or forecasts and ~~field~~runway condition reports indicate that a safe landing can be accomplished at the estimated time of landing~~.~~; and

(5) if the AFM does not contain en-route net flight path data, the gross OEI en-route flight path shall be diminished by a climb gradient of 1.1 % for two-engined aeroplanes, 1.4 % for three-engined aeroplanes, and 1.6 % for four-engined aeroplanes.

(d) The operator shall increase the width margins of (b) and (c) to 18.5 km (10 NM) if the navigational accuracy does not meet at least required navigation performance 5 (RNP 5).

8. CAT.POL.A.220 is amended as follows:

CAT.POL.A.220 En-route — aeroplanes with three or more engines, two engines inoperative

(a) At no point along the intended track shall an aeroplane having three or more engines be more than 90 minutes, with all engines operating at cruising power or thrust, as appropriate,~~at the all-engines-long-range-cruising-speed~~ at standard temperature in still air, away from an aerodrome at which the ~~performance~~ requirements of CAT.POL.A.230 or CAT.POL.A.235(a) as applicable at the expected landing mass are met, unless it complies with (b) to (f).

(b) The two-engines-inoperative en-route net flight path data shall allow the aeroplane to continue the flight, in the expected meteorological conditions, from the point where two engines are assumed to fail simultaneously to an aerodrome at which it is possible to land and come to a complete stop when using the prescribed procedure for a landing with two engines inoperative. The net flight path shall clear vertically, by at least 2 000 ft, all terrain and obstructions along the route within 9.3 km (5 NM) on either side of the intended track. At altitudes and in meteorological conditions requiring ice protection systems to be operable, the effect of their use on the net flight path data shall be taken into account. If the navigational accuracy does not meet at least RNP5, the operator shall increase the width margin given above to 18.5 km (10 NM).

(c) The two engines shall be assumed to fail at the most critical point of that portion of the route where the aeroplane is more than 90 minutes, with all engines operating at cruising power or thrust, as appropriate,~~at the all-engines-long-range-cruising-speed~~ at standard temperature in still air, away from ~~an~~the aerodrome specified in (a) above~~at which the performance requirements applicable at the expected landing mass are met~~.

(d) The net flight path shall have a positive gradient at 1 500 ft above the aerodrome where the landing is assumed to be made after the failure of two engines.

(e) Fuel jettisoning shall be permitted to an extent consistent with reaching the aerodrome with the required fuel reserves of (f) below, if a safe procedure is used.

(f) The expected mass of the aeroplane at the point where the two engines are assumed to fail shall not be less than that which would include sufficient fuel to proceed to an aerodrome where the landing is assumed to be made, and to arrive there at least 1 500 ft directly over the landing area and thereafter to fly ~~level~~ for 15 minutes at cruising power or thrust, as appropriate.

9. CAT.POL.A.230 is amended as follows:

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 turbojet-powered aeroplanes, within 60 % of the landing distance available (LDA); ~~and~~

(2) for turbopropeller-powered aeroplanes, within 70 % of the LDA~~.~~ and;

(3) notwithstanding (a)(1) and (a)(2) above, for aeroplanes having a maximum certified take-off mass (MCTOM) of 45 360 kg or less and a maximum operational passenger seating configuration (MOPSC) of 19 or less, used in non-scheduled on-demand commercial air transport (CAT) operations, within 80 % of the LDA when CAT.POL.A.255 is complied with.

(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.

(c) For short landing operations, the operator shall use the landing distance data factored in accordance with (a) and shall comply with CAT.POL.A.250.

(d) When determining the landing mass, the operator shall take the following into account:

(1) the altitude at the aerodrome;

(2) not more than 50 % of the headwind component or not less than 150 % of the tailwind component; and

(3) the runway slope in the direction of landing if greater than ± 2 %.

(e) For dispatching the aeroplane it shall be assumed that:

(1) the aeroplane will land on the most favourable runway, in still air; and

(2) the aeroplane will land on the runway most likely to be assigned, considering the probable wind speed and direction, the ground handling characteristics of the aeroplane and other conditions such as landing aids and terrain.

~~(f) If the operator is unable to comply with (e)(1) for a destination aerodrome having a single runway where a landing depends upon a specified wind component, the aeroplane may be dispatched if two alternate aerodromes are designated that permit full compliance with (a) to (e). Before commencing an approach to land at the destination aerodrome, the commander shall check that a landing can be made in full compliance with (a) to (d) and CAT.POL.A.225.~~

(~~g~~f) If the operator is unable to comply with (e)(2) for the destination aerodrome, the aeroplane shall be only dispatched if an alternate aerodrome is designated that allows full compliance with (a) to (~~e~~d).

10. CAT.POL.A.235 is amended as follows:

CAT.POL.A.235 Landing — wet and contaminated runways

(a) When the appropriate weather reports and/or forecasts indicate that the runway at the estimated time of arrival may be wet, the LDA shall be at least 115 % of the required landing distance, determined in accordance with CAT.POL.A.230.

(b) When the appropriate weather reports and/or forecasts indicate that the runway at the estimated time of arrival may be contaminated, the LDA shall be at least the landing distance determined in accordance with (a), or at least 115 % of the landing distance determined in accordance with approved contaminated landing distance data or equivalent, whichever is greater. The operator shall specify in the operations manual if equivalent landing distance data are to be applied.

(c) A landing distance on a wet runway shorter than that required by (a), but not less than that required by CAT.POL.A.230(a), may be used if the AFM includes specific additional information about landing distances on wet runways.

(d) A landing distance on a specially prepared ~~contaminated~~winter runway shorter than that required by (b), but not less than that required by CAT.POL.A.230(a), may be used if the AFM includes specific additional information about landing distances on contaminated runways.

(e) For (b), (c) and (d), the criteria of CAT.POL.A.230 shall be applied accordingly, except that CAT.POL.A.230(a) shall not be applied to (b) above.

(f) For (b) and (d) above, if the operator is unable to comply with CAT.POL.A.230(e)(1) for a destination aerodrome where a landing depends upon a specified wind component, the aeroplane may be dispatched if two alternate aerodromes are designated that permit full compliance with CAT.POL.A.230(a) to (e).

11. CAT.POL.A.250 is amended as follows:

CAT.POL.A.250 Approval of short landing operations

(…)

(b) To obtain the approval, the operator shall provide evidence that the following conditions are met:

(1) the distance used for the calculation of the permitted landing mass may consist of the usable length of the declared safe area plus the declared LDA;

(…)

(11) the slope of the declared safe area does not exceed 5 % upward nor 2 % downward in the direction of landing; ~~and~~

(12) reduced required landing distance operations in accordance with CAT.POL.A.255 are prohibited; and

(1~~2~~3) additional conditions, if specified by the competent authority, taking into account aeroplane type characteristics, orographic characteristics in the approach area, available approach aids and missed approach/balked landing considerations.

12. New CAT.POL.A.255 is added:

CAT.POL.A.255 Approval of reduced required landing distance operations

(a) For aeroplanes having a maximum certified take-off mass (MCTOM) of 45 360 kg or less and a maximum operational passenger seating configuration (MOPSC) of 19 or less, used in non-scheduled on-demand commercial air transport (CAT) operations, landing operations with a landing mass of the aeroplane allowing a full stop landing within 80 % of the landing distance available (LDA) require prior approval by the competent authority.

(b) To obtain the approval, the operator shall provide evidence that:

(1) a risk assessment has been conducted by the operator to demonstrate that a level of safety equivalent to that intended by CAT.POL.A.230(a)(1) or CAT.POL.A.230(a)(2), as applicable, is achieved; or

(2) the following conditions are met:

(i) special-approach procedures, such as steep approaches, planned screen heights higher than 60 ft or lower than 35 ft, low-visibility operations, planned operations outside stabilised approach criteria, are prohibited;

(ii) short landing operations in accordance with CAT.POL.A.250 are prohibited;

(iii) an adequate training, checking and monitoring process for the flight crew is established;

(iv) an aerodrome landing analysis programme (ALAP) is established by the operator to ensure that the following conditions are met:

(A) no tailwind is forecasted at the expected time of arrival;

(B) if the runway is forecasted to be wet at the expected time of arrival, the landing distance at dispatch shall either be determined in accordance with CAT.OP.MPA.303(a) or be at least 115 % of the landing distance required by CAT.POL.A.230(a)(3), whichever is longer;

(C) no expected contaminated runway conditions exist at the expected time of arrival; and

(D) no forecasted adverse weather conditions exist at the expected time of arrival;

(v) all the equipment affecting landing performance is operative before commencing the flight;

(vi) the flight crew is composed of at least two qualified and trained pilots having recency in reduced required landing distance operations;

(vii) the commander shall make the final decision to conduct reduced required landing distance operations and may decide not to do so when they consider this to be in the interest of safety; and

(viii) additional aerodrome conditions, if specified by the competent authority, taking into account aeroplane type characteristics, orographic characteristics in the approach area, available approach aids, missed-approach and balked-landing considerations.

13. CAT.POL.A.330 is amended as follows:

CAT.POL.A.330 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 within 70 % of the landing distance available (LDA). ~~taking into account:~~

(b) Notwithstanding (a) above, 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 may allow a full stop landing from 50 ft above the threshold within 80 % of the LDA when CAT.POL.A.355 is complied with.

(c) When determining the landing mass, the operator shall take the following into account:

(1) the altitude at the aerodrome;

(2) not more than 50 % of the headwind component or not less than 150 % of the tailwind component;

(3) the runway surface condition and the type of runway surface; and

(4) the runway slope in the direction of landing.

(d~~b~~) For steep approach operations, the operator shall use 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 comply with CAT.POL.A.345.

(e~~c~~) For short landing operations, the operator shall use landing distance data factored in accordance with (a) and comply with CAT.POL.A.350.

(f~~d~~) For dispatching the aeroplane in accordance with (a) to (c), it shall be assumed that:

(1) the aeroplane will land on the most favourable runway, in still air; and

(2) the aeroplane will land on the runway most likely to be assigned considering the probable wind speed and direction, the ground handling characteristics of the aeroplane and other conditions such as landing aids and terrain.

(g~~e~~) If the operator is unable to comply with (d)(2) for the destination aerodrome, the aeroplane shall only be dispatched if an alternate aerodrome is designated that permits full compliance with (a) to (d).

14. CAT.POL.A.350 is amended as follows:

CAT.POL.A.350 Approval of short landing operations

(…)

(b) To obtain the approval, the operator shall provide evidence that the following conditions are met:

(…)

(10) reduced required landing distance operations in accordance with CAT.POL.A.355 are prohibited; and

(1~~0~~1) additional conditions, if specified by the competent authority, taking into account aeroplane type characteristics, orographic characteristics in the approach area, available approach aids and missed approach/balked landing considerations.

15. New CAT.POL.A.355 is added:

CAT.POL.A.355 Approval of reduced required landing distance operations

(a) Operations with a landing mass of the aeroplane allowing a full stop landing within 80 % of the landing distance available (LDA) on the intended runway require prior approval by the competent authority. Such approval shall be obtained for each runway on which operations with reduced required landing distance are conducted.

(b) To obtain the approval, a risk assessment shall be conducted by the operator to demonstrate that a level of safety equivalent to that intended by CAT.POL.A.330(a) is achieved, and at least the following conditions shall be met:

(1) the state of the aerodrome has determined a public interest and operational necessity for the operation, either due to the remoteness of the aerodrome or to physical limitations relating to the extension of the runway;

(2) short landing operations in accordance with CAT.POL.A.250 and particular approaches approved under CAT.OP.MPA.115(a) are prohibited;

(3) a specific control procedure of the touchdown area is defined in the operations manual (OM) and implemented; this procedure shall include adequate go-around and balked-landing instructions when touchdown in the defined area cannot be achieved;

(4) an adequate aerodrome training and checking programme for the flight crew is established;

(5) the flight crew is qualified and have recency in the concerned aerodrome in accordance with the standards defined in the OM;

(6) an aerodrome landing analysis program (ALAP) is established by the operator to ensure that the following conditions are met:

(i) no tailwind is forecasted at the expected time of arrival;

(ii) no expected contaminated runway conditions exist at the expected time of arrival;

(iii) if the runway is forecasted to be wet at the expected time of arrival, the landing distance at dispatch shall either be determined in accordance with CAT.OP.MPA.303(b) or be at least 115 % of the landing distance required by CAT.POL.A.330(b), whichever is longer; and

(iv) no forecasted adverse weather conditions exist at the expected time of arrival;

(7) operational procedures and instructions are established to ensure that:

(i) all the equipment affecting landing performance and landing distance is operative before commencing the flight;

(ii) the deceleration devices are correctly used by the flight crew; and

(iii) landing on contaminated runways is prohibited;

(8) specific maintenance instructions and operational procedures are established for the aeroplane's deceleration devices to enhance the reliability of these systems;

(9) the final approach and landing are conducted under visual meteorological conditions (VMC) only; and

(10) additional aerodrome conditions, if specified by the competent authority.

16. CAT.POL.A.415 is amended as follows:

CAT.POL.A.415 En-route — OEI

(…)

(e) Fuel jettisoning is permitted to an extent consistent with reaching the aerodrome where the aeroplane is assumed to land after engine failure with the required fuel reserves as per CAT.OP.MPA.150, appropriate for an alternate aerodrome, if a safe procedure is used.

17. CAT.POL.A.420 is amended as follows:

CAT.POL.A.420 En-route — aeroplanes with three or more engines, two engines inoperative

(a) At no point along the intended track shall an aeroplane having three or more engines be more than 90 minutes, with all engines operating at cruising power or thrust, as appropriate~~at the all-engines long range cruising speed~~ at standard temperature in still air, away from an aerodrome at which the ~~performance~~ requirements of CAT.POL.A.430, applicable at the expected landing mass are met, unless it complies with (b) to (e).

(b) The two-engines-inoperative flight path shall permit the aeroplane to continue the flight, in the expected meteorological conditions, clearing all obstacles within 9,3 km (5 NM) either side of the intended track by a vertical interval of at least 2 000 ft, to an aerodrome at which the performance requirements applicable at the expected landing mass are met.

(c) The two engines are assumed to fail at the most critical point of that portion of the route where the aeroplane is more than 90 minutes, with all engines operating at cruising power or thrust, as appropriate~~at the all-engines long range cruising speed~~ at standard temperature in still air, away

from ~~an~~the aerodrome specified in (a) above~~at which the performance requirements applicable at the expected landing mass are met~~.

(d) The expected mass of the aeroplane at the point where the two engines are assumed to fail shall not be less than that which would include sufficient fuel to proceed to an aerodrome where the landing is assumed to be made, and to arrive there at an altitude of a least 450 m (1 500 ft) directly over the landing area and thereafter to fly ~~level~~ for 15 minutes at cruising power or thrust, as appropriate.

(e) The available rate of climb of the aeroplane shall be taken to be 150 ft per minute less than that specified.

(f) The width margins of (b) shall be increased to 18,5 km (10 NM) if the navigational accuracy does not meet at least RNP5.

(g) Fuel jettisoning is permitted to an extent consistent with reaching the aerodrome with the required fuel reserves as per (d) above~~,~~ if a safe procedure is used.

3.2. Draft CSs (draft EASA Decision)

3.2.1. CS-25 Book 1

Certification Specifications

Large Aeroplanes

SUBPART G — OPERATING LIMITATIONS AND INFORMATION

(…)

SUPPLEMENTARY INFORMATION

1. CS 25.1591 is amended as follows:

CS 25.1591
Take-off Performance Information for Operations with Contaminated Runway Surface Conditions

(See AMC 25.1591)

(a) Supplementary take-off performance information applicable to aeroplanes operated on runways contaminated with standing water, slush, snow or ice may be ~~furnished~~provided at the discretion of the applicant. If supplied, this information must include the expected performance of the aeroplane during take-off ~~and landing~~ on hard-surfaced runways covered by these contaminants. If information on any one or more of the above contaminated surfaces is not supplied, the AFM must contain a statement prohibiting take-off~~operation(s)~~ on the contaminated surface(s) for which information is not supplied. Additional information covering operation on contaminated surfaces other than the above may be provided at the discretion of the applicant.

(b) Performance information ~~furnished~~provided by the applicant must be contained in the AFM. The information may be used to assist operators in producing operational data and instructions for use by their flight crews when operating with contaminated runway surface conditions. The information may be established by calculation or by testing.

(c) The AFM must clearly indicate the conditions and the extent of applicability for each contaminant used in establishing the contaminated runway performance information. It must also state that actual conditions that are different from those used for establishing the contaminated runway performance information may lead to different performance.

2. New CS 25.1592 is added:

CS-25.1592
Performance Information for Landing Distance Assessment

(See AMC 25.1592)

(a) Landing performance information applicable to aeroplanes operated on dry and wet runways and supplementary landing performance information applicable to aeroplanes operated on runways contaminated with standing water, slush, snow or ice must be provided by the applicant.

(b) Performance information provided by the applicant must be contained in the aircraft flight manual (AFM). The information may be used to assist operators in producing operational data and instructions for use by their flight crews for performance assessment. The information may be established by calculation or by testing.

(c) The landing distance to be used for landing performance assessment consists of the horizontal distance from the point at which the main gear of the aeroplane is 50 ft above the landing surface to the point where the aeroplane comes to a complete stop. It considers runway surface conditions/braking action, winds, temperatures, average runway slope, pressure altitude, icing condition, planned final-approach speed, aeroplane mass and configuration, and deceleration devices used.

3.2.2. CS-25 Book 2

Acceptable Means of Compliance

Large Aeroplanes

AMC — SUBPART G

1. AMC 25.1591 is amended as follows:

AMC 25.1591
The derivation and methodology of performance information for use when taking-off ~~and landing~~ with contaminated runway surface conditions.

1.0 Purpose

This AMC provides information, guidelines, recommendations and acceptable means of compliance for use by applicants in the production of performance information for aeroplanes when ~~operated on~~taking off from runways that are contaminated by standing water, slush, snow, ice or other contaminants.

2.0 Technical Limitations of Data

(…)

~~It has been recently determined that the assumption to use wet runway surface field length performance data for operations on runway surfaces contaminated with dry snow (depths below 10 mm) and wet snow (depths below 5 mm) may be inappropriate. Flight test evidence together with estimations have indicated some measure of relatively low gear displacement drag and a measurable reduction in surface friction in comparison to the assumptions associated with wet runway field performance data. As a consequence it has been agreed that additional work is required to further develop the associated methodology. As an interim measure it has been concluded that it is reasonable to consider these surfaces by recommending that they be addressed by using the data for the lowest depth of the contaminant provided.~~It is recognised that the observation and reporting of the type and depth of contaminants (water, slush, dry snow and wet snow) is limited in terms of the accuracy and timeliness with which it can be made and relayed to the flight crew. Furthermore, shallow depths of contaminants do not generally reduce wheel braking friction below that of a wet runway, except in unfavourable circumstances for which lower than expected runway condition codes (RWYCCs) are reported (see AMC 25.1592). In line with International Civil Aviation Organization (ICAO) and Federal Aviation Authority (FAA) standards, a depth of more than 3 mm for contaminant accountability in take-off performance assessments is considered as a reasonable lower threshold. Below this depth, the runway is considered to be wet, for which AMC 25.1591 does not apply.

(…)

(…)

4.0 Definitions

~~These definitions may be different to those used by other sources but are considered appropriate for producing acceptable performance data, suitable for use in aeroplane operations.~~The following definitions are a subset of the runway surface condition descriptors for which a representative take-off performance model may be derived using the methods contained in this AMC.

4.1 Standing Water

Water of a depth greater than 3mm.~~ A surface condition where there is a layer of water of 3mm or less is considered wet for which AMC 25.1591 is not applicable.~~

Note: a surface condition where there is a layer of water of 3 mm or less is considered wet, for which AMC 25.1591 is not applicable.

4.2 Slush

~~Partly melted snow or ice with a high water content, from which water can readily flow, with an assumed specific gravity of 0.85. Slush is normally a transient condition found only at temperatures close to 0°C.~~Snow that is so water-saturated that water will drain from it when a handful is picked up or will splatter if stepped on forcefully.

4.3 Wet Snow

~~Snow that will stick together when compressed, but will not readily allow water to flow from it when squeezed, with an assumed specific gravity of 0.5.~~Snow that contains enough water to be able to make a well-compacted, solid snowball, without squeezing out water.

4.4 Dry Snow

~~Fresh snow that can be blown, or, if compacted by hand, will fall apart upon release (also commonly referred to as loose snow), with an assumed specific gravity of 0.2. The assumption with respect to specific gravity is not applicable to snow which has been subjected to the natural ageing process.~~ Snow from which a snowball cannot readily be made.

4.5 Compacted Snow

~~Snow which has been compressed into a solid mass such that the aeroplane wheels, at representative operating pressures and loadings, will run on the surface without causing significant rutting.~~Snow that has been compacted into a solid mass such that aeroplane tires, at operating pressures and loadings, will run on the surface without significant further compaction or rutting of the surface.

4.6 Ice

Water ~~which~~that has frozen or compacted snow that has transitioned into ice~~on the runway surface, including the condition where compacted snow transitions to a polished ice surface~~, in cold and dry conditions.

Note: this definition excludes wet ice that has a film of water on top of it or contains melting ice, which provides minimal braking friction and uncertain lateral control.

4.7 Slippery Wet

A wet runway where the surface friction characteristics of a significant portion of the runway have been determined to be degraded.

4.~~7~~8 Specially Prepared Winter Runway

A runway, with a dry frozen surface of compacted snow and/or ice which has been treated with sand or grit or has been mechanically or chemically treated to improve runway friction. The runway friction is ~~measured~~monitored and reported on a regular basis in accordance with national procedures.

4.~~8~~9 Specific Gravity

The density of the contaminant divided by the density of water.

5.0 Contaminant Properties to be Considered

5.1 Range of Contaminants

(…)

Contaminant Type	***Range of Depths to be Considered - mm***	***Specific Gravity Assumed for Calculation***	***Is Drag Increased?***	***Is Braking Friction Reduced below Dry Runway Value?***	***Analysis Paragraphs Relevant***
Standing Water, Flooded runway	More than 3 up to 15 (see Note 1)	1.0	Yes	Yes	7.1, 7.3, 7.4
Slush	More than 3 up to 15 (see Note 1)	0.85	Yes	Yes	7.1, 7.3, 7.4
Wet Snow (see Note 2)	~~Below~~More than 3 up to 5 (see Note 1)		No	Yes	7.3, 7.4
Wet Snow (see Note 3)	More than 5 up to 30	0.5	Yes	Yes	7.1, 7.3, 7.4
Dry Snow (see Note 2)	~~Below~~More than 3 up to 10 (see Note 1)		No	Yes	7.3, 7.4
Dry Snow	More than 10 up to 130	0.2	Yes	Yes	7.2, 7.3, 7.4
Compacted Snow	0 (see Note 4)		No	Yes	7.3, 7.4
Ice	0 (see Note 4)		No	Yes	7.3, 7.4
Slippery Wet	0		No	Yes	7.3, 7.4
Specially Prepared Winter Runway (see Note 5)	0 (see Note 4)		No	Yes	7.3.4, 7.4

Table 1

Note 1: Runways with water depths or slush or snow depths of~~less than~~ 3 mm or less are considered wet, for which AMC 25.1591 is not applicable.

Note 2: Contaminant drag may be ignored.

Note 3: For conservatism the same landing gear displacement and impingement drag methodology is used for wet snow as for slush.

Note 4: Where depths are given as zero it is assumed that the aeroplane is rolling on the surface of the contaminant.

Note 5: No default model is proposed for specially prepared winter runways in this AMC. Such surfaces are specific and treatment may be of variable effectiveness. The procedures and methods should be approved by the competent authority of the state of operator.

(…)

6.0 Derivation of Performance Information

6.1 General Conditions

Take-off ~~and landing~~ performance information for contaminated runways should be determined in accordance with the assumptions given in paragraph 7.0.

(…)

(…)

~~6.3 Landing on a Contaminated Runway~~

~~6.3.1 Airborne distance~~

~~Assumptions regarding the airborne distance for landing on a contaminated runway are addressed in paragraph 7.4.2.~~

~~6.3.2 Ground Distance~~

~~Except as modified by the effects of contaminant as derived below, performance assumptions for ground distance determination remain unchanged from those used for a dry runway. These assumptions include:~~

~~- Touchdown time delays.~~

~~- Stopping means other than wheel brakes (but see paragraph 7.4.3).~~

7.0 Effects of Contaminant

7.1 Contaminant Drag ~~-~~— Standing Water, Slush, Wet Snow

General advice and acceptable calculation methods are given for estimating the drag force due to fluid contaminants on runways:

Total drag due to fluid contaminant	=	Drag due to fluid displacement by tyres	+	Drag due to airframe impingement of fluid spray from tyres

The essence of these simple calculation methods is the provision of appropriate values of drag coefficients below, at, and above tyre aquaplaning speed, V_P (see paragraph 7.1.1):

— Paragraphs 7.1.2.a and 7.1.2.b give tyre displacement drag coefficient values for speeds below V_P.

— Paragraph 7.1.3.b.2 gives tyre equivalent displacement drag coefficient values to represent the skin friction component of impingement drag for speeds below V_P.

— Paragraph 7.1.4 gives the variation with speed, at and above V_P, of drag coefficients representing both fluid displacement and impingement.

The applicant may account for contaminant drag for computation of the deceleration segment of the accelerate-stop distance. However, if the actual contaminant depth is less than the reported value, then, using the reported value to determine contaminant drag will result in a higher drag level than the one that actually exists, leading to a conservative take-off distance and take-off run, but a potentially optimistic accelerate-stop distance. It is assumed that these effects will offset each other; however, the applicant may consider:

— either using 100 % of the reported contaminant depth when determining the acceleration portion, and 50 % when considering the deceleration portion; or

— using 50 % of the reported contaminant depth when determining both the acceleration and the stop portion of the accelerate-stop distance. This will result in a conservative computation of the resultant take-off distance without being unduly penalising. The applicant should check to ensure that using drag for half of the contaminant depth for the accelerate-stop computation is conservative for the applicant's aeroplane configuration.

7.1.1 Aquaplaning Speed

An aeroplane will aquaplane at high speed on a surface contaminated by standing water, slush or wet snow. For the purposes of estimating the effect of aquaplaning on contaminant drag, the aquaplaning speed, V_P, is given by -

$$V_P = 9\sqrt{P}$$

where V_P is the ground speed in knots and P is the tyre pressure in lb/in^2.

For the purpose of estimating the effect of aquaplaning on wheel-to-ground friction, the aquaplaning speed V_P given above should be factored with a coefficient of 0.85.

Predictions (Reference 5) indicate that the effect of running a wheel over a low density liquid contaminant containing air, such as slush, is to compress it such that it essentially acts as high density contaminant. This means that there is essentially no increase in aquaplaning speed to be expected with such a lower density contaminant.

For this reason, the aquaplaning speed given here is not a function of the density of the contaminant.

(See References 1, 5 and 10)

(…)

7.3 Braking Friction (All Contaminants)

On most contaminant surfaces the braking action of the aeroplane will be impaired. Performance data showing these effects can be based on either the minimum conservative 'default' values, given in Table 2 or test evidence and assumed values (see paragraph 7.3.2). In addition the applicant may optionally provide performance data as a function of aeroplane braking coefficient or wheel braking coefficient.

7.3.1 Default Values

To enable aeroplane performance to be calculated conservatively in the absence of any direct test evidence, default friction values as defined in Table 2 may be used. These friction values represent the maximum effective braking coefficient of a~~n~~ fully modulating anti-skid controlled braked wheel/tyre. For quasi-modulating systems, multiply the listed braking coefficient by 0.625. For on-off systems, multiply the listed braking coefficient by 0.375. For the classification of anti-skid systems, please refer to AMC 25.109(c)(2). Aeroplanes without anti-skid systems will need to be addressed separately on a case-by-case basis.

Contaminant	**Default Wheel Braking Coefficient μ**
Standing Water and Slush	$= -0.0632\left(\frac{V}{100}\right)^3 + 0.2683\left(\frac{V}{100}\right)^2 - 0.4321\left(\frac{V}{100}\right) + 0.3485$ where V is ground speed in knots Note: For V greater than 85 % of the aquaplaning speed, use μ = 0.05 constant
Wet Snow ~~below 5mm~~above 3 mm depth	0.16~~7~~
~~Wet Snow~~	~~0.17~~
Dry Snow ~~below 10mm~~above 3 mm depth	0.16~~7~~
~~Dry Snow~~	~~0.17~~
Compacted Snow below outside air temperature (OAT) -15 °C	0.20
Ice ~~(Cold & Dry)~~	0.07~~5~~
Slippery Wet	0.16

Note: Braking Force = load on braked wheel x Default Friction Value μ

Table 2

Note: For a specially prepared winter runway surface no default friction value can be given due to the diversity of conditions that will apply.

(See reference 10)

(…)

7.3.3 Use of Ground Friction Measurement Devices

~~Ideally it would be preferable to relate aeroplane braking performance to a friction index measured by a ground friction device that would be reported as part of a Surface~~

~~Condition Report. However, t~~There is not, at present, a correlation between aircraft stopping capability and~~mmon friction index for all~~ ground friction measuring devices. Hence it is not practicable at the present time to determine aeroplane performance on the basis of a~~n internationally accepted~~ friction index measured by ground friction devices. Notwithstanding this lack of correlation~~a common index~~, the applicant may optionally choose to present take-off ~~and landing~~ performance data as a function of an aeroplane braking coefficient or wheel braking coefficient constant with ground speed for runways contaminated with ~~wet snow, dry snow,~~ compacted snow or ice. The responsibility for relating this data to a friction index measured by a ground friction device will fall on the operator and the ~~operating~~competent authority of the state of operator.

7.3.4 Specially Prepared Winter Runway Surface

At the option of the applicant, take-off performance data may be provided for specially prepared winter runway surfaces. This may include icy surfaces that have been treated with sand or gravel in such a way that a significant improvement of friction may be demonstrated. It is suggested that a reasonable margin should be applied to the observed braking action in performance computations for such surfaces, and that effective friction not greater than 0.16 (for fully modulating anti-skid systems) should be assumed. The continued effectiveness of such a treatment must be frequently monitored. Appropriate procedures and methods should be approved by the competent authority of the state of aerodrome.

(…)

~~7.4.2 Landing Air Distance~~

~~For contaminated surfaces, the airborne distance should be calculated by assuming that 7 seconds elapse between passing through the 50 ft screen height and touching down on the runway. In the absence of flight test data to substantiate a lower value, the touchdown speed should be assumed to be 93% of the threshold speed.~~

7.4.2~~3~~ Reverse Thrust

Performance information may include credit for reverse thrust where available and controllable, as described in AMC 25.109.

8.0 Presentation of Supplementary Performance Information

(…)

8.3 Take-off ~~and Landing~~ Data

This should be presented either as separate data appropriate to a defined runway contaminant or as incremental data based on the AFM normal dry or wet runway information. ~~Information relating to the use of speeds higher than VREF on landing, that is speeds up to the maximum recommended approach speed additive to VREF, and the associated distances should also be included.~~The take-off distance (TOD) should be determined in accordance with CS 25.113(b) and the take-off run (TOR) in accordance with CS 25.113(c)(2).

~~The landing distance must be presented either directly or with the factors required by the operating manuals, with clear explanation where appropriate.~~

The applicant should provide crosswind guidance for operations on contaminated runways.

Where data is provided for a range of contaminant depths, for example greater than 3, 6, 9, 12, 15mm, then the AFM should clearly indicate how to define data for contaminant depths within the range of contaminant depths provided.

The AFM should provide:

— the performance data for operations on contaminated runways;

— definitions of runway surface conditions; and

— the procedures and assumptions used to develop the performance data.

The AFM should state that operations are prohibited on runways with contaminant depths greater than those for which data is provided. Instructions for use of the data should be provided in the appropriate documentation.

Where the AFM presents data using VSTOP and VGO, it must be stated in the AFM that use of this concept is acceptable only where operation under this standard is permitted.

9 References

Reference sources containing worked methods for the processes outlined in 7.1 to 7.3.3 are identified below:

1. ESDU Data Item 83042, December 1983, with Amendment A, May 1998. 'Estimation of Spray Patterns Generated from the Side of Aircraft Tyres Running in Water or Slush'.
2. ESDU Data Item 98001, May 1998. 'Estimation of Airframe Skin -Friction Drag due to Impingement of Tyre Spray'.
3. ESDU Data Item 90035, November 1990, with Amendment A, October 1992. 'Frictional and Retarding Forces on Aircraft Tyres. Part V: Estimation of Fluid Drag Forces'.
4. ESDU Memorandum No.97, July 1998. 'The Order of Magnitude of Drag due to Forward Spray from Aircraft Tyres'**.**
5. ESDU Memorandum No. 96, February 1998. 'Operations on Surfaces Covered with Slush'.
6. ESDU Memorandum No. 95, March 1997, 'Impact Forces Resulting From Wheel Generated Spray: Re-Assessment Of Existing Data'.
7. NASA Report TP-2718 'Measurement of Flow Rate and Trajectory of Aircraft Tire - Generated Water Spray'.
8. Van Es, G.W.H., 'Method for Predicting the Rolling Resistance of Aircraft Tires in Dry Snow'. AIAA Journal of Aircraft, Volume 36, No.5, September -October 1999.
9. Van Es, G.W.H., 'Rolling Resistance of Aircraft Tires in Dry Snow', National Aerospace Laboratory NLR, Technical Report TR-98165, Amsterdam, 1998.

10. ESDU Data Item 72008, May 1972. 'Frictional and retarding forces on aircraft tyres'. Part III: planning.

11. FAA AC 25-31, 'Takeoff Performance Data for Operations on Contaminated Runways', 22 December 2016.

12. ICAO Doc 10064, 'Aeroplane Performance Manual' (to be published).

2. New AMC 25.1592 is added as follows:

AMC 25.1592
The Derivation and Methodology of Performance Information for Landing Distance Assessment at Dispatch and at Time of Arrival

1.0 Purpose

This AMC provides information, guidelines, recommendations and acceptable means of compliance for use by applicants in the production of landing performance information. This information is for use by operators:

— before flight when planning to land on runways that are contaminated by standing water, slush, snow, ice or other contaminants; and

— at the time of arrival, whatever the runway surface condition is.

2.0 Applicability of Data

Appropriate landing performance data assists operators in performing dispatch or time-of-arrival landing performance assessments. Because of differences in the variables to be taken into account and of the various ways that those data are to be used, the landing performance data for time-of-arrival landing performance assessments may be different than the landing performance data developed in accordance with CS 25.125 and provided in the aeroplane flight manual (AFM) in accordance with CS 25.1587(b). The methods contained in this AMC 25.1592 include those for derivation of landing distance on dry and wet runways intended to be used at the time of arrival only. The preflight landing performance assessment, when planning to land on a dry or wet runway surface, uses the landing distance developed in compliance with CS 25.125. The data derived in accordance with the method(s) contained in this AMC is appropriate for the preflight landing performance assessment when planning to land on a contaminated runway surface only.

3.0 Standard Assumptions

The data for time-of-arrival landing performance assessments should represent expected landing performance of a trained flight crew of average skill following normal flight procedures and training. It should take into account runway surface conditions/runway condition codes, winds, temperatures, average runway slope, pressure altitude, icing condition, final-approach speed, aeroplane weight and configuration, and deceleration devices used.

Like the landing distances defined in CS 25.125, the landing distances to be used for time-of-arrival landing performance assessments should consist of the horizontal distance from the point

at which the main gear of the aeroplane is 50 ft above the landing surface to the position where the aeroplane is brought to a stop. See Figure 1 below.

4.0 Definitions

In addition to those defined in AMC 25.1591 above, the following runway conditions should be considered:

4.1 Frost

Ice crystals formed from airborne moisture on a surface whose temperature is below freezing. Frost differs from ice in that frost crystals grow independently and, therefore, have a more granular texture.

Note 1: below freezing refers to air temperature equal to or lower than the freezing point of water (0 °C).

Note 2:— under certain conditions, frost can cause the surface to become very slippery, which is then reported appropriately as 'reduced braking action'.

4.2 Runway Condition Code (RWYCC)

A number describing the runway surface condition to be used in the runway condition report. See Section 6.2 of this AMC for the classification of runway conditions.

Note: the purpose of RWYCC is to permit an operational aeroplane performance calculation by the flight crew. Procedures for the determination of the runway condition code are described in ICAO Doc 9981 'PANS — Aerodromes'.

5.0 Assumptions for Landing Distances

Landing performance data should be provided in terms of RWYCCs within the approved operational envelope for landing. Data should be provided for codes 6 through 1. At the option of the applicant, additional data for fluid contaminants (dry snow, wet snow, slush and standing water) may be provided for the range of depths given in Table 2 of Section 7.0 of this AMC.

Landing performance data is not presented for code 0 (zero) because this is not a performance category but rather a condition in which flight operations should cease on the runway until the aerodrome has taken an action to improve the braking action.

Landing distance data should cover all normal operations with all engines operating within the normal landing operating envelope. The effect of each of the parameters affecting landing distance should be provided, by taking into account the following:

— approved landing configurations, including Category III landing guidance, where approved;

— approved deceleration devices (e.g. wheel brakes, speed brakes/spoilers, and thrust reversers);

— pressure altitudes within the approved landing operating envelope;

— weights up to the maximum take-off weight (MTOW);

— expected airspeeds at the runway threshold, including speeds up to the maximum recommended final-approach speed, considering possible speed additives for winds and icing conditions;

— temperatures within the approved landing operating envelope;

— winds within the approved landing operating envelope:

- 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;

— runway slopes within the approved landing operating envelope; and

— icing conditions, if required to provide the landing distances required under CS 25.125 in icing conditions.

6.0 Derivation of Landing Distance

The landing distance consists of three segments:

— an airborne segment,

— a transition segment, and

— a final stopping configuration (full braking) segment,

as shown in Figure 1 below.

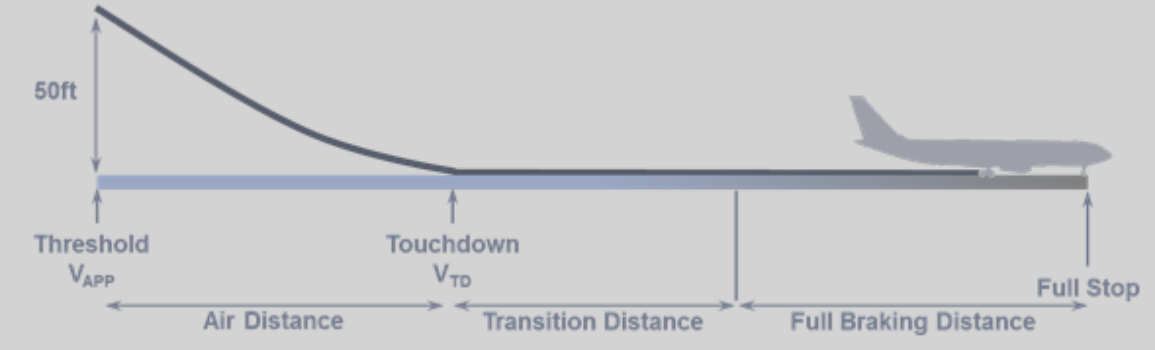


Figure 1 — Landing distance segments

The landing distance for a time-of-arrival landing performance assessment may be determined analytically from the landing performance model developed to show compliance with CS 25.125. For the purposes of determining the landing distance for time-of-arrival assessments, the model should be modified as described in the following sections.

Changes in the aeroplane's configuration, speed, power, and thrust used to determine the landing distance for time-of-arrival landing performance assessments should be made using procedures established for operation in service. These procedures should:

— be able to be consistently executed in service by crews of average skill;

— use methods or devices that are safe and reliable; and

— include allowance for any time delays that may reasonably be expected in service (see Section 6.2. below).

The procedures and assumptions used to develop the operational landing distances should be documented in the AFM.

6.1 Air Distance

As shown in Figure 1 above, the air distance is the distance from a height of 50 ft above the landing surface to the point of main gear touchdown. This definition of the air distance is unchanged compared to that used for compliance with CS 25.125. However, the air distance determined under CS 25.125 may not be appropriate for use when making time-of-arrival landing performance assessments. The air distances determined under CS 25.125 may be shorter than the distance that the average pilot is likely to achieve in normal operations.

The air distance used for any individual landing at any specific runway is a function of the following parameters:

— runway approach guidance;

— runway slope;

— use of any aeroplane features or equipment (e.g. heads-up guidance, autoflight systems, etc.);

— pilot technique; and

— the inherent flare characteristics of the specific aeroplane.

Unless the air distance used for compliance with CS 25.125 is representative of an average pilot flying in normal operations (see flight test demonstration below), the air distance used for time-of-arrival landing performance assessments should be determined analytically as the distance traversed over a time period of 7 sec at a speed of 98 % of the recommended speed over the landing threshold, also referred to as the final-approach speed (VAPP). This represents a flare time of 7 sec and a touchdown speed (VTD) of 96 % of the VAPP. The VAPP should be consistent with the procedures recommended by the applicant, including any speed additives, such as those that may be used for winds or icing. The effect of higher speeds, to account for variations that occur in operations or are caused by the operating procedures of individual operators, should also be provided.

If the air distance is determined directly from flight test data instead of using the analytical method provided above, the flight test data should meet the following criteria:

— procedures should be used that are consistent with the applicant's recommended procedures for operations in service; these procedures should address the recommended final-approach airspeed, flare initiation height, thrust/power reduction height and technique, and target pitch attitudes;

— at a height of 50 ft above the runway surface, the aeroplane should be at an airspeed not slower than the recommended final-approach airspeed; and

— the touchdown rate of descent should be in the range of 1–4 ft per sec.

If the air distance is based on a time of 7 sec at a speed of 98 % of the recommended speed over the runway threshold, this air distance is considered valid for downhill runway slopes up to 2 % in magnitude (no credit should be taken for an uphill runway slope).

6.2 Transition Distance

As shown in Figure 1 above, the transition distance is the distance travelled from the point of main gear touchdown to the point where all deceleration devices used for determining the landing distance are operating. If the air distance is based on a time of 7 sec at a speed of 98 % of the recommended speed over the runway threshold, the speed at the start of the transition segment should be 96 % of the final approach speed.

The transition distance should be based on the recommended procedures for use of the approved means of deceleration, both in terms of sequencing and of any cues for initiation. Reasonably expected time delays should also be taken into account.

For procedures that call for initiation of deceleration devices beginning at nose gear touchdown, the minimum time for each pilot action taken to deploy or activate a deceleration means should be the demonstrated time, but not less than one second.

For procedures that call for initiation of deceleration devices beginning prior to nose gear touchdown, the minimum time for each pilot action taken to deploy or activate a deceleration means should be the demonstrated time plus one second.

For deceleration means that are automatically deployed or activated (e.g. auto speed brakes or autobrakes), the demonstrated time may be used with no added delay time.

The distance of the transition segment, and the speed at the start of the final stopping configuration segment should include the expected evolution of the braking force achieved over the transition distance. The evolution of the braking force should take into account any differences that may occur for different RWYCCs, such as the aeroplane transition to the full braking configuration (see Table 1 below for the wheel braking coefficient of the full braking configuration of each runway surface condition and pilot-reported braking action).

RWYCC	Runway surface condition description	Wheel braking coefficient
6	— Dry	90 % of certified value used to comply with CS 25.125[1]
5	— Frost — Wet (includes damp and water equal to or less than 3 mm deep) Depth of 3 mm or less of: — Slush — Dry snow — Wet snow	Per method defined in CS 25.109(c)
4	–15 °C and colder outside air temperature (OAT) — Compacted snow	0.20[2]
3	— Wet ('Slippery Wet' runway) — Dry snow or wet snow (any depth) over compacted snow More than 3 mm depth of: — Dry snow — Wet snow Warmer than – 15 °C OAT — Compacted snow	0.16[2]
2	More than 3 mm depth of: — Water — Slush	(1) For speeds below 85 % of the hydroplaning speed[3], 50 % of the wheel braking coefficient determined in accordance with CS 25.109(c), but not greater than 0.16[2] (2) For speeds at 85 % of the hydroplaning speed[3] and above, 0.05[2]
1	— Ice	0.08[2]
0	— Wet ice — Water on top of compacted snow — Dry snow or wet snow over ice	Not applicable (no operations in RWYCC = 0 conditions)

Table 1 — Correlation between wheel braking coefficient and RWYCC

[1] 100 % of the wheel braking coefficient used to comply with CS 25.125 may be used if the testing from which that braking coefficient was derived was conducted on portions of runways containing operationally representative amounts of rubber contamination and paint stripes.

[2] These wheel braking coefficients assume a fully modulating anti-skid system. For quasi-modulating systems, multiply the listed braking coefficient by 0.625. For on-off systems, multiply the listed braking coefficient by 0.375. For the classification of anti-skid systems, please refer to AMC 25.109(c)(2). Aeroplanes without anti-skid systems will need to be addressed separately on a case-by-case basis.

[3] The hydroplaning speed, V_P, may be estimated by the equation $V_P = 9\sqrt{P}$, where V_P is the ground speed in kt and P is the tire pressure in lb/in^2.

6.3 Final Stopping Configuration Distance (Full Braking Distance)

As shown in Figure 1 above, the final stopping configuration (full braking) segment begins at the end of the transition segment, which is the point where all deceleration devices used in determining the landing distance are operating. It ends at the nose gear position when the aeroplane comes to a stop.

The calculation of the final stopping configuration distance should be based on the braking coefficient associated with the runway surface condition or pilot-reported braking action, including the effect of hydroplaning, if applicable. Credit may be taken for the use of thrust reversers, where available and controllable. See following Section 7 for information about taking into account contaminant drag from loose contaminants.

7.0 Contaminant Drag — Standing Water, Slush, Wet Snow

Loose contaminants result in additional contaminant drag due to the combination of the displacement of the contaminant by the aeroplane tires and impingement of the contaminant spray on the airframe. This contaminant drag provides an additional force helping to decelerate the aeroplane, which reduces the distance needed to stop the aeroplane. Because contaminant drag increases with contaminant depth, the deeper the contaminant is, the shorter the stopping distance will be. However, the actual contaminant depth is likely to be less than the reported depth for the following reasons:

— contaminant depths are reported in runway surface condition reports using specific depth increments;

— the procedure for reporting contaminant depths is to report the highest depth of the contaminant along the reported portion of the runway surface; contaminant depths, however, are unlikely to be uniform over the runway surface (or reported portion of the runway surface), so it is likely that there will be areas of lesser contaminant depth; and

— in a stable weather environment (that is, no replenishment of the contaminant on the runway), the contaminant depth is likely to decrease as successive aeroplanes traverse through this environment and displace the contaminant.

If the actual contaminant depth is less than the reported value, using the reported value to determine the contaminant drag will result in a higher drag level than the one that actually exists, leading to an optimistic stopping distance prediction. Therefore, it is recommended not to include the effect of contaminant drag in the calculation of landing distances for time-of-arrival landing performance assessments. If the effect of contaminant drag is included, it should be limited to no more than the drag resulting from 50 % of the reported depth.

If the effect of contaminant depth is included in the landing distance data, then data should be provided for the reportable contaminant depths up to the maximum contaminant depth for each contaminant for which landing operations are permitted. In considering the maximum depth of runway contaminants, it may be necessary to take account of the maximum depth for which the engine air intakes have been shown to be free of ingesting hazardous quantities of water in accordance with CS 25.1091(d)(2).

If the effect of contaminant depth is included in the landing distance data, then data should be provided for the specific gravities shown in Table 2 below.

Loose contaminant	***Maximum depth***	***Specific gravity***
Standing Water	15 mm	1.0
Slush	15 mm	0.85
Dry Snow	130 mm	0.2
Wet Snow	30 mm	0.5

Table 2 — Maximum depth and specific gravity of loose contaminants

For the method of determining the contaminant drag, refer to AMC 25.1591.

8.0 Presentation of Supplementary Performance Information

8.1 General

Performance information for contaminated runways, derived in accordance with Sections 5.0–7.0 of this AMC, should be accompanied by appropriate statements such as the following:

— operation on runways contaminated with water, slush, snow, ice or other contaminants implies uncertainties with regard to runway friction and contaminant drag and, therefore, to the achievable performance and control of the aeroplane during landing since the actual conditions may not completely match the assumptions on which the performance information is based; where possible, every effort should be made to ensure that the runway surface is cleared of any significant contamination;

— the performance information assumes any runway contaminant to be of uniform depth and density; and

— the provision of performance information for contaminated runways should not be taken as implying that ground handling characteristics on these surfaces will be as good as those that may be achieved on dry or wet runways, in particular following engine failure, in crosswinds or when using reverse thrust.

8.2 Procedures

In addition to performance information appropriate to operating on a contaminated runway, the AFM should also include recommended procedures associated with this performance information. Differences in other procedures for operation of the aeroplane on a contaminated surface should also be presented, e.g. reference to crosswinds.

8.3 Landing Data

This should be presented either as separate data appropriate to a defined runway contaminant or as incremental data based on the normal dry or wet runway information in the AFM. Information relating to the use of speeds higher than the VREF on landing, that is, the VREF with an increment up to the maximum recommended approach speed, as well as the associated distances, should also be included. The landing distance should be

presented either directly or with the factors required by the operating manuals (OMs), with a clear explanation, where appropriate.

Where data is provided for a range of contaminant depths, e.g. greater than 3, 6, 9, 12, 15 mm, then the AFM should clearly indicate how to define data for contaminant depths within the range of the contaminant depths provided.

The AFM should provide:

— the performance data for operations on contaminated runways;

— definitions of runway surface conditions; and

— the procedures and assumptions used to develop the performance data.

The AFM should state that operations are prohibited on runways with contaminant depths greater than those for which data is provided. Instructions for use of the data should be provided in the appropriate documentation.

9.0 References

1. FAA AC 25-32, 'Landing Performance Data for Time-of-Arrival Landing Performance Assessments', 22 December 2015.

3.3. Draft AMC/GM (draft EASA Decision)

3.3.1. Definitions

1. New GM13 Annex I Definitions is added as follows:

GM13 Annex I Definitions
CONTAMINATED RUNWAY

As the runway condition is reported in runway thirds, a significant portion of the runway surface area is more than 25 % of one third of the runway surface area within the required length and width being used.

2. New GM14 Annex I Definitions is added as follows:

GM14 Annex I Definitions
DRY RUNWAY

The 'area intended to be used' means the area of the runway that is part of the take-off run available (TORA) or landing distance available (LDA) declared in the aeronautical information publication (AIP) or by notice to airmen (NOTAM).

3.3.2. Part-ORO

Subpart GEN — General requirements

SECTION I — GENERAL

1. GM3 ORO.GEN.130(b) is amended as follows:

GM3 ORO.GEN.130(b) Changes related to an AOC holder
CHANGES REQUIRING PRIOR APPROVAL

The following GM is a non-exhaustive checklist of items that require prior approval from the competent authority as specified in the applicable Implementing Rules:

(…)

(n) performance:

(1) increased bank angles at take-off (for performance class A aeroplanes);

(2) short landing operations (for performance class A and B aeroplanes);

(3) steep approach operations (for performance class A and B aeroplanes); and

(4) reduced required landing distance operations (for performance class A and B aeroplanes);

(…)

SUBPART MLR — MANUALS, LOGS AND RECORDS

2. New GM1 ORO.MLR.100 is added as follows:

GM1 ORO.MLR.100 Operations manual — general
CROSSWIND LIMITATIONS IN THE OPERATIONS MANUAL (OM)

When publishing operational crosswind limitations in Part B of the OM in accordance with AMC3 ORO.MLR.100, operators should consider:

(a) the following manufacturer's information:

(1) values published in the 'Limitations' Section of the aircraft flight manual (AFM);

(2) maximum demonstrated crosswind values, when more limiting values are not published in the 'Limitations' Section of the AFM;

(3) gust values; and

(4) additional guidance or recommendations;

(b) operational experience; and

(c) operating-environment factors such as:

(5) runway width;

(6) runway surface condition; and

(7) prevailing weather conditions.

3.3.3. Part-CAT

Subpart B — Operating procedures

Section 1 — Motor-powered aircraft

1. AMC1 CAT.OP.MPA.300 is amended as follows:

AMC1 CAT.OP.MPA.300 Approach and landing conditions — aeroplanes
IN-FLIGHT DETERMINATION OF THE LANDING DISTANCE

The in-flight determination of the landing distance should be based on the latest available meteorological ~~or~~and runway ~~state~~condition report~~, preferably not more than 30 minutes before the expected landing time~~. When meteorological conditions may lead to a degradation of the runway condition, the commander should determine during the approach preparation the most unfavourable runway condition that may be accepted in order to conduct a safe landing.

2. New AMC1 CAT.OP.MPA.301 is added as follows:

AMC1 CAT.OP.MPA.301 Approach and landing conditions — helicopters
IN-FLIGHT DETERMINATION OF THE LANDING DISTANCE

The in-flight determination of the final approach and take-off area (FATO) suitability landing distance should be based on the latest available meteorological or runway condition report, preferably no more than 30 minutes before the expected landing time.

3. New AMC1 CAT.OP.MPA.303(a) and (b)(1) and (c)(1) is added as follows:

AMC1 CAT.OP.MPA.303(a) and (b)(1) and (c)(1) In-flight check of the landing distance at the time of arrival — aeroplanes
PERFORMANCE INFORMATION FOR LANDING DISTANCE ASSESSMENT AT THE TIME OF ARRIVAL

(a) Performance information for landing distance assessment at the time of arrival should be developed in accordance with AMC 25.1592, or equivalent, and included in the operations manual (OM).

(b) When the aircraft manufacturer does not provide the relevant data for performance class A aeroplanes, performance information for landing distance assessment at the time of arrival may be determined by applying the following methods:

(1) Correction factors may be applied to the certified landing distances on dry runway published in the AFM for turbojet-powered aeroplanes and turbopropeller-powered aeroplanes.

(2) For this purpose, the landing distance factors (LDFs) from Table 1 below may be used:

Table 1 — LDFs

Runway condition code (RWYCC)	**6**	**5**	**4**	**3**	**2**	**1**
Braking action	**Dry**	**Good**	**Good to medium**	**Medium**	**Medium to poor**	**Poor**
Runway description	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1
Turbojet without reverse	1.67	2.6	2.8	3.2	4.0	5.1
Turbojet with reverse	1.67	2.2	2.3	2.5	2.9	3.4
Turboprop (see Note 2)	1.67	2.0	2.2	2.4	2.7	2.9

Note 1: runway descriptions may be found in the runway condition assessment matrix (RCAM) for each RWYCC or braking action.

Note 2: these LDFs apply only to modern turboprops with efficient disking drag. For older turboprops without adequate disking drag, use the Turbojet, No Reverse LDFs.

Note 3: the LDFs can apply to any type of anti-skid system, i.e. fully-modulating, quasi-modulating or on-off system.

(3) To find the landing distance required (LDR) multiply the AFM (dry, unfactored) landing distance by the applicable LDFs from Table 1 above for the runway conditions existing at the time of arrival. If the AFM landing distances are presented as factored landing distances, then that data needs to be adjusted to remove the applicable dispatch factors applied to that data.

(4) The LDFs given in Table 1 above include a 15 % safety margin and an air distance representative of normal operational practices. They account for variations of temperature up to international standard atmosphere (ISA) + 20 °C, runway slopes between –2 % and +2 %, and an average approach speed increment of 5 up to 20 kt. They may not be conservative for all configurations in case of unfavourable combinations of these parameters.

4. New GM1 CAT.OP.MPA.303 is added as follows:

GM1 CAT.OP.MPA.303 In-flight check of the landing distance at the time of arrival — aeroplanes

TIMELINESS

The assessment is initially performed when landing weather and runway condition reports are obtained, usually around top of descent. The assessment includes consideration of how much deterioration in runway surface friction characteristics can be tolerated so that a quick decision is made just prior to landing if the preceding aircraft provides a pilot advisory report of braking action (AIREP) of worse than expected braking action.

RUNWAY CONDITION CONSIDERATIONS

When available for the portion of the runway that will be used for landing, the following elements are considered:

(a) runway condition code (RWYCC);

(b) expected runway conditions (contaminant type and depth); and

(c) pilot advisory report of braking action (AIREP).

AIRCRAFT PERFORMANCE CONSIDERATIONS

The following considerations may impact operational landing distance calculations:

(a) runway slope;

(b) aerodrome elevation;

(c) wind;

(d) temperature;

(e) aeroplane mass and configuration;

(f) approach speed at threshold;

(g) eventual adjustments to the landing distance, such as autoland; and

(h) planned use of aeroplane ground deceleration devices.

AUTOBRAKE USAGE

While autobrakes are a part of the aeroplane's landing configuration, the landing distance assessment at the time of arrival is not intended to force a selection of a higher than reasonable autobrake level. For operations when the runway is dry or wet grooved or with a porous friction course (PFC), if the manual braking distance provides a 15 % safety margin, then the braking technique may include a combination of autobrakes and manual braking even if the selected autobrake landing data does not provide a 15 % safety margin.

ASSESSMENT BASED ON DISPATCH CRITERIA

When the runway is dry or wet grooved or with a PFC, the assessment of the landing distance at the time of arrival may be done by confirming that the runway meets the criteria used for dispatch.

The required landing distance for dry runways determined in accordance with CAT.POL.A.230(a) contains adequate margin to fulfil the intent of the time-of-arrival landing distance calculation on a dry runway, which includes specific allowance for the additional parameters considered in that calculation.

When using wet runway dispatch applying the 15 % increase on the dry landing distance in accordance with CAT.POL.A.235(a) to determine the required landing distance for a wet grooved surface or with a PFC, there is adequate margin to cover eventualities considered in the time-of-arrival landing distance calculation.

DOCUMENTATION AND TRAINING

The Operations Manual (OM) and training material should include the assumptions about and the limitations on the use of the data provided for performing a landing distance assessment at the time-of-arrival.

5. New AMC1 CAT.OP.MPA.311 is added as follows:

AMC1 CAT.OP.MPA.311 Runway braking action reporting
GENERAL

Pilot reports of runways surface conditions and braking action are considered by the aerodrome when assessing the RWYCC reported in the runway condition report (RCR).

A single reference within the International Civil Aviation Organization (ICAO) documentation to the runway condition assessment matrix (RCAM) and associated procedures is published in ICAO Doc 9981 — 'PANS Aerodromes'.

Pilot reports of runway braking action should be done in the format of special air report (AIREP). Instructions for in-flight reporting of runway braking action may be found in ICAO Doc 4444 — 'PANS ATM'.

RCAM

The presentation of the information in the RCAM is appropriate for use by aerodrome personnel trained and competent in assessing the runway condition in a way relevant to aircraft performance. While full implementation of the proposed standards would eventually no longer require the flight crew to derive from various information available to them the appropriate runway condition to be used for the landing performance assessment at the time of arrival, it is desirable that pilots maintain an understanding of the performance effect of various components considered in the assessment.

It is the task of the aerodrome personnel to assess the appropriate RWYCC in order to allow the flight crew to assess any potential change of the runway surface conditions. When no RWYCC is available in winter conditions, the RCAM provides the flight crew with a combination of the relevant information (runway surface conditions: state and/or contaminant or pilot report of braking action (AIREP)) in order to assess the RWYCC.

Table 1 below is an excerpt of the RCAM and permits to perform the primary assessment based on the reported contaminant type and depth, as well as outside air temperature (OAT).

Table 1 — Association between runway surface condition and RWYCC based on reported contaminant type and depth and OAT

Runway surface condition	Surface condition descriptor	Depth	Notes	RWYCC
Dry		N/a	Including wet or contaminated runways below 25 % coverage in each runway third	6
Wet	Damp (any visible dampness)			5
	Wet	3 mm or less		5
Slippery wet				3
Contaminated	Compacted snow	Any	At or below OAT – 15 °C	4
			Above OAT – 15 °C	3
	Dry snow	3 mm or less		5
		More than 3 mm up to 100 mm	Including when any depth occurs on top of compacted snow	3
		Any	On top of ice	0[2]
	Frost[1]	Any		5
	Ice	Any	In cold and dry conditions	1
	Slush	3 mm or less		5
		More than 3 mm up to 15 mm		2
	Standing water	3 mm or less		5
		More than 3 mm up to 15 mm		2
		Any	On top of ice	0[2]
	Wet ice	Any		0[2]
	Wet snow	3 mm or less		5
		More than 3 mm up to 30 mm	Including when any depth occurs on top of compacted snow	3
		Any	On top of ice	0[2]

Note 1: under certain conditions, frost may cause the surface to become very slippery.

Note 2: operations in conditions where less-than-poor braking action prevails are prohibited.

A primary assessment may have to be downgraded based on an AIREP of lower braking action than the one typically associated with the type and depth of contaminant on the runway. The following table shows the correlation between AIREP terminology and RWYCC.

Table 2 — Association between AIREP and RWYCC

AIREP	Description	RWYCC
N/A		6
GOOD	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	5
GOOD TO MEDIUM	Braking deceleration OR directional control is between good and medium.	4
MEDIUM	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	3
MEDIUM TO POOR	Braking deceleration OR directional control is between medium and poor.	2
POOR	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	1
LESS THAN POOR	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	0

Note 1: the aerodrome personnel may downgrade or upgrade the reported RWYCC based on the friction coefficient (Mu) measured by a friction measuring device meeting standards set or agreed by the state of aerodrome. Such a decision should not be taken by a flight crew on the approach as it must be supported by all other observations. Measured friction values poorly correlate with actual aircraft braking capability/landing performance.

Subpart C — Aircraft performance and operating limitations

Section 1 — Aeroplanes

Chapter 2 — Performance class A

6. AMC1 CAT.POL.A.200 is amended as follows:

AMC1 CAT.POL.A.200 General
WET AND CONTAMINATED RUNWAY DATA

~~If the performance data have been determined on the basis of a measured runway friction coefficient, the operator should use a procedure correlating the measured runway friction coefficient and the effective braking coefficient of friction of the aeroplane type over the required speed range for the existing runway conditions.~~Determination of take-off performance for wet and contaminated runways should be based on the reported runway surface condition in terms of contaminant and depth. Determination of landing performance should be based on information provided in the operations manual (OM) on the reported runway condition code (RWYCC). The RWYCC is determined by the

aerodrome operator using the runway condition assessment matrix (RCAM) and associated procedures defined in ICAO Doc 9981 — 'PANS Aerodromes'.

7. New GM1 CAT.POL.A.200 is added as follows:

GM1 CAT.POL.A.200 General
APPLICABLE STANDARDS FOR LANDING DISTANCE ASSESSMENT AT THE TIME OF ARRIVAL

Applicable standards for the assessment of the landing distance at the time of arrival are provided under AMC1 CAT.OP.MPA.303(a) and (b)(1) and (c)(1).

8. AMC1 CAT.POL.A.230 is amended as follows:

AMC1 CAT.POL.A.230 Landing — dry runways
FACTORING OF AUTOMATIC LANDING DISTANCE PERFORMANCE DATA

In those cases where the landing requires the use of an automatic landing system, and the distance published in the AFM includes safety margins equivalent to those contained in CAT.POL.A.230 (a)(1), CAT.POL.A.230(a)(2) and CAT.POL.A.235, the landing mass of the aeroplane should be the lesser of:

(a) the landing mass determined in accordance with CAT.POL.A.230 (a)(1), CAT.POL.A.230(a)(2) or CAT.POL.A.235, as appropriate; or

(b) the landing mass determined for the automatic landing distance for the appropriate surface condition, as given in the AFM or equivalent document. Increments due to system features such as beam location or elevations, or procedures such as use of overspeed, should also be included.

9. GM1 CAT.POL.A.230 is amended as follows:

GM1 CAT.POL.A.230 Landing — dry runways
LANDING MASS

CAT.POL.A.230 establishes two considerations in determining the maximum permissible landing mass at the destination and alternate aerodromes:

(a) Firstly, the aeroplane mass will be such that on arrival the aeroplane can be landed within 60 %, 70 %, or ~~7~~80 % (as applicable) of the landing distance available (LDA) on the most favourable (normally the longest) runway in still air. Regardless of the wind conditions, the maximum landing mass for an aerodrome/aeroplane configuration at a particular aerodrome cannot be exceeded.

(b) Secondly, consideration should be given to anticipated conditions and circumstances. The expected wind, or ATC and noise abatement procedures, may indicate the use of a different runway. These factors may result in a lower landing mass than that permitted under (a), in which case dispatch should be based on this lesser mass.

(c) The expected wind referred to in (b) is the wind expected to exist at the time of arrival.

10. New GM1 CAT.POL.A.255(b)(1) is added as follows:

GM1 CAT.POL.A.255(b)(1) Approval of reduced required landing distance operations
NON-SCHEDULED ON-DEMAND COMMERCIAL AIR TRANSPORT (CAT) OPERATIONS

Non-scheduled on-demand CAT operations eligible for reduced required landing distance operations do not include holiday charters, i.e. charter flights that are part of a holiday travel package.

11. New GM2 CAT.POL.A.255(b)(1) is added as follows:

GM2 CAT.POL.A.255(b)(1) Approval of reduced required landing distance operations
EQUIVALENT LEVEL OF SAFETY

A level of safety equivalent to that intended by CAT.POL.A.230(a)(1) or CAT.POL.A.230(a)(2), as applicable, may be achieved when conducting reduced required landing distance operations if mitigating measures are established and implemented. Such measures should address flight crew, aircraft characteristics and performance, aerodromes and operations. It is, however, essential that all conditions established are adhered to as it is the combination of said conditions that achieves the intended level of safety. The operator should in fact also consider the interrelation of the various mitigating measures.

The mitigating measures may be determined by the operator by using a risk assessment or by fulfilling all the conditions established under CAT.POL.A.255(b). An operator willing to establish a set of conditions different from those under CAT.POL.A.255(b) should demonstrate to the competent authority the equivalent level of safety through a risk assessment.

The competent authority may require further mitigating measures in addition to those proposed by the operator.

12. New AMC1 CAT.POL.A.255(b)(1) is added as follows:

AMC1 CAT.POL.A.255(b)(1) Approval of reduced required landing distance operations
RISK ASSESSMENT

The risk assessment required by CAT.POL.A.255(b)(1) should include at least the following elements:

(a) flight crew qualification in terms of training, checking and recency;

(b) flight crew composition;

(c) runway surface conditions;

(d) dispatch criteria;

(e) weather conditions and limitations;

(f) aerodrome characteristics;

(g) aeroplane characteristics and limitations;

(h) aeroplane equipment and systems affecting landing performance;

(i) aeroplane performance data; and

(j) operating procedures and operating minima.

13. New AMC1 CAT.POL.A.255(b)(2)(iii) is added as follows:

AMC1 CAT.POL.A.255(b)(2)(iii) Approval of reduced required landing distance operations

GENERAL

(a) The operator should ensure that flight crew training programmes for reduced required landing distance operations include ground training, flight simulation training device (FSTD), and/or flight training.

(b) Flight crew with no reduced required landing distance operations experience should have completed the full training programme of (a) above.

(c) Flight crew with previous increased reduced required landing distance operations experience of a similar type of operation with another EU operator, may undertake the following:

(1) an abbreviated ground training course if operating an aircraft of a type or class different from that of the aircraft on which the previous reduced required landing distance operations experience was gained;

(2) an abbreviated ground, FSTD and/or flight training course if operating the same type or class and variant of the same aircraft type or class on which the previous reduced required landing distance operations experience was gained; this course should include at least the provisions of the conversion training contained in this AMC; the operator may reduce the number of approaches/landings required by the conversion training if the type/class or the variant of the aircraft type or class has the same or similar operating procedures, handling characteristics and performance characteristics as the previously operated aircraft type or class.

(d) Flight crew with reduced required landing distance operations experience with the operator may undertake an abbreviated ground, FSTD and/or flight training course according to the following conditions:

(1) when changing aircraft type or class, the abbreviated course should include at least the content of the conversion training;

(2) when changing to a different variant of aircraft within the same type or class rating that has the same or similar operating procedures, handling characteristics and performance characteristics, as the previously operated aircraft type or class, a difference course or familiarisation appropriate to the change of variant should fulfil the abbreviated course's purposes; and

(3) when changing to a different variant of aircraft within the same type or class rating that has significantly different operating procedures, handling characteristics and performance characteristics, the abbreviated course should include the content of the conversion training.

GROUND TRAINING

(a) The initial ground training course for reduced required landing distance operations should include at least the following:

(1) operational procedures and limitations, including flight preparation and planning;

(2) characteristics of the runway visual aids and runway markings;

(3) aircraft performance related to reduced required landing distance operations, including:

(i) aircraft-specific decelerating devices and equipment;

(ii) items that increase the aircraft landing distance, e.g. excess speed at touchdown, threshold crossing height, delayed brake application, delayed spoiler/speed brake or thrust reverser application; and

(iii) runway surface conditions;

(4) in-flight assessment of landing performance, including maximum landing masses and runway conditions;

(5) stabilised approach criteria;

(6) correct vertical flight path after the DA/MDA;

(7) correct flare, touchdown and braking techniques;

(8) touchdown within the appropriate touchdown zone;

(9) recognition of failure of aircraft equipment affecting aircraft performance, and action to be taken in that event;

(10) flight crew task allocation and pilot monitoring duties, including monitoring of the activation of deceleration devices;

(11) go-around/balked-landing criteria and decision-making;

(12) selection of precision approaches versus non-precision approaches if both are available; and

(13) qualification requirements for pilots to obtain and retain reduced required landing distance operations, including aerodrome landing analysis programme (ALAP) procedures.

FSTD TRAINING AND/OR FLIGHT TRAINING

(a) FSTD and/or flight training should at least be required for the commander and any other pilot flying for landing when performing reduced required landing distance operations.

(b) FSTD and/or flight training for reduced required landing distance operations should include checks of equipment functionality, both on the ground and in-flight.

(c) Initial reduced required landing distance operations training should consist of a minimum of two approaches and landings to include at least the following exercises which may be combined:

(1) an approach and landing at the maximum landing mass;

(2) an approach and landing without the use of visual approach;

(3) a landing on a wet runway;

(4) a malfunction of a stopping device on landing; and

(5) a go-around/balked landing.

(d) Special emphasis should be given to the following items:

(1) in-flight assessment of landing performance;

(2) stabilised approach, recognition of an unstable approach and, consequentially, a go-around;

(3) flight crew task allocation and pilot monitoring duties, including monitoring of the activation of deceleration devices;

(4) timely and correct activation of deceleration devices;

(5) correct flare technique; and

(6) landing within the appropriate touchdown zone.

CONVERSION TRAINING

Flight crew members should complete the following reduced required landing distance operations training if converting to a new type or class or variant of aircraft in which reduced required landing distance operations will be conducted.

(a) Ground training, taking into account the flight crew member's increased landing factor operations experience.

(b) FSTD training and/or flight training.

RECURRENT TRAINING AND CHECKING

(a) The operator should ensure that in conjunction with the normal recurrent training and operator's proficiency checks, the pilot's knowledge and ability to perform the tasks associated with reduced required landing distance operations are adequate.

(b) The items of the ground training should cover a 3-year period.

(c) An annual reduced required landing distance operations training should consist of a minimum of two approaches and landings so that it includes at least the following exercises which may be combined:

(1) an approach and landing at the maximum landing mass;

(2) an approach and landing without the use of visual approach;

(3) a landing on a wet runway;

(4) a malfunction of a stopping device on landing; and

(5) a go-around/balked landing.

FLIGHT CREW QUALIFICATION AND EXPERIENCE

(a) Flight crew qualification and experience are specific to the operator and type of aircraft operated.

(b) The operator should ensure that each flight crew member successfully completes the specified FSTD and/or flight training before conducting reduced required landing distance operations.

(c) The operator should ensure that no inexperienced flight crew members, as defined in AMC1.ORO.FC.200(a), perform an approach and landing with reduced required landing distance operations.

14. New GM1 CAT.POL.A.255(b)(2)(iii) is added as follows:

GM1 CAT.POL.A.255(b)(2)(iii) Approval of reduced required landing distance operations
MONITORING

(a) Reduced required landing distance operations should be continuously monitored by the operator to detect any undesirable trends before they become hazardous.

(b) A flight data monitoring (FDM) programme, as required by ORO.AOC.130, is an acceptable method to monitor operational risks related to reduced required landing distance operations.

(c) Although ORO.AOC.130 requires FDM only for aeroplanes with a maximum certified take-off mass (MCTOM) of more than 27 000 kg, FDM is recommended for all operators conducting reduced required landing distance operations.

15. New GM1 CAT.POL.A.255(b)(2)(iv) is added as follows:

GM1 CAT.POL.A.255(b)(2)(iv) Approval of reduced required landing distance operations
AERODROME LANDING ANALYSIS PROGRAMME (ALAP)

The intent of an ALAP is to ensure that the aerodrome critical data related to landing performance in reduced required landing distance operations are known and taken into account in order to avoid any further increase of the landing distance.

Two important aerodrome-related variables largely contribute to increasing the landing distance:

(a) unfavourable or variable winds; and

(b) runway surface condition.

16. New GM2 CAT.POL.A.255(b)(2)(iv) is added as follows:

GM2 CAT.POL.A.255(b)(2)(iv) Approval of reduced required landing distance operations
ADVERSE WEATHER

Adverse weather conditions include thunderstorms, showers, downbursts, squall lines, tornadoes, moderate or severe turbulence on approach, heavy precipitation, wind shear, icing conditions. In general, all weather phenomena having the potential to increase the landing distance should be carefully assessed. Among these, tailwind is particularly relevant, therefore, reduced required landing distance operations with tailwind are prohibited by CAT.POL.A.255(b)(2)(iv)(A).

Wind variations should be carefully monitored as they may lead to variations in the reported and/or actual wind at the touchdown zone. Due consideration should be given also to the crosswind perpendicular to the landing runway as a slight variation in the direction of the crosswind may result in a considerable tailwind component.

17. New AMC1 CAT.POL.A.255(b)(2)(v) is added as follows:

AMC1 CAT.POL.A.255(b)(2)(v) Approval of reduced required landing distance operations
EQUIPMENT AFFECTING LANDING PERFORMANCE

Equipment affecting landing performance typically includes flaps, slats, spoilers, brakes, anti-skid, autobrakes, reversers, etc. The operator should establish procedures to identify, based on the aircraft characteristics, those systems and the equipment that are performance relevant, and to ensure that they are verified to be operative before commencing the flight. Dispatch with such equipment that is inoperative under the minimum equipment list (MEL) is not allowed for reduced required landing distance operations.

18. New AMC1 CAT.POL.A.255(b)(2)(vi) is added as follows:

AMC1 CAT.POL.A.255(b)(2)(vi) Approval of reduced required landing distance operations
RECENCY

Flight crew conducting reduced landing distance operations should have a recency in said operations of at least two landings, either in actual operations or in an FSTD, performed within the validity period of the operator proficiency check (OPC).

19. New AMC1 CAT.POL.A.255(b)(2)(viii) is added as follows:

AMC1 CAT.POL.A.255(b)(2)(viii) Approval of reduced required landing distance operations
ADDITIONAL AERODROME CONDITIONS

(a) Operators should establish procedures to ensure that:

(1) the aerodrome information is obtained from an approved source;

(2) any change reducing landing distances that has been declared by the aerodrome operator has been taken into account; and

(3) no steep approaches, screen heights lower than 35 ft or higher than 60 ft, operations outside the stabilised approach criteria, or low-visibility operations are required at the aerodrome where reduced required landing distance operations are conducted.

(b) Additional aerodrome conditions related to aeroplane type characteristics, orographic characteristics in the approach area, available approach aids and missed approach/balked landing considerations, as well as operating limitations, should also be taken into account.

(c) When assessing the aerodrome characteristics and the level of risk of the aeroplane undershooting or overrunning the runway, the operator should consider the nature and location of any hazard beyond the runway end, including the topography and obstruction environment beyond the runway strip, and the effectiveness of any mitigation measures that may be in place to reduce the likelihood and the consequences of a runway overrun.

Chapter 3 — Performance class B

20. AMC1 CAT.POL.A.330 is amended as follows:

AMC1 CAT.POL.A.330 Landing — dry runways
LANDING DISTANCE CORRECTION FACTORS

(a) Unless otherwise specified in the AFM, or other performance or operating manuals from the manufacturers, the variable affecting the landing performance and the associated factor that should be applied to the AFM data are shown in the table below. It should be applied in addition to the operational factors as prescribed in CAT.POL.A.330-(a) and CAT.POL.A.330(b).

Table 1: Landing distance correction factors

Surface type	Factor
Grass (on firm soil up to 20 cm long)	1.15

(b) The soil should be considered firm when there are wheel impressions but no rutting.

21. GM1 CAT.POL.A.330 is amended as follows:

GM1 CAT.POL.A.330 Landing — dry runways
LANDING MASS

CAT.POL.A.330 establishes two considerations in determining the maximum permissible landing mass at the destination and alternate aerodromes.

(a) Firstly, the aeroplane mass will be such that on arrival the aeroplane can be landed within 70 % or 80 %, as applicable, of the LDA on the most favourable (normally the longest) runway in still air. Regardless of the wind conditions, the maximum landing mass for an aerodrome/aeroplane configuration at a particular aerodrome cannot be exceeded.

(b) Secondly, consideration should be given to anticipated conditions and circumstances. The expected wind, or ATC and noise abatement procedures, may indicate the use of a different runway. These factors may result in a lower landing mass than that permitted under (a), in which case dispatch should be based on this lesser mass.

(c) The expected wind referred to in (b) is the wind expected to exist at the time of arrival.

22. New GM1 CAT.POL.A.355(b) is added as follows:

GM1 CAT.POL.A.355(b) Approval of reduced required landing distance operations
EQUIVALENT LEVEL OF SAFETY

A level of safety equivalent to that intended by CAT.POL.A.330(a) may be achieved when conducting reduced required landing distance operations if mitigating measures are established and implemented. Such measures should address flight crew, aircraft characteristics and performance, aerodromes and operations. It is, however, essential that all conditions established are adhered to as it is the combination of said conditions that achieves the intended level of safety. The operator should in fact also consider the interrelation of the various mitigating measures.

The competent authority may require further mitigating measures in addition to those proposed by the operator.

23. New AMC1 CAT.POL.A.355(b)(3) is added as follows:

AMC1 CAT.POL.A.355(b)(3) Approval of reduced required landing distance operations
CONTROL OF THE TOUCHDOWN AREA

The control of the touchdown area may be ensured by using external references visible from the flight crew compartment. The end of the designated touchdown area should be clearly identified with a ground reference point beyond which a go-around is required. Adequate go-around and balked landing instructions should be established in the operations manual (OM). A written and/or pictorial description of the procedure should be provided for crew use.

24. New AMC1 CAT.POL.A.355(b)(4) and (b)(5) is added as follows:

AMC1 CAT.POL.A.355(b)(4) and (b)(5) Approval of reduced required landing distance operations
TYPE EXPERIENCE

The operator should specify in the operations manual (OM) the minimum pilot's experience on the aircraft type or class required to conduct such operations.

TRAINING PROGRAMME

(a) Initial training

(1) The aerodrome training programme shall include ground and flight training with a suitably qualified instructor.

(2) Flight training should be carried out on the runway of the intended operations, and should include a suitable number of:

(i) approaches and landings; and

(ii) missed approach/balked landings.

(3) When performing approaches and landings, particular emphasis should be placed on:

(i) stabilised approach criteria;

(ii) accuracy of flare and touchdown;

(iii) positive identification of the ground reference point controlling the touchdown area; and

(iv) correct use of deceleration devices.

(4) These exercises should be conducted in accordance with the specific control procedure of the touchdown area established by the operator, and should enable the flight crew to identify the external visual references and the designated touchdown area.

(b) Recurrent training

The operator should ensure that in conjunction with the recurrent training and checking programme required by Subpart FC of Annex III (Part-ORO) to Regulation (EU) No 965/2012, the

pilot's knowledge and ability to perform the tasks associated with this particular operation, for which the pilot is authorised by the operator, are verified.

RECENCY

The operator should define in the OM appropriate recent-experience requirements to ensure that the pilot's ability to perform an approach to and landing on the intended runway is maintained.

25. New GM1 CAT.POL.A.355(b)(6) is added as follows:

GM1 CAT.POL.A.355(b)(6) Approval of reduced required landing distance operations
AERODROME LANDING ANALYSIS PROGRAMME (ALAP)

The intent of an ALAP is to ensure that the aerodrome critical data related to landing performance in reduced required landing distance operations are known and taken into account in order to avoid any further increase of the landing distance.

Two important aerodrome-related variables largely contribute to increasing the landing distance:

(a) unfavourable or variable winds; and

(b) runway surface condition.

ADVERSE WEATHER

Adverse weather conditions include thunderstorms, showers, downbursts, squall lines, tornadoes, moderate or severe turbulence on approach, heavy precipitation, wind shear, icing conditions. In general, all weather phenomena having the potential to increase the landing distance should be carefully assessed. Among these, tailwind is particularly relevant, therefore, reduced required landing distance operations with tailwind are prohibited by CAT.POL.A.355(b)(6)(i).

Wind variations should be carefully monitored as they may lead to variations in the reported and/or actual wind at the touchdown zone. Due consideration should be given also to the crosswind perpendicular to the landing runway as a slight variation in the direction of the crosswind may result in a considerable tailwind component.

26. New GM1 CAT.POL.A.355(b)(7)(i) is added as follows:

GM1 CAT.POL.A.355(b)(7)(i) Approval of reduced required landing distance operations
EQUIPMENT AFFECTING LANDING PERFORMANCE

Equipment affecting landing performance typically includes flaps, slats, spoilers, brakes, anti-skid, autobrakes, reversers, etc. The operator should establish procedures to identify, based on the aircraft characteristics, those systems and the equipment that are performance relevant, and to ensure that they are verified to be operative before commencing the flight. Dispatch with such equipment that is inoperative under the minimum equipment list (MEL) is not allowed for reduced required landing distance operations.

27. New GM1 CAT.POL.A.355(b)(7)(ii) is added as follows:

GM1 CAT.POL.A.355(b)(7)(ii) Approval of reduced required landing distance operations
CORRECT USE OF DECELERATION DEVICES

Flight crew should use full reverse when landing irrespectively of any noise-related restriction on its use unless this affects the controllability of the aircraft. The use of all stopping devices, including reverse thrust, should commence immediately after touchdown without any delay.

28. New AMC1 CAT.POL.A.355(b)(8) is added as follows:

AMC1 CAT.POL.A.355(b)(8) Approval of reduced required landing distance operations
SPECIFIC MAINTENANCE INSTRUCTIONS

Additional maintenance instructions, such as more frequent checks, for the aircraft's deceleration devices, especially for the reverse system, should be established by the operator in accordance with the manufacturer's recommendations, and be included in the operator's maintenance programme in accordance with Annex I (Part-M) to Regulation (EU) No 1321/2014.

SPECIFIC OPERATIONAL PROCEDURES

The operator should establish procedures for the flight crew to check before take-off the correct deployment of the deceleration devices, such as the reverse system.

29. New AMC1 CAT.POL.A.355(b)(10) is added as follows:

AMC1 CAT.POL.A.355(b)(10) Approval of reduced required landing distance operations
ADDITIONAL AERODROME CONDITIONS

(a) Operators should establish procedures to ensure that:

(1) the aerodrome information is obtained from an approved source; and

(2) any change reducing landing distances declared by the aerodrome operator has been taken into account.

(b) Additional aerodrome conditions related to aeroplane type characteristics, orographic characteristics in the approach area, available approach aids and missed approach/balked landing considerations, as well as operating limitations, should also be taken into account.

(c) When assessing the aerodrome characteristics and the level of risk of the aeroplane undershooting or overrunning the runway, the operator should consider the nature and location of any hazard beyond the runway end, including the topography and obstruction environment beyond the runway strip, and the effectiveness of any mitigation measures that may be in place to reduce the likelihood and the consequences of a runway overrun.

4. RIA

4.1. Issues to be addressed

General review of aeroplane performance requirements

A first attempt to review the operational requirements on aeroplane performance for CAT operations with the purpose of harmonisation between US and EU rules was initiated by the Joint Aviation Authorities (JAA)/Federal Aviation Authority (FAA) Aviation Rulemaking Advisory Committee (ARAC) Performance Harmonisation Working Group (PERFHWG).

The recommendations of said working group were subsequently discussed by the JAA OPS Performance Sub-Committee (PERFSC) and included in an NPA (NPA-OPS 47). Such NPA became the input for EASA rulemaking task OPS.008 (former task number).

The main effects of the proposed changes were considered to be an improvement of clarity, technical accuracy and flexibility for operators ,as well as harmonisation with the FAA rules.

A general consistency review of the aeroplane performance requirements in Subpart C 'AIRCRAFT PERFORMANCE AND OPERATING LIMITATIONS' of Part-CAT is also performed in this NPA.

A further need for coordination and a consistency check has been identified in eventual changes proposed for aeroplane-performance-related rules by the following RMTs:

— RMT.0379 'All-weather operations' (AWO), and

— RMT.0570 'Reduction of runway excursions'.

ICAO amendments

However, it soon became evident that the number of issues and safety concerns to be addressed in the field of aeroplane performance was larger.

Later on in fact, it was recognised that airworthiness standards and operating rules may not cover adequately all conditions for take-off and landing performance, particularly in relation to runway surface condition when the runway is wet or contaminated. This issue touches multiple domains of the aviation regulatory framework such as Airworthiness (AW), Air Operations (Air OPS) and ADR.

For this reason, the FAA tasked the Takeoff and Landing Performance Assessment Advisory Rulemaking Committee (TALPA ARC) to perform an exhaustive review of operations on contaminated runways.

TALPA ARC developed proposals along the three main directions of:

— standards for runway condition reporting by aerodromes;

— standards for aircraft manufacturers to produce data for operational landing performance computation at the time of arrival; and

— operational rules for aircraft operators.

Most of the TALPA ARC recommendations were endorsed by the European Action Plan for the Prevention of Runway Excursions (EAPPRE), which, in particular, contained the following SRs to EASA:

— *3.7.1 — Establish and implement one consistent method of contaminated runway surface condition assessment and reporting by the aerodrome operator for use by aircraft operators. Ensure the relation of this report to aircraft performance as published by aircraft manufacturers.*

— *3.7.3 — It is recommended that aircraft operators always conduct an in-flight assessment of the landing performance prior to landing. Note: Apply an appropriate margin to these results.*

Under the Research Project EASA.2008/4, EASA also published in 2010 a study on runway friction characteristics measurement and aircraft braking (RuFAB), which endorses some of the TALPA ARC recommendations.

Part of the TALPA ARC recommendations on certification aspects related to performance were also initially considered by EASA in RMT MDM.069 —'Take-off and landing performance assessment', which was then deleted from the EASA Rulemaking Programme to be included in the present RMT.

The TALPA ARC recommendations were also the basis for the following two draft Advisory Circulars (ACs) published by the FAA in December 2015:

— AC 25-32: Landing Performance Data for Time of Arrival Landing Performance Assessments. This AC provides guidance and standardised methods that data providers, such as type certificate (TC) holders, supplemental type certificate (STC) holders, applicants, and aeroplane operators, can use when developing landing performance data for time-of-arrival landing performance assessments for transport category aeroplanes. This AC also promotes the use of consistent terminology for runway surface conditions used among data providers and FAA personnel.

— AC 25-31: Takeoff Performance Data for Operations on Contaminated Runways. This AC is equivalent to the above one but intended for developing take-off performance data.

The TALPA ARC recommendations have been endorsed as well by ICAO through the work of the Friction Task Force (FTF). The result of this work were presented in ICAO State Letter 4/1.1.55-15/30, issued in 2015, including a number of standards and recommended practices amending the following annexes:

— ICAO Annex 3 'Meteorological Service for International Air Navigation';

— ICAO Annex 6 'Operation of Aircraft', Part I and Part II;

— ICAO Annex 8 'Airworthiness of Aircraft';

— ICAO Annex 14 'Aerodromes'; and

— ICAO Annex 15 'Aeronautical Information Services;

as well as the following documents:

— ICAO Doc 9981 'PANS — Aerodromes'; and

— ICAO Doc 4444 'PANS — ATM'.

Such proposals were then adopted by the Council of ICAO in 2016.

This NPA addresses the following ICAO amendments:

— assessment of performance at the time of landing (State Letter AN 11/1.3.29-16/12, ICAO Annex 6, Part I — Amendment 40);

— reporting of degraded runway conditions by the flight crew (State Letter AN 11/1.3.29-16/12, ICAO Annex 6, Part I — Amendment 40); and

— provision of distances at the time of landing in the OM (ICAO Annex 8, Part IIIB — Amendment 105).

The other amendments to ICAO Annexes will be addressed by a dedicated RMT in the context of ADR. However, the content of the amendment to ICAO Annex 14 (State Latter AN 4/1.2.26-16/19), as a well as that of Amendment 1 to the Procedures for Air Navigation Services — Aerodromes in PANS-Aerodromes, as well as Amendment 7 to PANS-ATM will be referenced in the present NPA.

In this context, the following SR to EASA:

— UNKG-2008-076: *The European Aviation Safety Agency should require operators to ensure that flight crews are provided with guidance material on aircraft performance when operating on a runway that is notified as 'may be slippery when wet', or has sections thereof notified as 'may be slippery when wet'*

is also addressed.

Crosswind limitations

Furthermore, EASA has received the following SR:

— NORW-2011-011: *The Accident Investigation Board Norway (AIBN) recommends that FAA, EASA and the Civil Aviation Authority (CAA) Norway evaluate the airlines' crosswind limits in relation to friction values and consider whether they should be subject to separate approval by the authorities*;

and a similar SR in EAPPRE:

— *3.7.2 — Establish and implement one consistent method of calculation of crosswind limits for use by aircraft manufacturers and aircraft operators.*

Guidance on crosswind limitations has been already produced by EASA in the Safety Information Bulletin (SIB) No 2014-20 but, based on the above SRs, further assessment and regulatory developments are necessary.

Reduced required landing distances for certain CAT operations

In 2014, the European Business Aviation Association (EBAA) approached EASA to discuss the applicable landing factors for CAT operations in relation to the specificities of certain aircraft types, belonging to performance class A and used in business aviation, in order to determine whether more flexibility is achievable under given conditions. Such flexibility exists in the US in the context of 'eligible on-demand operations' regulated under Federal Aviation Regulation (FAR).135 and 91K. For this purpose, EBAA has commissioned a study to an independent research body (National Aerospace Laboratory (NLR)) and has submitted it to EASA for consideration in the present RMT (Report No NLR-CR-2014-206 — Safety Assessment Of Landing Performance Factors Of Business Type Of Aircraft). The study identifies the risks related to landing operations with an increased landing factor of 80 % of the LDA, i.e. with a reduced required landing distance (RLD), as well as the mitigating measures to attain a level of safety equivalent to that of the current rules.

A similar proposal, but for performance class B aeroplanes, was submitted to EASA in 2015 by the Direction Générale de l'Aviation Civile (DGAC) France. The drivers of this proposal are however different as in this case, the possibility to use an increased landing factor of 80 % of the LDA is restricted to specific aerodromes where a public interest exists. The safety justification of the proposal is based on a risk assessment that defines a number of mitigating measures tailored to the characteristics of the types in use in order to attain a level of safety equivalent to that of the current rules.

Summary of the issues

Based on the above, the following issues are addressed in this NPA:

Issue	Input sources
General review of aeroplane performance requirements	— JAA NPA-OPS 47 — Aeroplane Performance; — technical improvements, clarifications and consistency check of the rules on aeroplane performance; — coordination with RMT.0379 — AWO; — coordination with RMT.0570 — Reduction of runway excursions
ICAO Amendment 1 Standards for runway surface condition assessment and reporting	— EAPPRE SR 3.7.1; — SR UNKG-2008-076; — ICAO SL 2015/30; — ICAO SL 2016/12; — ICAO SL 2016/19; — Runway Friction Characteristics Measurement and Aircraft Braking (RuFAB) study
ICAO Amendment 2 Airworthiness standards for landing performance computation at the time of arrival	— EAPPRE SR 3.7.1; — ICAO SL 2015/30; — ICAO SL 2016/29; — ICAO SL 2016/12; — FAA AC 25-32; — FAA AC 25-31
ICAO Amendment 3 In-flight assessment of landing performance at the time of arrival	— EAPPRE SR 3.7.3; — ICAO SL 2015/30; — ICAO SL 2016/12
Crosswind limitations	— EAPPRE SR 3.7.2; — SR NORW-2011-011; — EASA SIB No 2014-20
Reduced required landing distance for performance class A and B aeroplanes	— Report No NLR-CR-2014-206; — FAR 135.385(f); — DGAC France proposal

4.1.1. Safety risk assessment

General review of aeroplane performance requirements

The JAA NPA-OPS 47 originally contained the following 10 proposals:

Proposal	JAR-OPS reference	Subject
Proposal 1	1.475	Deletion of the definition of 'Damp Runway'.
Proposal 2	1.480	Introduction of the definition of 'Grooved or Porous Friction Course Wet Runway' and changes to the definitions of runway surface contaminants.
Proposal 3	1.485	Amendment of the reference to airworthiness standards for wet runways
Proposal 4	1.490/1.495	Editorials. Guidance on 'Grooved or Porous Friction Course Wet Runway'. Guidance for non-linear runway slope accountability
Proposal 5	1.495	Clarifications on the maximum bank angles that can be used with and without approval
Proposal 6	1.500	Text clarifications and new paragraph added to specify net flight path margins for two-, three- and four-engined aeroplanes
Proposal 7	1.505	Text clarifications and technical-accuracy improvements
Proposal 8	1.510	Clarifications on missed approach climb gradient requirements
Proposal 9	1.515	Several changes on landing performance
Proposal 10	1.570	Editorials

Proposals 1, 2, 3, 4 and 9 were recognised to be superseded by the ICAO amendments addressed in this NPA and, therefore, were not considered further.

Proposals 5 and 8 are not harmonised with the corresponding FAA rules. Furthermore, some of the issues touched by these proposals are under consideration in the FTWHG, which, having a wider representation of manufacturers in its composition, is considered to be a more appropriate forum to deliberate. Therefore, said proposals are not considered further in this NPA.

The remaining Proposals 6, 7 and 10 are transposed into the corresponding requirements of Part-CAT.

Further necessary consistency changes have been introduced, as a consequence of the changes proposed to address the other issues of this NPA.

No further changes have been identified through RMT.0570 and RMT.0379, for each of which an NPA is yet to be published.

Therefore, due to the nature of the above amendments, no safety impact has been identified for this issue and consequently, it will not be subject to this RIA.

Implementation of the ICAO amendments

Runway surface conditions have contributed to many safety events, and investigations have revealed shortfalls in the accuracy and timeliness of assessment and reporting methods currently in use. An issue has been identified particularly in the lack of standardisation in the way runway surface conditions, and consequently braking action, are assessed and reported.

Similarly, operating rules and performance data defined in accordance with the current airworthiness standards do not address adequately all conditions for take-off and landing performance in relation to the runway surface condition when the runway is wet or contaminated.

The International Air Transport Association (IATA) Safety Report 2014 indicates that 87 % of runway excursions occurred in the landing phase, and poor weather conditions were present in 43 % of those cases. Said Report further recommends to operators to use a standardised runway surface condition reporting system harmonised with performance information provided by manufacturers, and to apply appropriate margins to the take-off and landing distances in relation to the runway surface condition.

These issues are captured by EAPPRE SRs 3.7.1 and 3.7.3 as well as UNKG-2008-076.

Furthermore, in a safety analysis conducted by EASA for this RMT over a period of 5 years (2011–2015), the accidents and serious incidents were reviewed in which at least one of the following conditions had been fulfilled:

— aeroplane performance calculation was inadequate to the reported runway condition;

— measurement and/or reporting of the runway condition was inaccurate; and

— runway condition was a causal factor in an occurrence.

In the analysis, 13 occurrences were identified, out of which 5 were classified as accidents and 9 as serious incidents. The majority occurred during landing. There is a balance between the number of runway overruns and that of side excursions that occurred during landing. The following figure shows the distribution of the occurrences by mass and propulsion type.

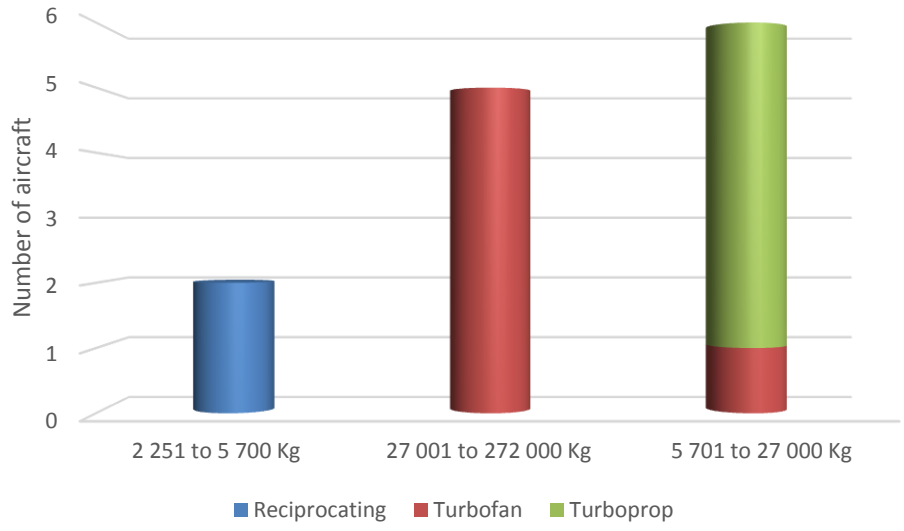


Figure 1 — Distribution of occurrences by aircraft mass and propulsion type

In order to address these issues, further to an accident occurred to a 737-700, the FAA tasked in 2007 the TALPA ARC with an exhaustive review of safety issues of operations on contaminated runways. This working group was composed of a wide range of stakeholders such as aviation authorities, air operators, aerodrome operators, aeroplane manufacturers and various associations.

In 2009, the TALPA ARC submitted to the FAA its proposals which were oriented along the following three main axes:

— standards for runway condition reporting by aerodromes (in FAR 139);

— definition of the operational landing performance computation (in FAR 25); and

— operational rules for transport category aeroplanes (in FAR 121).

In the period 2010–2011, field trials were conducted with volunteering aerodromes and operators to validate a crucial element of the proposals, the RCAM.

The FAA has then taken the approach of implementing the proposals of the TALPA ARC in a series of ACs, as well as other guidance and policy documents that allow the various stakeholders to apply them on a voluntary basis.

However, several aircraft manufacturers and States have already adopted significant elements of the TALPA ARC work in their operational documentation and reporting systems.

The TALPA ARC proposals have been also endorsed by ICAO that, as mentioned above, through the work of the FTF, addressed the following three issues of interest for this NPA:

(a) Standards for runway surface condition assessment and reporting

In ICAO Annex 6 (Section 4.4.2.1) pilots are required to issue the runway braking action special air report (AIREP) when the runway braking action encountered is not as good as reported.

(b) Airworthiness standards for landing performance computation at the time of arrival

In ICAO Annex 8 (Section 2.2.7.1(f)), manufacturers are required to provide in the AFM landing performance data for the time of landing.

(c) In-flight assessment of landing performance at the time of arrival

In ICAO Annex 6 (Section 4.4.11) pilots are required to assess landing performance at the time of arrival against the latest runway surface condition information available.

These changes are considered in this NPA along with other relevant elements from other ICAO annexes and documents.

Said assessment addresses SRs 3.7.1 and 3.7.3 of EAPPRE as well as UNKG-2008-076.

Crosswind limitations

The establishment, the understanding and the correct application of crosswind limitations, also in relation to runway surface conditions, have a significant safety relevance as crosswind has a major impact on directional stability.

Crosswind is recognised as an important causal factor in runway excursions.

The AIBN, in its Report SL 2011/10, performed a systematic analysis of 30 reports of accidents and incidents related to operations on contaminated and slippery runways over a 10-year period, and in 19 of those accidents/incidents, a correlation with the presence of crosswind was found.

The safety relevance of crosswind limitations was also recognised in EAPPRE (SR 3.7.2).

This assessment addresses EAPPRE SR 3.7.2 and SR NORW-2011-011.

A study on crosswind (Research Project EASA.2011/08 'NGW — Near-Ground Wind Gust Detection') was commissioned by EASA and carried out by the National Aerospace Laboratory of the Netherlands (NLR). This study showed that a crosswind or tailwind component was a causal factor in a significant number of occurrences investigated since 1990 and involving CS-25-certified aeroplanes operated in CAT. These occurrences typically resulted in wingtip strikes, tail strikes, hard landings and runway excursions. The wind in these occurrences was frequently accompanied by gusty conditions. The analysis of existing practices revealed several issues:

— demonstrated values of crosswind limits of different aircraft types cannot be compared with each other as different ways of wind determination during the flight tests may be used;

— for most commercial aircraft designed since 1950, no hard crosswind limits were established during certification flight testing;

— for the vast majority of commercial aircraft designed since 1950, gust is not mentioned in the demonstrated crosswind;

— there is currently no common industry standard on how to derive advisory crosswind values for non-dry runway conditions;

— most but not all operators surveyed for this study used hard crosswind limits;

— not all operators consider gusts when evaluating crosswind limits; and

— there is no generally accepted way of decomposing reported wind gusts into crosswind and tailwind components.

Based on the above conclusions, EASA issued SIB No 2014-20 to raise awareness on the risks associated with operations in strong and/or gusty crosswind conditions and to provide guidance to manufacturers, operators and training organisations.

The current EU rules on Air OPS, namely Part-CAT, are requiring operators to publish wind limitations in their OM, but no specific guidance is provided on how this limitations should be developed for crosswind, nor it is defined how to establish a correlation between crosswind and runway surface conditions.

Having regard to EAPPRE SR 3.7.2, the RG considered the possibility to develop a standardised methodology for the calculation of crosswind limits; however, it was recognised that a similar action is already under consideration by the FTHWG.

Furthermore, one of the conclusions of Research Project EASA.2011/08 'NGW — Near-Ground Wind Gust Detection' indicated that the need for harmonisation among manufacturers of the methodology for determining crosswind limits is at the level of flight testing.

The RG concluded that regulatory material for the development of such methodology is beyond the scope of this RMT and that this issue is more appropriately addressed by the FTHWG.

Similarly, having regard to SR NORW-2011-011, the RG considered the possibility to require an approval of the operator's crosswind limits by the CA.

This possibility was, however, also discarded as the definition of operational crosswind limits is either based on manufacturer's approved data in the AFM or manufacturer's advisory data provided in other documents. Thus, an additional approval by the CA is not considered necessary.

It was then decided to provide only guidance to operators on how to use the information available from manufacturers to establish crosswind limits in the OM and to relate such limits to the runway surface conditions.

Due to the nature of this proposed amendment, no negative safety impact or other adverse impacts have been identified and, consequently, it is not part of the RIA.

Reduced required landing distance operations for performance class A and B aeroplanes

The possibility to introduce flexibility into the methodology used to determine the landing distance is advocated by certain stakeholders.

The current EU rules, namely CAT.POL.A.230, require to determine the landing mass of the aeroplane in a way that allows the aeroplane to come to a full stop within 60 % of the LDA for turbojet-powered aeroplanes and within 70 % of the LDA for turbopropeller-powered aeroplanes, respectively.

The application of this factor to the landing distance is intended to provide an adequate safety margin against landing overruns.

The business aviation community requested EASA to allow the use of an 80 % landing factor for business aviation operations conducted with performance class A aeroplanes. The application of this factor to the LDA results in a reduction of the required landing distance. The proposal is based on a rule in force in the US regulatory framework under FAR.135 and 91K (eligible on-demand operations) and is substantiated by a study which defines a number of risk-mitigating conditions in order to attain a level of safety equivalent to that of the current rule. The adoption of this regulatory proposal would allow more flexibility for the above-mentioned business operators, facilitate the access to certain regional aerodromes and, according to EBAA, eliminate a competitive disadvantage for European operators.

DGAC France has submitted to EASA a similar proposal to allow the use of the 80 % landing factor for the operation of performance class B aeroplanes. In this case, however, the reasons are different as these operations would be limited to specific aerodromes where the state of the aerodrome has determined a public interest (e.g. remote or isolated areas with reduced or no availability of other transport modes, aerodromes with short runways that cannot be extended, aeromedical services, etc.), and an operational necessity exist. This proposal is also based on a set of mitigating measures.

The driver for the consideration of the issue in this NPA is, therefore, not safety but rather flexibility and proportionality of the rules; however, it should be noted that a safety risk is introduced if an 80 % landing factor is allowed without establishing appropriate mitigating measures to attain a level of safety equivalent to that originally attained through CAT.POL.A.230 and CAT.POL.A.330.

4.1.2. Who is affected?

The issues identified in and addressed by this NPA affect CAT aeroplane operators and flight crews as they have to directly comply with the aeroplane performance requirements.

CAs are also affected as the authorities responsible for the oversight and approvals related to aeroplane performance.

Aeroplane manufacturers are also affected as they have to provide the necessary performance data to operators.

4.1.3. How could the issue/problem evolve?

In case the issues considered in this NPA are not addressed, and if the regulatory framework is not changed, it is expected that the identified safety risks related to operations on wet and contaminated runways and in crosswind conditions would remain the same or possibly develop further.

The harmonisation level between EU and US rules would remain the same or most likely develop further in relation to the implementation of the TALPA ARC recommendations as well as of reduced required landing distance on-demand operations.

Moreover, the EU rules would remain non-aligned with the corresponding ICAO SARPs.

Finally, the lack of flexibility for business aviation operators when operating with a reduced required landing distance could create a competitive disadvantage for European operators.

4.2. Objectives

The overall objectives of the EASA system are defined in Article 2 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Chapter 2 of this NPA.

The general objective of this proposal is to maintain a uniform and high level of safety with cost-efficient rules.

The specific objectives of this proposal are to:

— reduce the number of accidents and serious incidents where aeroplane performance is a causal factor;

— provide improved clarity, technical accuracy, flexibility or a combination of these benefits for the EU operational requirements on aeroplane performance for CAT operations; and

— contribute to the harmonisation of FAA and EU operational requirements on aeroplane performance for CAT operations.

4.3. Policy options

Two of the issues listed under Section 4.1.1 above, namely ‘General review of aeroplane performance requirements’ and ‘Crosswind limitations’, do not require a RIA.

The other two issues, having different starting points and drivers, will be subject to separate RIAs.

Implementation of ICAO amendments

When considering the implementation of the ICAO amendments, the RG assessed the option to introduce a new unified dispatch criterion for the landing distance by using already at dispatch the performance data for the in-flight assessment. This was an attempt to avoid using two different sets of performance data for landing performance, one at dispatch and one in-flight, the use of those two

different sets being in accordance with the new requirement of in-flight assessment of landing performance.

However, this option was discarded for the following reasons:

— the review of dispatch criteria was outside the scope of the TALPA ARC and ICAO amendments;

— it would lead to disharmonisation with the FAA; and

— landing distances calculated using the criteria at dispatch are used in the certification process of aeroplanes, therefore, the impact of this Option could not be estimated for most of the existing types.

Table 1 — Selected policy options for ICAO amendments

Option No	Short title	Description
0	No change	Baseline option (no change in rules; risks remain as outlined in the issue analysis).
1	Implement ICAO amendments	Introduce: — a requirement for pilot reports on the runway braking action; — a requirement for an in-flight check of landing performance at the time of arrival; — airworthiness standards for the production of landing performance data at the time of arrival.

Reduced required landing distance operations for performance class A and B aeroplanes

For this issue, the following options have been identified:

Table 2 — Selected policy options for the reduced required landing distance operations for performance class A and B aeroplanes

Option No	Short title	Description
0	No change	Baseline option (no change in rules; risks remain as outlined in the issue analysis).
1	Reduced required landing distance	Introduce the possibility of using a landing factor of 80 % of the LDA for performance class A and B aeroplanes under defined conditions and with the approval of the CA.

4.4. Methodology and data (only for a full RIA)

4.4.1. Applied methodology

The methodology applied to this RIA is the multi-criteria analysis (MCA), which allows comparing all options by scoring them against a set of criteria.

The MCA covers a wide range of techniques that aim at combining a variety of positive and negative impacts into a single framework to allow an easier comparison of scenarios. Essentially, it applies cost-benefit thinking to cases where there is a need to present impacts that are a mixture of qualitative, quantitative, and monetary data, and where there are varying degrees of certainty. The MCA key steps generally include:

— establishing the criteria to be used for comparing the options (these criteria must be measurable, at least in qualitative terms);

— scoring how well each option meets the criteria; the scoring needs to be relative to the baseline scenario;

— ranking the options by combining their respective weights and scores; and

— performing a sensitivity analysis of the scoring to test the robustness of the ranking.

The criteria used to compare the options were derived from the Basic Regulation, and the guidelines for the RIA were developed by the European Commission. The principal objective of EASA is to 'establish and maintain a high uniform level of safety' in accordance with Article 2(1) of the Basic Regulation. As additional objectives, the Basic Regulation identifies environmental, economic, proportionality, and harmonisation aspects, which are reflected below.

For the scoring of the impacts, a scale of –5 to +5 is used to indicate the negative and positive impacts of each option (i.e. from 'very high' to 'very low' negative/positive impacts). The intermediate levels of benefits are termed 'high', 'medium' and 'low', providing a total of 5 levels in each direction (5 in the positive and 5 in the negative one), with a 'no impact' score also being possible.

4.4.2. Data collection

In order to estimate the impact of the selected policy options for each issue considered in the RIA, the following data are needed:

— fleet information;

— information on stakeholders' awareness of the ICAO amendments and their voluntary alignment therewith when manufacturers' data is available; and

— aerodrome information in relation to the use of increased landing factors.

Fleet information is based on current fleet figures from the Ascend Flightglobal Consultancy. The data set includes most turbine-powered aircraft except a few piston-to-turbine conversions and kit-built aircraft[6].

[6] Cessna 206 Soloy, Cessna 207 Soloy, Cessna 210 Centurion, Cessna 421 Turbo Conversion, Comp Air Aviation 10, Comp Air Aviation 12, Comp Air Aviation 9, Epic Aircraft LT/Dynasty, Gulfstream Aerospace Goose, Gulfstream Aerospace S-2T Turbo Tracker, Hawker

The following fleet figures were extracted on 1 February 2016. They include all aircraft in service or temporarily stored in the fleet of EASA Member State (MS) operators used generally in CAT, or in business/corporate/executive aviation.

Table 3 — MTOW and seat capacity of the CAT fleet of European operators

Categories	≤ 5 700 kg	5 700–45 360 kg	> 45 360 kg	Total
19 or less	1 326	1 853	26	3 205
More than 19	11	1 031	3 657	4 699
Freight / Cargo	15	203	233	451
Total	1 352	3 087	3 916	8 355

Table 4 — MTOW and seat capacity of the business aviation fleet of European operators

Seats	≤ 5 700 kg	5 700–45 360 kg	> 45 360 kg	Total
19 or less	1 167	1 683	25	2 875
More than 19		16	47	63
Total	1 167	1 699	72	2 938

A survey on the awareness and voluntary implementation of the ICAO amendments was conducted by EASA among stakeholders between mid-December 2015 and mid-February 2016. 73 stakeholders from 22 countries responded, amongst which: national aviation authorities (NAAs), air navigation service (ANS) providers, aerodrome operators, business aviation aircraft operators, General Aviation Manufacturers Association (GAMA) manufacturers and European Cockpit Association (ECA) pilots. The survey is provided as an Appendix to this NPA (see Chapter 6 below).

Aerodrome information has been derived from Report No NLR-CR-2014-206 — Safety Assessment Of Landing Performance Factors Of Business Type Of Aircraft. The study is provided as an Appendix to this NPA (see Chapter 6 below).

Traffic data for business aviation has been derived from Eurocontrol's 'Briefing: Business Aviation in Europe in 2012', STATFOR Briefing 167.

Furthermore, EASA conducted a safety analysis over a period of 5 years (2011–2015) to review the accidents and serious incidents in which at least one of the following conditions was fulfilled:

— aeroplane performance calculation was inadequate to the reported runway condition;

— measurement and/or reporting of the runway condition was inaccurate; and

— runway condition was a causal factor in an occurrence.

The analysis is provided as an Appendix to this NPA (see Chapter 6 below).

Beechcraft 18, Hawker Beechcraft Bonanza (turbine), Lancair Evolution, Lancair Propjet, Maule Aircraft 7, Pacific Aerospace Cresco, Pacific Aerospace FU-24, and Partenavia P68.

Other specific data, as necessary for the purposes of this NPA, were provided to the RG by Airbus, Embraer and IATA. Where necessary, the use of such data and their source are detailed in the following Sections.

4.5. Analysis of impacts

4.5.1. Safety impact

Implementation of ICAO amendments

The safety issues identified in relation to:

— runway surface conditions assessment and reporting;

— manufacturers' performance data not addressing adequately take-off and landing performance on contaminated runways; and

— the need to reassess landing performance at the time of arrival when the conditions considered at dispatch have changed,

may be addressed effectively only in combination.

In fact, a pilot report of braking action is effective only if based on a global and consistent methodology for assessing and reporting runway surface conditions. Such information may be then used to reassess the landing performance calculation at the time of arrival when the actual conditions at the time of arrival differ from those at dispatch. However, the in-flight assessment has to be based on performance data consistent with the information on the runway surface condition.

For this reason, the ICAO amendments imply the introduction of the following changes:

— a requirement for pilot reports on the runway braking action;

— a requirement for an in-flight check of landing performance at the time of arrival; and

— airworthiness standards for the production of landing performance data at the time of arrival.

The FAA, ICAO and the EAPPRE have concurred on the validity of these changes.

In addition to the occurrences and the consequent SRs already considered in this NPA, the safety analysis conducted by EASA over the last 5 years identified the following events, where one or more of the above issues was a causal or contributing factor:

Occurrence class	Manufacturer	Type	Date	Location
Accident	ATR	72-200	11/08/2012	Romania
Accident	Airbus	A321-100	29/03/2013	France
Accident	Airbus	A320-200	24/05/2013	Bulgaria
Serious incident	Saab	340	21/11/2011	Sweden
Serious incident	Boeing	737-800	25/08/2013	Czech Republic
Serious incident	Airbus	A319-100	18/12/2013	United Kingdom
Serious incident	Fokker	F27 - 50	10/01/2014	Sweden
Serious incident	BAE	Jetstream 3100-3200	31/01/2014	Sweden
Serious incident	De Havilland	DHC8-200	29/12/2014	Denmark
Serious incident	Boeing	737-800	25/05/2015	Norway

In the period 2011–2015, there were 29.9 million flights in Europe, which gives the following rates:

— 1 accident per 10 million flights; and

— 2.3 serious incidents per 10 million flights.

In the base scenario of EUROCONTROL's latest 7-year forecast (updated in February 2016), an average traffic growth of 2.2 % per annum is predicted for Europe between 2015 and 2022. However, it should be noted that this forecast is conservative, and that in the long term, the traffic growth is expected to be higher.

The numbers of flights as well as the rates of accidents and serious incidents that may be expected if no regulatory changes are introduced are the following:

Year	Flights	Accidents	Serious incidents
2016	6 035 023	0.6	1.4
2017	6 167 794	0.6	1.4
2018	6 303 485	0.6	1.5
2019	6 442 162	0.6	1.5
2020	6 583 890	0.7	1.5
2021	6 728 735	0.7	1.6
2022	6 876 767	0.7	1.6
2023	7 028 056	0.7	1.6
2024	7 182 673	0.7	1.7
2025	7 340 692	0.7	1.7
Total	66 689 278	6.7	15.6

The proposed changes are expected to prevent or mitigate the consequences of these potential accidents or serious incidents.

	Impact	**Rationale**
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	4	This Option is expected to prevent or mitigate the consequences of the potential accidents or serious incidents indicated in the table above. The safety impact is, therefore, considered high positive.

Reduced required landing distance operations for performance class A and B aeroplanes

The driver for the proposed changes in the use of a reduced required landing distance for performance class A and B aeroplanes under given conditions is flexibility and proportionality of the rules.

In order to avoid that a safety risk is introduced, appropriate mitigating measures are necessary to attain a level of safety equivalent to that originally attained through CAT.POL.A.230 and CAT.POL.A.330.

Performance class A aeroplanes

Under FAR.135 and 91K, the use of a landing factor of 80 % is allowed under certain conditions. Such factor in turn permits to reduce the required landing distance and to operate either on shorter runways or with higher payloads. Operators using this higher landing factor must meet certain requirements as per FAA 14 Code of Federal Regulation (CFR) Part 135.4, including a two-pilot crew, specific additional flight crew experience, crew pairing requirements, the use of a destination airport analysis program (DAAP), and the prior approval of the CA.

EU rules require either a factor of 60 % for turbojets or of 70 % for turboprops.

In order to consider the use of an 80 % factor, a quantitative safety assessment is necessary.

Such assessment was made in the study contained in Report No NLR-CR-2014-206 — Safety Assessment Of Landing Performance Factors Of Business Type Of Aircraft, which was conducted by the National Aerospace Laboratory Air Transport Safety Institute (NLR-ATSI).

The level of safety in this context is defined as the probability of a landing overrun and it is calculated by means of an engineering model based on a Montecarlo simulation, which considers aircraft characteristics, landing performance data and operational factors (floating, crew reaction times, threshold speed deviations, headwind/tailwind, runway surface condition, aircraft mass).

The safety assessment is conducted for performance class A business-operated aircraft with a maximum take-off mass (MTOM) of 45 000 kg and a maximum seating capability of 19 passengers, reflecting the largest business aircraft currently operated and grouped in 4 categories:

— 13–19-passenger jet aircraft;

— 9–12-passenger jet aircraft;

— 6–8-passenger jet aircraft; and

— 14-passenger turboprop aircraft.

For each group, an existing aircraft model was selected.

The model showed that until the threshold of the 80 % factor, mitigating measures allow achieving an equivalent level of safety. Above that threshold, mitigating measures are not effective any longer.

The following mitigating measures were identified:

— avoidance of unstable approaches;

— avoidance of long landings (floating);

— use of reverse thrust or propeller reverse on each landing (if installed);

— no landings on a runway that is forecasted to be contaminated;

— no landings on a runway where tailwind is forecasted; and

— no MEL dispatch allowed with inoperative systems having an effect on landing performance.

The RG, based on these results, discussed extensively the issue and first limited the applicability of these operations to CAT operations where:

— the aircraft has an MCTOM of 45 360 kg and an MOPSC of 19, and

— a prior approval is granted by the CA.

Then the conditions for obtaining the approval were defined by means of a risk assessment based on 4 main criteria related to:

— operational conditions:

- special approach procedures, low-visibility operations or other operations requiring prior approval by the CA are prohibited in order to avoid the cumulation of different risks;

— flight crew:

- the crew is composed of two pilots having recency in those operations;
- requirements for qualification, training, checking and monitoring of the flight crew are in place; and
- the commander has the final authority to decide whether or not such operations shall be conducted:

— aerodrome:

- an ALAP is established to ensure that no tailwind, runway contamination conditions or other adverse weather conditions exist at the destination; and
- a check of landing performance against wet runway landing criteria is made when the runway is wet; and

— aircraft:

- all equipment affecting landing performance is operative.

Alternatively the operator may conduct a risk assessment covering all aspects identified by the 4 criteria above.

Finally, the CA may impose additional conditions if specific concerns exist.

Overall, the RG considered that through the proposed conditions, the mitigating measures identified by the study are implemented, and further safety barriers are created that permit to achieve a level of safety equivalent to that originally intended by CAT.POL.A.230.

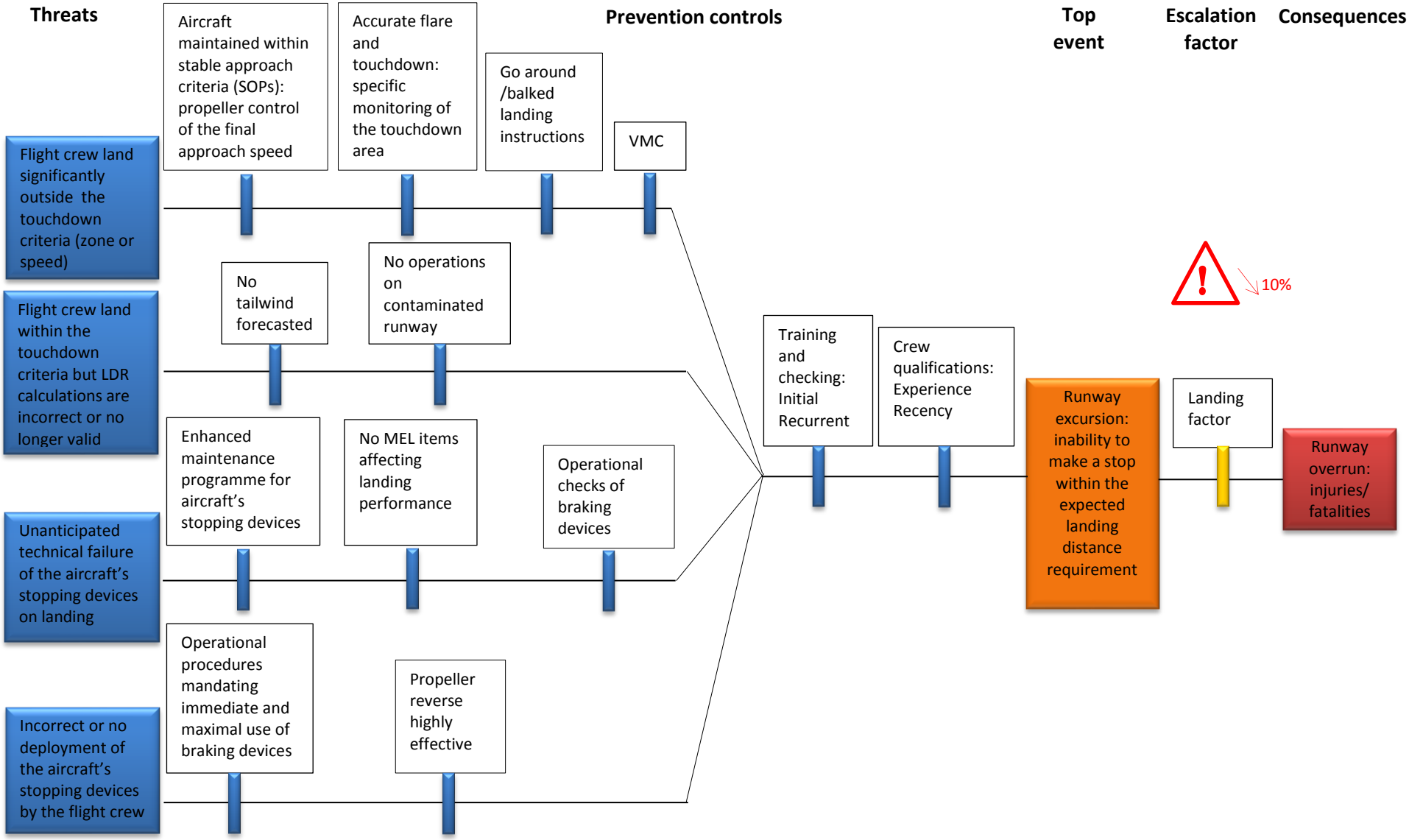
Performance class B aeroplanes

The proposal for performance class B aeroplanes requires an assessment similar to that of performance class A aeroplanes; however, the following additional element was also considered:

— the applicability of the proposed change is strongly limited by the fact that the required approval is for specific runways of specific aerodromes and is possible only in those aerodromes where a public interest has been declared,

which significantly reduces the exposure of these operations to safety risks.

Subsequently, a risk assessment was conducted to identify the appropriate mitigating measures for performance class B aeroplanes (see the following figure):



which is summarised as follows:

Threat	Preventive measures	Risk
Flight crew land significantly outside the touchdown criteria (zone or speed).	A specific monitoring of the touchdown area aims to improve the accuracy of the flare and touchdown performed by the flight crew. This monitoring may be based on the use of external references that already exist (e.g. taxiway) or that must be created (e.g. specific painting on the runway), beyond which a go-around is mandatory. If an efficient control of the touchdown area is implemented, it may be considered that there is no more inaccuracy in the air distance, and the safety margin of 30 % may only be applied to the ground roll part. Adequate go-around or balked landing instructions should be established in the OM.	Runway excursion: inability to make a stop within the expected landing distance requirement.
	Benefits of performance class B aeroplanes: at the lowest flight idle, propellers generate a significant drag that allows a better control of the final approach speed than turbofans on jet aircraft.	
	Visual meteorological conditions that help perform a touchdown within the designated area.	
	Crew qualifications, specific training and checking as well as aerodrome recency enhance the flight crew proficiency in performing an accurate landing in compliance with the specific operational procedures implemented by the operator. The initial and recurrent training shall include flight training. The specific aerodrome training and recency conditions help the flight crew to familiarise themselves with the airfield and acquire the necessary visual references to control the touchdown area.	
Flight crew land within the touchdown	No tailwind is forecasted around the estimated time of arrival. This constraint reduces the severity of the consequences that may be induced by the variations between the forecasted and the actual wind.	

criteria but LDR calculations are incorrect or no longer valid.	Landing on contaminated runway is prohibited.	
Unanticipated technical failure of the aircraft's deceleration devices on landing	Additional maintenance instructions, such as more frequent checks of the aircraft's deceleration devices, especially of the reverse system, should be established by the operator, in liaison with the manufacturer, in order to enhance the reliability of these systems.	
	The operator shall establish operational procedures to ensure that all equipment affecting landing performance is operative before commencing the flight.	
Incorrect or no deployment of the aircraft's deceleration devices by the flight crew	The operator shall establish operational procedures to ensure the immediate and maximal use of deceleration devices by the flight crew.	
	Benefits of class B performance aircraft: propeller reverse is highly effective and can be used at much lower speeds than reverse thrust on jet aircraft.	
	Crew qualifications, specific training and checking as well as aerodrome recency ensure appropriate use of deceleration devices by the flight crew in accordance with the operational procedures established by the operator. The initial and recurrent training shall include flight training.	

Based on the above assessment, the RG recognised that most of the risks are adequately addressed by the conditions defined for performance class A aeroplanes and, in addition to those, decided to introduce requirements for:

— the control of the touchdown area; and

— operations in VMC only.

Overall, the RG considered that through the proposed conditions, the mitigating measures identified for performance class B aeroplanes are implemented in order to achieve a level of safety equivalent to that originally intended by CAT.POL.A.330.

Summary

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore; no impact is expected through this option.
Option 1	0	Due to the limitations on the applicability of the changes proposed by this Option in combination with the mitigating measures required for performance class A and B aeroplanes, respectively, no impact on safety is expected through this Option.

4.5.2. Environmental impact

Implementation of ICAO amendments

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore; no impact is expected through this Option.
Option 1	–1	This Option may have an environmental impact due to increased fuel consumption and CO_2 emissions in those cases where the in-flight landing distance check gives a landing distance longer than that calculated at dispatch and does not allow a landing. In such cases, in fact, a diversion would be necessary. Airbus, having already voluntarily implemented the TALPA ARC recommendations, has conducted a large-scale check representative of 8 aircraft types on 8 000 runways. It was found that for wet runways, only 8 runways would be so limited to have operational consequences. In no cases, all runways of the same aerodrome were limited. A more limited study on contaminated runways (namely on one aircraft type and on runways contaminated with compacted snow and standing water) has identified that 15 aerodromes were limited. On average, the landing distances calculated in-flight were systematically longer than the one at dispatch only on contaminated runways. Another survey conducted by Embraer among its operators found that a limited number of diversions occur when TALPA ARC recommendations are applied. Overall, this Option is expected to have a very low negative environmental impact.

Reduced required landing distance operations for performance class A and B aeroplanes

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	–1	The study contained in Report No NLR-CR-2014-206 indicates that the adoption of the changes proposed by this Option would lead to an increase of 15 % of the usable runways. Data form Eurocontrol ('Briefing: Business Aviation in Europe in 2012') indicates a yearly traffic growth forecast between 3 % and 4 % until 2018. However, business aviation contributes only by 1.1 % to CO_2 emission in aviation. On this basis, this Option is expected to have a very low negative environmental impact.

4.5.3. Social impact

Implementation of ICAO amendments

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	0	No social impact is expected through this Option.

Reduced required landing distance operations for performance class A and B aeroplanes

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	3	This Option will lead to an increase of traffic in regional aerodromes and will facilitate access to locations where a public interest exists. The social impact is expected to be medium positive.

4.5.4. Economic impact

Implementation of ICAO amendments

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	–1	A cost is expected for aircraft manufacturers for the production of performance data required by this Option. Several large aeroplane manufacturers, among which Airbus, Boeing and Embraer, have already produced performance data in accordance with the TALPA ARC recommendations. Such data is provided to operators either as a standard or as an option. For the manufacturers of smaller aeroplanes, a cost is also expected; however, for all performance class B and C aeroplanes, the changes proposed by this Option do not mandate the use of dedicated manufacturer data for the in-flight assessment of the landing distance at the time of arrival when such data is not available. A cost for operators for the implementation of this Option is also expected. Data provided to the RG by Airbus, IATA and Embraer shows, respectively, that: — 97 % of Airbus European operators have implemented the TALPA ARC methodology for the in-flight assessment of the landing distance at the time of arrival; — 11 Embraer operators out of 74 surveyed perform in-flight assessment of the landing distance at the time of arrival based on the TALPA ARC methodology; and — out of 80 IATA operators contacted, 17 provided a reply, 14 of which European; overall, 16 perform in-flight assessment of the landing distance at the time of arrival. Therefore, considering that voluntary implementation of the changes proposed by this Option has started, the cost for operators is considered small. As regards the cost for aerodromes becoming unusable due to the increased landing distance calculated at the time of arrival, which may lead to a diversion, the analysis done for the environmental impact shows that a very low economic impact is also expected. Overall, this option is expected to have a very low negative economic impact.

Reduced required landing distance operations for performance class A and B aeroplanes

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	3	The study contained in Report No NLR-CR-2014-206 indicates that the adoption of the changes proposed by this Option for performance class A aeroplanes would lead to an increase of 15 % of the usable runways. Data from Eurocontrol ('Briefing: Business Aviation in Europe in 2012') indicates for business aviation a yearly traffic growth forecast between 3 % and 4 % until 2018. An economic benefit due to the increase of traffic is expected both for operators and aerodromes. Conversely, some costs have been identified for operators, mainly for the qualification and training of the flight crew. However, this regulatory proposal offers the flexibility to conduct the training either in an FSTD or in-flight during normal operations. Overall, such costs are assumed to be largely outweighed by the enhanced operational flexibility and the increase of traffic. A small positive economic impact is expected also for performance class B aeroplane operations. On this basis, this option is expected to have a medium positive economic impact.

4.5.5. General aviation and proportionality issues

Implementation of ICAO amendments

	Impact	Rationale
Option 0	0	No impact on general aviation and proportionality is expected through this Option as the current situation would remain unchanged.
Option 1	0	The criteria for the in-flight assessment of the landing distance at the time of arrival have been tailored to the different categories of aeroplanes. In most cases, the assessment is reduced to confirming the criteria used at dispatch and, therefore, the implementation effort will be limited. The negative impact of this Option is therefore considered insignificant.

Reduced required landing distance operations for performance class A and B aeroplanes

	Impact	Rationale
Option 0	0	No impact on general aviation and proportionality is expected through this Option as the current situation would remain unchanged.
Option 1	3	A medium positive impact is expected through this Option as it would introduce more flexibility and proportionality for small operators.

4.5.6. Impact on 'better regulation' and harmonisation

Implementation of ICAO amendments

	Impact	Rationale
Option 0	–5	This Option will leave the current situation unchanged, thus making EU rules non-aligned with ICAO SARPs once the changes adopted by ICAO will enter into force. The impact is considered highly negative.
Option 1	5	This Option fully aligns EU rules with the described ICAO amendments and, therefore, is considered to have a very positive high impact. The harmonisation with the FAA is also achieved on the content of the proposed changes; however, regarding the implementation, the FAA has opted for a voluntary system rather than mandating the ICAO standards.

Reduced required landing distance operations for performance class A and B aeroplanes

	Impact	Rationale
Option 0	0	The current situation would remain unchanged; therefore, no impact is expected through this Option.
Option 1	3	This Option introduces into the EU regulatory framework a similar concept to that of the 'eligible on-demand operations' existing in the US under FAR 135 and 91K although it defines more precise and stringent conditions to obtain the approval for such operations. The impact on harmonisation with the FAA is considered medium positive.

4.6. Comparison and conclusion

4.6.1. Comparison of options

The following table summarises the impacts of the options considered in this NPA.

	Implementation of ICAO amendments		**Reduced required landing distance operations for performance class A and B aeroplanes**	
	Option 0	**Option 1**	**Option 0**	**Option 1**
Safety impact	0	4	0	0
Environmental impact	0	–1	0	–1
Social impact	0	0	0	3
Economic impact	0	–1	0	3
GA and proportionality issues	0	0	0	3
Impact on 'better regulation' and harmonisation	–5	5	0	3
Total	**–5**	**7**	**0**	**11**

Based on this assessment, it is considered that the following options provide the best global positive impact:

Implementation of ICAO amendments:

Option 1.

Reduced required landing distance operations for performance class A and B aeroplanes:

Option 1.

4.6.2. Monitoring and ex post evaluation

The need for monitoring and ex post evaluation of the implementation of the new requirements will be determined based on the results of the NPA public consultation.

5. References

5.1. Affected regulations

— Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 296, 25.10.2012, p. 1)

5.2. Affected CS, AMC and GM

— Decision No. 2003/2/RM of the Executive Director of the Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large aeroplanes ('CS-25')

— Decision N° 2012/015/Directorate R of the Executive Director of the Agency of 24th October 2012 on Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 965/2012 of 5 October 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council 'Guidance Material to Annex I — Definitions'

— Decision 2014/017/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-ORO of Regulation (EU) No 965/2012 and repealing Decision 2012/017/R of the Executive Director of the Agency of 24 October 2012 'AMC and GM to Part-ORO — Issue 2'

— Decision 2014/015/R of the Executive Director of the Agency of 24 April 2014 adopting Acceptable Means of Compliance and Guidance Material to Part-CAT of Regulation (EU) No 965/2012 and repealing Decision 2012/018/R of the Executive Director of the Agency of 24 October 2012 'AMC and GM to Part-CAT — Issue 2'

5.3. Reference documents

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— SR UNKG-2008-076 — Aircraft Accident Report 1/2009, Air Accidents Investigation Branch (AAIB), UK Department for Transport, 9 January 2009

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— European Action Plan for the Prevention of Runway Excursions (EAPPRE), Released Edition 1.0, January 2013

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— Research Project EASA.2011/08 NGW — Near-Ground Wind Gust Detection (Report no. NLR-CR-2012-143)

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— EASA Safety Information Bulletin (SIB) No 2014-20 — Aeroplane Operations in Crosswind Conditions, 23 June 2014

— Federal Aviation Regulation (FAR) Part 121

— Federal Aviation Regulation (FAR) Part 135

— FAA AC No. 25-32 — Landing Performance Data for Time of Arrival Landing Performance Assessments

— FAA AC No. 25-31— Takeoff Performance Data for Operations on Contaminated Runways

— ICAO Annex 6 to the Chicago Convention on International Civil Aviation, Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes, 9th Edition, July 2010

— ICAO Annex 8 to the Chicago Convention on International Civil Aviation, Airworthiness of Aircraft, 11th Edition, July 2010.

— ICAO Annex 14 to the Chicago Convention on International Civil Aviation, Aerodromes, Volume I — Aerodrome Design and Operations, 6th Edition, July 2013

— ICAO State Letter AN 4/1.1.55-15/30 of 29 May 2015

— ICAO State Letter AN 3/5.10-16/29 of 6 April 2015

— ICAO State Letter AN 11/1.3.29-16/12 of 8 April 2016

— ICAO State Letter AN 4/1.2.26-16/19 of 5 April 2016

— ICAO Doc 9981 — PROCEDURES FOR AIR NAVIGATION SERVICES (PANS) — Aerodromes

— ICAO Doc 4444 — PROCEDURES FOR AIR NAVIGATION SERVICES (PANS) — Air Traffic Management (ATM)

6. Appendices

Below documents are available for information only at the following address: https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2016-11

— Report No NLR-CR-2014-206 — Safety Assessment Of Landing Performance Factors Of Business Type Of Aircraft, conducted by the National Aerospace Laboratory Air Transport Safety Institute (NLR-ATSI)

— EASA EU Survey on RMT.0296 (February 2016)

— Runway Excursions (RE) analysis 2011–2015 — Annex A: Safety data collection for RMT.0296 'Review of aeroplane performance requirements for commercial air transport operations'