European Union Aviation Safety Agency

Explanatory Note to Decision 2020/001/R

Reduction of runway excursions

AND

Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability

'CS-25 Amendment 24'

RELATED NPA/CRD 2018-12 — RMT.0570

AND

NPA/CRD 2014-02 – RMT.0049

EXECUTIVE SUMMARY

The objectives of this Decision are to:

– reduce the number of runway excursions during landings of large aeroplanes by providing design-related means to support the flight crew in identifying and managing the risk of a longitudinal runway excursion; and

– clarify and standardise specifications and acceptable means of compliance related to large aeroplanes safety assessments of critical systems, flight control systems, and aeroelastic stability.

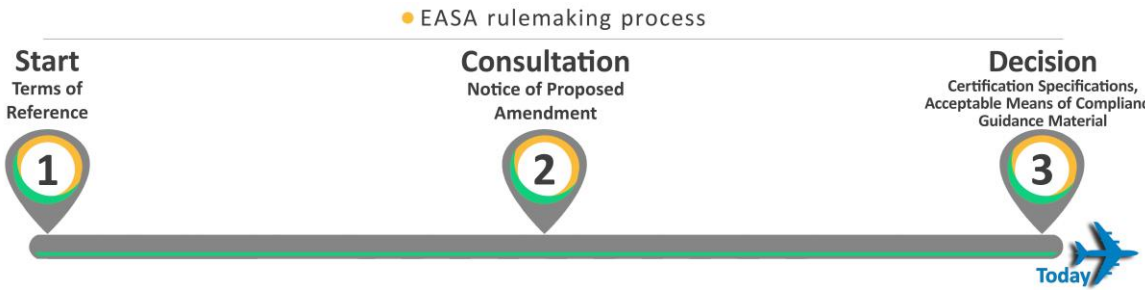
CS-25 is amended to:

– require that new large aeroplane designs are equipped with a runway overrun awareness and alerting system; and

– clarify and standardise the specific risk and criteria used for conducting aeroplane-level safety assessments of critical systems, as well as the specifications and acceptable means of compliance for flight control systems and aeroelastic stability.

These amendments are expected to increase safety, and increase the cost-effectiveness of the certification process.

Action area:	Runway safety; Design, production and maintenance improvements		
Affected rules:	CS-25		
Affected stakeholders:	Design Approval Holders (DHAs), Type Certificate (TC) and Supplemental TC applicants (large aeroplanes)		
Driver:	Safety	**Rulemaking group:**	No
Impact assessment:	Full (RMT.0570) Light (RMT.0049)	**Rulemaking Procedure:**	Standard



RMT.0570: 9.10.2012 **RMT.0049: 7.1.2011**	**15.10.2018** **27.1.2014**	**10.1.2020**

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1. About this Decision

The European Union Aviation Safety Agency (EASA) developed ED Decision 2020/001/R in line with Regulation (EU) 2018/1139[1] ('Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the European Plan for Aviation Safety (EPAS)[3] under rulemaking tasks (RMT).0570 and RMT.0049. The scope and timescales of the tasks were defined in the related Terms of Reference[4].

The draft text of this Decision has been developed by EASA. All interested parties were consulted through Notice of Proposed Amendment (NPA) 2018-12 and NPA 2014-02[5].

Regarding NPA 2018-12 (RMT.0570), 99 (unique) comments were received from interested parties, including industry, national aviation authorities (NAAs), and social partners.

Regarding NPA 2014-02 (RMT.0049), 323 comments were received from interested parties, including industry and NAAs.

EASA reviewed the comments received during the public consultation. The comments received and EASA's responses to them are presented in Comment-Response Documents (CRD) 2018-12 and CRD 2014-02[6].

In addition for RMT.0049:

- CRD 2014-02 was published on 5.9.2018 to allow for any reactions of stakeholders regarding possible misunderstandings of the comments received and the responses provided to them by EASA. This exceptional reaction period was decided by EASA because of the long delay since the publication of NPA 2014-02, the substantial nature of the proposed amendments to CS-25, and the nature of the comments received showing a need to improve various elements of the proposal; and
- EASA liaised with the National Civil Aviation Agency (ANAC) Brazil, the US Federal Aviation Administration (FAA), and Transport Canada (TCCA) (all bilateral agreement partners) to seek agreement of the content of the CS-25 amendments, in view of facilitating future harmonisation of the regulations.

The final text of this Decision with the certification specifications (CSs) and acceptable means of compliance (AMC) has been developed by EASA.

The major milestones of this rulemaking activity are presented on the title page.

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1 Regulation (EU) 2018/1139 of the European Parliament and of the Council of 4 July 2018 on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency, and amending Regulations (EC) No 2111/2005, (EC) No 1008/2008, (EU) No 996/2010, (EU) No 376/2014 and Directives 2014/30/EU and 2014/53/EU of the European Parliament and of the Council, and repealing Regulations (EC) No 552/2004 and (EC) No 216/2008 of the European Parliament and of the Council and Council Regulation (EEC) No 3922/91 (OJ L 212, 22.8.2018, p. 1) (https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1535612134845&uri=CELEX:32018R1139).

2 EASA is bound to follow a structured rulemaking process as required by Article 115(1) of Regulation (EU) 2018/1139. Such a 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 EASA for the issuing of opinions, certification specifications and guidance material (http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure).

3 https://www.easa.europa.eu/document-library/general-publications?publication_type%5B%5D=2467

4 https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions

5 In accordance with Article 115 of Regulation (EU) 2018/1139 and Articles 6(3) and 7 of the Rulemaking Procedure.

6 http://easa.europa.eu/document-library/comment-response-documents

2. In summary — why and what

2.1. Why we need to change the CS/AMC & GM

a) RMT.0570 Reduction of runway excursions

For the last few decades, runway excursions have been recognised as major contributors to accidents worldwide, and as significant risks to aviation safety.

The EASA Annual Safety Review identifies runway excursion as one of the two highest key risk areas (n°1 in 2018, n°2 in 2019) based on an analysis of occurrence data taking into account the frequency of occurrence, and the risk score from the European Risk Classification Scheme (ERCS), for large aeroplanes in Commercial Air Transport (CAT)-Airlines and Non-Commercial Complex (NCC)-Business operations. Furthermore, runway excursions account for 30 % of the non-fatal accidents (airlines and cargo operations over the past decade).

The number of occurrences of runway excursions during landings has increased in line with the growth in traffic. As aviation traffic is expected to continue to grow worldwide, including in Europe, the number of runway excursions can also be expected to increase further if no action is taken.

b) RMT.0049 Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability

The Airplane-level Safety Analysis Working Group (ASAWG), and the Flight Controls Harmonisation Working Group (FCHWG), established by the Aviation Rulemaking Advisory Committee (ARAC) in the United States in the previous years, identified the need to clarify and standardise large aeroplanes safety assessment of critical systems, and the specifications that are applicable to flight control systems and aeroelastic stability. These WGs of experts have issued recommendations to amend FAR-25 and equivalent regulations like CS-25 in Europe. Throughout the years, EASA gained experience applying these recommendations during certification projects by using special conditions, acceptable means of compliance or interpretative material.

The investigations of accidents involving a ditching after loss of engine power, including the Hudson River accident to the Airbus A320 N106US, identified the need to demonstrate, during the certification of the aeroplane, that the ditching parameters can be attained without engine power by the pilots without the use of exceptional skill or strength.

2.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 1 of Regulation (EU) 2018/1139. This Decision will contribute to the achievement of the overall objectives by addressing the issues outlined in Section 2.1.

The specific objective of this Decision is, therefore, to:

a) RMT.0570 Reduction of runway excursions: reduce the number of runway excursions during landings of large aeroplanes by providing design-related means to support the flight crew in identifying and managing the risk of a longitudinal runway excursion; and

b) RMT.0049 Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability: clarify and standardise specifications and acceptable

means of compliance related to large aeroplanes safety assessment of critical systems, flight control systems, and aeroelastic stability.

2.3. How we want to achieve it — overview of the amendments

CS-25 is amended as summarised below:

a) RMT.0570 Reduction of runway excursions: CS 25.705 is created to require that large aeroplanes are equipped with a runway overrun awareness and alerting system (ROAAS). This system will reduce the risk of a longitudinal runway excursion during landing by providing an alert, in flight and on the ground, to the flight crew when the aeroplane is at risk of not being able to stop within the available distance to the end of the runway. AMC 25.705 is created to refer to an industry standard (EUROCAE ED-250), which is available to support the demonstration of compliance with the new requirement, and

b) RMT.0049 Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability:

i. CS 25.629 (aeroelastic stability requirements) is amended to clarify the kinds of failure combinations which must be considered when aeroelactic stability relies on flight control system stiffness and/or damping. AMC 25.629 is amended to reflect these changes;

ii. CS 25.671 (flight control system) is amended as follows:

- CS 25.671(a) is amended to specify the conditions under which the system shall continue to operate, respond to commands, and not hinder the recovery of the aeroplane;
- CS 25.671(b) is amended to clarify that, when minimising the probability of incorrect assembly of elements of the system, marking may only be used where design means are impractical and considering the consequence of an incorrect assembly;
- CS 25.671(c) is amended such that continued safe flight and landing must be demonstrated after any jam in the system, and after the following failures: single failures and a combination of failures that are not shown to be extremely improbable. In addition, the pilot must be able to readily counteract any probable failure;
- CS 25.671(d) is amended to clarify that, after the failure of all engines, in addition of the aeroplane being controllable in flight, it must be possible to conduct an approach, perform a flare (landing and ditching), and stop the aeroplane on ground;
- CS 25.671(e) is created to require an indication to the flight crew when the primary means of control is near the limit of control authority; and
- CS 25.671(f) is created to require to alert the flight crew when the aeroplane enters a mode of operation that significantly changes or degrades the normal handling or operational characteristics of the aeroplane.

AMC 25.671 is amended concurrently to support compliance with CS 25.671;

iii. AMC 25.672(c)(1) (stability augmentation and automatic and power-operated systems) is deleted as this item is now covered by CS 25.1309;

iv. CS 25.933(a)(1)(ii) (reversing systems) is amended to require that in-flight thrust reversal failure conditions comply with CS 25.1309(b) to ensure consistency with other systems; and

v. CS 25.1309 (equipment, systems, and installations) is amended as follows:

- The list of exceptions from CS 25.1309(b)(1)(ii) is updated to reflect the amendment of CS 25.671;
- CS 25.1309(b)(4) is created to require that any significant latent failure is eliminated, as far as practical; otherwise the latency must be minimised; and
- CS 25.1309(b)(5) is created to address the specific risk where the aeroplane is one failure away from a catastrophe in presence of a latent failure. In addition, to show that it is impractical to add a redundancy, the applicant must minimise the probability of the failure condition (remote), and the combined probabilities of all latent failures that may be combined with an evident failure must also be minimised (not more than 0.001).

AMC 25.1309 is amended concurrently to support compliance with CS 25.1309.

2.4. What are the stakeholders' views

a) RMT.0570 Reduction of runway excursions

Among the 25 stakeholders who commented (99 (unique) comments) on the NPA, a majority of the commentators were supportive of the EASA proposal, in particular of the proposed amendment to CS-25.

Nevertheless, one stakeholder, representing the business aviation industry, proposed to exempt business jet types of aeroplanes from being required to be equipped with a ROAAS, claiming that a mandate would not be cost effective. Also, two aeroplane manufacturers suggested to remove the requirement that the ROAAS must perform energy-based calculations. These proposals have not been accepted.

More details on these comments are available in CRD 2018-12..

b) RMT.0049 Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability

The stakeholders views were expressed among the 323 comments published in CRD 2014-02 (which included a revised text of the amendments to CS-25) and in the 76 reactions received thereto.

The main general comments were that:

- The amendments should be such as to harmonise the specific risk assessment across CS 25.671, CS 25.933 and CS 25.1309, consistent with the objective provided to the ASAWG: EASA agrees and has made changes to the resulting text in order to reach this objective.
- It is important that EASA harmonises the proposed amendments with FAA, TCAA, and ANAC Brazil: EASA shares this position and has communicated with the three authorities to find an

agreement on the proposed regulatory text. The outcome is that an agreement could be reached on the text and/or the technical intent on the majority of the paragraphs, and this has been incorporated in the final text of this amendment of CS-25. The FAA now has to follow a different rulemaking process, but they intend to work towards harmonisation as much as possible. ANAC Brazil and TCCA have not yet initiated a corresponding rulemaking process, nevertheless, they made a valuable contribution to the development of the regulatory text.

Various specific comments were received and many of them were used to improve or clarify the specifications and the acceptable means of compliance.

Regarding the proposed amendments of CS/AMC 25.629 and Appendix K, some comments opposed the elements being beyond the intial scope of interaction between systems and structure. EASA agreed with these comments and these elements have been withdrawn.

Regarding the proposed amendments of CS/AMC 25.671, some commentators considered that some elements were beyond the FCHWG recommendations, or that some elements should be aligned with CS 25.1309(b). On the first point, EASA does not fully agree as there were dissenting views recorded and the proposed text reflects what has been applied via Special Conditions by EASA on certification projects. On the second point, EASA agreed and deleted the part addressing latent failures in CS 25.671(c)(2). This will now be addressed by CS 25.1309(b).

Regarding the proposed amendments of CS/AMC 25.1309, some commentators complained that the new specifications on specific risk assessment will increase certification costs and that some elements are subjective (e.g. minimisation of the latency, practicality to eliminate a latent failure). EASA has improved the text, notably in the AMC to provide a method for demonstrating compliance. It is recognised that discussions and agreements will be needed for individual projects on these elements. However, the EASA position is that this safety issue must be addressed through a robust certification process.

More details on these comments are available in CRD 2014-02.

2.5. What are the benefits and drawbacks

a) RMT.0570 Reduction of runway excursions

According to the Regulatory Impact Assessment (RIA) of NPA 2018-12, the amendment of CS-25, combined with an amendment of Regulation (EU) 2015/640 (Part-26), reaches the most cost-effective option. The amendment of Regulation (EU) 2015/640 has been proposed by EASA through Opinion 04/2019[7].

This combination would create a significant safety benefit, with an estimate of 13 accidents avoided, 9 fatalities and 81 injuries prevented over a 21-year period, and avoided accident costs in the order of EUR 94 million. The costs for implementing this option are estimated to range between EUR 65 and 196 million, depending on the unit cost assumptions.

A key cost-effectiveness indicator was calculated, which was the net cost per fatality prevented. According to this indicator, the amendment of CS-25, combined with the amendment of Part-26, is the most cost-effective of all assessed options: the avoided accident costs are higher than the low

[7] Opinion 04/2019 on 'Reduction of runway excursions' and 'Class-D compartments' issued on 7 October 2019 (https://www.easa.europa.eu/document-library/opinions/opinion-042019)

estimate for the equipment costs, while the high estimate for the equipment installation would result in a cost of EUR 11 million per fatality prevented.

b) RMT.0049 Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability

This amendment of CS-25 will bring a moderate safety benefit by upgrading the robustness and the quality of the safety assessment of aeroplane systems.

It will also implement the content of some recurrent special conditions and interpretative material (e.g. flight control systems) applied to certification projects for years, which will, therefore, increase the efficiency of future certification projects and save costs for EASA and applicants. Regarding the CS 25.1309 specific risk assessment, although a supplementary effort will be needed to demonstrate compliance with the new specifications, this additional cost can be compensated by the cost saved on post entry-into-service corrective actions that may be required once unacceptable latent failures are identified. Globally a positive economic impact is foreseen.

No environmental and social impacts have been identified.

3. How do we monitor and evaluate the rules

a) RMT.0570 Reduction of runway excursions

This amendment applies to new large aeroplane designs.

Therefore, the monitoring of the effects created by the new specifications and acceptable means of compliance will consist of:

(i) feedback from future large aeroplane certification projects, and

(ii) in the long term, monitoring the trend of accidents and incidents that involve a runway excursion during landing.

Item (i) depends on the applications received after the amendment of CS-25. A review cannot be made earlier than 5 years after the CS-25 amendment.

Item (ii) will allow EASA to evaluate the efficiency and adequacy of the new CS 25.705 rule, and the equivalent new Part-26 rule (mandating a ROAAS on large aeroplanes manufactured after a certain date) if it is adopted by the European Commission as proposed by EASA.

The monitoring will be ensured in the frame of the usual continuing airworthiness process followed by EASA and type certificate holders, and also through the investigations of occurrences and safety recommendations from designated safety investigation authorities.

b) RMT.0049 Aeroplane-level safety assessments of critical systems, specifications for flight control systems and aeroelastic stability

No specific monitoring action is recommended. Feedback information from certification projects, as well as lessons learned from accident or incident safety investigations in the next few years, will be used by EASA to assess the benefits that are introduced by these amendments of CS-25.

4. References

4.1. Affected decisions

— ED Decision No. 2003/2/RM of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large aeroplanes 'CS-25' (https://www.easa.europa.eu/document-library/agency-decisions/ed-decision-2003002rm).

4.2. Other reference documents

— EUROCAE document ED-250, 'Minimum Operational Performance Standard for a Runway Overrun Awareness and Alerting System', dated December 2017.

— Opinion 04/2019 on 'Reduction of runway excursions' and 'Class-D compartments' issued on 7 October 2019 (https://www.easa.europa.eu/document-library/opinions/opinion-042019).