European Aviation Safety Agency

Explanatory Note to Decision 2018/006/R

Update of flight simulation training device requirements

Upset prevention and recovery training

RELATED NPA/CRD: 2017-13 — RMT.0196

EXECUTIVE SUMMARY

The objective of this Decision is to increase the fidelity of the provisions to support the approach-to-stall and the upset prevention and recovery training (UPRT) requirements as proposed by EASA Opinion No 06/2017 'Loss of control prevention and recovery training' (RMT.0581). Furthermore, it proposes to increase the fidelity of the simulation of the engine and airframe icing effects, and develop and deploy an instructor operating station (IOS) feedback tool.

This Decision amends the Certification Specifications for Aeroplane Flight Simulation Training Devices (CS-FSTD(A)) (Initial issue), and one of its primary objectives is to achieve the maximum alignment possible with FAA CFR 14 Part 60 Change 2, which would support FSTD operators that have dually qualified devices (both FAA- and EASA-qualified), and with the applicable elements of ICAO Doc 9625 'Manual of Criteria for the Qualification of Flight Simulation Training Devices', 4th Edition.

The amendments are expected to increase safety by addressing low FSTD fidelity or lack of ability of an FSTD to conduct certain training tasks that may have contributed to previous incidents and accidents.

The date of entry into force of the proposed requirements and provisions is envisaged for April 2018, followed by a transition period to ensure alignment with EASA Opinion No 06/2017 that proposed amendments to Annex I (Part-FCL) to Regulation (EU) No 1178/2011 (the 'Aircrew Regulation').

Besides the update of CS-FSTD(A), Notice of Proposed Amendment (NPA) 2017-13 proposed the following:

— AMC/GM to Annex VI (Part-ARA) to the Aircrew Regulation with the inspector competency framework. This amendment will be issued with a separate decision currently being drafted. The related CRD will be published with the decision;

— AMC/GM to Annex I (Part-FCL) to the Aircrew Regulation with the training matrix. This amendment was subject to focused consultation in March 2018. To be published at a later stage with the relevant decision.

Action area:	Aviation personnel		
Affected rules:	CS-FSTD(A)		
Affected stakeholders:	Competent authorities (CAs); training organisations (approved training organisations (ATOs) and declared training organisations (DTOs)); FSTD operators; air operator certificate (AOC) holders; pilots; instructors; examiners; FSTD manufacturers; and aeroplane original equipment manufacturers (OEMs)		
Driver:	Safety	**Rulemaking group:**	Yes
Impact assessment:	Full	**Rulemaking Procedure:**	Standard

Table of contents

1. About this Decision

The European Aviation Safety Agency (EASA) developed ED Decision 2018/006/R in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2].

This rulemaking activity is included in the EASA 5-year Rulemaking Programme[3] under rulemaking task RMT.0196. The scope and timescales of the task were defined in the related Terms of Reference[4] and updated in the European Plan for Aviation Safety (EPAS) for 2018–2022.

The draft text of this Decision has been developed by EASA based on the input of the RMT.0196 Rulemaking Group (RMG). All interested parties were consulted through NPA 2017-13[5]. 200 comments were received from all interested parties, including industry (139 comments) and competent authorities (61 comments).

EASA reviewed the comments received during the consultation with the support of the team leader of the RMT.0196 UPRT Subgroup. The comments received and the EASA's responses thereto are presented in Comment-Response Document (CRD) 2017-13[6].

The final text of this Decision with the certification specifications (CSs) has been developed by EASA based on the input of the RMT.0196 RMG.

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

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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) (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/system/files/dfu/ToR%20RMT.0196%20Issue%201.pdf

5 In accordance with Article 52 of Regulation (EC) No 216/2008, and Articles 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 amend the CSs

The amendment of CS-FSTD(A) with the present Decision will enhance the modernisation of training tools to cope with new technologies and updated training methodologies. Moreover, it will support the need for aviation personnel to take advantage of the safety opportunities presented by new technologies, as stated by EPAS for 2016–2020.

One of the most effective safety barriers in the aviation system is the training of aviation personnel, and of flight crew in particular. Continuous training has been proven to be an effective tool in refreshing flight crew's knowledge and in exposing them to abnormal situations in order to keep them abreast of the necessary flying skills and of how to perform the relevant procedures. The use of FSTDs provides a more realistic and at the same time safer exposure of flight crew to abnormal situations, and permits the recreation of a wider range of scenarios. However, current FSTDs are not qualified to reproduce aeroplane behaviour in certain flight conditions, especially in those close or even beyond the boundaries of the FSTD training envelope. For example, the previous qualification provisions for FSTDs did not mandate the simulation of the approach-to-stall in all conditions, or the performance degradation caused by ice accretion on the aerodynamic surfaces of the aeroplane. The amended CSs aim to rectify the situation.

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.

A baseline definition for this proposal is that training needs trigger simulator requirements; therefore, the current update of Part-FCL under the umbrella of Opinion No 06/2017 (RMT.0581) dictates in certain areas the direction taken by this Decision. In the context of harmonisation with FAA Part 60 Change 2, the term 'full stall' is adopted in the CS-FSTD(A) text as meaning the same as 'post stall', as referred to in Opinion No 06/2017.

The specific objectives of this proposal are to:

(a) ensure that FSTDs better facilitate current and future training needs by establishing the necessary simulation fidelity levels required to support training tasks;

(b) ensure that CS-FSTD(A) paves the way for new technologies;

(c) reinforce the level of safety by addressing low FSTD fidelity or lack of ability of an FSTD to conduct certain training tasks that may have contributed to previous incidents and accidents;

(d) harmonise CS-FSTD(A) with elements of FAA 14 CFR Part 60, Change 2, as appropriate;

(e) ensure consistent application of the relevant FSTD regulations when qualifying FSTDs; and

(f) align CS-FSTD(A) with the outcome of RMT.0581 'Loss of control prevention and recovery training'.

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

EASA has aimed, when possible, to align the proposed technical specifications of CS-FSTD(A) with those of FAA 14 CFR Part 60, Change 2.

The main amendments issued with this Decision are the following:

— approach-to-stall objective requirements;

— determine whether the FSTDs' capability is appropriate to facilitate UPRT;

— establish a definition of 'FSTD training envelope';

— increase the fidelity of the simulation of the engine and airframe icing effects;

— provide guidance on IOS feedback tools, such as the interpretation of the velocity versus load factor (V-n) and alpha/beta diagrams.

2.4. What are the stakeholders' views

200 comments were submitted by 31 stakeholders during the NPA 2017-13 public consultation. 131 comments were made on the proposals for CS-FSTD Book 1 and Book 2. Almost half of them were made by the largest OEMs worldwide and ¼ by CAs.

The stakeholders that commented on the NPA included European competent aviation authorities (CAs), the FAA, type certificate holders (EU and non-EU), and others.

There is in general a strong support for the proposed amendments that are expected to improve safety by settling the needed simulation fidelity levels required to support training tasks.

The nature of the comments received ranges from specific technical aspects to comments aiming to improve the wording of the proposed amendments.

Several comments were accepted or partially accepted, thus leading to substantial amendments of the proposed text which, in certain elements, has been significantly improved.

A number of comments expressed the concern of the lack of full alignment with the FAA regulations. In particular, in contrast with the FAA, EASA does not mandate training in the post-stall regime. However, to limit any adverse impact for FSTD operators that have dually qualified devices, EASA has included optional qualification criteria in line with FAA Part 60.

Stakeholders highlighted the importance of the applicability dates. Given that this Decision is related to Opinion No 06/2017, they recommended to align both applicability dates and include provisions to extend the compliance dates for operators that are unable to comply in a timely manner.

Some comments were expressed regarding the feasibility of the economic impacts for the FSTD operators to comply with the new requirements. The cost-benefit analysis was updated in this respect. Further details are presented in Section 2.5 below.

For additional details and individual responses to comments, please refer to CRD 2017-13.

2.5. What are the benefits and drawbacks

The expected benefits of updating the FSTD provisions and requirements to better support enhanced approach-to-stall training, as well as the benefits of developing and deploying IOS feedback tools, are the following:

— Safety improvement by further mitigating/preventing loss of control in-flight (LOC-I). Safety would improve due to the objective testing provisions which would validate not only the cruising configuration, but also the approach and landing configurations. Current FSTDs would be qualified to accurately reproduce the approach to stall in certain conditions and the behaviour of the aeroplane when affected by ice. The updated FSTD provisions would improve flight crew training, as a safety barrier, to mitigate the risk of LOC-I by facilitating early detection of aeroplane upset safety issues. In the period 2012–2016, EU AOC holders estimated that in 6 (2 fatal accidents, 4 serious incidents) out of 58 cases, the training of the flight crew in an enhanced-capability FSTD would have provided them with additional resources, thus facilitating the detection of approach to stall. In 4 cases (serious incidents) out of 6, accretion of ice modified the aerodynamic performance of the aeroplane. In the other 2 cases (fatal accidents), the flight crew was neither able to detect the approach to stall nor to provide efficient flight control inputs to recover from the stall.

— Full implementation of the UPRT provisions. The updated requirements would also ensure full implementation of the UPRT requirements and provisions as part of the EU pilot training regulatory framework, proposed by Opinion No 06/2017.

— Gains for pilots by receiving better and more accurate training in higher-fidelity FSTDs. Pilots would receive training in an environment with higher-fidelity FSTDs, hence, be better prepared for unexpected situations and their resilience would improve.

— Gains for instructors by improving their ability to provide more accurate feedback during UPRT. Apart from pilots, instructors would also be positively affected by the higher FSTD fidelity when instructing pilots in properly reacting to an approach to stall in certain conditions.

— To a large extent, close alignment and harmonisation with FAA 14 CFR Part 60 Change 2 and ICAO Doc 9625 requirements. The provisions would ensure harmonisation with the FAA and ICAO by facilitating enhanced approach-to-stall training. However, EASA also acknowledges that there might be a negative impact for FSTD operators that operate FSTDs qualified in compliance with the FAA requirements, because of dual qualification (both by EASA and the FAA). To reduce this possible negative impact as well as the administrative burden for FSTD operators, the proposal includes the possibility for operators who wish to conduct post-stall training: the CA would perform a special evaluation in order to ensure that the FSTD has the appropriate fidelity to provide post-stall training.

As regards costs, it is expected that the new provisions would incur overall **a low negative impact for the commercial air transport fixed-wing sector (see Table 2)**. The analysis assumes that the total costs for updating FSTDs would be transferred in the chain from the OEM/data package providers to the FSTD manufactures and later on to the FSTD operators which would then transfer the costs to the commercial air transport fixed-wing sector. The latter have to pay for the use of updated devices as UPRT training would require the use of updated FSTDs with higher fidelity (EASA Opinion No 06/2017 proposing amendments to Part-FCL). This chain of 'transferred costs' was already analysed in NPA 2017-13 — however, up to the level of the FSTD operator.

In the current document, the cost analysis is updated to better address the stakeholders' comments and overall impact:

(a) it presents the overall impact for the final stakeholders (commercial air transport fixed-wing sector) which would bear the overall cost incurred for the update of FSTDs;

(b) it makes better estimation and presentation of the costs per device, considering that the cost would be quite different depending on the age of the device (e.g. update of the new devices will cost less than the update of old devices).

— The overall costs for the update of all FSTD(A) devices in the NPA stage were estimated at ca EUR 30 million. Following the update of the economic impact, the overall costs are estimated much higher at ca max EUR 120 million (see Table 2), based on the revised data, provided and agreed with the RMG that developed the impact assessment. The huge difference in the overall costs is due to several issues: (1) some development costs for the FSTD update were not considered in the estimation of the costs in the NPA stage; (2) downtime when the simulator would not be in use was not accurately taken into account; (3) the age of the device was not properly estimated. In fact, in NPA 2017-13, mainly new devices in the market were considered whose update would be much cheaper than the update of devices aged more than 5 years.

In order to address these comments, the impact assessment in the current document has been updated. All 800 FSTDs[7] qualified by the EASA MSs' competent authorities and by EASA as a competent authority were provisionally divided in 3 groups:

Table 1: Distribution of FSTDs qualified by EASA Member States and by EASA by device age

Group 1 (new devices < 5 years old)	Group 2 (devices between 5–20 years old)	Group 3 (old devices (> 20 years old))
ca 15 % of all devices/ 120 devices	ca 60 % of all devices/ 480 devices	ca 25 % of all devices/ 200 devices

The cost estimation below is based on conservative assumptions, already mentioned in NPA 2017-13:

— The cost analysis is performed assuming an update of all 800 FSTDs that were qualified in the EASA MSs and those qualified by EASA (acting as competent authority) in third countries. This scenario is, however, too conservative as the FSTD operators may not update all the devices they are operating, but only some of them, depending on the strategy and business model of each FSTD operator.

— Some of these 800 FSTDs might have been already updated in compliance with FAA 14 CFR Part 60, Change 2, to facilitate enhanced approach-to-stall training. Therefore, they would not be updated again against the provisions of the current Decision. The number of these devices is ca 160.

— The update of the devices would happen within one year, after the rules are in force, as the transition period is aligned with the applicability of the UPRT training (EASA Opinion No 06/2017 proposing amendments to Part-FCL). Nevertheless, in case the FSTD operators have more than one FSTD, they may decide to update their simulators within a longer transition period as long as the FSTD is not used for UPRT training.

[7] Based on the FSTDIS (Flight Synthetic Training Devices Information System).

Table 2: Revised <u>maximum</u> estimated economic costs for UPRT update following NPA 2017-13 and the CRD caveat:

[i] All these figures are the best estimates provided to EASA to support the analysis.

[ii] The updated costs are based on the information provided by OEM/data package providers, FSTD manufacturers and FSTD operators that participated in the RMT.0196 RMG.

[iii] The costs would occur over 1-year period in compliance with the transition period for the implementation of CS-FSTD(A).

[iv] Unit cost is in EUR (2017).

[v] Geographic coverage: EASA Member States and third countries overseen by EASA as a competent authority for FSTDs.

Costs borne by:	Type of cost	Cost for update of FSTD device to facilitate approach-to-stall training (revised following CRD)		
		Group 1 (Newest) devices < 5 years old	Group 2 (Middle) devices > 5 years old and < 20 years old	Group 3 (Old) devices > 20 years old
FSTD manufacturers	Development costs to update software per device (one-off costs) (EUR)	63 250	88 000	187 000
FSTD operators	Special evaluation and downtime (e.g. 15 sessions when the sim will not be used) one-off costs per device (EUR)	30 000	30 000	30 000
—	Number of devices in each group	120	480	200
	Costs for FSTD manufacturers and operators for all EASA-qualified devices in the market (individual cost per device for the FSTD manufacturer and operator[i,ii,iii,iv,v] number of devices in each group) (EUR)	11 190 000	56 640 000	43 400 000
OEM/data package suppliers	Total one-off cost for update FSTD data package with required data (for new aeroplanes, old aeroplanes with or without data) (EUR)	12 000 000		
Commercial air transport fixed-wing sector	Total maximum costs for update of FSTD for UPRT and facilitate approach-to-stall training (with conservative assumptions as explained in the text above) (EUR)	123 230 000		
	Estimated turnover for commercial air transport fixed-wing sector (EUR)	220 000 000 000[8]		
	Overall impact: low negative	0.06 %		

These costs would trigger an overall low negative economic impact for the commercial air transport fixed-wing sector which is expected to bear these costs for the update of FSTDs. The updated requirements would also ensure full implementation of the UPRT requirements and provisions as part of the EU pilot training regulatory framework, proposed by EASA Opinion No 06/2017.

[8] In 2016, EASA estimated a total European market for airlines to be worth approximately EUR 220 billion.

2.6. How do we monitor and evaluate the rules

It is recommended that the updated CS-FSTD(A) be subject to robust monitoring and, in case it is necessary, to an evaluation of their impact, effectiveness and efficiency.
It is recommended that the following monitoring indicators be used to review the implementation of the new provisions:

Table 3: Proposed indicative indicators to monitor the implementation of the rules regarding CS-FSTDs to facilitate approach-to-stall training

Monitoring indicator	Data source	Indicative frequency	Tool for data collection
Number of FSTD(A) devices updated in the EASA MSs, following the publication of the updated CS-FSTD(A) requirements	EASA standardisation inspections for Full Flight Simulators (FFS) qualified by EASA MSs EASA database for FFS, qualified by EASA	2 years after rules are in place	Regular standardisation of CAs and oversight of non-EU countries' activities
Cost per FSTD for update, following the publication of the updated CS-FSTD(A) requirements	FSTD operators	Minimum 2 years after rules are in place	Survey
Perception of the cost increase of pilot training, following the publication of the updated CS-FSTD(A) requirements	Airlines/ATOs/DTOs	Minimum 5 years after rules are in place	Survey
Assessment of cases where the flight crew detected and prevented LOC-I caused by ice contamination	Airlines	Minimum 5 years after rules are in place	Study/survey

Based on the monitoring results, EASA may evaluate the impact of the adopted amendments to CS-FSTD(A). This evaluation shall assess the achieved impact of the amendments versus the expected consequences, and shall conclude on the overall relevance, effectiveness and efficiency of the rules. It is recommended to be carried out indicatively 5 (five) years after the rules are in place.

3. References

3.1. Affected regulations

— N/A

3.2. Affected decisions

— Decision N° 2012/010/Directorate R of the Executive Director of the Agency of 4 July 2012 on the Certification Specifications for Aeroplane Flight Simulation Training Devices

3.3. Other reference documents

— 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), in particular Article 21(2)(b)(i) and (ii)

— Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (OJ L 311, 25.11.2011, p. 1), and in particular its Annex VI (Part-ARA)

— 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)

— Draft Annex 4 to the Bilateral Air Safety Agreement (BASA) between EU and USA on FSTDs

— EASA Opinion No 03/2015 'Revision of operational approval criteria for Performance-Based Navigation (PBN)' of 31 March 2015

— ICAO Doc 9625 'Manual of Criteria for the Qualification of Flight Simulators', 4th Edition, Vol I — Aeroplanes, 2015

— ICAO Doc 10011 'Manual on Aeroplane Upset Prevention and Recovery Training', 1st Edition, February 2017

— FAA 14 Code of Federal Regulations (CFR), Part 60, Change 2

— Safety Recommendation FRAN-2012-045 (BEA)

— Safety Recommendation RUSF-2013-002 (AIB)

— Safety Recommendation SPAN-2011-020 (CIAIAC)

— Safety Recommendation FRAN-2016-006 (BEA)

— ICAO Doc 8335 'Manual of Procedures for Operations Inspection, Certification and Continued Surveillance', Part I, paragraphs 5.3.1 and 6.2.3, Edition 5, 2010

— International Air Transport Association (IATA), Flight Simulator Evaluator Pilot Guide, Chapter 5, 1st Edition, 2000

— Joint Aviation Authorities (JAA) Administrative & Guidance Material, Section Six: Synthetic Training Devices (STD/FSTD), Part Two: Procedures, Chapter 3

4. Appendix

Appendix to ED Decision 2018/006/R ‘Update of flight simulation training device requirements — Upset prevention and recovery training’: CRD to NPA 2017-13