



Explanatory Note to Decision 2018/005/R

CS-25 Amendment 21

RELATED NPA/CRD 2017-06 – RMT.0647

NPA/CRD 2017-12 – RMT.0673

EXECUTIVE SUMMARY

CS-25 is amended to implement the outcome of two rulemaking tasks:

a. RMT.0647 – ‘Loss of control or loss of flight path during go-around or other flight phases’:

- The objective of this rulemaking task is to mitigate the safety risk for large aeroplanes of a loss of the normal go-around (G/A) flight path, or a loss of control of the aeroplane during G/A or other flight phases executed at low-speed, ensuring that:
 - the design of large aeroplanes is such that the G/A procedure with all engines operating (AEO) can be safely conducted by the flight crew without requiring exceptional piloting skill or alertness;
 - the risk of excessive crew workload and the risk of the somatogravic illusion must be carefully evaluated, and
 - design mitigation measures must be put in place if those risks are too high;
- the design of large aeroplanes provides adequate longitudinal controllability and authority during G/A and other flight phases (focusing on low-speed situations).

b. RMT.0673 – ‘Regular update of CS-25’:

The objective of this rulemaking task is to reflect the state of the art of large aeroplane certification and improve the harmonisation of CS-25 with the FAA Part 25 regulations.

Various paragraphs of CS-25 Book 1 and Book 2 are amended to:

- introduce the content of generic certification review items (topics: landing in abnormal configurations, indication that engine anti-icing systems are functioning, oxygen fire hazards in gaseous oxygen systems, non-magnetic standby compass, engine cowl retention);
- harmonise with FAR 25 rules (topics: fuel tank vent fire protection, flight crew seats, security requirements);
- add some clarifications identified during certification projects (topics: flight instrument external probe de-icing test, engine ETOPS capability);
- make editorial corrections.

This Amendment is expected to provide a fair safety benefit against an acceptable cost impact for large aeroplane manufacturers, and to have no social or environmental impacts. The changes stemming from the regular update should also provide some economic benefits by streamlining the certification process.

Action area:	Aircraft upset in flight (LOC-I) (RMT.0647); regular updates/review of rules (RMT.0673)		
Affected rules:	CS-25		
Affected stakeholders:	Design organisations — large aeroplanes		
Driver:	Safety (RMT.0647), Efficiency/proportionality (RMT.0673)	Rulemaking group:	Yes for RMT.0647; No for RMT.0673
Impact assessment:	Full for RMT.0647; None for RMT.0673	Rulemaking Procedure:	Standard

● EASA rulemaking process



RMT.0647: 6.7.2015	11.5.2017	27.3.2018
RMT.0673: ‘regular update of CS-25’	24.7.2017	



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1. About this Decision

The European Aviation Safety Agency (EASA) developed ED Decision 2018/005/R in line with Regulation (EC) No 216/2008¹ (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure².

This rulemaking activity is included in the EASA 5-year Rulemaking Programme³ under rulemaking tasks (RMT).0647 and (RMT).0673. The scope and timescales of the task were defined in the related Terms of Reference⁴.

The draft text of this Decision has been developed by EASA based on the input of a rulemaking group in the case of RMT.0647, and by EASA in the case of RMT.0673. All the interested parties were consulted through NPA 2017-06 and NPA 2017-12⁵. The two NPAs respectively received 84 and 42 comments from all the interested parties, including industry and national aviation authorities.

EASA reviewed the comments received during the consultation. The comments received and EASA's responses thereto were presented in Comment-Response Documents (CRD) 2017-06 and 2017-12⁶.

The final text of this Decision, along with the certification specifications (CSs) and acceptable means of compliance (AMC), has been developed by EASA, based on the input from a rulemaking group in the case of RMT.0647.

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

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) <http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1467719701894&uri=CELEX:32008R0216>.

² EASA is bound to follow a structured rulemaking process as required by Article 52(1) of Regulation (EC) No 216/2008. 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 <http://easa.europa.eu/rulemaking/annual-programme-and-planning.php>

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

⁵ In accordance with Article 52 of Regulation (EC) No 216/2008 and 6(3) and 7 of the Rulemaking Procedure.

⁶ <https://www.easa.europa.eu/document-library/comment-response-documents>



2. In summary — why and what

2.1. Why we need to change CS-25

RMT.0647: A number of commercial air transport large aeroplane accidents or serious incidents have occurred either during/at the end of a go-around (G/A) phase, or with the aeroplane close to the ground (but not in G/A mode) and with the pilots attempting to climb. A loss of the normal G/A flight path or loss of control of the aeroplane has been observed in relation to inadequate awareness of the aeroplane's state, or inadequate management by the flight crew of the relationship between pitch attitude and thrust. An unusual pitch-up trim position has also been a factor in some occurrences in other flight phases.

RMT.0673: certification specifications (CS) and acceptable means of compliance (AMC) need to be updated regularly to ensure that they are fit for purpose, cost-effective, and can be implemented in practice. Regular updates are issued when relevant data is available following an update of industry standards, feedback from certification activities or minor issues raised by the stakeholders.

2.2. What we want to achieve — 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 2.1.

RMT.0647: the specific objective is to mitigate the safety risk for large aeroplanes of a loss of the normal G/A flight path, or a loss of control of the aeroplane during G/A or other flight phases executed at low speed, ensuring that:

- the design of large aeroplanes is such that the G/A procedure with all engines operating (AEO) can be safely conducted by the flight crew without requiring exceptional piloting skill or alertness. The risk of excessive crew workload and the risk of somatogravic illusion must be carefully evaluated, and design mitigation measures must be put in place if those risks are too high;
- the design of large aeroplanes provides adequate longitudinal controllability and authority during G/A and other flight phases (focusing on low-speed situations).

RMT.0673: the specific objective of this proposal is to amend CS-25 based on the selection of non-complex, non-controversial and mature subjects, with the ultimate goal being to increase safety.

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

RMT.0647: CS-25 is amended in order to:

- Upgrade the assessment of the G/A manoeuvre and its procedure to include an evaluation of whether the G/A with AEO can be managed without creating excessive workload on the crew and without an excessive risk of a somatogravic illusion. When an unacceptable level of risk is identified, the applicant has to implement design solutions to decrease this risk to an acceptable level. Implementing a reduced G/A thrust function is one of the possible solutions which can be used, as it allows more time for the flight and it makes the manoeuvre less dynamic, thus reducing the flight crew workload and mitigating the risk of mismanagement of the aeroplanes'



trajectory (including the effect of a somatogravic illusion). As other means may be proposed by industry, this is considered to be an acceptable means of compliance (AMC);

- Upgrade the certification specifications and acceptable means of compliance related to longitudinal control and authority during G/A or other flight phases. For G/A, the aim is to demonstrate adequate longitudinal controllability and an adequate stall margin during a transition from any approved approach and landing configuration to G/A and up to the next flight phase and level-off (AEO and full thrust/power, different combinations of automation to be evaluated). For other flight phases, when the aeroplane has an automatic pitch trim function, the stabiliser (or trim tab) travel should be limited before or at stall warning activation to prevent excessive pitch trim such that it is possible to command a prompt pitch down of the aeroplane for control recovery.

RMT.0673:

RMT.0673 identified 11 items for inclusion in this update of CS-25.

Consequently, the following amendments are:

Item 3: Indication that engine anti-icing systems are functioning

A new AMC 25.1305(c)(5) has been created to clarify, and avoid misinterpretation of, the rule requiring 'An indicator to indicate the functioning of the powerplant ice protection system for each engine'.

Item 4: Oxygen fire hazards in gaseous oxygen systems

A new AMC 25.1441(b) has been created to address the risk assessment related to oxygen fire hazards in gaseous oxygen systems.

Item 5: Flight instrument external probe de-icing test

Paragraph 9.b of AMC 25.1324 on flight instrument external probes has been amended to avoid some misinterpretations or confusions with regard to the need to perform de-icing tests.

Item 6: Flight crew seats

CS 25.562(b) has been amended to remove the exception for flight deck crew seats.

Item 7: Non-magnetic standby compass

CS 25.1303(a)(3) has been amended, a new AMC 25.1303(a)(3) has been created, and AMC 25.1327 and AMC 25-11 have been amended, to reflect that direction indicators other than 'non-stabilised magnetic compass' have been found compliant with the intent of CS 25.1303(a)(3)

Item 8: Security requirements

Appendix S has been amended by creating paragraph S25.60 on security requirements, to exempt non-commercially operated aeroplanes certified in accordance with Appendix S from the CS 25.795(b), (c) and (d) requirements.

Item 9: Engine ETOPS capability

CS 25.1535 has been amended to clarify the requirement for the engine to be approved for ETOPS capability in accordance with CS-E 1040, and to clarify that both flight and cabin crews must be considered in the scope of sub-paragraph (b).



Item 10: Engine cowl retention

CS 25.1193 ('Cowling and nacelle skin') has been amended and a new AMC 25.1193(e)(4) and (f) has been created, to introduce new specifications addressing the protection against the risk of an engine cowl separation.

Item 11: Editorial corrections

AMC 25.21(g), paragraph 4.1.1 has been amended, to update the example reference to the operating rules.

Other editorial corrections:

The following editorial corrections are made to CS-25:

- In AMC 25.1581, Paragraph 5(d), the reference to AMC 25.1583(c) was deleted, as this AMC does not exist.
- AMC 25-19, Appendix 3, Example 2, paragraph g.1 was corrected in respect of an unintended copy/paste error with Appendix 3, Example 1, paragraph f.1.
- Several other simple editorial corrections are also made in other places.

2.4. What are the stakeholders' viewsRMT.0647:

Overall, EASA received many positive comments aimed at improving the proposal. Nevertheless, some commentators explained that the design aspects addressed by the proposed CS-25 amendment are not sufficient to prevent all the go-around related occurrences, in particular the ones triggered by somatogravic illusions. EASA considers that, although it is agreed that design changes alone will not fully eliminate the risk of inadequate management of go-arounds, they will bring a safety benefit and contribute to a global strategy to fight against the identified risk, which includes flight crew training improvements and recommendations for air traffic control instructions. For more details, please refer to CRD 2017-06.

RMT.0673:

The comments received were mostly positive and some of them expressed the need to clarify certain elements of the proposed text. For more details, please refer to CRD 2017-12.

2.5. What are the benefits and drawbacks

RMT.0647: the amendment is expected to provide a fair safety benefit by requiring that all new CS-25 aeroplanes have design features that ensure that managing a G/A manoeuvre does not create an unacceptable risk of a loss of control of the trajectory or a loss of control of the aeroplane, including the risk of a somatogravic illusion. Several manufacturers have already developed systems to reduce the thrust during G/A; these systems avoid applying excessive thrust, thereby providing more time to the flight crew to perform the required action, and make the flight phase less dynamic, which decreases both the risks of excessive pitch attitudes and of somatogravic illusions. Such a design improvement would also be required from other manufacturers who develop aeroplanes that can also present a similar level of risk. In addition, the amendment requires manufacturers to further investigate the longitudinal controllability and authority in G/A and other flight phases, which should



contribute to mitigating the risks of upset attitudes and losses of control, in particular in relation to the effect of the automatic pitch trim. The non-recurring cost is substantial for manufacturers who have not yet developed a mitigation means such as a reduced G/A thrust function, however, when included in the development of an aeroplane, this is not significant relative to the overall cost of developing an aeroplane. Operators/owners would face little or no recurring costs associated with these design improvements.

RMT.0673: this amendment of CS-25 reflects the state of the art of large aeroplane certification and improves the harmonisation of CS-25 with FAR 25. Overall, the changes made are expected to provide a moderate safety benefit, to have no social or environmental impacts, and to provide some economic benefits by streamlining the certification process.

2.6. How do we monitor and evaluate the rules

RMT.0647: this amendment will apply to new aeroplane type designs, therefore the monitoring of the effects created by the new specifications and acceptable means of compliance will consist of:

- 1) feedback from future CS-25 type certification projects, in particular the results of the G/A manoeuvre risk assessments and longitudinal controllability/authority assessments, and
- 2) in the long term, monitoring the trend of accidents and incidents during or after G/As (i.e. losses of flight path or losses of control), or in other flight phases at low speed (where longitudinal controllability or authority is a factor).

Item 1 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 2 would be available once the new type designs have entered into service and experienced sufficient flight time, which would require several years (at least 5 years after entry into service to obtain relevant statistical information).

In addition, the changes made to CS-25 might be subject to interim/on-going/ex-post evaluation that will show what is the outcome obtained after the application of the new rules, taking account of earlier predictions made in the impact assessment. The evaluation will provide evidence-based judgement of the extent to which the proposal has been relevant (given the needs and its objectives), effective and efficient, coherent, and has provided added value to the EU. The decision on whether an evaluation will be necessary will also be taken based on the monitoring results.

RMT.0673: this amendment results from EASA's monitoring and evaluation activities.

EASA continuously monitors the implementation of certification specifications, acceptable means of compliance and guidance material through feedback from stakeholders and via the EASA advisory bodies.

EASA will continue to monitor and evaluate CS-25, including the new or amended elements from this update.



3. References

3.1. Affected decisions

- Decision No. 2003/2/RM of the Executive Director of the European Aviation Safety Agency of 17 October 2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for large aeroplanes (« CS-25 »).

3.2. Other reference documents

- Study on Aeroplane State Awareness during Go-Around (ASAGA), published in August 2013. The report is available on the Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (BEA) website at:
<https://www.bea.aero/en/safety-studies/access-to-studies/aeroplane-state-awareness-during-go-around>
- FAA Final rule entitled 'Fuel Tank Vent Fire Protection ' of Federal Register 81 FR 41200, published on 24 June 2016, effective on 23 August 2016 (Docket No.: FAA-2014-0500; Amdt. Nos. 25-142, 21-376, and 129-53).
<https://www.federalregister.gov/documents/2016/06/24/2016-14454/fuel-tank-vent-fire-protection>
- Correction published and effective on 26 July 2016 of Federal Register 81 FR 48693 (Docket No.: FAA-2014-0500; Amdt. Nos. 25-143, 121-375, and 129-52):
<https://www.federalregister.gov/documents/2016/07/26/2016-17590/fuel-tank-vent-fire-protection-correction>
- FAA AC 25.975-1 entitled 'Fuel Vent Fire Protection', dated 24 June 2016:
https://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.information/documentID/1029668
- Notice of Proposed Rulemaking (NPRM), Notice No. 07-13, entitled 'Special Requirements for Private Use Transport Category Airplanes' (72 FR 38731):
<https://www.federalregister.gov/documents/2007/07/13/E7-13582/special-requirements-for-private-use-transport-category-airplanes>
- Final rule, SFAR No. 109, entitled 'Special Requirements for Private Use Transport Category Airplanes' (74 FR 21533):
<https://www.federalregister.gov/documents/2009/05/08/E9-10807/special-requirements-for-private-use-transport-category-airplanes>



4. Appendices

Appendix 1 to Decision 2018/005/R 'CS-25 amendment 21' — CRD 2017-06

Appendix 2 to Decision 2018/005/R 'CS-25 amendment 21' — CRD 2017-12

