European Aviation Safety Agency

Notice of Proposed Amendment 2017-13

Update of flight simulation training devices requirements

Upset prevention and recovery training, FSTD inspector competencies framework, training matrix

RMT.0196

EXECUTIVE SUMMARY

Rulemaking task (RMT).0196 'Update of flight simulation training devices requirements' has been divided into three work packages (WP1, WP2, and WP3). According to Rulemaking Programme (RMP) 2017-2021, the related documents are planned to be published between 2017 and 2019, in order to complete the modernisation of the certifications specifications (CSs) and acceptable means of compliance/guidance material (AMC/GM) on flight simulation training devices (FSTDs). The objective of this NPA (WP1) is to update CS-FSTD(A), as well as AMC/GM to Annex I (Part-FCL) and Annex VI (Part-ARA) to Regulation (EU) No 1178/2011 (the 'Aircrew Regulation'), to reflect the technological advancements in the field of FSTDs whilst ensuring that FSTD provisions and AMC/GM are fully in line with the current and proposed new training requirements and AMC/GM for flight crew (FC). Furthermore, it aims at supporting the competent authorities (CAs), FSTD operators, and training organisations, by providing a competencies framework for FSTD inspectors as well as guidance for the use of each type of FSTD based on the training need.

This NPA proposes to:

— increase the fidelity of the provisions in order to support the approach-to-stall training, as well as of the new upset prevention and recovery training (UPRT) requirements as proposed by Opinion 06/2017 (RMT.0581);
— increase the fidelity of the simulation of the engine and airframe icing effects;
— develop and deploy an instructor operating station (IOS) feedback tool;
— introduce an FSTD inspector competencies framework; and
— introduce guidance on the additional (non-mandatory) capability of each FSTD to assist stakeholders in defining the use of the appropriate FSTDs to support the training course syllabus as well as the CA in performing the evaluation.

Additionally, the NPA proposes the option to qualify FFSs for the post-stall regime based on a special evaluation. These optional fidelity and testing requirements, based on Federal Aviation Administration (FAA) 14 CFR Part 60, Change 2, would support FSTD operators having dual-qualified devices (both FAA- and EASA-qualified).

Action area:	Human factors and competence of personnel		
Affected rules:	CS-FSTD(A); AMC/GM to Part-FCL; AMC/GM to Part-ARA		
Affected stakeholders:	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 NPA

1.1. How this NPA was developed

The European Aviation Safety Agency (EASA) developed this NPA 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 text of this NPA has been developed by EASA based on the input of Rulemaking Group (RMG) RMT.0196 for WP1. It is hereby submitted to all interested parties[4] for consultation.

1.2. 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/**[5].

The deadline for submission of comments is **25 September 2017.**

1.3. The next steps

Following the closing of the public commenting period, EASA will review all comments.

Based on the comments received, EASA will develop a decision issuing the related CSs (CS-FSTD(A)) and amending the AMC/GM to Part-FCL and Part-ARA.

The comments received and the EASA responses will be reflected in a comment-response document (CRD). The CRD will be annexed to the decision.

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

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

2. In summary — why and what

2.1. Why we need to change the rules — issue/rationale

The European Plan for Aviation Safety (EPAS) 2016-2020 highlights the importance of training tools modernisation to cope with new technologies and updated training methodologies. It also underlines the need for aviation personnel to take advantage of the safety opportunities presented by new technologies. RMT.0196 is one of the safety-driven rulemaking tasks related to human factors (HF) and competence of personnel.

The driver of EPAS 2016-2020 is the commitment to improve safety. EPAS is the documented output of an evidence-based proactive approach to safety risks, provides the reader with an overview of the risks of the aviation safety system, and establishes safety priorities in the European Union (EU). Furthermore, it supports safety management at EU level by complementing existing regulations and safety investigations.

Related safety issues

The following safety recommendations (SRs) addressed to EASA through aircraft accident investigation reports, published by the designated safety investigation authority of the Member States (MSs) (please refer to Regulation (EU) No 996/2010[6]), are considered in this RMT. New SRs related to this task may be also taken into consideration during its development.

[6] Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC (OJ L 295, 12.11.2010, p. 35) (http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1479716039678&uri=CELEX:32010R0996).

Table 1 — SRs

SR number	Summary of the SR text	Accident/ incident	Aircraft type and registration	Date of accident	Location of accident	How RMT.0196 has addressed this SR
FRAN-2012-045 (BEA)	*The BEA[7] recommends that EASA modifies the basis of the regulations in order to ensure better fidelity for simulators in reproducing realistic scenarios of abnormal situations.*	Accident	AIRBUS-A330 F-GZCP	1.6.2009	En route between Rio de Janeiro and Paris	EASA has addressed this SR by providing the following: (a) means to evaluate the fidelity of the high-altitude approach-to-the-stall simulation and of the instructor's feedback tools in order to facilitate enhanced training in this area and give better feedback on the realism of the exercise; and (b) means to evaluate the fidelity of icing simulation in order to enhance training in this area; whilst not directly linked to this SR, EASA has evidence through occurrence reports that this is a safety risk. In addition, EASA aims at aligning with FAA 14 CFR Part-60, Change 2. This was done in close coordination with RMG RMT.0581 to ensure that FSTDs provide optimum fidelity to support new training requirements in case these abnormal situations occur.
RUSF-2013-002 (AIB[8])	*IAC[9] recommends EASA and other simulator certification authorities to consider the possibility to add into the simulator data-package the capability to simulate*	Accident	ATR-ATR72 VP-BYZ	2.4.2012	Roschino (Tyumen) Airport	EASA and RMG RMT.0581 pointed out that from a training perspective, it is not realistic to train for 'unexpected' or 'sudden' stalls. In relation to a (type-specific) recovery from a stall, the assessment of, as well as the comments received on NPA 2015-13 also indicated concerns over potential negative transfer of training when using a full-flight simulator (FFS). For the above reasons, RMT.0196 concentrated only on

7 Bureau d'Enquêtes et d`Analyses.

8 Accident Investigation Board.

9 Interstate Aviation Committee

	an unexpected or sudden aircraft stall at any stage of flight.					improving fidelity to support training up to the stall (approach to stall).
SPAN-2011-020 (CIAIAC[10])	*It is recommended that […] EASA establish requirements for flight simulators so as to allow simulator training to cover sustained takeoff stalls that reproduce situations that could exceed the flight envelope limits. (REC 20/11)*	Accident	DOUGLAS-DC9 EC-HFP	20.8.2008	Madrid-Barajas Airport	EASA and RMG RMT.0581 pointed out that from a training perspective, it is not possible to simulate 'sustained take-off' stalls. Such dynamic stall simulations are not realistic and are likely to lead to negative training and negative transfer of training. With reference to Section 2.3.4 of Opinion 06/2017[11], in relation to a (type-specific) recovery from a stall, the assessment of, as well as the comments received on NPA 2015-13 also indicated concerns over potential negative transfer of training when using an FFS. For the above reasons, experts from RMG RMT.0196 consider that no change to CS-FSTD(A) is necessary.
FRAN-2016-006 (BEA)	*[…] EASA evaluate the possibility of developing an alternative programme for complex high-performance single-pilot aeroplanes for which there is no adequate flight simulator, for example by using a flight simulator from a similar aeroplane.*	Accident	Piper PA31T OE-FKG	28.10.2011	Toulouse-Blagnac Airport	This SR has been addressed by the following RMTs: — RMT.0188 (FCL.002) Appendix 9 has been amended and new AMC created to explain the evaluation procedures. — RMT.0196 GM1 Appendix 9 to Part-FCL is proposed to be amended to support the proposed changes to CS-FSTD(A). FTD1, FTD2/FNPTII MCC requirements in combination with aeroplane

10 Comisión de Investigación de Accidentes e Incidentes de Aviación Civil.

11 https://www.easa.europa.eu/document-library/opinions/opinion-062017

From 2012 to 2016, **19 accidents classified as loss of control in-flight (LoC-I)**[12] occurred worldwide during commercial air transport (CAT) operations[13]. In 17 of those cases, the accidents were fatal. In the same period, **in 2 of the fatal accidents, the operators had an EASA air operator certificate (AOC).**

There are several scenarios and many different factors leading or contributing to LoC-I. However, it is unanimously acknowledged that the common safety barriers to prevent such a situation from developing out of the initial upset are flight crew (FC) awareness and the close monitoring of the flight. Both are critical factors in detecting in-flight deviations at an early stage to prevent the upset from evolving to a LoC-I or in recovering from LoC-I itself. The analysis of accidents and serious incidents shows that in many cases, flight crews are caught by surprise in the event of an upset or have limitations and difficulties to detect the upset and the approach to stall. In certain cases, the flight crew does not realise that the aeroplane is in an actual stall.

One of the most effective safety barriers in the aviation system is the training of the aviation personnel, and of the flight crew in particular. Continuous training has been proven to be an effective tool in refreshing the 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 the 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, current qualification provisions for FSTDs do not mandate the simulation of the approach to stall in all conditions, a full stall, or the performance degradation caused by ice accretion on the aerodynamic surfaces of the aeroplane.

Apart from analysing the occurrences classified as LoC-I, another objective of the analysis was to identify occurrences that are precursors to LoC-I (e.g. before the flight crew loses control of the aeroplane). In order to assess the need to extend the current capabilities of the FSTDs, **a review of the LoC-I CAT aeroplane accidents and serious incidents worldwide between 2012 and 2016** was carried out, revealing a total number of 58 occurrences. The review is based on the available investigation reports or the safety review of the operator involved. The objective of the review is to assess whether in the occurrence scenario, the training of the flight crew in an enhanced-capability FSTD would have made any difference in the development of the occurrence. It is acknowledged that there are many and complex factors affecting the development of an occurrence, especially in a LoC-I event. **Among those factors, the fidelity of the FSTD used by the flight crew for the type rating or refreshment training may have a contribution**. Within the scope of this NPA, however, it is considered sufficient to assess the contribution of the FSTD only in the potential unfolding of the occurrence.

The review focuses on two stages of the upset, the approach to stall and the full stall. In addition, it considers the scenario of ice accretion affecting the aerodynamic performance of the aeroplane. The analysis assumes that flight crews involved in those occurrences were trained in a non-enhanced-capability FSTD.

[12] LoC-I in the CAST-ICAO Common Taxonomy Team (CICTT) taxonomy of occurrence categories means: *the loss of aircraft control while or deviation from intended flightpath inflight, being an extreme manifestation of a deviation from intended flightpath. The phrase "loss of control" may cover only some of the cases during which an unintended deviation occurred.* (Aviation Occurrence Categories, Definitions and Usage Notes, October 2011.)

[13] List of occurrences 2012-2016. Source: EASA Internal Occurrence Reporting System (IORS) repository.

In 10 (4 fatal accidents, 6 serious incidents) out of the 58 cases reviewed (23 accidents, 21 fatal accidents, 34 serious incidents) related to LoC-I (though, not necessarily categorised as such), it was assessed that the training of the flight crew in an enhanced-capability FSTD would have provided additional resources to the flight crew facilitating the detection firstly of the approach to stall and secondly of the full stall. Therefore, the training of the flight crew in an enhanced-capability FSTD would provide a clear safety benefit, especially with regard to the simulation of the icing conditions. **In 6 out of the 10 cases, the operators had an EASA AOC; 2 were fatal accidents and the other 4 serious incidents**.

In 7 cases (1 fatal accident) out of this 10, accretion of ice modified the aerodynamic performance of the aeroplane. In all these cases, the flight crew seemed to be surprised by the sudden manifestation of the effect of icing, causing them difficulties to control the aeroplane. In this situation, the crew had very little time to react and this led to an imminent LoC-I in all cases except one. **4 out of the 7 cases were serious incidents with operators having an EASA AOC.**

In the other 3 cases, the flight crew was unable to detect the approach to stall and later to exercise efficient flight control to recover from the stall. In all cases, the clear indication of an imminent stall, such as buffeting, did not trigger the correct fight crew reaction. However, it is acknowledged that in those situations, the flight crew normally suffers a cognitive saturation[14] that makes it difficult to process sensory information. **2 cases out of these 3 were with operators having an EAS AOC and both were fatal accidents.**

International Civil Aviation Organization (ICAO) and third-countries references relevant to the content of this RMT

References considered for alignment

— ICAO Doc 9625, 'Manual of Criteria for the Qualification of Flight Simulation Training Devices', 4th Edition, 2015;

— ICAO Doc 10011, 'Manual on Aeroplane Upset Prevention and Recovery Training', 1st Edition, 2014; and

— Federal Aviation Administration (FAA) 14 Code of Federal Regulations (CFR) Part 60, Flight Simulation Training Device Initial and Continuing Qualification and Use, Change 2, effective as of 31 May 2016

References to differences

No references.

[14] It is normal to experience cognitive saturation in an unexpected situation and it is the aim of the training to educate the flight crews how to identify a situation at the earliest stage and how to postpone the point where cognitive saturation starts. RMT.0196 aims at addressing these issues by increasing the fidelity of the FSTD training.

2.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 2[15] 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.

A baseline definition for this RMT is that training needs trigger simulator requirements, therefore, the current update of Part-FCL under the umbrella of Opinion 06/2017 (RMT.0581) dictates in certain areas the direction taken by this RMT.

The specific objectives of this RMT as stated in the related Terms of Reference (ToR) RMT.0196, Issue 1, are:

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

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

(c) to reinforce the level of safety by addressing the 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) to harmonise CS-FSTD(A) with elements of ICAO Doc 9625 (4th Edition) and FAA 14 CFR Part 60, Change 2, as appropriate;

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

(f) to align CS-FSTD(A) to the outcome of RMT.0581 'Loss of Control Prevention and Recovery Training'.

These objectives were addressed to the extent defined by the activities allocated to WP1 (please refer to Section 2.3 below).

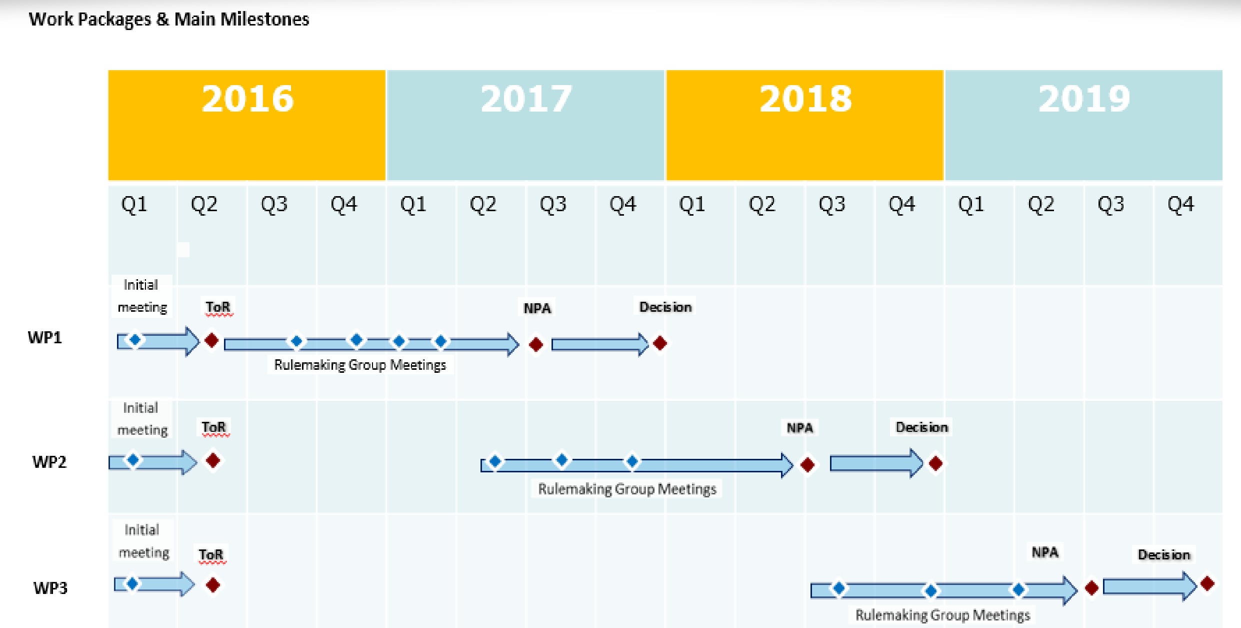
---

[15] Article 2 — *Objectives*

1. *The principal objective of this Regulation is to establish and maintain a high uniform level of civil aviation safety in Europe.*
2. *Additional objectives are, in the fields covered by this Regulation, as follows:*
   - *(a) to ensure a high uniform level of environmental protection;*
   - *(b) to facilitate the free movement of goods, persons and services;*
   - *(c) to promote cost-efficiency in the regulatory and certification processes and to avoid duplication at national and European level;*
   - *(d) to assist Member States in fulfilling their obligations under the Chicago Convention, by providing a basis for a common interpretation and uniform implementation of its provisions, and by ensuring that its provisions are duly taken into account in this Regulation and in the rules drawn up for its implementation;*
   - *(e) to promote Community views regarding civil aviation safety standards and rules throughout the world by establishing appropriate cooperation with third countries and international organisations;*
   - *(f) to provide a level playing field for all actors in the internal aviation market.*
3. *The means of achieving the objectives set out in paragraphs 1 and 2 shall be:*
   - *(a) the preparation, adoption and uniform application of all necessary acts;*
   - *(b) the recognition, without additional requirements, of certificates, licences, approvals or other documents granted to products, personnel and organisations in accordance with this Regulation and its implementing rules;*
   - *(c) the establishment of an independent European Aviation Safety Agency (hereinafter referred to as the Agency);*
   - *(d) the uniform implementation of all necessary acts by the national aviation authorities and the Agency within their respective areas of responsibility.*

Due to the complexity and volume of the FSTDs requirements update, RMG RMT.0196 decided to divide the task into three different WPs starting with the most urgent issues. A full achievement of the objectives is expected when the two subsequent WPs are also concluded.

Each WP will be concluded with a decision; those three decisions are planned to be published in three consecutive years. For WP1, the Decision is expected to be published in 2017/Q4 and, subsequently, for WP2 in 2018/Q4 and for WP3 in 2019/Q4. The following figure provides an overview of this RMT's deliverables:



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

As a general rule, when possible, the proposed technical specifications of CS-FSTD(A) are aligned with those of FAA 14 CFR Part 60, Change 2.

The aforementioned objectives are addressed through the following proposals of WP1[16]:

— determine if the FFSs' capability is appropriate to facilitate UPRT;

— create a definition of 'validated training envelope (VTE)[17]';

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

— review the FSTD inspector competencies framework;

— provide guidance on the use of an FSTD and its qualification level;

— ensure that a gap analysis between ICAO Doc 9625 (4th Edition) and CS-FSTD(A) is performed (WP2);

— align CS-FSTD(A) elements already present in CS-SIMD, as one constituent of operational suitability data (OSD), to avoid duplication of information (WP2);

16 Three of the activities contained in the related ToR RMT.0196, Issue 1, will be addressed through WP2, as indicated in the text.

17 This has been replaced by 'FSTD training envelope'.

— determine the use of special FSTDs for complex high-performance single-pilot aeroplane type rating training and checking when no full FFS qualified in accordance with CS-FSTD(A) exists for that type or is not readily available, and make proposals for amendments to the Aircrew Regulation, as appropriate; in this context, the term 'available' also needs to be further considered and defined (WP2); and

— in coordination with RMT.0379 'All-weather operations' (AWO), determine the necessary changes to CS-FSTD(A) to meet the AWO training needs.

The WP1 proposals were subdivided into three working areas, explained in the sections below:

— UPRT;

— FSTD inspector competencies framework; and

— guidance on FSTD-related training tasks.

2.3.1. UPRT

For UPRT, ToR RMT.0196, Issue 1[18], proposed the following activities:

— To determine if the FFSs' capability is appropriate to facilitate UPRT.

The evaluation criteria contained in CS-FSTD(A) are intended to address specific training tasks that require additional evaluation to ensure adequate FSTD fidelity.

The provisions of CS-FSTD(A), Appendix 9 to Part-FCL contain additional qualification criteria for specific training tasks applicable only to those FSTDs utilised for obtaining training, testing or checking credits within an EASA-approved flight training programme. In order for FSTD operators to have additional qualification for the tasks described in Book 2 of CS-FSTD(A) (AMC/GM), they must obtain a qualification certificate (QC). FSTDs that are found to meet the provisions of Appendix 9 will have their QC amended to reflect the additional training tasks that the FSTD has been qualified to conduct. The additional qualification provisions, as defined in Appendix 9, are divided into the following categories as per training tasks:

- Additional qualification provisions for post-stall training tasks: according to this proposal, qualifying the FSTD for post-stall capability is not mandated. Thus, training at post-stall stage is not mandated. However, it is still possible to demonstrate or provide training post-stall as long as the training organisation ensures that the FFS is qualified in accordance with CS-FSTD(A) (special evaluation), as well as to demonstrate to the competent authority (CA) how the ATO mitigates any potential negative transfer of training.
- Additional qualification provisions for UPRT tasks: it is proposed to qualify FSTDs for UPRT with defined IOS, as well as additional validation data provisions.
- Additional qualification provisions for engine and airframe icing training tasks.

A further proposal is to modify objective test provisions based upon the guidance of FAA 14 CFR Part 60, Change 2, on UPRT, stall and icing.

— To create a definition of 'validated training envelope (VTE)'.

[18] https://www.easa.europa.eu/document-library/terms-of-reference-and-group-compositions/tor-rmt0196

RMG RMT.0196 decided to replace this term with 'FSTD training envelope' to harmonise CS-FSTD(A) with FAA 14 CFR Part 60, Change 2;

— To provide guidance on instructor operating station (IOS) feedback tools such as for the interpretation of the V-n and alpha/beta diagrams in order to facilitate enhanced training in this area and provide better feedback on the realism of the exercise. Moreover, additional guidance is provided to explain the use of IOS in facilitating UPRT;

— In coordination with RMT.0379 'AWO', to determine the necessary changes to CS-FSTD(A) to meet the AWO training needs. RMG RMT.0196 came to the conclusion that there is no need for an update at this time (WP1).

The upcoming CS-FSTD(A), Issue 2, will have the following structure:

— Book 1 will include the amended provisions as per FAA 14 CFR Part 60, Change 2; and

— Book 2 will include 5 new AMCs, 1 new GM, a new definition of 'high angle of attack' modelling and an explanation of 'modelling continuity' (in AMC9 FSTD(A).300(3)):

- AMC9 FSTD(A).300 Guidance on upset, stall (including in icing conditions), and qualification of FSTDs: new AMC with detailed information related to the new subjective and objective training tests;
- AMC10 FSTD(A).300 Guidance on high-angle-of-attack/stall model evaluation to harmonise with FAA 14 CFR Part 60, Change 2;
- AMC11 FSTD(A).300 Guidance on high-angle-of-attack/stall model evaluation and approach to stall for qualified FSTDs to harmonise with FAA 14 CFR Part 60, Change 2;
- AMC12 FSTD(A).300 Guidance on upset prevention and recovery training (UPRT) for the FSTD standards table: new AMC with IOS requirements for UPRT;
- GM12 FSTD(A).300 Additional guidance on upset prevention and recovery training (UPRT) for the FSTD standards table; and
- AMC13 FSTD(A).300 Guidance material for engine and airframe icing evaluation provisions to harmonise with FAA 14 CFR Part 60, Change 2.

2.3.2. FSTD inspector competencies framework

ToR RMT.0196, Issue 1, envisages the revision of the FSTD inspector competencies framework. In particular, it proposes to:

— amend the existing initial evaluation procedure for inspectors;

— establish for the first time the required competencies of an FSTD inspector;

— include the experience required both for a technical inspector and a flight inspector; and

— clarify the initial as well as the recurrent training criteria of FSTD inspectors.

The current CS-FSTD(A) does not have an adequate level of granularity in terms of the expected and required FSTD inspectors qualification. The incorporation of AMC1 ARA.FSTD.101(a) FSTD inspector competency and training, GM1 ARA.FSTD.101(a) FSTD inspector competency, and GM2 ARA.FSTD.101(a) FSTD inspector training will facilitate the implementation of the applicable rules by the CAs. Furthermore, the new proposed AMC on the inspector competencies, as well as the GM on how to acquire those competencies, will facilitate the FSTD industry, thereby meeting the level playing field objective. Some aviation authorities have already implemented the training programme described in the new GM, providing a positive feedback. It is acknowledged that FSTD inspectors have a wide range of activities in various domains and, therefore, their competencies should cover this range and domains. However, the new AMC/GM are not considered to create an additional burden for the CAs.

2.3.3. Training tasks VS FSTD

— Provide guidance on the use of each device qualification level in relation to training, testing and checking;

— Determine the use of other FSTDs for complex high-performance single-pilot aeroplane type rating training and checking, when no FFS qualified in accordance with CS-FSTD(A) exists for that type or is not readily available, and propose amendments to the Aircrew Regulation, as appropriate; in this context, the term 'available' also needs to be further considered and defined (WP2).

One of the activities of WP1 is to provide guidance on the use of each FSTD for training based on its qualification level, and specifically, to:

— identify the FSTD credits for each initial-training licence or rating for fixed-wing and rotary-wing aircraft; and

— for each initial-training licence or rating, define the suitability of the FSTD for training in each task as partial, complete or none; when the task is partial, the task's proportion or elements that can be credited should be specified.

This guidance is expected to assist training providers in defining the use of appropriate FSTDs to support the training course syllabus, as well as CA inspectors in evaluating the training programme and the appropriate use of FSTDs, thus improving standardisation of both crediting and training.[19]

The related changes will be introduced into AMC/GM to Part-FCL through a new AMC.

2.4. What are the expected benefits and drawbacks of the proposals

The expected benefits and drawbacks of the proposal are summarised below. For the full impact assessment of alternative options, please refer to Chapter 4.

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

— safety improvement, by further mitigating LOC-I;

— full implementation of UPRT provisions;

— gains for the pilots, by receiving better and more accurate training in higher-fidelity FSTDs;

— gains for the instructors, by improving their ability to provide more accurate feedback during UPRT; and

[19] During the NPA public consultation, EASA expects comments from training providers which might lead to further amendments to the proposed text.

— a cost-efficient framework: the affected stakeholders will not incur significant costs.

The aim is to align CS-FSTD(A) as well as AMC/GM with FAA 14 CFR Part 60, Change 2 requirements and to update both Part-FCL and Part-ARA as per the ToR for RMT.0196, Issue 1, providing the different possibilities:

— for FSTD operators, to be optionally qualified for the post-stall regime to reduce the burden posed by having dual-qualified FSTDs; and

— for training providers, to be optionally qualified for the post-stall regime to be able to deliver training under the post-stall regime, if desired.

3. Proposed amendments and rationale in detail

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

— deleted text is ~~struck through~~;

— new or amended text is highlighted in grey;

— an ellipsis '[…]' indicates that the rest of the text is unchanged.

3.1. Draft certification specifications (Draft EASA decision)

3.1.1. CS-FSTD(A) — Book 1

1. Appendix 1 to CS FSTD(A).300 is amended as follows:

Draft resulting text

APPENDICES

Appendix 1 to CS FSTD(A).300 Flight Simulation Training Device Standards

[…]

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
	1. General											
a.1	A fully enclosed flight deck.	✓	✓	✓	✓							
a.2	A cockpit/flight deck sufficiently enclosed to exclude distraction, which will replicate that of the aeroplane or class of aeroplane simulated.						✓	✓	✓	✓	✓	
a.3	Flight deck, a full scale replica of the aeroplane simulated. Equipment for operation of the cockpit windows shall be included in the FSTD, but the actual windows need not be operable. The flight deck, for FSTD purposes, consists of all that space forward of a cross section of the fuselage at the most extreme aft setting of the pilots' seats. Additional required flight crew member duty stations and those required bulkheads aft of the pilot seats are also considered part of the flight deck and shall replicate the aeroplane.	✓	✓	✓	✓							Flight deck observer seats are not considered to be additional flight crew member duty stations and may be omitted. Bulkheads containing items such as switches, circuit breakers, supplementary radio panels, etc. to which the flight crew may require access during any event after preflight cockpit preparation is complete are considered essential and may not be omitted. Bulkheads containing only items such as landing gear pin storage compartments, fire axes or extinguishers, spare light bulbs, ~~aircraft~~aeroplane document pouches etc. are not considered essential and may be omitted. Such items, or reasonable facsimile, shall still be available in the FSTD but may be relocated to a suitable location as near as practical to the original position. Fire axes and any similar purpose instruments need only be represented in silhouette.
a.4	Direction of movement of controls and switches identical to that in the aeroplane.	✓	✓	✓	✓							

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
a.5	A full size panel of replicated system(s) which will have actuation of controls and switches that replicate those of the aeroplane simulated.					✓	✓					The use of electronically displayed images with physical overlay incorporating operable switches, knobs, buttons replicating aeroplane instruments panels may be acceptable to the competent authority.
a.6	Cockpit/flight deck switches, instruments, equipment, panels, systems, primary and secondary flight controls sufficient for the training events to be accomplished shall be located in a spatially correct flight deck area and will operate as, and represent those in, that aeroplane or class of aeroplane.							✓	✓	✓	✓	For Multi-Crew Cooperation (MCC) qualification additional instrumentation and indicators may be required. See table at start of this Appendix. For BITDs the switches and controls size and shape and their location in the cockpit shall be representative.
a.7	Crew members' seats shall be provided with sufficient adjustment to allow the occupant to achieve the design eye reference position appropriate to the aeroplane or class of aeroplane and for the visual system to be installed to align with that eye position.						✓		✓	✓		
b.1	Circuit breakers that affect procedures and/or result in observable cockpit indications properly located and functionally accurate.	✓	✓	✓	✓	✓	✓		✓	✓		

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
c.1	Flight dynamics model that accounts for various combinations of drag and thrust normally encountered in flight corresponding to actual flight conditions, including the effect of change in aeroplane attitude, sideslip, thrust, drag, altitude, temperature, gross weight, moments of inertia, centre of gravity location, and configuration.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	For FTD levels 1 and 2 aerodynamic modelling sufficient to permit accurate systems operation and indication is acceptable. For FNPTs and BITDs class-specific modelling is acceptable.
d.1	All relevant instrument indications involved in the simulation of the applicable aeroplane shall automatically respond to control movement by a flight crew member or induced disturbance to the simulated aeroplane; e.g., turbulence or wind shear.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	For FNPTs instrument indications sufficient for the training events to be accomplished. Reference AMC3 FSTD(A).300. For BITDs instrument indications sufficient for the training events to be accomplished. Reference AMC4 FSTD(A).300.
d.2	Lighting environment for panels and instruments shall be sufficient for the operation being conducted.					✓	✓	✓	✓	✓	✓	For FTD level 2 lighting environment shall be as per aeroplane.
d.3	Instrument indications respond appropriately to icing effects.			✓	✓							

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
e.1	Communications, navigation, and caution and warning equipment corresponding to that installed in the applicant's aeroplane with operation within the tolerances prescribed for the applicable airborne equipment.	✓	✓	✓	✓	✓	✓					For FTD 1 applies where the appropriate systems are replicated.
e.2	Navigation equipment corresponding to that of the replicated aeroplane or class of aeroplanes, with operation within the tolerances prescribed for the actual airborne equipment. This shall include communication equipment (interphone and air/ground communications systems).							✓	✓	✓	✓	
e.3	Navigational data with the corresponding approach facilities. Navigation aids should be usable within range without restriction.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	For FTD 1 applies where navigation equipment is replicated. For all FFSs and FTDs 2 where used for area or airfield competence training or checking, navigation data should be updated within 28 days. For FNPTs and BITDs complete navigational data for at least five different European airports with corresponding precision and non-precision approach procedures including current updating within a period of three months.

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
f.1	In addition to the flight crew member duty stations, three suitable seats for the instructor, delegated examiner and competent authority inspector. The competent authority shall consider options to this standard based on unique cockpit configurations. These seats shall provide adequate vision to the pilot's panel and forward windows. Observer seats need not represent those found in the aeroplane but in the case of FSTDs fitted with a motion system, the seats shall be adequately secured to the floor of the FSTD, fitted with positive restraint devices and be of sufficient integrity to safely restrain the occupant during any known or predicted motion system excursion.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	For FTDs and FNPT's suitable seating arrangements for the instructor and examiner or competent authority's inspector should be provided. For BITDs suitable viewing arrangements for the instructor shall be provided.

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
g.1	FSTD systems shall simulate applicable aeroplane system operation, both on the ground and in flight. Systems shall be operative to the extent that all normal, abnormal, and emergency operating procedures can be accomplished.	✓	✓	✓	✓	✓	✓		✓	✓		For FTD level 1, applies where system is simulated. For FNPTs systems shall be operative to the extent that it shall be possible to perform all normal, abnormal and emergency operations as may be appropriate to the aeroplane or class of aeroplanes being simulated and as required for the training.
g.2	For aeroplanes equipped with a stick pusher system, control forces, displacement, and surface position of the aeroplane correspond to those of the aeroplane being simulated.			✓	✓							A statement of compliance (SOC) is required verifying that the stick pusher system has been modelled, programmed, and validated using the aeroplane manufacturer's design data or other acceptable data source. The SOC must address, at a minimum, the stick pusher activation and cancellation logic as well as system dynamics, control displacement and forces as a result of the stick pusher activation.
h.1	Instructor controls shall enable the operator to control all required system variables and insert abnormal or emergency conditions into the aeroplane systems.	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Where applicable and as required for training the following shall be available: — position and flight freeze; — a facility to enable the dynamic plotting of the flight path on approaches, commencing at the final approach fix, including the vertical profile; — hard copy of map and approach plot.

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
h.2	The FSTD must have a real-time feedback tool to notify the instructor/evaluator whenever the FSTD training envelope or aeroplane operating limits have been exceeded. Additionally, and optionally, a recording mechanism may be utilised.			✓	✓							This feedback tool must include the following: (a) FSTD validation envelope: this must be in form of an alpha/beta envelope (or equivalent method) depicting the 'confidence level' of the aerodynamic model,. This 'confidence level' depending on the degree of flight validation or on the source of predictive methods. There must be a minimum of a flaps-up and flaps-down envelope available. (b) Flight control inputs: These must enable the instructor and examiner to assess the pilot's flight control displacements and forces (including fly-by-wire, as appropriate). (c) Aeroplane operational limits: this must display the aeroplane operating limits during the manoeuvre as applicable for the configuration of the aeroplane. An SOC is required that defines the source data used to construct the FSTD validation envelope. Please refer to AMC11 FSTD(A).300.

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
h.3	Upset scenarios: when equipped with instructor operating station (IOS) selectable dynamic aeroplane upsets, the IOS is to provide guidance on the method used to drive the FSTD into an upset condition, including any malfunction or degradation of the FSTD's functionality, required to initiate the upset. The unrealistic degradation of simulator functionality (such as degrading flight control effectiveness) to drive an aeroplane upset is generally not acceptable unless used purely as a tool for repositioning the FSTD with the pilot out of the loop.			✓	✓							An SOC is required, to confirm that each upset prevention and recovery feature programmed at the IOS and the associated training manoeuvre have been evaluated by a suitably qualified pilot. Please refer to AMC9 FSTD(A).300(a)(1).

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
i.1	Control forces and control travel shall correspond to that of the replicated aeroplane. Control forces shall react in the same manner as in the aeroplane under the same flight conditions.	✓	✓	✓	✓		✓	✓	✓	✓	✓	For FTD level 2 control forces and control travel should correspond to that of the replicated aeroplane with CT&M. It is not intended that the device should be flown manually other than for short periods when the autopilot is temporarily disengaged. For FNPT level I and BITDs control forces and control travel shall broadly correspond to that of the replicated aeroplane or class of aeroplane. Control force changes due to an increase/decrease in ~~aircraft~~aeroplane speed are not necessary. In addition, for FNPT level II and MCC control forces and control travels shall respond in the same manner under the same flight conditions as in the aeroplane or class of aeroplane being simulated.

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
j.1	Ground handling and aerodynamic programming shall include: (1) Ground Effect. For example: round-out, flare, and touchdown. This requires data on lift, drag, pitching moment, trim, and power ground effect. (2) Ground reaction – reaction of the aeroplane upon contact with the runway during landing to include strut deflections, tyre friction, side forces, and other appropriate data, such as weight and speed, necessary to identify the flight condition and configuration. (3) Ground handling characteristics – steering inputs to include crosswind, braking, thrust reversing, deceleration and turning radius.	✓	✓	✓	✓				✓	✓		Statement of compliance required. Tests required. For level 'A' FFS, generic ground handling to the extent that allows turns within the confines of the runway, adequate control on flare, touchdown and roll-out (including from a crosswind landing) only is acceptable. For FNPTs a generic ground handling model need only be provided to enable representative flare and touch down effects.

FLIGHT SIMULATION TRAINING DEVICE STANDARDS		FFS LEVEL				FTD LEVEL		FNPT LEVEL			BITD	COMPLIANCE
		A	B	C	D	1	2	I	II	MCC		
k.1	Wind shear models shall provide training in the specific skills required for recognition of wind shear phenomena and execution of recovery manoeuvres. Such models shall be representative of measured or accident derived winds, but may include simplifications which ensure repeatable encounters. For example, models may consist of independent variable winds in multiple simultaneous components. Wind models shall be available for the following critical phases of flight: (1) Prior to take-off rotation (2) At lift-off (3) During initial climb (4) Short final approach			✓	✓							Tests required. ~~See~~Please refer to AMC1 FSTD(A).300, (b)(3) 2.g.

[…]

s.1	Aerodynamic modelling ~~shall be provided. This shall~~ includes, for aeroplanes issued an original type certificate after June 1980, low altitude level flight ground effect, Mach effect at high altitude, normal and reverse dynamic thrust effect on control surfaces, aeroelastic representations, and representations of non-linearities due to sideslip based on aeroplane flight test data provided by the manufacturer.			✓	✓							Statement of compliance require, to: — include Mach effect, aeroelastic representations, and non-linearities due to sideslip;~~ are normally included in the FSTD aerodynamic model. The statement of Compliance shall address each of these items.~~ — include ~~S~~separate tests for thrust effects; and~~ a statement of compliance are required.~~ — determine that the combination of angle of attack and sideslip does not exceed the range of flight-test-validated data or wind tunnel/analytical data while performing the upset recovery manoeuvre. Please refer to AMC9 FSTD(A).300(a)(2).
s.2	The aerodynamic model has to incorporate an angle of attack and sideslip range to support the training tasks.			✓	✓							An SOC is required. Please refer to AMC9 FSTD(A).300(a)(3).
s.3	Applicable only for those FSTDs that are to be qualified for aerodynamic-stall training tasks. The aerodynamic modelling has to support stall-recovery training tasks in the following flight conditions: (a) stall entry at wing level (1g); (b) stall entry into turning flight of at least 25° bank angle (accelerated stall); (c) stall entry into a power-on condition (required only for propeller-driven			✓	✓							An SOC is required which describes the aerodynamic-modelling methods, validation, as well and check of the stall characteristics of the FSTD. The SOC has also to include a verification that the FSTD has been evaluated by a subject-matter expert pilot acceptable to the competent authority. Please refer to AMC10 FSTD(A).300. Please refer to AMC9 FSTD(A).300(a)(4). Please refer to AMC1 FSTD(A).200 for clarification of the 'near performance limited condition'.

	aeroplanes); and (d) aeroplane configurations of second-segment climb, high-altitude cruise ('near performance limited condition')**,** and approach or landing.											
t.1	Modelling that includes the effects of ~~airframe and engine~~ icing, where appropriate, on the airframe, aerodynamics, and the engine(s). Icing-effects simulation models are only required for aeroplanes authorised for operation in icing conditions.			✓	✓				~~✓~~	~~✓~~		~~Statement of compliance required.~~ Icing models must simulate the aerodynamic degradation effects of ice accretion on the aeroplane-lifting surfaces, including loss of lift, decrease in stall angle of attack, change in pitching moment, decrease in control effectiveness, and changes in control forces in addition to any overall increase in drag. Aeroplane systems (such as the stall protection system and auto flight system (must respond properly to ice accretion, consistent with the simulated aeroplane. Aeroplane original-equipment manufacturer (OEM) data or other acceptable analytical methods must be used to develop ice accretion models. Acceptable analytical methods may include wind tunnel analysis and/or engineering analysis of the aerodynamic effects of icing on the aeroplane-lifting surfaces coupled with tuning and supplemental subjective assessment by a subject-matter expert pilot. An SOC is required ~~shall~~ describ~~e~~ing the effects that provide training in the specific skills ~~required~~ for recognition of icing phenomena and execution of recovery. The SOC must describe the source data and any analytical methods used to develop ice accretion models, including a verification that these effects have been tested. Please refer to AMC12 FSTD(A).300.

t.2	Modelling that includes the effects of airframe and engine icing. Icing-effects simulation models are only required for those aeroplanes authorised for operations in icing conditions.								✓	✓		An SOC is required describing the effects that provide training in the specific skills for recognition of icing phenomena and execution of recovery.

[…]

	2. Motion system											
a.1	Motion cues as perceived by the pilot shall be representative of the aeroplane, e.g. touchdown cues shall be a function of the simulated rate of descent.	✓	✓	✓	✓							For FSTDs where motion systems are not specifically required, but have been added, they will be assessed to ensure that they do not adversely affect the qualification of the FSTD. Special consideration is given to the motion system response during upset prevention and recovery manoeuvres. Notwithstanding the limitations of simulator motion, specific emphasis has to be placed on tuning out objectionable motion system responses.
b.1	A motion system shall: (1) provide sufficient cueing, which may be of a generic nature to accomplish the required tasks;	✓										Statement of compliance required. Tests required.
	(2) have a minimum of 3 degrees of freedom (pitch, roll & heave); and		✓									
	(3) produce cues at least equivalent to those of a six-degrees-of-freedom synergistic platform motion system.			✓	✓							
c.1	A means of recording the motion response time as required.	✓	✓	✓	✓							

d.1	Motion effects programming shall include: (1) effects of runway rumble, oleo deflections, groundspeed, uneven runway, centreline lights and taxiway characteristics; (2) buffets on the ground due to spoiler/speedbrake extension and thrust reversal; (3) bumps associated with the landing gear; (4) buffet during extension and retraction of landing gear; (5) buffet in the air due to flap and spoiler/speedbrake extension; (6) approach to stall buffet and stall buffet (where applicable); (7) touchdown cues for main and nose gear; (8) nose wheel scuffing; (9) thrust effect with brakes set; (10) Mach and manoeuvre buffet; (11) tyre failure dynamics; (12) engine malfunction and engine damage; and (13) tail and pod strike.	✓	✓	✓	✓							For level ‘A’ FFS: effects may be of a generic nature sufficient to accomplish the required tasks. If there are known flight conditions where buffet is the first indication of the stall, or where no stall buffet occurs, this characteristic should be included in the model.

[…]

	4. Sound System											
a.1	Significant flight deck sounds which result from pilot actions corresponding to those of the aeroplane or class of aeroplane.	✓	✓	✓	✓		✓	✓	✓	✓	✓	For FNPT level I and BITD engine sounds only need to be available.
b.1	Sound of precipitation, rain removal equipment and other significant aeroplane noises perceptible to the pilot during normal and abnormal operations and the sound of a crash when the FSTD is landed in excess of limitations.			✓	✓							A ~~S~~statement of compliance is required. Sounds have to be directionally representative. For FSTDs qualified for full-stall training tasks, sounds associated with stall buffet have to be replicated, if significant in the aeroplane.
c.1	Comparable amplitude and frequency of flight deck noises, including engine and airframe sounds. The sounds shall be coordinated with the required weather.				✓							Tests required.
d.1	The volume control shall have an indication of sound level setting which meets all qualification requirements.	✓	✓	✓	✓							

Rationale

The FSTD provisions are updated for qualifying FSTDs Level C and D, by addressing the following:

— enhancement of stall characteristics (for those FSTDs to be qualified for aerodynamic-stall training tasks);

— aerodynamic modelling;

— UPRT (upset scenarios and IOS requirements);

— icing effects; and

— motion cues and effects.

The proposed amendments to CS-FSTD(A) (Book 1) aim at aligning with the current regulatory text from FAA 14 CFR Part 60, Change 2.

3.1.2. CS-FSTD(A) — Book 2

1. AMC1 FSTD(A).200 is amended as follows:

Draft resulting text

SUBPART B — TERMINOLOGY

AMC1 FSTD(A).200 Terminology and abbreviations

(a) Terminology

In addition to the principal terms defined in the requirement itself, additional terms used in the context of CS-FSTD(A) and CS-FSTD(H) have the following meanings:

[…]

— 'FSTD training envelope' means high- and moderate-confidence regions of the FSTD validation envelope.

[…]

— 'High angle of attack' means flying at an angle higher than in normal operation beyond the first indication of stall or stall protection systems, whichever occurs first.

[…]

— 'Near performance limited condition' (when related to approach to stall or stall) means a stall event occurring close to the lowest limit of the following:

- maximum certified altitude (structural);
- thrust-limited altitude; and
- buffet- or manoeuvre-limited altitude.

Stall data above flight level (FL) 250 should generally be acceptable.

[…]

(b) Abbreviations

[…]

EVS = enhanced vision system

[…]

FMS = flight management system

[…]

GNSS = global navigation satellite system

[…]

HUGS = head-up guidance system

[…]

MMO = maximum operating Mach

[…]

PBN = performance-based navigation

[…]

VMO = maximum operating limit airspeed

Rationale

This AMC has been updated to introduce definition of terms and abbreviations associated with UPRT, high angle of attack, and stall.

2. AMC1 FSTD(A).300 is amended as follows:

Draft resulting text

SUBPART C — AEROPLANE FLIGHT SIMULATION TRAINING DEVICES

AMC1 FSTD(A).300 Qualification basis

(a) Introduction

(1) Purpose

[…]

(2) Background

(i) The availability of advanced technology has permitted greater use of FSTDs for training, testing and checking of flight crew members. The complexity, costs and operating environment of modern aeroplane also encourage broader use of advanced simulation. FSTDs can provide more in-depth training than can be accomplished in aeroplane and provide a safe and suitable learning environment. Fidelity of modern FSTDs is sufficient to permit pilot assessment with the assurance that the observed behaviour will transfer to the aeroplane. Fuel conservation and reduction in adverse environmental effects are important by-products of FSTD use.

(ii) The methods, procedures, and testing criteria contained in this AMC are the result of the experience and expertise of competent authorities, operators, and aeroplane and FSTD manufacturers. From 1989 to 1992 a specially convened international working group under the sponsorship of the Royal Aeronautical Society (RAeS) held several meetings with the stated purpose of establishing common test criteria that would be recognised internationally. The final RAeS document, entitled International Standards for the Qualification of Airplane Flight Simulators, dated January 1992 (ISBN 0–903409–98–4), was the core document used to establish these criteria and also the ICAO Doc 9625 Manual of Criteria for the Qualification of Flight Simulators (1995 or as amended). An international review under the co-chair of FAA and JAA during 2001 was the basis for a major modification of the ICAO Manual and for this CS.

[…]

Table of FSTD Validation Tests

TESTS	**TOLERANCE**	**FLIGHT CONDITIONS**	**FSTD LEVEL**										**COMMENTS**
			FFS				**FTD**		**FNPT**			**BITD**	
			A	**B**	**C**	**D**	**Init**	**Rec**	**I**	**II**	**MCC**		
													For FNPT and BITD CT&M should be used for initial evaluations. The tolerances should be applied for recurrent evaluations (see AMC1 FSTD(A).300 (a)(5)(iv)). It is accepted that tests and associated tolerances only apply to a level 1 FTD if that system or flight condition is simulated.
1. PERFORMANCE													

[…]

2. HANDLING QUALITIES													
a. STATIC CONTROL CHECKS													NOTE: Pitch, roll and yaw controller position vs. force or time should be measured at the control. An alternative method is to instrument the FSTD in an equivalent manner to the flight test aeroplane. The force and position data from this instrumentation should be directly recorded and matched to the aeroplane data. Such a permanent installation could be used without any time for installation of external devices. CCA: Testing of position versus force is not applicable if forces are generated solely by use of aeroplane hardware in the FSTD.
(1) Pitch controller position vs. force and surface position calibration.	± 0·9 daN (2 lbs) breakout. ± 2·2 daN (5 lbs) or ± 10% force. ± 2º elevator angle	Ground	✓	✓	✓	✓	C T & M	✓					Uninterrupted control sweep to stops. Should be validated (where possible) with inflight data from tests such as longitudinal static stability, stalls, etc. Static and dynamic flight control tests should be accomplished at the same feel or impact pressures.

Column position vs. force only.	± 2.2 daN (5 lbs) or ± 10% force.	Cruise or approach							✓	✓	✓	✓	FNPT 1 and BITD: control forces and travel should broadly correspond to that of the replicated class of aeroplane.

[…]

(10) Stick pusher system force calibration (if applicable)	± 10 % or ± 5 lb (2.2 daN) stick/column transient force	Ground or flight			✓	✓							This test is intended to validate the stick/column transient force resulting from a stick pusher system activation. This test may be conducted in an on-ground condition through stimulation of the stall protection system in a manner that generates a stick pusher response representative of an in-flight condition. Aeroplane manufacturer design data may be utilised as validation data, if acceptable to the competent authority. The test provisions may be met through column force validation testing in conjunction with the stall characteristics test (please refer to AMC1 FSTD(A).300(2)(c)(8)).

b. DYNAMIC CONTROL CHECKS													Tests 2.b(1), 2.b(2), and 2.b(3) are not applicable if dynamic response is generated solely by use of aeroplane hardware in the flight simulator. Power setting may be that required for level flight unless otherwise specified.
(1) Pitch control.	<u>For underdamped systems:</u> ± 10% of time from 90% of initial displacement (A_d) to first zero crossing and ± 10(n+1)% of period thereafter ± 10% amplitude of first overshoot applied to all overshoots greater than 5% of initial displacement (A_d). ± 1 overshoot (first significant overshoot should be matched) <u>For overdamped systems:</u> ± 10% of time from 90% of initial displacement (A_d) to 10 % of initial displacement (0·1 A_d).	Take-off, cruise, and landing			✓	✓							Data should be for normal control displacements in both directions (approximately 25% to 50% full throw or approximately 25% to 50% of maximum allowable pitch controller deflection for flight conditions limited by the manoeuvring load envelope). Tolerances apply against the absolute values of each period (considered independently). n = The sequential period of a full oscillation. Please r~~R~~efer to AMC1 FSTD(A).300(b)(4)(i).

(2) Roll control.	<u>For underdamped systems:</u> ± 10% of time from 90% of initial displacement (A_d) to first zero crossing and ± 10(n+1)% of period thereafter. ± 10% amplitude of first overshoot applied to all overshoots greater than 5% of initial displacement (A_d). ± 1 overshoot (first significant overshoot should be matched) <u>For overdamped systems:</u> ± 10% of time from 90% of initial dis-placement (A_d) to 10 % of initial dis-placement (0·1 A_d).	Take-off, cruise, and landing			✓	✓							Data should be for normal control displacement (approximately 25% to 50% of full throw or approximately 25% to 50% of maximum allowable roll controller deflection for flight conditions limited by the manoeuvring load envelope). Please r~~R~~efer to AMC1 FSTD(A).300(b)(4)(i).

(3) Yaw control.	<u>For underdamped systems:</u> ± 10% of time from 90% of initial displacement (A_d) to first zero crossing and ± 10(n+1)% of period thereafter. ± 10% amplitude of first overshoot applied to all overshoots greater than 5% of initial displacement (A_d). ± 1 overshoot (first significant overshoot should be matched) <u>For overdamped systems:</u> ± 10% of time from 90% of initial displacement (A_d) to 10 % of initial displacement (0·1 A_d).	Take-off, cruise, and landing			✓	✓							Data should be for normal displacement (approximately 25% to 50% of full throw). Please r~~R~~efer to AMC1 FSTD(A).300(b)(4)(i).

[…]

c. LONGITUDINAL													Power setting may be that required for level flight unless otherwise specified.
(1) Power change dynamics.	± 3 kts airspeed ± 30 m (100 ft) altitude. ± 1.5º or ± 20% pitch angle	Approach	✓	✓	✓	✓	C T & M	✓		✓	✓		Power change from thrust for approach or level flight to maximum continuous or go-around power. Time history of uncontrolled free response for a time increment equal to at least 5 s before initiation of the power change to completion of the power change + 15 s. CCA: Test in normal AND non-normal control state.
Power change force	± 2.2 daN (5 lbs) or ± 10% Force	Approach							✓	✓	✓	✓	For an FNPT I and a BITD the power change force test only is acceptable.

[…]

(8a) Stall characteristics.	~~± 3 kts airspeed for initial buffet, stall warning, and stall speeds.~~ ~~For aeroplanes with reversible flight control systems (for FS only):~~ ~~± 10% or ± 2·2 daN (5 lb) column force (prior to g-break only.)~~ ± 3 kt airspeed for	2nd segment climb, high altitude cruise (near performance limited condition) and approach or landing	~~✓~~	~~✓~~	✓	✓	~~✓~~	~~✓~~	~~✓~~	~~✓~~	~~✓~~	~~✓~~	~~Wings-level 1 g stall entry with thrust at or near idle power. Time history data should be shown to include full stall and initiation of recovery. Stall warning signal should be recorded and should occur in the proper relation to stall. FSTDs for aeroplanes exhibiting a sudden pitch attitude change or 'g break' should demonstrate this~~

	stall warning and stall speeds. ±2° angle of attack for the buffet threshold of perception and for the initial buffet based upon the Nz component. Approach to stall: ±2.0° pitch angle; ±2.0° angle of attack; and ±2.0° bank angle Stall warning up to stall: ±2.0° pitch angle; ±2.0° angle of attack; and correct trend and magnitude for roll rate and yaw rate Stall break and recovery: see AMC10 FSTD(A).300 Additionally, for those simulators with reversible flight control systems or equipped with stick pusher systems: ± 10% or ± 2·2 daN (5 lb) stick/column force (prior to the												~~characteristic.~~ ~~CCA: Test in normal AND non-normal control state.~~ ~~FNPT and BITD: Test should determine the actuation of the stall warning device only.~~ Please refer to AMC9 FSTD(A).300(b)(1). CCA: test in normal and non-normal control states. In normal state, it is expected that envelope protections will take effect, and it may not be possible to reach the aerodynamic-stall condition. In these circumstances, it is adequate to complete the test until the envelope protection is cancelled. In non-normal state, it is necessary to perform the test to the aerodynamic stall. It is understood that flight test data may not be available and in this circumstance, engineering validation data may be used and the extent of the test should be adequate to allow training through to recovery, in accordance with the training objectives. For safety of flight considerations, the flight test data may be limited to the stall angle of attack, and the

	stall angle of attack).												modelling beyond the stall angle of attack is limited to continuity and completion of recovery.
(8b) Approach-to-stall characteristics	±3 kt airspeed for stall-warning speeds. ±2.0° angle of attack for initial buffet: ±2.0° pitch angle; ±2.0° angle of attack; and ±2.0° bank angle. Additionally, for those aeroplanes with reversible flight control systems: ±10 % or ±5 lb (2.2 daN)) stick/column force.	2nd segment climb, high altitude cruise (near performance limited condition) and approach or landing	✓	✓			✓	✓	✓	✓	✓	✓	Please refer to AMC9 FSTD(A).300(b)(2). CCA: test in normal and non-normal control states.
(9) Phugoid dynamics.	± 10% period. ± 10% time to ½ or double amplitude or ± 0·02 of damping ratio.	Cruise	✓	✓	✓	✓				✓	✓		Test should include three full cycles or that necessary to determine time to ½ or double amplitude, whichever is less. CCA: Test in non-normal control state.
	± 10% Period with representative damping	Cruise							✓			✓	Test should include at least three full cycles. Time history recommended.

(10) Short period dynamics.	± 1·5º pitch angle or ± 2º/s pitch rate. ± 0·1 g normal acceleration.	Cruise	✓	✓	✓	✓				✓	✓		CCA: Test in normal AND non-normal control state.
d. LATERAL DIRECTIONAL													Power setting may be that required for level flight unless otherwise specified.
(1) Minimum control speed, air (V_{MCA} or V_{MCL}), per applicable airworthiness standard – or – Low speed engine inoper-ative handling characteristics in the air.	± 3 kts airspeed	Take-off or landing (whichever is most critical in the aeroplane)	C T & M	✓	✓	✓	C T & M	✓	✓	✓	✓	✓	Minimum speed may be defined by a performance or control limit which prevents demonstration of V_{MC} or V_{MCL} in the conventional manner. Take-off thrust should be set on the operating engine(s). Time history or snapshot data may be used. CCA: Test in normal OR non-normal control state. FNPT and BITD: It is important that there exists a realistic speed relationship between V_{mca} and V_s for all configurations and in particular the most critical full-power engine-out take-off configurations.

[…]

(8) Steady state sideslip.	For a given rudder position: ± 2º bank angle ± 1º sideslip angle ± 10% or ± 2º aileron ± 10% or ± 5º spoiler or equivalent roll controller position or force For FFSs representing ~~aircraft~~aeroplane with reversible flight control systems: ±10% or ±1·3 daN (3 lb) wheel force ±10% or ±2·2 daN (5 lb) rudder pedal force.	Approach or landing	✓	✓	✓	✓			✓	✓	✓	✓	May be a series of snapshot tests using at least two rudder positions (in each direction for propeller driven aeroplanes) one of which should be near maximum allowable rudder. For FNPT and BITD a roll controller position tolerance of ± 10% or ± 5º applies instead of the aileron tolerance. For a BITD the force tolerance should be CT&M.

[…]

f. GROUND EFFECT													
(1) A Test to demonstrate ground effect.	± 1º elevator ± 0·5º stabilizer angle. ± 5% net thrust or equivalent. ± 1º AOA ± 1·5 m (5 ft) or ± 10% height ± 3 kts airspeed ± 1º pitch angle	Landing		✓	✓	✓							Please r~~R~~efer to AMC1 FSTD(A).300(b)(4)(ii). A rationale should be provided with justification of results. CCA: Test in normal OR non-normal control state.

[…]

i. ENGINE AND AIRFRAME ICING EFFECTS													
(1) Engine and airframe icing effects Demonstration (high angle of attack)	± 3 kt airspeed. ± 0.5 m/s (100 ft/ min) or ±5 % rate of climb, but not less than aeroplane performance data.	Take-off or approach or landing (one flight condition, two tests: ice on and ice off)			✓	✓							Please refer to AMC9 FSTD(A).300(b)(3).
3. MOTION SYSTEM													
a. Frequency response	As specified by the applicant for FFS qualification.	n/a	✓	✓	✓	✓							Appropriate test to demonstrate frequency response required. See also AMC1 FSTD(A).300 (b)(4)(iii)(B)

[…]

g. Characteristic motion vibrations	None	Ground and flight											The recorded test results for characteristic buffets should allow the comparison of relative amplitude versus frequency. For atmospheric disturbance testing, general purpose disturbance models that approximate demonstrable flight test data are acceptable. Principally, the flight simulator results should exhibit the overall appearance and trends of the aeroplane plots, with at least some of the frequency “spikes” being present within 1 or 2 Hz of the aeroplane data. See AMC1 FSTD(A).300 (b)(4)(iii)(E).
The following tests with recorded results and an SOC are required for characteristic motion vibrations, which can be sensed at the flight deck where applicable by aeroplane type:													
(1) Thrust effects with brakes set	n/a	Ground				✓							Test should be conducted at maximum possible thrust with brakes set.

[…]

(6) Stall buffet	n/a	Cruise (high altitude), second-segment climb, and approach or landing.			✓	✓							Test required only for FSTDs qualified for full stall training tasks or for those aeroplanes which exhibit stall buffet before the activation of the stall-warning system. Tests must be conducted for an angle of attack range between the buffet threshold of perception to the pilot and the stall angle of attack. Post-stall characteristics are not required. If stabilised flight data between buffet threshold of perception and stall angle of attack are not available, PSD analysis should be conducted for a time span between initial buffet and stall angle of attack.
(~~6~~7) High speed or Mach buffet	n/a	Flight				✓							Test condition should be for high speed manoeuvre buffet/wind-up-turn or alternatively Mach buffet.
(~~7~~8) In-flight vibrations	n/a	Flight (clean configuration)				✓							Test should be conducted to be representative of in-flight vibrations for propeller driven aeroplanes.

[…]

Rationale

This 'Table of FSTD Validation Tests' is proposed to be updated to incorporate acceptable means to comply with objective provisions relating to stick pusher, stall, approach-to-stall characteristics, engine and airframe icing effects, and stall buffet.

Draft rule text

Functions and subjective tests

TABLE OF FUNCTIONS AND SUBJECTIVE TESTS	FFS				FTD		FNPT			BITD
	A	B	C	D	1	2	I	II	MCC	
a PREPARATION FOR FLIGHT										
(1) Preflight. Accomplish a functions check of all switches, indicators, systems, and equipment at all crew members' and instructors' stations and determine that:										
(a) the flight deck design and functions are identical to that of the aeroplane or class of aeroplane simulated	✓	✓	✓	✓	✓	✓	✓	✓	✓	
(b) design and functions represent those of the simulated class of aeroplane										✓

[...]

f MANOEUVRES										
(1)(a) High angle of attack, approach to stalls, stall warning~~,~~ and stall buffet, (and g-break if applicable)(take-off, cruise, approach, and landing configuration) including reaction of the autoflight system and stall protection system	✓	✓	~~✓~~	~~✓~~	✓	✓	✓	✓	✓	✓
(1)(b) High angle of attack, approach to stalls, stall warning, stall buffet and stall (take-off, cruise, approach, and landing configuration) including reaction of the autoflight system and stall protection system			✓	✓						
(1)(c) Upset prevention and recovery manoeuvre within the FSTD validation envelope			✓	✓						
(2) Flight envelope protection (high angle of attack, bank limit, overspeed, etc.)	✓	✓	✓	✓	✓	✓				
(3) Turns with/without speedbrake/spoilers deployed	✓	✓	✓	✓	✓	✓	✓	✓	✓	
(4) Normal and standard rate turns	✓	✓	✓	✓						✓
(5) Steep turns	✓	✓	✓	✓						✓
(6) Performance turn	✓	✓	✓	✓						
(7) In-flight engine shutdown and restart (assisted and windmill)	✓	✓	✓	✓	✓	✓			✓	
(8) Manoeuvring with one or more engines inoperative, as appropriate	✓	✓	✓	✓	✓	✓	✓(2)	✓	✓	✓(2)
(9) Specific flight characteristics (e.g. direct lift control)	✓	✓	✓	✓	✓	✓				

(10) Flight control system failures, reconfiguration modes, manual reversion and associated handling	✓	✓	✓	✓	✓	✓			✓	
(11) Other	✓	✓	✓	✓	✓	✓				

[…]

n MOTION EFFECTS										

[…]

(5) Buffet in the air due to flap and spoiler/speedbrake extension ~~and approach to stall buffett~~ (a) First perform an approach and extend the flaps and slats, especially with airspeeds deliberately in excess of the normal approach speeds. In cruise configuration verify the buffets associated with the spoiler/speedbrake extension. The above effects could also be verified with different combinations of speedbrake/flap/gear settings to assess the interaction effects	*	✓	✓	✓						

(6) Approach to stall buffet and stall buffet (where applicable) (a) Conduct an approach-to-stall with engines at idle and a deceleration of 1 kt/s. Check that the motion cues of the buffet, including the level of buffet increase with decreasing speed, are reasonably representative of the actual aeroplane Note: For FSTDs qualified for full-stall training tasks, modelling that accounts for any increase in buffet amplitude from the initial buffet threshold of perception to the critical angle of attack or deterrent buffet as a function of the angle of attack; the stall buffet modelling should include effects of Nz, as well as Nx and Ny, if relevant.	✓	✓	✓	✓						

[…]

p SPECIAL EFFECTS										

[…]

(2) Effects of Airframe and Engine Icing (a) See Appendix 1 to CS FSTD(A).300 1.t.1 Required only for those aeroplanes authorised for operations in known icing conditions. With the FSTD airborne, autopilot on and auto-throttles off, engine and aerofoil anti-ice/de-ice systems deactivated; activate icing conditions at a rate that allows monitoring of the FSTD and systems' response. Icing recognition typically includes airspeed decay, change in FSTD pitch attitude, change in engine performance indications (other than due to airspeed changes), and change in data from the pitot/static system. Activate heating, anti-ice, or de-ice systems independently. Recognition includes proper effects of these systems, eventually returning the simulated aeroplane to normal flight. Please refer to AMC12 FSTD(A).300.			✓	✓						

NOTE: For level 'A', an asterisk (*****) denotes that the appropriate effect is required to be present.
NOTE: It is accepted that tests will only apply to FTD level 1 if that system and flight condition is simulated. It is intended that the tests listed below should be conducted in automatic flight. Where automatic flight is not possible and pilot manual handling is required, the FTD should be at least controllable to permit the conduct of the flight.

[…]

Rationale

This 'Functions and subjective tests' table is proposed to be updated to incorporate acceptable means to comply with functions and subjective test provisions relating to high angle of attack, approach to stall, upset prevention and recovery manoeuvres within the FSTD validation envelope, approach-to-stall buffet, stall buffet (where applicable), as well as effects of airframe and engine icing.

3. Appendix 8 to AMC1 FSTD(A).300 is amended as follows:

Draft resulting text

Appendix 8 to AMC1 FSTD(A).300 General technical requirements for FSTD qualification levels

This appendix summarises the general technical requirements for full flight simulators level A, B, C and D, flight training devices level 1 and 2, flight navigation procedures trainers level I, II and IIMCC, and basic instrument training devices.

Table 1: General technical requirements for level A, B, C and D full flight simulators (FFS)

Qualification Level	General technical requirements
A	The lowest level of FFS technical complexity. An enclosed full-scale replica of the aeroplane cockpit/flight deck including simulation of all systems, instruments, navigational equipment, communications and caution and warning systems. An instructor's station with seat should be provided. Seats for the flight crew members and two seats for inspectors/observers should also be provided. Control forces and displacement characteristics should correspond to that of the replicated aeroplane and they should respond in the same manner as the aeroplane under the same flight conditions. The use of class specific data tailored to the specific aeroplane type with fidelity sufficient to meet the objective tests, functions and subjective tests is allowed. Generic ground effect and ground handling models are permitted. Motion, visual and sound systems sufficient to support the training, testing and checking credits sought are required. The visual system should provide at least 45 degrees horizontal and 30 degrees vertical field of view per pilot. The response to control inputs should not be greater than 300 ms more than that experienced on the ~~aircraft~~aeroplane.
B	As for level A plus: Validation flight test data should be used as the basis for flight and performance and systems characteristics. Additionally ground handling and aerodynamics programming to include ground effect reaction and handling characteristics should be derived from validation flight test data.

C	The second highest level of FFS fidelity. As for level B plus: A daylight/twilight/night visual system is required with a continuous, cross-cockpit, minimum collimated visual field of view providing each pilot with 180 degrees horizontal and 40 degrees vertical field of view. A six-degrees-of-freedom motion system should be provided. The sound simulation should include the sounds of precipitation and other significant aeroplane noises perceptible to the pilot and should be able to reproduce the sounds of a crash landing. The response to control inputs should not be greater than 150 ms more than that experienced on the airplane. Windshear simulation should be provided. An upset prevention and recovery training (UPRT) instructor operating station (IOS) feedback mechanism should be available.
D	The highest level of FFS fidelity. As for level C plus: Extended set of sound and motion buffet tests.

[…]

Rationale

This Appendix proposes to add the provision on the UPRT instructor operating station (IOS) feedback mechanism for Level C and D FSTDs in order to enable those FSTDs to support UPRT.

4. New AMC9 FSTD(A).300 is inserted as follows:

Draft resulting text

AMC9 FSTD(A).300 Guidance on upset, stall (including in icing conditions), and qualification of FSTDs

(a) Flight Simulation Training Device Standards table of Appendix 1 to CS FSTD(A).300

(1) 1. General, h.3:

(i) a suitably qualified pilot should:

(A) hold a type rating qualification for the aeroplane being simulated;

(B) have first-hand experience in recovering upset situations on a real aeroplane; and

(C) be familiar with the upset scenarios and associated recovery methods as well as the cues necessary to accomplish the required training objectives;

(ii) the statement of compliance (SOC) should also confirm that for each upset scenario, the recovery manoeuvre can be performed such that the FSTD does not exceed the FSTD validation envelope, or when the envelope is exceeded, that the FSTD is within the realms of confidence in the simulation accuracy;

(iii) the unrealistic degradation of the FSTD functionality (such as degrading flight control effectiveness) to drive an aeroplane upset is not acceptable unless used purely as a tool for repositioning the FSTD with the pilot out of the loop; and

(iv) consideration should be given to flight-envelope-protected aeroplanes as artificially positioning the aeroplane to a specified attitude may incorrectly initialise flight control laws.

(2) 1. General, s.1:

(i) the FSTD should be evaluated for specific upset recovery manoeuvres; a minimum set of manoeuvres:

(A) a nose-high wings level aeroplane upset;

(B) a nose-low aeroplane upset; and

(C) a high bank-angle aeroplane upset;

(ii) other upset recovery scenarios, as developed by the FSTD operator, should be evaluated in the same manner; and

(iii) these evaluations should be made available to the instructor/evaluator.

(3) 1. General, s.2:

(i) for continuity purposes, the model should remain contiguous beyond the FSTD training envelope to the extent to allow completion of the recovery training; and

(ii) where known limitations exist in the aerodynamic model for particular stall event manoeuvres (such as aeroplane configuration, approach-to-stall entry methods, and limited range for continuity of the modelling), these limitations should be declared in the required SOC.

(4) 1. General, s.3:

(i) the aerodynamic-stall modelling should include degradation of the static/dynamic lateral directional stability;

(ii) degradation in control response (pitch, roll, and yaw), uncommanded roll response or roll-off requiring significant control deflection to counter;

(iii) apparent randomness or non-repeatability;

(iv) changes in pitch stability;

(v) Mach effects; and

(vi) stall buffet,

as appropriate to the aeroplane type;

(A) the model should be capable of capturing the variations seen in the stall characteristics of the aeroplane (e.g. the presence or absence of a pitch break, deterrent buffet, or other indications of a stall where present on the aeroplane);

(B) where known limitations exist in the aerodynamic model for particular stall manoeuvres (such as aeroplane configuration and stall-entry methods), these limitations must be declared in the required SOC;

(C) specific guidance should be available to the instructor which clearly communicates the flight configurations and stall manoeuvres that have been evaluated in the FSTD for use in training; and

(D) FSTDs qualified for full-stall training tasks must also meet the instructor operating station (lOS) provisions for upset prevention and recovery training (UPRT) tasks as described under 1. General, h.2 of the FSTD standards table.

(b) FSTD validation tests

(1) Stall characteristics test:

(i) Control inputs must be plotted and demonstrate correct trend and magnitude.

(ii) Each of the following stall entries must be demonstrated in at least one of the three flight conditions:

(A) stall entry at wings level (1 g);

(B) stall entry in turning flight of at least 25° bank angle (accelerated stall); and

(C) stall entry in a power-on condition (required only for propeller-driven aeroplanes).

(iii) The cruise flight condition must be conducted in a flaps-up (clean) configuration. The second-segment climb flight condition must use a different flap setting than for the approach or landing flight condition.

(iv) The stall warning signal and initial buffet, if applicable, must be recorded. Time history data must be recorded for a full stall through recovery to normal flight. The stall warning signal must occur in the proper relation to buffet/stall. FSTDs of aeroplanes exhibiting a sudden pitch attitude change or 'g break' must demonstrate this characteristic. FSTDs of aeroplanes exhibiting a roll-off or loss-of-roll control authority must demonstrate this characteristic.

(v) Numerical tolerances are not applicable past the stall angle of attack, but must demonstrate correct trend through recovery. Please refer to AMC10 FSTD(A).300 for additional information concerning data sources and required angle-of-attack ranges.

(vi) For aeroplanes with stall envelope protection systems, the normal-mode testing is only required at an angle-of-attack range necessary to demonstrate the correct operation of the system. These tests may be used to satisfy the required (angle of attack) flight manoeuvre and envelope protection tests of AMC1 FSTD(A).300. Non-normal control states must be tested through stall identification and recovery.

(vii) In instances where flight test validation data is limited due to safety-of-flight considerations, engineering simulator validation data may be used in lieu of flight test validation data for angles of attack that exceed the activation of a stall protection system or stick pusher system.

(viii) Buffet threshold of perception should be based on 0.03 g peak to peak normal acceleration above the background noise at the pilot seat. Initial buffet to be based on normal acceleration at the pilot seat with a larger peak to peak value relative to buffet threshold of perception (some airframe manufacturers have used 0.1 g peak to peak). Demonstrate correct trend in growth of buffet amplitude from initial buffet to stall speed for normal and lateral acceleration.

(ix) The maximum buffet may be limited based on motion platform capability/limitations or other simulator system limitations.

(x) Tests may be conducted at centres of gravity and weights typically required for aeroplane certification stall testing.

(xii) This test is only for FSTDs qualified to conduct full-stall training tasks.

(xiii) Where approved engineering simulation validation is used, the reduced engineering tolerances (as defined in Appendix 1 to AMC1.300(b)) do not apply.

(2) Approach-to-stall characteristics test:

(i) Control displacements and flight control surfaces must be plotted and demonstrate correct trend and magnitude.

(ii) Each of the following stall entries must be demonstrated in at least one of the three flight conditions:

(A) approach to stall entry at wings level (1 g);

(B) approach to stall entry in turning flight of at least 25° bank angle (accelerated stall); and

(C) approach to stall entry in a power-on condition (required only for propeller-driven aeroplanes).

(iii) The cruise flight condition must be conducted in a flaps-up (clean) configuration. The second-segment climb flight condition must use a different flap setting than for the approach or landing flight condition.

(iv) For computer-controlled aeroplanes (CCAs) with stall envelope protection systems, the normal-mode testing is only required at an angle-of-attack range necessary to demonstrate the correct operation of the system. These tests may be used to satisfy the required (angle of attack) flight manoeuvre and envelope protection tests of AMC1 FSTD(A).300(2)(h).

(3) Engine and airframe icing effects demonstration (high angle of attack):

(i) Time history of a full stall and of the initiation of the recovery: tests are intended to demonstrate representative aerodynamic effects caused by in-flight ice accretion. Flight test validation data is not required.

(ii) Two tests are required, to demonstrate engine and airframe icing effects. One test demonstrates the FSTDs baseline performance without ice accretion, and the second test demonstrates the aerodynamic effects of ice accretion relative to the baseline test.

(iii) The test must utilise the icing model(s) as described in the SOC required in Appendix 1 to CS FSTD(A).300 1.t.1. The test must include a rationale that describes the icing effects being demonstrated. Icing effects may include, but are not limited to, the following effects, as applicable to the particular aeroplane type:

(A) decrease in the stall angle of attack;

(B) changes in the pitching moment;

(C) decrease in control effectiveness;

(D) changes in control forces;

(E) increase in drag;

(F) change in stall buffet characteristics and threshold of perception; and

(G) engine effects (power reduction/variation, vibration, etc. where expected to be present on the aeroplane in the ice accretion scenario being tested).

(iv) Tests are evaluated for representative effects on relevant aerodynamic and other parameters, such as angle of attack, control inputs, and thrust/power settings.

Recorded parameters (in the validation test result) should include the following:

(A) altitude;

(B) airspeed;

(C) normal acceleration;

(D) engine power;

(E) angle of attack;

(F) pitch attitude;

(G) bank angle;

(H) flight control inputs; and

(I) stall warning and stall buffet onset.

5. New AMC10 FSTD(A).300 is inserted as follows:

Draft resulting text

AMC10 FSTD(A).300 Guidance on high-angle-of-attack/stall model evaluation

(a) This AMC applies to all FSTDs used to satisfy training provisions for stall manoeuvres conducted at angles of attack beyond the activation of the stall-warning system. This AMC is not applicable to FSTDs only qualified for approach-to-stall manoeuvres where recovery is initiated at the first indication of the stall. This AMC supplements the following:

(1) Appendix 1 to CS FSTD(A).300 Flight Simulation Training Device Standards;

(2) AMC1 FSTD(A).300(b)(3) Table of FSTD Validation Tests; and

(3) AMC1 FSTD(A).300(c) Functions and subjective tests.

(b) General provisions

The provisions for high-angle-of-attack modelling should be applied to evaluate the recognition cues as well as performance and handling qualities of a developing stall through the stall identification angle-of-attack and stall recovery. Strict time-history-based evaluations against flight test data may not adequately validate the aerodynamic model in an unsteady and potentially unstable flight regime, such as stalled flight. As a result, the objective testing provisions of AMC1 FSTD(A).300 do not contain strict tolerances for any parameter at angles of attack beyond the stall identification angle-of-attack. In lieu of mandating such objective tolerances, an SOC should define the source data and methods used to develop the aerodynamic-stall model.

(c) Fidelity provisions

The provisions for the evaluation of full-stall training manoeuvres should provide the following levels of fidelity:

(1) aeroplane-type-specific recognition cues of the first indication of the stall (such as the stall-warning system or aerodynamic stall buffet);

(2) aeroplane-type-specific recognition cues of an impending aerodynamic stall; and

(3) recognition cues and handling qualities from stall break through recovery which are sufficiently representative of the aeroplane being simulated to allow successful completion of the stall recovery training tasks.

For the purposes of stall manoeuvre evaluation, the term 'representative' is defined as a level of fidelity that is type-specific of the simulated aeroplane to the extent that the training objectives can be satisfactorily accomplished. Therefore, the term 'representative' in this AMC is specifically limited to the characteristics of the aerodynamic model in the post-stall region. The description of this term is given to explain the intent of the model rather than defining the meaning of the term 'representative modelling' which may be described in other simulator definitions.

(d) SOC (aerodynamic model)

At a minimum, the following must be addressed in the SOC:

(1) Source data and modelling methods

The SOC must identify the sources of data used to develop the aerodynamic model. These data sources may be from the aeroplane original equipment manufacturer (OEM), the original-FSTD manufacturer/data provider, or other data provider acceptable to the competent authority. Of particular interest is a mapping of test points in the form of an alpha/beta envelope plot for a minimum of flaps-up and flaps-down aeroplane configurations. For the flight test data, a list of the types of manoeuvres used to define the aerodynamic model for angle-of-attack ranges greater than the first indication of stall must be provided per flap setting. Flight test reports, when available, describing stall characteristics of the aeroplane type being modelled, issued by the OEM or flight test pilot, can be referred to. In cases where it is impractical to develop and validate a stall model with flight-test data (e.g. due to safety concerns involving the collection of flight-test data past a certain angle of attack), the data provider is expected to make a reasonable attempt to develop a stall model through the required angle-of-attack range using analytical methods and empirical data (e.g. wind tunnel data).

(2) Validity range

The FSTD operator should declare the range of angle of attack and sideslip where the aerodynamic model remains valid for training. Satisfactory aerodynamic-model fidelity must be shown through stall recovery training tasks. For the purposes of determining this validity range, the stall is defined as the angle of attack where the pilot is given a clear and distinctive indication to ease any further increase in the angle of attack where one or more of the following characteristics occur:

(i) no further increase in pitch occurs when the pitch control is held at the full aft stop for two seconds, leading to an inability to arrest the descent rate;

(ii) an uncommanded nose-down pitch that cannot be readily arrested, which may be accompanied by an uncommanded rolling motion;

(iii) buffeting of a magnitude and severity that is a strong and effective deterrent to a further increase in the angle of attack;

(iv) activation of a stick pusher: for the validity range, the modelling continuity should allow for an angle-of-attack range that is adequate to allow for the completion of stall recovery; for pusher-equipped aeroplanes, this should be adequate to capture any inappropriate action during the recovery procedure; and

(v) for aeroplanes equipped with a stall envelope protection system, the model should allow training with the protection systems disabled or otherwise degraded (such as a degraded flight control mode as a result of a pitot/static system failure).

(3) Model characteristics

Within the declared model validity range, the SOC must address, and the aerodynamic model must incorporate, the following stall characteristics, where applicable by aeroplane type:

(i) degradation of the static/dynamic lateral-directional stability;

(ii) degradation in control response (pitch, roll, and yaw);

(iii) uncommanded roll acceleration or roll-off requiring significant control deflection to counter;

(iv) apparent randomness or non-repeatability;

(v) changes in pitch stability;

(vi) stall hysteresis;

(vii) Mach effects;

(viii) stall buffet; and

(ix) angle-of-attack rate effects.

An overview of the methodology used to address these features must be provided.

(e) SOC (subject-matter expert (SME) pilot's evaluation)

The operator must provide an SOC confirming that the simulation stall model has been subjectively evaluated by an SME pilot knowledgeable of the aeroplane's stall characteristics (please refer to (d)(1) above).

The purpose is to ensure that the stall model has been sufficiently evaluated using those general aeroplane configurations and stall entry methods that will likely be conducted in training.

In order to qualify as an acceptable SME to evaluate the stall model characteristics, the SME must meet the following:

(1) have held or currently hold a type rating/qualification in the aeroplane being simulated;

(2) have direct experience in conducting stall manoeuvres in an aeroplane that shares the same type rating as the make, model, and series of the simulated aeroplane; this stall experience must include hands-on manipulation of the controls at angles of attack sufficient to identify the stall (e.g. deterrent buffet, stick pusher activation, etc.) through recovery to stable flight;

(3) where the SME's stall experience is in an aeroplane of a different make, model, and series within the same type rating, differences in aeroplane-specific stall recognition cues and handling characteristics must be addressed using available documentation; this documentation may include aeroplane operating manuals (OMs), aeroplane manufacturer flight test reports, or other documentation that describes the stall characteristics of the aeroplane; and

(4) be familiar with the intended stall training manoeuvres to be conducted in the FSTD (e.g. general aeroplane configurations, stall entry methods, etc.) and the cues necessary to accomplish the required training objectives.

This SOC will only be required at the time the FSTD is initially qualified for stall training tasks as long as the FSTD's stall model remains unmodified compared to what was originally evaluated and qualified. Where an FSTD shares common aerodynamic and flight control models with those of an engineering or development simulator, the competent authority will accept an SOC from the aeroplane manufacturer or data provider confirming that the stall characteristics have been subjectively assessed by an SME pilot on the engineering/development simulator (please refer to AMC1 FSTD(A).200 and AMC7 FSTD(A).300(b) for the description of an engineering/development simulator).

An FSTD operator may submit a request to the competent authority for approval of a deviation from the SME pilot's experience provisions under this paragraph. This request for deviation must include the following information:

(1) an assessment of pilot availability demonstrating that a suitably qualified pilot, meeting the experience described in AMC10 FSTD(A).300(e), is not available; and

(2) alternative methods to subjectively evaluate the FSTD's capability to provide the stall recognition cues and handling characteristics needed to accomplish the training objectives.

(f) SOC (subjective tests)

Test provisions

The necessity of subjective tests arises from the need to confirm that the simulation model has been integrated correctly and performs as declared under (d) above. It is vital to examine, for example, that the simulation validity range allows modelling continuity that is adequate to allow for the completion of stall recovery.

Considerations on aeroplane certification flight test provisions

In aeroplane certification flight tests, there is no provision to go beyond the maximum coefficient of lift (CL max), and the aeroplane is not to be held in full-stall condition, so this provision should be applied in the same way during the simulator's subjective evaluation.

The subjective tests of the simulation model should assess modelling continuity when slightly increasing the angle of attack beyond CL max.

The increase in angle of attack beyond CL max should be limited to a value greater than the maximum angle achieved two seconds after stall recognition, which is sufficient to allow a proper recovery manoeuvre.

Stall recognition is defined as:

(1) no further increase in pitch when the pitch control is held on the aft stop for two seconds, leading to an inability to arrest the descent rate;

(2) an uncommanded nose-down pitch that cannot be readily arrested, which may be accompanied by an uncommanded rolling motion;

(3) buffeting of a magnitude and severity that is a strong and effective deterrent to a further increase in the AOA; and

(4) activation of a stick pusher.

The handling provisions at low speed and maximum angle of attack cover aeroplanes with protection. For pusher-equipped aeroplanes, this should be adequate to capture any inappropriate pilot action during the recovery procedure.

Where known limitations exist in the aerodynamic model for particular stall event manoeuvres (such as aeroplane configuration, approach-to-stall entry methods, and limited range for continuity of the modelling), these limitations must be declared in the required SOC.

6. New AMC11 FSTD(A).300 is inserted as follows:

Draft resulting text

AMC11 FSTD(A).300 Guidance on high angle of attack/stall model evaluation, and approach to stall for qualified FSTDs

For FSTDs already qualified under CS-FSTD(A), it may not always be possible to provide the required validation data for the new or revised objective test cases, to support the FSTD qualification for stall and approach to stall. These validation tests have the following characteristics:

(a) Objective testing for stall characteristics (please refer to Table of FSTD Validation Tests, 2.c.(8a)) are only required for the (wings level) second-segment climb and approach or landing flight conditions.

(b) For the testing of the high-altitude cruise and turning-flight stall conditions, these manoeuvres may be subjectively evaluated by a qualified SME pilot and addressed in the required statement of compliance (SOC); these tests should utilise the footprint method to document the SME evaluation and this should be included in the approved master qualification test guide (MQTG). To allow for any randomisation during recurrent testing, one should apply engineering judgement to ensure that the key characteristics of the original SME assessment are maintained.

(c) Where existing flight test validation data in the FSTD's MQTG is missing required parameters, or is otherwise unsuitable to fully meet the objective testing provisions, the competent authority may accept alternative sources of validation, including subjective validation by an SME pilot with direct experience in the stall characteristics of the aeroplane.

(d) Objective testing for characteristic motion vibrations (please refer to Table of FSTD Validation Tests, 3.g.(6)) is not required where the FSTD's stall buffets have been subjectively evaluated by an SME pilot. For previously qualified Level D FSTDs that currently have objective stall buffet tests in their approved MQTG, the results of these existing tests must be provided to the competent authority with the updated stall and stall buffet models in place.

(e) As described in AMC10 FSTD(A).300, the competent authority may accept an SOC from the data provider, confirming that the stall characteristics have been subjectively evaluated by an SME pilot on an engineering simulator or development simulator that is acceptable to the competent authority. Where this evaluation takes place on an engineering or development simulator, additional objective 'proof-of-match' testing for all flight conditions, as described in Tests 2.c.(8a) and 3.g.(6), is required to verify the implementation of the stall model and stall buffets on the FSTD.

7. New AMC12 FSTD(A).300 is inserted as follows:

Draft resulting text

AMC12 FSTD(A).300 Guidance on upset prevention and recovery training (UPRT) for the FSTD standards table

(a) Background

(1) This AMC provides guidance on Appendix 1 to CS FSTD(A).300, namely on the following:

(i) 1. General:

(A) h.2 (IOS tools);

(B) h.3 (upset scenarios); and

(C) s.1 (aerodynamics); and

(ii) 2. Motion system, a.1.

(2) This AMC applies to all FSTDs used to satisfy training provisions for UPRT manoeuvres. For the purposes of this AMC, an airplane upset (as defined in the ICAO Airplane Upset Prevention & Recovery Training Aid (AUPRTA) Rev 3, February 2017) is an undesired aeroplane state characterised by unintentional deviations from parameters experienced during normal operations. An aeroplane upset may involve pitch and/or bank angle deviations as well as inappropriate airspeeds for the given conditions.

(3) FSTDs used to conduct training manoeuvres where the FSTD is repositioned either into an aeroplane upset condition or an artificial stimulus (such as weather phenomena or system failures) that is intended to result in a flight crew entering an aeroplane upset condition must be evaluated and qualified.

(b) FSTD standards provisions

(1) The provisions of Appendix 1 to CS FSTD(A).300 define three basic elements required for qualifying an FSTD for UPRT manoeuvres:

(i) FSTD training envelope: see definition in AMC1 FSTD(A).200;

(ii) instructor feedback: provides the instructor/evaluator with a minimum set of feedback tools to properly evaluate the trainee's performance in accomplishing a UPRT task; and

(iii) upset scenarios: where dynamic upset scenarios or aeroplane system malfunctions are used to drive the FSTD into an aeroplane upset condition, specific guidance must be available to the instructor on the IOS which describes how the upset scenario is driven along with any malfunction or degradation in FSTD functionality required to stimulate the upset.

(2) FSTD validation envelope

This envelope is defined by the following three subdivisions (see Appendix 3-D of ICAO AUPRTA').

(i) Flight-test-validated region

This is the region of the flight envelope which has been validated with flight test data, typically by comparing the performance of the FSTD against these flight test data through tests incorporated in the QTG and other flight test data utilised to further extend the model beyond the minimum provisions. Within this region, there is high confidence that the FSTD responds similarly to the aeroplane. Please note that this region is not strictly limited to what has been tested in the QTG; as long as the aerodynamics mathematical model has been conformed to the flight test results, that portion of the mathematical model is considered to be within the flight-test-validated region.

(ii) Wind tunnel and/or analytical region

This is the region of the flight envelope for which the FSTD has not been compared to flight test data, but for which there has been wind tunnel testing or the use of other reliable predictive methods (typically by the aeroplane manufacturer) to define the aerodynamic model. Any extensions to the aerodynamic model which have been evaluated in accordance with the definition of a representative stall model (as described in AMC10 FSTD(A).300) must be clearly indicated. Within this region, there is moderate confidence that the FSTD will respond in a similar way as the aeroplane.

(iii) Extrapolated region

This is the region extrapolated beyond the flight-test-validated and wind tunnel/analytical regions. The extrapolation may be a linear one, a holding of the last value before the extrapolation began, or some other set of values. Whether this extrapolated data is provided by the aeroplane or FSTD manufacturer, it is a 'best estimation' only. Within this region, there is low confidence that the FSTD will respond in a similar way as the aeroplane.

(c) IOS feedback mechanism

(1) For the instructor/evaluator to provide feedback to the student during the upset prevention and recovery manoeuvre training, additional information must be accessible which indicates the fidelity of the simulation, the magnitude of the trainee's flight control inputs, as well as the aeroplane operational limits that could potentially affect the successful completion of the manoeuvre(s). At a minimum, the following must be available to the instructor/evaluator:

(i) FSTD validation envelope

The FSTD must employ a method to display the FSTD's expected fidelity with respect to the FSTD validation envelope. This may be displayed as an angle of attack vs sideslip (alpha/beta) envelope cross-plot on the IOS or other alternative method to clearly convey the FSTD's fidelity level during the manoeuvre. The cross-plot or other alternative method must display the relevant validity regions for flaps-up and flaps-down at a minimum. This validation envelope must be derived by the aerodynamic-data provider, or using information and data sources provided by the aerodynamic-data provider

(ii) Flight control inputs

The FSTD must employ a method for the instructor/evaluator to assess the trainee's flight control inputs during the upset recovery manoeuvre. Additional parameters, such as cockpit control forces (forces applied by the pilot to the controls) and the flight control law mode for fly-by-wire aeroplanes, must be portrayed in this feedback mechanism as well). For passive side-sticks, whose displacement is the flight control input, the force applied by the pilot to the controls does not need to be displayed. This tool must include a time history or other equivalent method of recording flight control positions.

(iii) Aeroplane operational limits

The FSTD must employ a method to provide the instructor/evaluator with real-time information concerning the aeroplane operating limits. The simulated aeroplane's parameters must be displayed dynamically in real-time and provided in a time history or equivalent format. At a minimum, the following parameters must be available to the instructor:

(A) airspeed and airspeed limits, including the stall speed and maximum operating limit airspeed (VMO)/maximum operating Mach (MMO);

(B) load factor and operational load factor limits; and

(C) angle of attack and stall identification angle-of-attack (please refer to AMC10 FSTD(A).300(d)(2) for additional information on the definition of the stall identification angle-of-attack); this parameter may be displayed in conjunction with the FSTD validation envelope.

(2) Optionally, a recorded feedback mechanism is available to the instructor/evaluator.

8. <u>New GM12 FSTD(A).300 is inserted as follows:</u>

Draft resulting text

GM12 FSTD(A).300 Additional guidance on upset prevention and recovery training (UPRT) for the FSTD standards table

(a) Introduction

The FSTD should be provided with information pertaining to the aeroplane parameters as described in AMC12 FSTD(A).300. This AMC details some of the performance provisions for these features.

The objective of IOS feedback during UPRT exercises is to provide the instructor with the ability to assess the timely and proper control action, including sequence, to complete the recovery in a safe manner.

(b) Background

IOS feedback, which may also be via a separate mobile device, is used to monitor and debrief the crew regarding UPRT exercises, to verify that proper control activity was executed. The instructor should have the necessary information to clearly establish if the recovery was completed in the FSTD training envelope (please refer to AMC12 FSTD(A).300), and take any necessary action to complete the training.

The FSTD should include tools for the instructor to be able to immediately debrief the pilots after the training event.

(c) IOS parameters

The tool should normally display:

(1) Control inputs, including:

(i) pitch,

(ii) roll,

(iii) rudder,

(iv) throttles,

(v) flaps, and

(vi) speed brakes/spoilers.

Time history of control inputs

In order to ascertain that the control inputs are applied in a correct, timely and smooth manner, the display should indicate these at a sampling frequency rate that is sufficiently high to prevent from missing possible abrupt pilot action. This may be limited to the debrief mode following the execution of the exercise or individual manoeuvre.

(2) Primary flight display, including:

(i) pitch attitude,

(ii) roll attitude,

(iii) turn/sideslip,

(iv) indicated airspeed,

(v) stall-warning speed/stall buffet speed,

(vi) VMO/MMO,

(vii) altitude,

(viii) rate of climb,

(ix) autopilot status, and

(x) auto-throttle status.

(3) Angle of attack.

(4) Angle of sideslip.

(5) G-loading.

The limitations of (3), (4), and (5) shall also be indicated, as follows:

One method is the simultaneous depiction of angle-of-attack vs angle-of-sideslip and the corresponding FSTD validation envelope.

A presentation of the G-loading as function of the current airspeed and flight configuration

The V-n diagram indicates the limitations of the aeroplane under given conditions. It displays the flight envelope as function of the airspeed versus G-loading. It shows the lower airspeed limits by means of a parabolic line. The intersection of this line with the 1.0-g horizontal line corresponds to the stall speed at 1 g. The regions above the 2.5-g upper limit (maximum design limit) to the right of VNE and below the – 1.0-g lower limit are the structural exceedance limits and should be avoided. The shape of the V-n diagram depends on the aeroplane itself, its configuration, as well as the environmental and flight conditions.

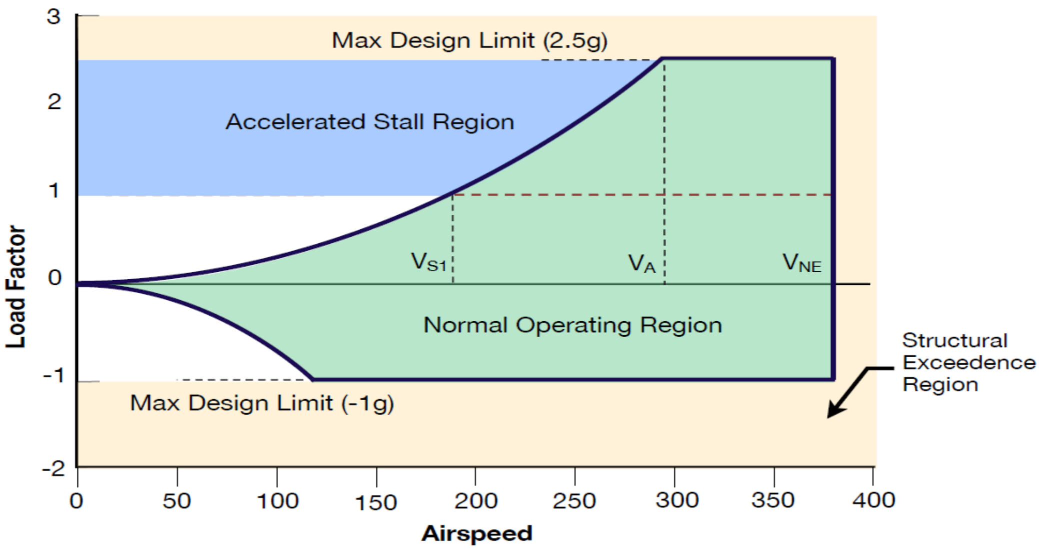


Figure 1 —V-n diagram (example)

Legend to Figure 1:

V_{S1} = clean stall speed at 1 g

V_A = design manoeuvre speed

V_{NE} = never-exceed speed

9. <u>New AMC13 FSTD(A).300 is inserted as follows:</u>

Draft resulting text

AMC13 FSTD(A).300 Guidance material for engine and airframe icing evaluation provisions

(a) Applicability

This AMC applies to all FSTDs used to satisfy training provisions for engine and airframe icing. New general provisions as well as objective provisions for FSTD qualification have been developed in order to define aeroplane-specific icing models that support training objectives for the recognition of, and recovery from, an in-flight ice accretion event.

(b) General provisions

The following elements should be considered when developing the qualified ice accretion models for use in FSTD training:

(1) icing models must be able to train the specific skills required for the recognition of ice accumulation and for generating the required response;

(2) icing models must contain aeroplane-specific recognition cues as determined through data supplied by an aeroplane original-equipment manufacturer (OEM) or through other suitable analytical methods; and

(3) at least one qualified icing model must be objectively tested to demonstrate that it has been implemented correctly and that it generates the correct cues as necessary for training.

(c) Statement of compliance (SOC)

The SOC described in Appendix 1 to CS FSTD(A).300 1.t.1. must contain the following information to support FSTD qualification of aeroplane-specific icing models:

(1) A description of expected aeroplane-specific recognition cues and degradation effects due to a typical in-flight icing encounter.

Typical cues may include loss of lift, decrease in stall angle of attack, changes in pitching moment, decrease in control effectiveness, and changes in control forces in addition to any overall increase in drag. This description must be based on relevant data source, such as aeroplane OEM-supplied data, accident/incident data, or other acceptable data sources. Where a particular airframe has demonstrated vulnerabilities to a specific type of ice accretion (due to accident/incident history), which requires specific training (such as supercooled large-droplet icing or tailplane icing), ice accretion models must be developed that address those training provisions.

(2) A description of the data sources used to develop the qualified ice accretion models. Acceptable data sources may be, but are not limited to, flight test data, aeroplane certification data, aeroplane OEM engineering simulation data, or other analytical methods based on established engineering principles.

(d) Objective demonstration testing

The purpose of the objective demonstration test is to demonstrate that the ice accretion models, as described in the SOC, have been correctly implemented and demonstrate the proper cues and effects, as defined in the approved data sources. At least one ice accretion model must be selected for testing and included in the master qualification test guide (MQTG). Two tests are required to demonstrate engine and airframe icing effects. One test demonstrates the FSTDs baseline performance without icing, and the second test demonstrates the aerodynamic effects of ice accretion relative to the baseline test.

(1) Recorded parameters: in each of the two required MQTG cases, a time-history recording of the following parameters should be made:

(i) altitude;

(ii) airspeed;

(iii) normal acceleration;

(iv) engine power/settings;

(v) angle of attack/pitch attitude;

(vi) bank angle;

(vii) flight control inputs;

(viii) stall warning and stall buffet onset; and

(ix) other parameters necessary to demonstrate the effects of ice accretion.

(2) Demonstration manoeuvre: the FSTD operator must select an ice accretion model, as identified in the SOC for testing. The selected manoeuvre must demonstrate the effects of ice accretion at high angles of attack from a trimmed condition through approach to stall and 'full' stall, as compared to a baseline (no ice build-up) test. The ice accretion models must demonstrate the cues necessary to recognise the onset of ice accretion on the airframe, lifting surfaces, and engines, and provide a representative degradation in performance and handling qualities to the extent that a recovery can be executed. Typical recognition cues that may be present depending on the simulated aeroplane include:

(i) decrease in stall angle of attack;

(ii) increase in stall speed;

(iii) increase in stall buffet threshold of perception speed;

(iv) changes in pitching moment;

(v) changes in stall buffet characteristics;

(vi) changes in control effectiveness or control forces; and

(vii) engine effects (power variation, vibration, etc.).;

The demonstration test may be conducted by initialising and maintaining a fixed amount of ice accretion throughout the manoeuvre in order to consistently evaluate the aerodynamic effects.

3.2. Draft AMC/GM (draft EASA Decision)

3.2.1 AMC/GM to Part-FCL

1. New GM1 Appendix 9 to Part-FCL is inserted as follows:

Draft resulting text

GM1 Appendix 9 to Part-FCL

Aeroplane FSTD training credits

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)									
	AIRCREW/AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		BITD	FNPT I	FNPT II	FNPT II MCC	FTD 1	FTD 2	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																
LAPL(A)																
Modular	FCL.115	30	15	NO	6		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
PPL(A)																
Modular	FCL.210.A	45	25	NO	10		YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
CPL(A) modular																
Instrument flight instruction	Appendix 3, Part E	10	10	NO	NO		YES (5)	YES (5)	YES (5)	YES (5)	NO	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
CPL(A) integrated																
Instrument flight instruction	Appendix 3, Part D to Annex 1	10	10	NO	NO		NO	YES (5)	YES (5)	YES (5)	NO	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
CPL/IR(A) integrated																
Instrument rating training	FCL.315	50	50	20	NO		NO	YES (25)	Yes (40)	YES (40)	NO	YES (40)	YES (40)	NO	NO	NO
ATPL(A)																
Integrated (instrument training)	FCL.515 + Appendix 3 Subpart A	50	50	20	NO		NO	YES (25)	YES (40)	YES (40)	NO	YES (40)	YES (40)	YES (40)	YES (40)	YES (40)
Integrated (MCC training)	FCL.515 + Appendix 3 Subpart A	15	15	NO	NO		NO	NO	NO	YES (15)	NO	NO	YES (15)	YES (15)	YES (15)	YES (15)
MPL integrated																
Phase 1	FCL.410.A + Appendix 5 to Annex 1						YES	YES	NO	NO	NO	NO	NO	NO	NO	NO
Phase 2	FCL.410.A + Appendix 5 to Annex 1						NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
Phase 3	FCL.410.A + Appendix 5 to Annex 1						NO	NO	NO	NO	NO	NO	NO	YES	YES	YES

	EASA Training Provisions (hours)					Maximum FSTD Training Credits (hours)									
	AIRCREW/AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)	BITD	FNPT I	FNPT II	FNPT II MCC	FTD 1	FTD 2	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training															
Phase 4	FCL.410.A + Appendix 5 to Annex1					NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Class Rating(A)															
TMG (extension to LAPL(A))	FCL.725.A	3	3	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SEP (Land)	FCL.725.A			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SEP (Sea)	FCL.725.A	10, 8 if SEP (Land) rated	10, 8 if SEP (Land) rated	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
MEP (Land)	FCL.725.A	6	6	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
MEP (Sea)	FCL.725.A	10, 8 if MEP (Land) rated	10, 8 if MEP (Land) rated	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SET	FCL.725.A														
MET	FCL.725.A														
Type Rating															
Type Rating Course SP	FCL.725.A + AMC2 ORA.ATO.125(j)					NO	NO	NO	NO	YES	YES	YES	YES	YES	YES
Type Rating Course MP	FCL.725.A + AMC2 ORA.ATO.125(j)	MPA 32 hours/16 using an FFS				NO	NO	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	YES	YES	YES
ZFT Type Rating Course	FCL.730.A	MPA 32 hours/16 using an FFS				NO	NO	NO	NO	PARTIALLY	PARTIALLY	NO	NO	YES	YES
Recency of Experience															
Recent Experience	FCL.060(b)	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES
Operator Recurrent Training															
Route/Area/ Aerodrome Knowledge	AMC1 ORO.FC.105(b)(2);(c)(a),(2)(ii) + (c)(2)					NO	NO	NO	NO	NO	YES*	YES	YES	YES	YES
CRM Training	AMC 1 ORO.FC.115(a)(1) + (a)(4)					NO	NO	NO	NO	NO	YES*	YES	YES	YES	YES
Command Course	ORO.FC.205					NO	NO	NO	NO	NO	NO	PARTIALLY	YES	YES	YES
Operator Conversion ZFTT (6 circling patterns)	ORO.FC.220(e)(2)					NO	NO	NO	NO	NO	NO	NO	NO	YES	YES
Operator Conversion Training and Checking	AMC 1 OROR.FC.220(a)(iii) + (d)(4)					NO	NO	NO	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	YES	YES

	EASA Training Provisions (hours)					Maximum FSTD Training Credits (hours)									
	AIRCREW/AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)	BITD	FNPT I	FNPT II	FNPT II MCC	FTD 1	FTD 2	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training															
Upset Prevention Training	AMC2 ORO.FC.220&230(a)					NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Upset Recovery Training	AMC2 ORO.FC.220&230(b)					NO	NO	NO	NO	NO	NO	NO	YES*	YES	YES
Recurrent Training and Checking	ORO.FC.230(f)					NO	NO	NO	NO	NO		PARTIALLY	YES	YES	YES
Instrument Rating															
IR-SE	FCL. 615 + Appendix 6, Subpart A	50	50	NO	NO	NO	20	35	35	NO	NO	35	35	35	35
IR-ME	FCL. 615 + Appendix 6, Subpart A	55	55	NO	NO	NO	25	40	40	NO	NO	40	40	40	40
IR-SE (A) to IR-ME	Appendix 6, Subpart A.9	5	5	NO	NO	NO	NO	3	3	NO	NO	3	3	3	3
IR-SE (A)/IR-ME revalidation	FCL.625.A IR(A)					NO	NO	YES (2)	YES (2)	NO	NO	YES (2)	YES (2)	YES (2)	YES (2)
IR(H) to IR-SE	Appendix 6, Subpart A.10.2	10	10	NO	NO	NO	YES*	YES*	YES*	NO	NO				
IR(H) to IR-ME	Appendix 6, Subpart A.10.2	10	10	NO	NO	NO	YES*	YES*	YES*	NO	NO				
EIR (SE)	FCL.825(c)	15	15	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
EIR (ME)	FCL.825(c)	16, 4 of them with an MEP aeroplane	16, 4 of them with an MEP aeroplan e	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
EIR (SE-ME) revalidation	FCL.825(g)			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CB-IR-SE	FCL. 615 + Appendix 6, Subpart Aa	40	40	NO	NO	NO	10	25	25	NO	NO	YES	YES	YES	YES
CB-IR ME	FCL. 615 + Appendix 6, Subpart Aa	45	45	NO	NO	NO	YES	YES	YES	NO	NO	YES	YES	YES	YES
Multi-Crew Cooperation															
MCC modular course	FCL.735.A	20	20	NO	NO	NO	NO	NO	20	NO	NO	20	20	20	20
Instructor Training															
FI	FCL.930.FI FI(b)(3)	30	25	NO	NO	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES
CRI SE	FCL.930.CRI CRI + AMC1 FCL.930.CRI CRI(c)	3	3	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
CRI ME	FCL.930.CRI CRI + AMC1 FCL.930.CRI CRI(c)	5	5	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES
IRI	FCL.930.IRI IRI(3)(i)	10, 5 if FI (A)	10, 5 if FI (A)	NO	NO	NO	YES	YES	YES	NO	YES	YES	YES	YES	YES
MCCI (A)	FCL.930.MCCI MCCI + AMC 1 FCL.930.MCCI MCCI	3	3	NO	NO	NO	NO	NO	YES	NO	YES	YES	YES	YES	YES
MPL instructor	FCL.925(b)(1)			NO	NO	NO	NO	NO	NO	NO	YES (1*)	YES	TES	YES	YES

	EASA Training Provisions (hours)					Maximum FSTD Training Credits (hours)									
	AIRCREW/AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)	BITD	FNPT I	FNPT II	FNPT II MCC	FTD 1	FTD 2	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training															
MPL Instructor Revalidation	FCL.925(c)(1)	1 hour air exercise + 1 simulator session		NO	NO	NO	NO	NO	YES	NO	YES (1*)	YES	YES	YES	YES
STI (A)	FCL.930.STI STI	3	3	NO	NO	NO	NO	YES	YES	NO	YES	YES	YES	YES	YES
SFI (A)	FCL.930.SFI SFI	32 + 10	3 2 + 10	NO	NO	NO	NO	NO	NO	NO	PARTIALLY	PARTIALLY	YES	YES	YES
TRI SP (A)	FCL.930.TRI TRI	5	5	NO	NO	NO	NO	NO	NO	NO	YES (1*)	YES	YES	YES	YES
TRI MP (A)	FCL.930.TRI TRI	10	10	NO	NO	NO	NO	NO	NO	NO	YES (1*)	PARTIALLY	YES	YES	YES
Examiner Training															
FE (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
CRE (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY
IRE (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY
SFE (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	NO	NO	NO	NO	YES (1*)	YES	YES	YES	YES
TRE SP (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	NO	NO	NO	NO	YES (1*)	YES	YES	YES	YES
TRE MP (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	NO	NO	NO	NO	YES (1*)	YES	YES	YES	YES
FIE (A)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
								(*) combination of FNPT and aeroplane for a total of 10 hours							
								(1*) if fitted with a visual system							
								(2) yes, for each alternate proficiency check							

Helicopter FSTD training credits

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNPT 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
LAPL (H)																				
Modular	FCL.11O.H. LAPL (H)	40	20	NO	10		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
PPL (H)																				
Visual/Basic Instrument	FCL.210.H PPL (H)	45	25	NO	10		YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	NO	NO	NO	NO	NO	YES (5)	YES (5)	YES (5)	YES (5)
CPL (H) modular		30	30																	
Visual Training	FCL.315 + Appendix 3 Subpart K(8)		20	NO	NO		NO	YES (5)	YES (5)	YES (5)	YES (5)	NO	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
Basic Instrument	FCL.315 + Appendix 3 Subpart K(8)		10	NO	NO		YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
CPL (H) Integrated		135	85	40	15															
Visual Training	FCL.315 + Appendix 3 Subpart J(8)		75	35	15		NO	YES (20)	YES (20)	YES (20)	YES (20)	NO	YES (25)	YES (25)	YES (25)	YES (25)	YES (30)	YES (30)	YES (30)	YES (30)
Basic Instrument	FCL.315 + Appendix 3 Subpart J(8)		10	NO	NO		YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	NO	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
CPL/IR (H) Integrated		180	125	40	15															
Visual Training including ME T/R Training	FCL.315 + Appendix 3 Subpart I(8)		75				NO	YES (20)	YES (20)	YES (20)	YES (20)	NO	YES (25)	YES (25)	YES (25)	YES (25)	YES (30)	YES (30)	YES (30)	YES (30)
Instrument Rating Training	FCL.315 + Appendix 3 Subpart I(8)		50	20	NO		YES (10)	YES (20)	YES (20)	YES (20)	YES (20)	NO	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)
ATP/IR (H) Integrated		195	140	40	15															
Visual Training including ME T/R Training	FCL.515 + Appendix 3 Subpart F 8)		75				NO	YES (20)	YES (20)	YES (20)	YES (20)	NO	YES (25)	YES (25)	YES (25)	YES (25)	YES (25)	YES (25)	YES (30)	YES (30)
Instrument Rating Training	FCL.515 + Appendix 3 Subpart F(8)		50				YES (10)	YES (20)	YES (20)	YES (20)	YES (20)	NO	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)	YES (20)
Integrated (MCC	FCL.515 + Appendix 3		15	NO	NO		NO	NO	YES (15)	NO	YES (15)	NO	NO	YES (15)	NO	YES (15)	YES (15)	YES (15)	YES (15)	YES (15)

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNPT 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
Training)	Subpart F (8)																			
ATP (H)/VFR Integrated		150	95	40	15															
Visual Training	FCL.515 + Appendix 3 Subpart G		75				NO	YES(20)	YES(20)	YES(20)	YES(20)	NO	YES(25)	YES(25)	YES(25)	YES(25)	YES(30)	YES(30)	YES(30)	YES(30)
Basic Instrument Instruction	FCL.515 + Appendix 3 Subpart G		10	NO	NO		YES (5)	YES(5)	YES(5)	YES(5)	YES(5)	NO	YES(5)	YES(5)	YES(5)	YES(5)	YES(5)	YES(5)	YES(5)	YES(5)
MCC/VFR training	FCL.515 + Appendix 3 Subpart G		10	NO	NO		NO	NO	YES(10)	NO	YES(10)	NO	NO	YES(10)	NO	YES(10)	YES(10)	YES(10)	YES(10)	YES(10)
Type Rating Initial Issue (Minimum Flight Instruction excluding Skill Test)																				
SEP(H) or	AMC2 FCL.725(a)(c)	5 on helicopter	5	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SEP(H) or	AMC2 FCL.725(a)(c)	2 on helicopter + 4 on FFS	6	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (4)	YES (4)
SEP(H)	AMC2 FCL.725(a)(c)	4 on helicopter + 2 on FTD	6	NO	NO		NO	NO	NO	NO	NO	NO	YES (2)	YES (2)	YES (2)	YE S(2)	NO	NO	NO	NO
SET(H) under 3175-kg MTOM or	AMC2 FCL.725(a)(c)	5 on helicopter	5	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SET (H) under 3175-kg MTOM or	AMC2 FCL.725(a)(c)	2 on helicopter + 4 on FFS	6	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (4)	YES (4)
SET (H) under 3175- kg MTOM	AMC2 FCL.725(a)(c)	4 on helicopter + 2 on FTD	6	NO	NO		NO	NO	NO	NO	NO	NO	YES (2)	YES (2)	YES (2)	YES (2)	NO	NO	NO	NO
SET (H) at or over 3175-kg MTOM or	AMC2 FCL.725(a)(c)	8 on helicopter	8	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SET (H) at or over 3175- kg MTOM or	AMC2 FCL.725(a)(c)	2 on helicopter + 8 on FFS	10	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (8)	YES (8)
SET (H) at or over 3175- kg MTOM	AMC2 FCL.725(a)(c)	4 on helicopter + 6 on FTD	10	NO	NO		NO	NO	NO	NO	NO	NO	YES (6)	YES (6)	YES (6)	YES (6)	NO	NO	NO	NO

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNP T 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
SPH MET (H) CS and FAR 27 and 29 or	AMC2 FCL.725(a)(c)	8 on helicopter	8	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SPH MET (H) CS and FAR 27 and 29 or	AMC2 FCL.725(a)(c)	2 on helicopter + 8 on FFS	10	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (8)	YES (8)
SPH MET (H) CS and FAR 27 and 29	AMC2 FCL.725(a)(c)	4 on helicopter + 6 on FTD	10	NO	NO		NO	NO	NO	NO	NO	NO	YES (6)	YES (6)	YES (6)	YES (6)	NO	NO	NO	NO
MPH or	AMC2 FCL.725(a)(c)	10 on helicopter	10	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
MPH or	AMC2 FCL.725(a)(c)	2 on helicopter + 10 on FFS	12	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (10)	YES (10)
MPH	AMC2 FCL.725(a)(c)	4 on helicopter + 8 on FTD	12	NO	NO		NO	NO	NO	NO	NO	NO	YES (8)	YES (8)	YES (8)	YES (8)	NO	NO	NO	NO
Additional Types (Minimum Flight Instruction excluding Skill Test)																				
SEP (H) to SEP (H) within AMC1 FCL.740.H(a)(3) or	AMC2 FCL.725(a)(d)	2 on helicopter	2	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SEP (H) to SEP (H) within AMC1 FCL.740.H(a)(3) or	AMC2 FCL.725(a)(d)	1 on helicopter + 2 on FFS	3	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (2)	YES (2)
SEP (H) to SEP (H) within AMC1 FCL.740.H(a)(3)	AMC2 FCL.725(a)(d)	1 on helicopter + 3 on FTD	4	NO	NO		NO	NO	NO	NO	NO	NO	YES (3)	YES (3)	YES (3)	YES (3)	NO	NO	NO	NO
SEP (H) to SEP (H) not included in AMC1 FCL.740.H(a)(3) or	AMC2 FCL.725(a)(d)	5 on helicopter	5	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SEP (H) to SEP (H) not	AMC2 FCL.725(a)(d)	1 on helicopter	6	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (5)	YES (5)

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNP T 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
included in AMC1 FCL.740.H(a)(3) or		+ 5 on FFS																		
SEP (H) to SEP (H) not included in AMC1 FCL.740.H(a)(3)	AMC2 FCL.725(a)(d)	2 on helicopter + 3 on FTD	5	NO	NO		NO	NO	NO	NO	NO	NO	YES (3)	YES (3)	YES (3)	YES (3)	NO	NO	NO	NO
SET (H) to SET (H) or	AMC2 FCL.725(a)(d)	2 on helicopter	2	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
SET (H) to SET (H) or	AMC2 FCL.725(a)(d)	1 on helicopter + 2 on FFS	3	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (2)	YES (2)
SET (H) to SET (H)	AMC2 FCL.725(a)(d)	1 on helicopter + 3 on FTD	4	NO	NO		NO	NO	NO	NO	NO	NO	YES (3)	YES (3)	YES (3)	YES (3)	NO	NO	NO	NO
MET (H) to MET (H) or	AMC2 FCL.725(a)(d)	3 on helicopter	3	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
MET (H) to MET (H) or	AMC2 FCL.725(a)(d)	1 on helicopter + 3 on FFS	4	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (3)	YES (3)
MET (H) to MET (H)	AMC2 FCL.725(a)(d)	2 on helicopter + 3 on FTD	5	NO	NO		NO	NO	NO	NO	NO	NO	YES (3)	YES (3)	YES (3)	YES (3)	NO	NO	NO	NO
MPH to MPH or	AMC2 FCL.725(a)(d)	5 on helicopter	5	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
MPH to MPH or	AMC2 FCL.725(a)(d)	1 on helicopter + 5 on FFS	6	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (5)	YES (5)
MPH to MPH	AMC2 FCL.725(a)(d)	2 on helicopter + 5 on FTD	7	NO	NO		NO	NO	NO	NO	NO	NO	YES (5)	YES (5)	YES (5)	YES (5)	NO	NO	NO	NO
Extension of privileges on same TR from SPH to MPH, or from MPH to SPH or	AMC2 FCL.725(a)(d)	2 on helicopter	2	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Extension of privileges on same TR from SPH to MPH, or from MPH to SPH	AMC2 FCL.725(a)(d)	1 on helicopter + 2 on FFS	3	NO	NO		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES (2)	YES (2)
Recency of Experience																				
Recent Experience	FCL.060(b)(1) and (b)(2)	NO	NO	NO	3 T/O - 3		NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNP T 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
ME or SE					landings															
Operator Recurrent Training																				
Route/Area/ Aerodrome Knowledge	AMC1 ORO.FC.105(b)(2);(c)(a)(2)(ii) +(c)(2)			NO	NO		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
CRM Training	AMC 1 ORO.FC.115(a)(1) + (a)(4)			NO	NO		NO	NO	NO	?	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Command Course	ORO.FC.205			NO	NO		NO	NO	NO	?	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Operator Conversion Training and Checking	AMC 1 ORO.FC.220(a)(iii)			NO	NO		NO	NO	NO	NO	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	YES	YES
Recurrent Training and checking	ORO.FC.230(f)			NO	NO		NO	NO	NO	?	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	PATIALLY	YES	YES	YES
Instrument Rating																				
IR-SE (H)	FCL.615(a)(2) + Appendix 6, Subpart B(7)	50	50	NO	NO		20	35	35	35	35	NO	35	35	35	35	35	35	35	35
IR-ME (H)	FCL.615(a)(2) + Appendix 6, Subpart B(8)	55	55	NO	NO		20	40	40	40	40	NO	40	40	40	40	40	40	40	40
IR-SE (H) IR-ME (H) revalidation	FCL.625.H IR(H)(a)(2)			NO	NO		NO	NO	NO	NO	NO	NO	YES*	YES*	YES*	YES*	YES*	YES*	YES*	YES*
Extension of Privileges from IR (SE) to IR (ME)	FCL.630.H IR(H) + AMC2 FCL.725	5	5	NO	NO		NO	YES (3)	YES (3)	YES (3)	YES (3)	NO	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)
Extension of IR (H) to Further Types	AMC2 FCL.725(e)	2	2	NO	NO		NO	NO	NO	NO	NO	NO	YES (2)	YES (2)	YES (2)	YES (2)	YES (2)	YES (2)	YES (2)	YES (2)
SE-IR (A) to IR-SE (H)	FCL.615(a)(2) + Appendix 6, Subpart B(9.2)	10	10	NO	NO		NO	YES (7)	YES (7)	YES (7)	YES (7)	NO	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)
ME-IR (A) to IR-ME (H)	FCL.615(a)(2) + Appendix 6, Subpart B(9.2)	10	10	NO	NO		NO	YES (7)	YES (7)	YES (7)	YES (7)	NO	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)	YES (7)

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNPT 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
Multi Crew Cooperation																				
MCC/VFR Modular Course	FCL.735.H(a)(2)	15	15	NO	NO		NO	NO	YES	NO	YES	NO	NO	YES	NO	YES	YES	YES	YES	YES
MCC/IR Modular Course	FCL.735.H(a)(1)	20	20	NO	NO		NO	NO	YES	NO	YES	NO	NO	YES	NO	YES	YES	YES	YES	YES
MCC/VFR to MCC/IR Modular Course	FCL.735.H(e)	5	5	NO	NO		NO	NO	YES	NO	YES	NO	NO	YES	NO	YES	YES	YES	YES	YES
Instructor Training							AMC2 FCL.725(a)													
FI (H)	FCL.930.FI FI (b)(3)	30	25	NO	NO		YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	NO	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)	YES (5)
IRI (H)	FCL.930.IRI IRI (3)(ii)	10	10	NO	NO		NO	YES (10)	YES (10)	YES (10)	YES (10)	NO	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)
MCCI (H)	FCL.930.MCCI MCCI (a)(3)	3	3	NO	NO		NO	NO	YES (3)	NO	YES (3)	NO	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)
STI (H)	FCL.930.STI STI	3	3	NO	NO		NO	YES (3)	YES (3)	YES (3)	YES (3)	NO	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)	YES (3)
SFI (H)	FCL.930.SFI SFI	TR programme +10	TR programme +10	NO	NO		NO	NO	NO	NO	NO	NO	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)	YES (10)
TRI SP (H)	FCL.930.TRI TRI	5	5	NO	NO		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
TRI MP (H)	FCL.930.TRI TRI	10	10	NO	NO		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Examiner Training																				
FE (H)	FCL.1000 + FCL.1015 + AMC1FCL.1015	2 skills tests	NO	NO	NO		NO	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
IRE (H)	FCL.1000 + FCL.1015 + AMC1FCL.1015	2 skills tests	NO	NO	NO		NO	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	NO	NO	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY	PARTIALLY
SFE (H)	FCL.1000 + FCL.1015 + AMC1FCL.1015	2 skills tests	NO	NO	NO		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
TRE SP (H)	FCL.1000 + FCL.1015 + AMC1FCL.1015	2 skills tests	NO	NO	NO		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
TRE MP (H)	FCL.1000 +	2 skills	NO	NO	NO		NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES

	EASA Training Provisions (hours)						Maximum FSTD Training Credits (hours)													
	AIRCREW/ AIROPS reference	Flight Instructions	Dual	SPIC	Solo (PIC)		FNP T 1	FNPT II	FNPT II MCC	FNPT III	FNPT III MCC	FTD 1	FTD 2	FTD 2 MCC	FTD 3	FTD 3 MCC	FFS Level A/AG	FFS Level B/BG	FFS Level C, CG, interim C	FFS Level D/DG
Type of Training																				
	FCL.1015 + AMC1.FCL.1015	tests																		
FIE (H)	FCL.1000 + FCL.1015 + AMC1.FCL.1015	2 skills tests	NO	NO	NO		NO	YES	YES	YES	YES	NO	YES	YES	YES	YES	YES	YES	YES	YES
									(*) for each alternate proficiency check											

Rationale

One of the activities of WP1 is to develop guidance on the use of each FSTD based on its qualification level, and specifically to:

— identify the FSTD credits for each Part-FCL licence and associated ratings for fixed-wing and rotary-wing aircraft; and

— for each license and rating issued, define the suitability of the FSTD for each task, as partial, complete or none; when partial, the proportion or elements to be credited should be specified.

This GM is expected to assist training providers in defining the use of appropriate FSTDs to support the course syllabus, as well as CA inspectors in evaluating the training programme and the appropriate use of FSTDs, thus improving standardisation of both crediting and training.

3.2.2 AMC/GM to Part-ARA

1. New AMC1 ARA.FSTD.101(a) is added as follows:

AMC1 ARA.FSTD.101(a) FSTD inspector competency and training

(a) FSTD inspector competencies

(1) For the qualification of inspectors involved in the FSTD domain, the competent authority should develop criteria identifying the various competencies required from inspectors to perform their activity. These competencies should be defined for each task concerned, such as technical and flight inspections, initial qualifications, recurrent evaluations, FSTD operators' compliance-monitoring system (CMS) audits, etc.

(2) Considering the areas to be covered and the tasks to be performed, the competent authority should define the level at which these competencies have to be demonstrated.

(b) FSTD inspector training

(1) The competent authority should define the prerequisites required to be appointed as an FSTD inspector. The inspectors should have relevant education and/or experience providing the necessary understanding of the FSTD domain.

(2) The competent authority should prepare a customised training plan for the trainee to reach the required competency. That plan should include the trainee's experience and training needed to develop the required competencies. The initial training should cover those areas where the competency is not yet achieved (please refer to (b)(1) above). If certain training items are omitted due to the competency the trainee acquired earlier, the justification of this omission should be documented.

(3) A formal statement in the training records should be made that the inspector is released to work as an FSTD technical inspector (TI) or FSTD flight inspector (FI).

(4) Continuation, recurrent and/or refreshment training is necessary to maintain the acquired competency. The procedures and depth of such training should be defined by the competent authority.

2. New GM1 ARA.FSTD.101(a) is added as follows:

GM1 ARA.FSTD.101(a) FSTD inspector competency

FSTD inspector competency levels

(a) Table 1 below shows the desired competencies and observable behaviours. The observable behaviours should take into account the following elements:

(1) role (technical inspector/flight inspector (TI/FI);

(2) FSTD evaluation type (initial/recurrent);

(3) FSTD type; and

(4) FSTD qualification level.

(b) Please refer to GM1 ARA.FSTD.100(a) for further guidance on the appropriate topics of training.

(c) The levels of inspector's competencies are defined in ascending order as follows:

(1) awareness (A):

(i) common knowledge or understanding of basic techniques and concepts; and

(ii) no need to complete tasks related to this competence;

(2) familiarisation (F):

(i) level of experience gained in classroom and/or as a trainee on the job;

(ii) acting as a team member, often requiring help from others; and

(iii) understanding and using terminology, concepts, principles, and practices;

(3) working level (W):

(i) successfully completing tasks mostly independently, but help from experts may be required from time to time;

(ii) understanding and discussing applications and their changes; and

(iii) understanding causal connections and combining different aspects affecting the subject matter; and

(4) expertise (E):

(i) successfully completing tasks fully independently;

(ii) explaining and taking a stand on difficult questions; and

(iii) participating in the development of reference and resource materials.

Table 1 — FSTD inspector's competencies

Core competencies	Description of the competency	Observable behaviour in FSTD domain	Compliance-monitoring system (CMS) audit		Initial and special evaluation		Recurrent evaluation	
			Init	Rec	TI	FI	TI	FI
Theoretical knowledge	Basic knowledge and understanding of flight simulation	Demonstrates the appropriate level of understanding of the following FSTD features/systems and their integration:						
		— motion-cueing system;	F	F	E	W	W	W
		— hardware (e.g. architecture, real/simulated parts, interface, host);	F	F	E	W	W	W
		— visual (e.g. image generation, projectors, optics, collimated/direct projection);	F	F	E	W	W	W
		— software (e.g. basics, re-hosted/retargeted avionics, binary- and loadable-software aeroplane part solutions) and configuration control processes;	W	W	E	W	W	W
		— databases (e.g. types and correlation);	W	W	E	W	W	W
		— flight controls/control loading (e.g. passive/active, reversible/non-reversible);	F	A	E	W	W	W
		— sound-cueing system (e.g. limitations, subjective/objective);	F	A	E	W	W	W
		— modelling of aeroplane performance and handling characteristics;	W	F	E	W	W	W
		— validation data and validation data roadmaps; and	F	A	E	W	W	W
		— aeroplane system modelling and data package types.	F	A	E	W	W	W
Regulatory knowledge	Understanding and application of regulation and procedures	Demonstrates the appropriate level of understanding and application of the following:						
		— concept and basis of applicable primary	W	W	E	W	W	W

		reference documents;						
		— all applicable regulations (e.g. Regulation (EC) No 216/2008, Annex VI (Part-ARA)/Annex VII (Part-ORA) to Regulation (EU) No 1178/2011;	E	W	E	W	W	W
		— internal work instructions;	W	W	W	W	W	W
		— guidance material on industry best practices (e.g. RAeS, ARINC, and ICAO publications[20]).	E	W	E	W	W	W
Teamwork skills	Leading and management of the oversight process	Demonstrates appropriate teamwork ability in the following:						
		— oversight preparation;	E	W	E	E	W	W
		— organising evaluation/audit processes and resources;	E	W	E	E	W	W
		— briefing and debriefing; and	E	W	E	E	W	W
		— task allocation.	E	W	E	E	W	W
FSTD operations	Knowledge of FSTD acceptance process and operations	Demonstrates the appropriate level of understanding and application of the following:						
		— acceptance and testing processes;	E	W	E	W	W	W
		— additional equipment (at qualification level);	E	W	E	W	W	W
		— modifications (e.g. AD, updates);	E	W	E	W	W	W
		— maintenance; and	E	W	E	W	W	W
		— performance metrics.	E	W	E	W	W	W
FSTD use	Knowledge of FSTD use in pilot training	Demonstrates the appropriate level of understanding of the following:						
		— FSTD as part of an approved training course;	W	W	W	E	F	W
		— credits vs different FSTD qualification levels;	W	W	W	E	F	W
		— FSTD training, testing and checking considerations; and	W	W	W	E	F	W
		— air operations and flight crew implications for FSTDs.	W	W	W	E	F	W

[20] Royal Aeronautical Society, Aeronautical Radio Incorporated, and International Civil Aviation Organization, respectively.

FSTD evaluation	Understanding and application of FSTD evaluation components	Demonstrates the appropriate level of understanding and balanced application of the following:						
		— QTG/objective testing;	W	W	E	W	W	F
		— functional/subjective testing;	W	W	E	E	W	W
		— engineering judgement;	W	W	E	W	W	F
		— proportionate decision-making;	W	W	E	E	W	W
		— additional training considerations; and	W	W	E	E	F	W
		— categorisation of findings.	E	E	E	E	W	W
CMS assessment	FSTD qualification certificate holder's CMS manual assessment and auditing	Demonstrates the appropriate level of understanding and application of the following:						
		— assessment of the management system (CMS, safety management system (SMS));	E	W	F	F	F	F
		— auditing techniques; and	E	W	F	F	F	F
		— what is expected from the FSTD operator's processes.	E	W	F	F	F	F

3. GM2 ARA.FSTD.101(a) is amended as follows:

Draft rule text

GM2 ARA.FSTD.101(a) FSTD inspector training

(a) Prerequisites for FSTD inspectors

When defining the prerequisites required to be appointed as a FSTD inspector, the following guidance should be taken into account:

(1) the inspectors should have relevant experience providing an adequate understanding of the FSTD domain in the following areas: flight mechanics and aerodynamics, image generation systems, electronics/avionics, computer programming, aeroplane systems and structures, methods of simulation, flight training and methods, and flight operations and methods;

(2) technical inspectors should hold a degree in aviation engineering; and

(3) AMC4 ARA.FSTD.100(a)(1) describes what is expected from a flight inspector; in addition to that:

(i) if the flight inspector's instructor privilege has expired more than three years before, the practical experience in FSTD evaluation as flight inspector should consist of at least eight recurrent FFS evaluations within the last three years to remain valid for the evaluation tasks; and

(ii) if the flight inspector's instructor rating has expired more than eight years before, the flight inspector's practical experience is not deemed valid for the evaluation tasks.

(b) Initial training of FSTD inspectors

The competent authority should ensure that the inspectors are competent in the domains they will be working on. In that respect, the following principles should be taken into account:

(1) inspectors working with experience in initial and special evaluations should have a higher level of competency than the inspectors with experience in recurrent evaluations;

(2) the training details (e.g. on QTG and subjective testing) should be differentiated between aeroplane and helicopter FSTD inspectors;

(3) inspectors should be trained, competent and assessed on all those FSTD qualification levels (i.e. FFS, FTD, FNPT, BITD) they will be working on;

(4) additional competency is required when evaluating specific areas related to special training considerations such as PBN, UPRT, stall, HUGS, EVS, helicopter special scenarios, etc.; and

(5) evaluation/audit teams should be composed so that they have the appropriate competencies.

(c) Any appropriate training methods such as lectures or self-study may be used. The training material should support the development of competencies. The trainers of FSTD inspectors should be qualified as described in AMC1 ARA.GEN.200(a)(2) and should have the following:

(1) expert-level competency in their instruction areas;

(2) wide experience in their instruction areas; and

(3) adequate pedagogic skills.

(d) Guidance on the training topics is provided in Table 1 below. The purpose of each training topic is to establish a certain level of competency in the topics and their associated rules, which the inspectors need in order to perform their tasks.

Table 1 — Training topics regarding inspectors performing FSTD evaluations and/or audits of FSTD qualification certificate holders

Area of training	Key learning points
(a) International aviation safety and regulation environment	(1) Chicago Convention on International Civil Aviation and ICAO Annexes and Documents; (2) European Union (EU) regulations; and (3) EASA AMC/GM
(b) Applicable primary reference documents (PRDs)	(1) History and generation of PRDs; and (2) Notable differences between different PRDs.

Area of training	Key learning points
(c) CS-FSTD(A) and/or CS-FSTD(H) (as applicable)	(1) Structure; (2) Main contents; (3) Definitions of different FSTD levels and their differences; and (4) Specific case of interim Level C.
(d) FSTD cues	(1) Human aspects; (2) Human self-motion perception; (3) Technology and ways to create and combine cues in FSTDs and; (4) Positive and negative transfer of training.
(e) Computing and real-time simulation	(1) History; (2) Limitations; (3) Simulation loop; (4) Host computer; (5) Nodes; and (6) Latency/transport delay.
(f) FSTD common hardware solutions	(1) Computer architecture; and (2) Control loading systems.
(g) Visual system	(1) History of visual systems; (2) Different projection types; (3) Image generation; (4) Visual-database creation; (5) Visual-system geometry; (6) Requirements for different FSTD qualification levels; and (7) Objective visual tests.
(h) Motion system	(1) Degrees of freedom; (2) Generation of motion cues; (3) Limitations; (4) Motion algorithms; (5) Fast Fourier-transformation; and (6) Power spectral density.
(i) Avionics simulation	(1) For generic FSTDs, acceptable system characteristics as in CS-23, CS-25, CS-27, and CS-29; (2) Reference documents for avionics (e.g. aircraft flight manual (AFM), flight crew operating manual (FCOM), data package); (3) Concept of re-hosting; (4) Use of real avionics boxes; (5) Use of simulated avionics; (6) Pros and cons of different solutions; (7) Simsoft (Aeronautical Radio Incorporated (ARINC) 610); and (8) Control system operation.

Area of training	Key learning points
(j) Navigation systems and their simulation	(1) Principles of common navigation systems operation (e.g. INS, VOR, NDB, DME, ILS, GNSS, etc.); (2) Principles of common interfaces of different generations (e.g. GNSS, FMS, integrated avionics suites, etc.); (3) Simulation of navigation databases; and (4) Performance-based navigation (PBN) procedures and required equipment.
(k) Flight operations in different aircraft	(1) Theoretical parts of pilot type course (e.g. competency-based training (CBT)) of at least two different aircraft types (e.g. turboprop and jet); and (2) Flight training (e.g. in FNPT) to gain understanding of instument flight rules (IFR) procedures and multi-engine handling (note: not necessarily targeted for a pilot license).
(l) Simulation of aerodynamics and engines	(1) Simulation loop; (2) Limits of models; (3) Upset simulation and exceedance of simulated envelope; and (4) Aircraft stability and associated provisions of CS-23, CS-25, CS-27, and CS-29.
(m) Validation data	(1) Data gathering; (2) Validation data roadmap (VDR) concept, approval and management of updates; (3) Data package; (4) Data acceptance; (5) Operational suitability data (OSD); (6) CS-SIMD; (7) Proof of match; (8) Use of engineering data; (9) Alternative engine/avionics data; and (10) Concepts of generic data and footprints.
(n) Qualification test guide (QTG)	(1) History of QTG testing; (2) Text part of QTG; (3) Master QTG (MQTG) and its revisions; (4) Concept of validation; (5) Tolerances; (6) QTG testing process; (7) Integrated testing; (8) Differences between automatic and manual testing; (9) Exercises; (10) Typical problems; (11) Use of open- and closed-loop controllers; and (12) Purpose of each individual QTG test (for training on aeroplanes using the RAeS Aeroplane Flight Simulator Evaluation Handbook, Vol I).
(o) Functions and subjective testing	(1) Requirements; (2) Methods for effective testing; (3) Team cooperation; (4) Reference documents (e.g. AFM, FCOM, etc.); (5) Malfunctions testing; (6) What to expect from generic FSTDs i.e. characteristics of different aircraft classes;

Area of training	Key learning points
	(7) Purpose and testing methods of each individual test required by CS-FSTD(A) and/or CS-FSTD(H) (for training on aeroplanes using RAeS Aeroplane Flight Simulator Evaluation Handbook, Vol II); and (8) Additional training considerations (e.g. UPRT and stall recovery, RNP AR, HUGS, etc.).
(p) FSTD evaluation, qualification, and their processes	(1) Initial, recurrent and special evaluations; (2) Documentation; (3) Dossier; (4) How to keep evaluation as objective as possible; (5) Team cooperation; (6) Conducting all the phases of the evaluation and qualification processes; (7) Classification and management of findings; (8) Content, language and form of the certificate and evaluation report; (9) Maintaining the FSTD qualification; and (10) Updates and upgrades.
(q) Training, testing and checking credits	(1) Overview of credits granted by Annex I (Part-FCL) to Regulation (EU) No 1178/2011 and Subpart FC of Annex III (Part-ORO) to Regulation (EU) No 965/2012 ; and (2) OSD reports.
(r) Internal organisational procedures and work instructions of the competent authority	(1) Applicable processes; and (2) Use of documents.
(s) Working as a professional inspector	(1) Participating as an observer on at least three evaluations (all phases); (2) Hands-on evaluation training in FSTD; and (3) Acting as a trainee team member under supervision on at least three evaluations (all phases). The total number of evaluations as a trainee should be determined by the trainee's development progress. The evaluations should cover those FSTD qualification levels (i.e. FFS, FTD, FNPT, BITD) where the inspector is planned to be working after training.
(t) Soft skills	(1) Communication skills; (2) Conflict management; (3) Teamwork; (4) Time management; and (5) Human factors (HF).
(u) Ability to exercise proper judgement	(1) Justification of findings (i.e. always based on evidence and documentation, such as requirements, or on operator manuals (OMs), but not on personal preferences); (2) Engineering judgement; and (3) Examples of different kind of problems that can be encountered, as well as findings of different levels and basis for their classification.
(v) Expectations of FSTD OMs	(1) Requirements concerning FSTD OMs, for example: (i) AMC1 ORA.GEN.200(a)(5);

Area of training	**Key learning points**
	(ii) AMC1 ORA.GEN.200(a)(6); (iii) GM1 ORA.GEN.200(a)(5); (iv) GM1 ORA.FSTD.100; and (v) GM2 ORA.FSTD.100; and (2) Ways of presenting a process (e.g. text, checklists or flow process charts indicating when, how, and by whom something is performed).
(w) Auditing process and general auditing methods and procedures	(a) Concept and definitions of process, audit and inspection (please refer to GM3 ORA.GEN.200(a)(6)); (b) 'General' auditing procedures and methods; e.g. preparation, conduction (interviewing, documentations practices, etc.), reporting, follow-up and closure of an audit; and (c) Practical training on CMS audits. The competent authority should define the number of audits in which the trainee should participate as an observer and then as a trainee team member under supervision before acting as a full audit team member. The total number of audits as a trainee should be determined by the trainee's development progress.
(x) Expectations of FSTD operator's processes and their main steps	(1) QTG management process: (i) annual test plan; (ii) approval of results; (iii) actions in case of failed test; (iv) MQTG and its revisions; (v) subjective testing process; (vi) functions testing process; (vii) annual test plan; (viii) used documentation; and (ix) contents of fly-out vs PRDs; (2) Reliability analysis (e.g. ARINC 433): (i) measured indicators; and (ii) targets for indicators; (3) Personnel training: initial and recurrent training; (4) Safety instructions for personnel and users; (5) Preventive maintenance: (i) program contents; and (ii) revisions to the programme as needs for change are identified; (6) Configuration control system: (i) management of software, hardware and database changes (e.g. planning, specification, development, acceptance, documentation); (ii) practices to test the integrity of an FSTD; and (iii) software backups; (7) Defect rectification (i.e. 'snag' handling): (i) how users can report defects; (ii) how users are notified of open defects; and (iii) prioritisation of defects; (8) Spare parts and tools management:

Area of training	Key learning points
	(i) management of spares; (ii) how disconnected parts are managed; and (iii) calibration and checks of applicable tools; (9) Document control and logs: (i) archiving of documents; (ii) retention periods; (iii) management of document versions (e.g. manuals, logs, instructions, etc.); and (iv) applicable logs; (10) Compliance monitoring: (i) monitoring of regulatory updates; (ii) planning; (iii) internal audits; (iv) internal inspections; (v) auditors; (vi) management of findings; (vii) root cause analysis; (viii) measurement of effectiveness and continuous improvement; and (ix) reporting to the competent authority; and (11) Safety management system (SMS): (i) recognition and management of FSTD operator's risks; (ii) mitigation of negative training; and (iii) cooperation between FSTD operator and users.

(e) Continuing competence of and recurrent training programme for FSTD inspectors

(1) In order to ensure an acceptable level of practical experience and the retention of the appropriate skills and routines, the inspectors should have recent experience of evaluations and audits. If needed, refreshment training should be provided before acting as a team member. The competent authority should ensure that the inspectors remain competent (please refer to AMC4 ARA.FSTD.100(a)(1)) in oversight activities, and recurrent training should be focused on that aspect as well.

(2) The recurrent training should concentrate at least on the following areas:

(i) areas where improvement is needed (please refer to ARA.GEN.200(a)(4));

(ii) new FSTD and aeroplane technologies; and

(iii) changes to rules affecting the FSTD domain.

(3) Some or all of the below-presented methods should be used for recurrent training:

(i) in-house training;

(ii) self-study (professional literature and/or magazines);

(iii) web-based training courses; and

(iv) participation in FSTD conferences.

Rationale

The current rules are not detailed enough regarding expectations and provisions for the FSTD inspectors' competency. The incorporation of AMC1 ARA.FSTD.101(a), GM1 ARA.FSTD.101(a), and GM2 ARA.FSTD.101(a) into the AMC/GM to Part-ARA will facilitate the standardisation of rules for CAs. Furthermore, through those new AMC on the competency requirements, as well as GM on how to acquire that competency, the FSTD industry will be better served, and the level-playing-field objective met. Some competent authorities have already implemented the training programme of the new GM, and have provided positive feedback. Generally, it is acknowledged that the FSTD inspectors have a wide working domain and, therefore, their required competencies should cover an accordingly wide range of topics/domains.

4. Impact assessment (IA)

4.1. What is the issue

This RMT aims to address the technological changes to FSTDs since the related certification specifications (CS-FSTD(A)) were transposed from the Joint Aviation Regulations (JARs) (see JAR-STD) back in 2009. While the fidelity of modern FSTDs has in the meantime significantly advanced, CS-FSTD(A)[21] has not encompassed this advancement; therefore some specifications have become obsolete, not reflecting technological changes that have occurred during this period. In addition, the fact that CS-FSTD(A) has not kept pace with the technological advancement affects the training of pilots, whose training needs in some cases cannot be fully addressed through FSTDs qualified in accordance with the existing CS-FSTD(A) provisions. Therefore, this RMT proposes to amend CS-FSTD(A), considering both the evolution of FSTD-related technology and the development of pilots' training needs.

This RMT is interlinked with RMT.0581 'Loss of Control Prevention and Recovery Training' as RMT.0196 supports the regulatory proposal included in Opinion 06/2017 (RMT.0581). In this context, the update of CS-FSTD(A) should also facilitate UPRT during recurrent and conversion operator training. Current FSTDs are not qualified to accurately reproduce the approach to stall in certain conditions, nor the behaviour of the aeroplane when affected by ice. In addition, FCs do not have the correct exposure to the above-mentioned situations during training due to FSTD fidelity limitations.

Furthermore, this RMT has another major driver, namely supporting both international cooperation and harmonisation with ICAO. The existing CS-FSTD(A) is not harmonised with ICAO Doc 9625[22], nor with FAA 14 CFR Part 60, Change 2, thus impeding the reciprocity of FSTD qualifications on an international level.

Moreover, this RMT responds to the safety risks identified through SRs proposing regulatory amendments based on related incidents/accidents. In that respect, the FAA acknowledges that the current FSTDs' lack of fidelity or inability to perform certain training tasks may have been a contributing factor in recent aircraft incidents and accidents[23].

Additionally, the FAA supports the adoption of elements of ICAO Doc 9625, Edition 4, which will eventually lead to a change of FAA 14 CFR Part 60, Change 2.

Overall, this RMT aims to resolve the following issues that could have undesired consequences:

— FSTDs not reflecting the technological advancements due to obsolete CSs; which should be enhanced to accommodate current and future training needs;

— exposure to safety risks due to the fact that the current FSTDs' lack of fidelity or inability to perform certain training tasks may have been a contributing factor in previous incidents and accidents;

[21] Decision N° 2012/010/Directorate R of the Executive Director of the Agency of 4th July 2012 on Certification Specifications for Aeroplane Flight Simulation Training Devices (https://www.easa.europa.eu/document-library/agency-decisions/ed-decision-2012010r).

[22] Editions 3 and 4 on the FSTD qualification.

[23] Please refer to the related FAA Notice of Proposed Rulemaking (NPRM) 14 CFR, Part 60 'Flight Simulation Training Device Qualification Standards for Extended Envelope and Adverse Weather Event Training Tasks'.

— non-acknowledgement of reciprocity of FSD qualifications between EASA MS and third countries; and

— financial burden for the industry due to two different standards between the EASA MSs and third countries, to be followed by data providers, FSTD manufacturers, and FSTD operators.

4.1.1. Safety risk assessment

Please refer to Section 2.1. 'Why we need to change the rules'.

4.1.2. Who is affected

The following stakeholders are affected by this RMT's proposed changes:

— Aeroplane OEMs and/or FSTD data providers: they might be affected due to the alignment of CS-FSTD(A) with CS-SIMD (Certification Specifications for Simulator Data), especially with regard to OSD.

— FSTD manufacturers: they would need to change FFSs to display UPRT-related tools on the IOS, as well as update the FSTD modelling with new data.

— FSTD operators: they would update FFSs and evaluate FSTDs.

— EASA and EASA MSs' CAs: they would need to evaluate and qualify the update of FSTDs.

— AOC holders/pilots/ATOs and DTOs/instructors/examiners: they are the final users in the chain, bearing the costs both for the update (one-off costs) and the recurrent evaluation of the FSTDs. This IA, however, does not explore the impact on the aforementioned stakeholders because different models and strategies may be used when transferring the FSTD operators' costs to the AOC holders/training organisations/pilots. Nevertheless, the analysis acknowledges that the FSTD operators' costs are paid by the final users (AOC holders/training organisations/pilots) as per Opinion 06/2017 which proposes the incorporation of UPRT requirements into the European Union (EU) pilot training regulatory framework.

4.1.3. How could the issue/problem evolve

Currently, 750 different Level C and D FFSs are qualified by EASA MSs' CAs as well as by EASA as the CA for operation outside the EASA MSs[24]. If CS-FSTD(A) is not updated, it would remain behind the technological evolution and the development of the pilot's training needs. More important, these FFSs would not be able to ensure an appropriate level of fidelity to facilitate the implementation of UPRT requirements, resulting in a gap between the EU pilot training regulatory framework and the current technologies. This RMT aims to prevent such a gap by aligning the FSTD technical provisions with the EU pilot training regulatory framework.

Furthermore, if no action is taken, the safety risks identified above would continue to be unaddressed. The lack of FSTD fidelity and inability to simulate unexpected or abnormal aeroplane situations might negatively affect safety in the EASA MSs. The value of UPRT training would be minimised or even compromised.

[24] The related data stem from EASA standardisation inspections in January 2017 as well as EASA databases (please refer to the following link: https://lisstdis.easa.europa.eu/eqstdis/). It is assumed that this is the maximum number of the affected FFSs as there might be some devices that are already qualified by the FAA in the USA, complying with ICAO Doc 9625.

Moreover, if the EU regulatory framework remains unchanged, the fact that third countries align their rules with the recent updates of ICAO Doc 9625 would likely lead to having two different standards to be followed by data providers, FSTD manufacturers, and FSTD operators both in EU MSs and third countries. This poses an unnecessary financial and administrative burden to industry. The harmonisation of the EU rules with elements of ICAO Doc 9625 would ensure consistent application of the relevant FSTD provisions when qualifying FSTDs. A (partial) alignment with FAA 14 CFR Part 60, Change 2 is also considered to be of importance for improving the reciprocity of FSTD qualifications between EU MSs and third countries.

4.2. What we want to achieve — objectives

Please refer to section 2.2 'What we want to achieve — objectives'

4.3. How it could be achieved — options

The following options have been identified to solve the issues explained above.

Table 2 — Selected policy options

Option No	*Short title*	*Description*
0	Do nothing	No policy change (no change to the existing CS-FSTD(A)). The issues identified in Section 1.1 would remain unchanged. The value of the training would be minimised/compromised, but the training itself would still be allowed.
1	Develop UPRT IOS feedback tools	This would provide mandatory provisions for updating FSTDs to support UPRT, in accordance with applicable Part-FCL requirements and ICAO Doc 10011 guidance. This Option includes technical and qualification provisions for operators to install IOS feedback tools that support UPRT. The proposed amendments would be applied to new and existing FSTDs.
2	Option 1 + increase FSTD fidelity to better facilitate approach-to-stall training	In addition to Option 1, this would provide mandatory provisions for updating FSTDs to support approach-to-stall training. Approach to stall is conducted today; however, the simulation fidelity provisions may not always be appropriately validated: — current objective testing provisions only validate the take-off (second-segment climb) and either approach or landing configuration; Option 2 proposes to extend the testing to include the cruising configuration, as well to require validation of both the approach and landing configurations; and — additionally, current objective testing provisions do not validate the effects of icing on stall speeds, therefore, this Option includes considerations for the proper aerodynamic modelling of ice in accordance with the ICAO Doc 9625 guidance as well as for the effects of icing on stall warning,

Option No	*Short title*	*Description*
		stall identification, and aerodynamic stall. The new provisions would be applicable both to new and existing FSTDs.

Based on the initial analysis of all options, the following options were discarded, as explained in Table 3 below:

Table 3 — List of discarded policy options

Title	*Rationale for being discarded*
Mandate to update CS-FSTD(A) for new and existing FSTDs	The updated CS-FSTD(A) would apply both to new FSTDs (ready for the market after the new CS-FSTD (A) is issued) and existing FSTDs (Level C and D FFSs qualified by EASA or EASA MSs' CAs). This option was discarded as the restrictions of ICAO Doc 10011 do not allow to apply it to existing FSTDs.
Mandate to update CS-FSTD(A) for new devices	The updated CS-FSTD(A) would only apply to new devices, ready for the market after the CS-FSTD(A) is issued. This option was discarded as the restrictions of ICAO Doc 10011 do not allow to apply it to new devices.
Partially align with ICAO Doc 9625, Edition 4	This option incorporates all of the provisions proposed by the previous two discarded options and allows for alignment with FAA 14 CFR Part-60, Change 2 provisions. It would apply to both new and existing devices. It was discarded as it goes beyond the scope of WP1 (please refer to TOR RMT.0196, Issue 1). It may be considered at the WP2 stage.
Fully align with ICAO Doc 9625, Edition 4	This option provides for more effective and efficient means to update FSTD standards and qualification provisions. It would apply to both new and existing devices. It was discarded as it goes beyond the scope of WP1. It may be considered at the WP2 stage.

4.4. Methodology and data

The objective of this IA is to assess the costs and benefits of the different options for various stakeholders. The scope of the IA is limited to that of WP1 (please refer to Section 2.3 for further details).

The other two WPs (WP2 and WP3) will be developed after concluding WP1, and the related IAs will be similarly incremented.

For this IA, only Level C and D FFSs, qualified by EASA and EASA MSs' CAs are considered as those devices will be mainly affected by the proposed changes. During the development of the IAs for WP2 and WP3, data on other devices (FTD, FNPT, BITD) will also be used to feed the analysis. The IA does not take into account devices qualified by other regulators (e.g. FAA-qualified FFSs).

Out of the scope of this IA is the update of the FSTD inspector competencies framework as this NPA proposes amendments also to Part-ARA which are out of the scope of the CS-FSTD(A) update. The related recommendations may be considered further in another RMT. Therefore, the IA does not analyse the impact of proposed changes on the FSTD inspector competencies framework.

4.4.1. Data collection

This IA has been performed using the following data sources:

— data from OEMs, data package providers, FSTD manufactures, FSTD operators, CAs, airlines, as members of RMG RMT.0196;

— 2017 data from the EASA standardisation inspections, on the number of active FFSs qualified by the EASA MSs' CAs;

— 2017 data from the EASA database on Level C and D FFSs qualified by EASA[25]; and

— World Simulator Census 2015[26].

4.4.2. Methodology applied

The IA was developed combining various IA tools:

(a) Multi-criteria analysis (MCA)

MCA covers a wide range of techniques that aim at combining positive and negative impacts into a single framework for an easier comparison of scenarios. The scoring of the impacts uses a scale of – 5 to + 5 to indicate, respectively, the negative and positive impacts of each option (ranging from 'very low' to 'very high' negative/positive impacts). The intermediate scores are termed 'low, 'medium', and 'high', providing a total of five levels of all impacts in each direction (positive and/or negative). A 'no impact' score is also possible.

Table 4 — Scoring of impacts

Positive impact	**Score**	**Negative impact**	**Score**
+ 5	Very high positive impact	– 5	Very high negative impact
+ 4	High positive impact	– 4	High negative impact
+ 3	Medium positive impact	– 3	Medium negative impact
+ 2	Low positive impact	– 2	Low negative impact
+ 1	Very low positive impact	– 1	Very low negative impact
0	Neutral/insignificant	0	Neutral/insignificant

[25] https://lisstdis.easa.europa.eu/eqstdis/

[26] https://www.halldale.com/sim-census

Table 5 — Economic scale

			Competent authorities (CAs)	**OEMs/data package providers**	**FSTD manufacturers**	**FSTD operators**
		Turnover (in million EUR)	1 000	52 800	3 000	4 800
Qualitative description	Score	Turnover impact				
Very high impact	+/– 5	> + 1.5 %	15	792	45	72
		1-1.5 %	15	792	792	72
High impact	+/– 4	0.8-1 %	10	528	30	48
		0.6-0.8 %	8	422.4	24	38.4
Medium impact	+/– 3	0.4-0.6 %	6	316.8	18	28.8
		0.2-0.4 %	4	211.2	12	19.2
Low impact	+/– 2	0.1-0.2 %	2	105.6	6	9.6
		0.05-0.1 %	1	52.8	3	4.8
Very low impact	+/– 1	0.02-0.05 %	0.5	26.4	1.5	2.4
		0-0.02 %	0.2	10.6	0.6	0.9
No impact	0		0	0	0	0

(b) Case studies

Due to the different business strategies/models that FSTD manufacturers/operators might apply to comply with the proposed rules, the impacts are illustrated and visualised more realistically through examples of impacts of the different options for different stakeholders.

(c) Impacts analysed

The impacts have been analysed using various criteria: safety, environmental, social, economic, proportionality and General Aviation (GA). These criteria are derived from the main objectives of the Basic Regulation. The impact on harmonisation with the FAA, ICAO and other organisations is analysed using the economic criterion as harmonisation has economic implications in terms of costs and benefits.

In addition, the following important remarks on methodology should be taken into consideration:

— Each option has been analysed separately, in comparison with Option 0. As Option 2 is a combination of Option 1 and some additional proposals, it has been considered in the analysis as a combination of the costs/benefits of Option 1 with those of the additional proposals (e.g. icing model implementation).

— The IA has been performed using a compensatory method[27] for assessing the impacts. This method allows a trade-off between different impact assessment criteria, e.g. low scores on one criterion may be compensated by high scores on another. Furthermore, the same principle is applied to the assessment of impacts for different stakeholders within one criterion (e.g. safety, social, economic, etc.).

4.5. What are the impacts

4.5.1. Safety impact

Option 0 — Do nothing

Current safety issues remain unchanged, as mentioned in the issue analysis. The safety risks identified above would continue to be unaddressed. The lack of FSTD fidelity and inability to simulate unexpected or abnormal aeroplane situations might negatively affect safety in the EASA MSs. The value of UPRT training would be minimised or even compromised. The safety level score is assessed as neutral (0) to negative.

Option 1 — Develop UPRT IOS feedback tools

The safety level is expected to increase by providing instant feedback to the instructor on how recovery was performed. However, the increase is assessed as low since the feedback to the instructor would not include reporting on major safety issues, especially in abnormal-recovery cases. Therefore, the overall safety benefits would be very marginal.

Option 2 — Option 1 + increase FSTD fidelity to better facilitate approach-to-stall training

Safety would improve more than through Option 1 because the objective testing provisions would validate not only the cruising configuration, but also the approach and landing configurations. Current FSTDs are not qualified to accurately reproduce the approach to stall in certain conditions, nor the behaviour of the aeroplane when affected by ice.

As mentioned in the issue analysis, EU AOC holders estimated that in **6 (2 fatal accidents, 4 serious incidents)** out of the 58 cases in the period 2012-2016, 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 the 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. In all cases, a clear indication of an imminent stall, such as buffeting, did not lead the fight crew to take correct action.

It is expected that the updated FSTD testing provisions will validate the effects of icing on stall speeds, in accordance with the ICAO Doc 9625 guidance, as well as the effects of icing on stall warning, stall identification, and aerodynamic stall. The flight crew will be exposed to such situations during training in order to be able to appropriately react when confronted with these situations in real operations. Therefore, the training of flight crew in enhanced-capability FSTDs to facilitate the approach-to-stall training is expected to provide a clear safety benefit, especially in the simulation of icing conditions.

[27] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/7612/1132618.pdf

Overall, this option is expected to improve flight crew training, as a safety barrier, to mitigate the risk of LOC-I. The overall safety impact is considered to be positive although the fidelity of the FSTD used by flight crew for the type rating or refresher training may have only a limited contribution in preventing LOC-I. Nevertheless, the strengthening of this barrier is expected to facilitate the early detection of the aeroplane upset safety issues and, hence, prevent the LOC-I; therefore, the overall safety impact of Option 2 is considered to be medium positive.

Based on the analysis above, the assessment of safety impacts is summarised in Table 6 below:

Table 6 — Safety impacts per option

Criterion	***Option 0*** ***Do nothing***	***Option 1*** ***Develop UPRT IOS feedback tools***	***Option 2*** ***Option 1 + Increase FSTD fidelity to better facilitate approach-to-stall training***
Safety	Safety issues remain unchanged	Limited safety benefit due to unchanged modelling/motion-cueing fidelity of FSTDs. Better awareness of instructors, which facilitates UPRT.	Improved safety level due to the validated cruising configuration, in addition to the approach and landing configuration, as well as due to the validation of the effects of icing on stall warning and identification. Strengthened training of flight crew to prevent and/or mitigate the risk of LOC-I.
	0 Neutral	+ 2 Low positive impact	+ 3 Medium positive impact

4.5.2. Environmental impact

N/a

4.5.3. Social impact

Option 0 — Do nothing

No social impact is expected from Option 0.

Option 1 — Develop UPRT IOS feedback tools

Through this Option, knowledge and skills of the pilots in handling recognition and prevention of, as well as recovery from, upset situations would be improved, by updating FSTD provisions in accordance with the applicable Part-FCL requirements, and ICAO Doc 10011 guidance.

This Option would have a positive impact for instructors receiving better feedback on the performance of the pilots through the installed IOS feedback tools. The instructor competence would further increase due to the newly introduced UPRT course.

However, the overall social impact is considered to be very low as the pilots would still not be trained in FSTDs qualified to accurately reproduce the approach to stall in certain conditions or the behaviour of the aeroplane when affected by ice.

Based on the analysis above, the overall social impact of Option 1 is scored with + 1 (very low positive).

Option 2 — Option 1 + increase FSTD fidelity to better facilitate approach-to-stall training

Apart from the social benefits of Option 1, the additional changes included in this option would have even more social benefits for pilots.

The pilots would receive training in an environment with higher-fidelity FSTDs, hence, be better prepared for unexpected situations and improve their resilience. As mentioned in the issue analysis, in 3 out of 10 fatal accidents and serious incidents[28], the flight crew was unable to detect the approach to stall and apply efficient flight control inputs to recover from the stall. In those cases, it was acknowledged that the flight crew had suffered a cognitive saturation, making it difficult to process sensorial information. Therefore, the increased FSTD fidelity to validate the take-off, approach or landing configuration, as well as the effects of icing on stall speeds, would expose flight crews to those situations during training.

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.

Table 7 — Social impacts per option

Criterion	*Option 0* *Do nothing*	*Option 1* *Develop UPRT IOS feedback tools*	*Option 2* *Option 1 + increase FSTD fidelity to better facilitate approach-to-stall training*
Social	No change	Improved knowledge and skills of instructors in terms of training and evaluating the UPRT outcome. However, this alone would have a very low impact due to the existing limitations of FSTDs in supporting the approach-to-stall training in certain conditions, including in icing conditions.	Considerably improved training for pilots due to the increased FSTD fidelity, facilitating the approach to stall in certain conditions. Pilots would therefore be better prepared to cope with such situations in real operations.
	0 Neutral	+ 1 Very low positive impact	+ 2 Low positive impact

4.5.4. Economic impact

The economic impacts are analysed for all stakeholder groups, starting with the OEMs/data package providers and ending with the airlines, ATOs, and pilots, who will benefit from the improved FSTD fidelity.

The economic impacts have been analysed on the following assumptions:

— OEM/data package providers would have to cover the costs for updating the FSTD data packages with required data. For Option 1, there would be negligible costs related to the instructor feedback tools as the data package would remain within the existing training envelope. However, for Option 2, there would be costs related to the updating of data packages, which are considered in the analysis.

[28] Review of the loss of control CAT aeroplane accidents and serious incidents worldwide between 2012 and 2016.

— FSTD manufacturers would bear the costs for the development of IOS UPRT display tools (Option 1), and for the deployment of FSTD modelling and its update with new data (Option 2) in the existing/new devices. The FSTD manufacturers' costs for the development of FSTD modelling are analysed as a lump sum at the manufacturer's level. The reason is that every manufacturer may have its own strategy to group the FSTDs into categories depending on the specific costs incurred in each case, the age of the FSTD (the older FSTDs typically require more effort to be updated), etc.

— FSTD operators would have to pay for the FFS update and the evaluation of FSTDs (for normal and, in some cases, for special evaluations). It is assumed that they would be the most affected stakeholders bearing the overall costs. However, these costs would eventually be incurred by the AOC holders, ATOs, pilots, passengers, etc. as UPRT training would require the use of updated FSTDs with higher fidelity, as proposed by Opinion 06/2017 amending Part-FCL. Therefore, the FSTD operators would bear the costs only up to a certain point, depending on the business model and strategy of the AOC operators, ATOs, etc. For the IA, the overall economic impact is analysed up to the FSTD operators' stage.

— EASA MSs' CAs would bear the costs for the updated training of inspectors based on the new requirements, as well as possible additional costs for the evaluation and qualification of the updated FFSs (normal or special evaluations in some cases). It is assumed that one hour of the CA's time to evaluate/quality an FFS costs EUR 230.

— In the analysis, the 5 major FSTD manufacturers have been taken into account, making up the majority of the FFS market.

— There are in total 755 Level C and D FFSs, qualified by the EASA MSs' CAs[29] or by EASA as the CA[30]. This is the maximum amount of devices to be qualified, as some devices might be located in the USA and qualified by FAA. They will need to be updated to respond to the new requirements if used to provide EASA-qualified training.

— In the coming three years, new FFSs are expected in the market (indicatively, 150 Level C and D FFSs), equipped with the updated FSTD model. It is assumed that they would be proportionally distributed on a yearly basis, e.g. 50 FSSs per year.

— The costs are analysed within one year's time after the date of applicability of the updated rules.

— All FFSs (existing and new ones) in the market are expected to be updated within a one year's period[31]. These assumptions are based on the transition period that would be granted for the implementation of the current draft rules, which is proposed to be one year after the date of applicability of the new CS-FSTD(A). Nevertheless, it is assumed that not all FFSs would be updated in that transition year. Depending on the strategy of the FSTD operator, this process may take two years or even more.

— The costs for every type of stakeholder are compared with each stakeholder's turnover in order to indicate the impact of the costs per type of stakeholder.

[29] 2017 data from the EASA standardisation inspections (January 2017) on the number of active FFSs qualified by EASA MSs' CAs.
[30] 2017 data from the EASA database on EASA-qualified Level C and D FFSs (https://lisstdis.easa.europa.eu/eqstdis/).
[31] However, a transition period of two years would be granted.

— The overall costs to be borne by the FSTD operators are compared with the turnover of the affected industry in general, following the assumption above that those costs would be incurred by the ATOs/airlines/pilots.

Option 0 — Do nothing

No economic impact is expected.

Option 1 — Develop UPRT IOS feedback tools

Direct costs/economic impact for OEMs/data providers

The economic costs for OEMs/data providers for providing data for IOS UPRT display tools would be negligible as the data package would remain within the existing training envelope. The impact of this Option is considered to be very low negative.

Impact for OEMs/data providers (in million EUR)	Option 1 (in million EUR)
Total one-off cost for updating the FSTD data package with required data (for new aeroplanes, as well as old ones with or without data)	2.4[32]
Total industry turnover (OEMs)[33]	52 800
Impact in %	0.00 %
	Negligible

Direct costs/economic impact for FSTD manufacturers

As mentioned above, the costs for modifying FSTDs to support UPRT IOS tools might be grouped in several categories with specific costs. For simplicity reasons, the costs are considered as a lump sum per manufacturer.

Impact for FSTD manufacturers	Option 1 (in EUR)
One-off development costs per manufacturer for updating the FSTDs' devices	690 250
Number of manufacturers	5
Recurrent costs	0
Total costs for the industry	3 451 250
Total FSTD manufacturers turnover	3 000 000 000
Impact in %	0.12 %
	Low negative

[32] The amount might be lower as the OEMs/data providers could not explicitly differentiate between the costs of Option 1 and those of Option 2.

[33] Please refer to Table 4 —Scoring of impacts.

Direct costs for the FSTD operators

The table below presents the direct costs to be borne by FSTD operators to comply with the updated rules.

Impact for FSTD operators	Option 1 (in EUR)
1. One-off costs	
1.1. Additional recurrent evaluation per FFS	1 100.00
2. Recurrent costs	
2.1. Additional costs during standard recurrent evaluations (one hour in addition to evaluate the FFS)	230
3. Total unit cost per FFS	1 330
4. Number of existing active EASA-qualified Level C and D FFSs in EASA MSs and third countries	755
4.1. FFSs qualified by EASA MSs — Source: EASA standardisation inspections, January 2017	426
4.2. FFSs qualified by EASA MSs — Source: EASA database (https://lisstdis.easa.europa.eu/eqstdis/)	329
5. Number of new FFSs in the market in 2018 (projection)	50
6. Number of all FFSs in 2018 (sum of 4. + 5. (projection))	805
Total costs for the industry (unit cost multiplied by the number of FFSs)	1 070 650

As mentioned above, FSTD operators would bear the overall costs, starting from the costs for the OEMs/data providers and ending with their direct costs for evaluating the FFSs. Therefore, the IA analysed the overall impact of the costs for FSTD operators. The FSTD operators turnover is used as a reference to illustrate the overall impact of these costs as it is assumed that the costs will be incurred at a later stage by the users of the updated FFSs (airlines, ATOs, pilots).

Overall costs/economic impact for FSTD operators

Overall impact on FSTD operators	Option 1 (in EUR)
Direct costs for OEMs/data providers	2 400 000
Direct costs for FSTD manufacturers	3 451 250
Direct costs for FSTD operators	1 070 650
Overall costs for FSTD operators	6 921 900
Total FSTD operators turnover	4 800 000 000
Impact in %	0.14 %
	Low

Economic impact for CAs

Option 1, the CAs would have additional costs for the evaluation and qualification of the updated FFSs. It is assumed that no training would be needed for the CA inspectors. As regards the time needed for the evaluation and qualification of updated FFSs, it is assumed that the evaluation of a UPRT FFS update would take five working hours.

Impact for CAs	Option 1 (in EUR)
Training of inspectors	0
One-off costs for evaluation and qualification of updated FFSs	1 150
Total costs for CAs for evaluation and qualification of 755 updated FFSs	868 250
Overall costs for CAs	868 250
Total budget for all EASA MSs' CAs[34]	1 000 000 000
Costs for the CAs as % of their budget	0.09 %
	Low

Summing up the economic impacts for all stakeholders, the overall economic impact of Option 1 would be low negative. The score of Option 1 is – 2.

Costs per stakeholder	Option 1	
	Total costs (in EUR)	Costs as % of the turnover per stakeholder
Total costs for OEMs/data providers	2 400 000	Negligible
Total cost for FSTD manufacturers	3 451 250	0.12 % Low negative
Total costs for FSTD operators	1 070 650	See the cell below
Overall costs to be borne by FSTD operators	6 921 900	0.14 % Low negative
CAs costs	868 250	0.09 % Low negative
Total costs	7 790 150	Low negative

Option 2 — Increase FSTD fidelity to better facilitate approach-to-stall training, in addition to Option 1.

Direct costs/economic impact for OEMs/data providers

The economic impact for OEMs/data providers for updating the FSTD modelling in order to accommodate the enhanced approach-to-stall training, as well as for developing and deploying IOS display tools, is expected to be a very low negative one.

34 Please refer to Table 4 — Scoring of impacts.

Impact for OEM/data providers	Option 2 (including Option 1) (in million EUR)
Total one-off cost for updating FSTD data package with required data (for new aeroplanes, as well as old ones with or without data)	12[35]
Total industry turnover (manufacturers)	52 800
Impact in % (manufacturers)	0.02 %
	Very low

Direct costs/economic impact for FSTD manufacturers

The same approach as for Option 1 was followed. The costs were analysed per manufacturer and multiplied by the number of manufacturers, giving the overall costs for the industry.

Impact for FSTD manufacturers	Option 1	Option 2 (only for icing model validation)	Option 2 (including Option 1)
One-off development costs per manufacturer for updating the software for their FSTDs	690 250	705 650	1 395 900
Number of manufacturers			5
Recurrent costs			0
Total costs for the industry			6 979 500
Total FSTD manufacturers turnover			3 000 000 000
Impact in %			0.23 % (low to medium)

Direct costs for FSTD operators

In contrast to Option 1, FSTD operators would need to perform as a one-off cost a special evaluation of the FSTDs in conjunction with the normal evaluation. Consequently, there would be additional recurrent costs for the extra three hours during standard recurrent evaluation.

Impact for FSTD operators	Option 2 (including Option 1) (in EUR)
1. One-off costs	
1.1. Special evaluation per FSTD in conjunction with a normal recurrent evaluation	10 000
2. Recurrent costs(	
2.1. Additional costs during standard recurrent evaluations	690
3. Total costs per FSTD	10 690
4. Number of existing active EASA-qualified Level C and D FFSs in EASA MSs and third countries	755

[35] The amount might be lower as the OEM/data providers could not explicitly differentiate between the costs of Option 1 and those of Option 2.

4.1. FFSs qualified by EASA MSs — Source: EASA standardisation inspections, January 2017	
4.2. FFSs qualified by EASA MSs — Source: EASA database (https://lisstdis.easa.europa.eu/eqstdis/)	
5. Number of new FSSs in the market in 2018 (projection)	50
6. Number of all FSSs in 2018 (sum of 4 + 5. (projection))	805
Total costs for the industry	8 605 450

In addition, as mentioned under Option 1, FSTD operators would bear the overall costs, therefore, the IA analysed the overall impact of the costs for FSTD operators. The FSTD operators turnover is used as a reference to illustrate the overall impact of these costs as it is assumed that the costs will be incurred at a later stage by the users of the updated FFSs (airlines, ATOs, pilots).

Overall costs/economic impact for FSTD operators

Overall impact on FSTD operators	Option 2 (in EUR)
Direct costs for OEMs/data providers	12 000 000
Direct costs for FSTD manufacturers	6 979 500
Direct costs for FSTD operators	8 605 450
Overall costs for FSTD operators	27 584 950
Total FSTD operators turnover	4 800 000 000
Impact in %	0.57 %
	Medium

Economic impact for CAs

Under Option 1, the CAs would have additional costs for the training of the staff as well as for the evaluation and qualification of the updated FFSs. As regards the training, it is assumed that each CA would train up to three inspectors for a total amount of EUR 10 000 per CA, with total training costs of EUR 310 000 for all EASA MSs' CAs. As regards the time for the evaluation and qualification of the updated FFSs, it is assumed that 15 working hours are needed for the special evaluation of an approach-to-stall update, including the UPRT update.

Impact for CAs	Option 2 (in EUR)
Training of inspectors (approximately 15 hours for three inspectors per CA)	310 000
Costs for CAs for evaluation and qualification of the updated FSTDs (per FSTD)	3 450
Number of existing FSSs	2 604 750
Total costs for the CAs	2 914 750
Total budget for all EASA MSs' CAs	1 000 000 000
Costs for the CAs as % of their budget	0.29 %
	Low to medium

Summing up the economic impacts for all stakeholders, the overall economic impact of Option 2 would be medium negative. The score of Option 2 is – 3.

Costs per stakeholder	Option 2	
	Total costs (in EUR)	Costs as % of the turnover per stakeholder
Total costs for OEMs/data providers	12 000 000	0.02 % Very low negative
Total cost for FSTD manufacturers	6 979 500	0.23 % Low to medium negative
Total costs for FSTD operators	8 605 450	(see the cell below)
Overall costs to be borne by FSTD operators	27 584 950	0.57 % Medium negative
CAs costs	2 914 750	0.29 % Low to medium negative
Total costs	30 499 700	Medium negative

The table below illustrates the economic impacts per stakeholders for both Option 1 and Option 2:

Costs per stakeholder	Option 1		Option 2	
	Total costs (in EUR)	Costs as % of the turnover per stakeholder	Total costs (in EUR)	Costs as % of the turnover per stakeholder
Total costs for OEMs/data providers	2 400 000	Negligible	12 000 000	0.02 % Very low negative
Total costs for FSTD manufacturers	3 451 250	0.12 % Low negative	6 979 500	0.23 % Low to medium negative
Total costs for FSTD operators	1 070 650	See the cell below	8 605 450	See the cell below
Overall costs to be borne by FSTD operators	6 921 900	0.14 % Low negative	27 584 950	0.57 % Medium negative
CAs costs	868 250	0.09 % Low negative	2 914 750	0.29 % Low to medium negative
Total costs	7 790 150	Low negative	30 499 700	Medium negative

Alignment/Harmonisation with the FAA/ICAO

The economic analysis includes also the assessment of the impacts of the alignment with FAA 14 CFR Part 60, Change 2 and ICAO Doc 9625.

Option 1

This option does not propose full alignment with the requirements of the aforementioned documents. Therefore, it may have some negative impact for FSTD operators operating dual-qualified FSTDs. These operators would be required an additional FSTD qualification by their CA/EASA, to meet the applicable

EU provisions. Consequently, this could possibly delay the amendment of EU-US BASA Annex 4 'FSTD' as this document is based on FAA 14 CFR Part 60, Change 1.

Option 2

This option proposes to closely align with the FAA 14 CFR Part 60, Change 2 and ICAO Doc 9625 requirements. It would ensure harmonisation with the FAA and ICAO, by facilitating enhanced approach-to-stall training, which would have a negative impact for FSTD operators operating dual-qualified FSTDs. To reduce this possible negative impact as well as the administrative burden for the FSTD operators, this Option includes the following possibility for operators who wish to conduct full-stall training: the CA would perform a special evaluation in order to ensure that the FSTD has the appropriate fidelity to provide full-stall training, thereby mitigating the effect of negative training. As Option 1, it could also possibly delay the amendment of EU-US BASA Annex 4 'FSTD' as the document is based on FAA 14 CFR Part 60 Change 2, Change 1.

Table 8 — Economic impacts per option

Criterion	*Option 0* *Do nothing*	*Option 1* *Develop UPRT IOS feedback tools*	*Option 2* *Option 1 + Increase FSTD fidelity to better facilitate approach-to-stall training*
Economic	No impact is expected.	The overall impact is considered to be low negative.	The overall impact is considered to be medium negative.
	0	– 2	– 3

4.5.5. General Aviation (GA) and proportionality

Option 0 — Do nothing

No impact is expected.

Option 1 — Develop UPRT IOS feedback tools

The option would affect only business aviation, not the full GA community. The latter would not be affected at all. The business aviation industry would be affected in the same way as CAT operators. The GA and proportionality impact is analysed in terms of its economic impact.

Option 2 — Option 1 + Increase FSTD fidelity to better facilitate approach-to-stall training

The same impact as under Option 1 is expected.

Table 9 – GA and proportionality impacts per option

Criterion	*Option 0* *Do nothing*	*Option 1* *Develop UPRT IOS feedback tools*	*Option 2* *Option 1 + Increase FSTD fidelity to better facilitate approach-to-stall training*
GA and proportionality	No impact is expected.	The impact on the business aviation industry is analysed in terms of its economic impact. Business aviation is treated as CAT operations. There is no impact on the other segments of the GA community.	Same as under Option 1.
	0	0	0

4.6. Conclusion

The table below summarises the impacts of all options.

Table 10 — Assessment of all options

Criteria	*Option 0* *Do nothing*	*Option 1* *Develop UPRT IOS feedback tools*	*Option 2* *Option 1 + Increase FSTD fidelity to better facilitate approach-to-stall training*
Safety	0	+ 2	+ 3
Social	0	+ 1	+ 2
Economic	0	– 2	– 3
GA and proportionality	0	0	0
TOTAL	0	+ 1	+ 2

The IA shows that Option 2, proposing mandatory provisions for the update of FSTDs to support approach-to-stall training in certain conditions, as well as for the development and deployment of IOS feedback tools, is the most beneficial option.

This option would strengthen the training of the flight crews (safety barrier in the system) to facilitate early detection of aeroplane upset safety issues, thus preventing LOC-I.

It would also ensure full implementation of the UPRT requirements and provisions as part of the EU pilot training regulatory framework, proposed by Opinion 06/2017. It would result in positive social benefits for the pilots receiving training in higher-fidelity FSTDs; this way, they would be better prepared for unexpected situations and improve their resilience.

As regards the economic impact, Option 2 is expected to cost all stakeholders a total of approximately EUR 30 million for updating in accordance with the new provisions the FFSs currently on the market. The overall impact is considered to be medium negative in case most of the FFSs are updated within one year's time after the date of applicability of the new rules. However, the economic impact would be lower if the cost for updating the existing FSTDs would be spread over a longer transition period, e.g. of two years or more.

Option 2 is cost-efficient as the total costs of approximately EUR 30 million to be borne by FSTD operators, if spread over one year (approximately EUR 40 000 per FSTD), would compensate for the cost of at least one catastrophic accident which is estimated at EUR 170 million[36.]

This option envisages alignment to a large extent with FAA 14 CFR Part 60, Change 2 and ICAO Doc 9625. It would ensure harmonisation with FAA and ICAO, by facilitating enhanced approach-to-stall training. However, it also acknowledges that there might be a negative impact for FSTD operators operating FSTDs qualified in compliance with FAA requirements. To reduce this possible negative impact as well as the administrative burden for the FSTD operators, Option 2 includes the following possibility for operators who wish to conduct full-stall training: the CA would

36 According to the EASA assessment of the benefits per accident, the average cost of a catastrophic event is estimated at EUR 162.6 million.

perform a special evaluation in order to ensure that the FSTD has the appropriate fidelity to provide full-stall training, thereby mitigating the effect of negative training.

Finally, the IA recommends the following:

— mandate provisions for updating FSTDs to support enhanced approach-to-stall training as well as for developing UPRT IOS feedback tools (Option 2);

— provide industry with a transition period of two years after the date of applicability of the rules, to update the existing FSTDs on the market; and

— plan a robust monitoring and evaluation of the effects of the proposed rules, based on the results of training and FSTD updates, in order to assess their effectiveness in improving aviation safety.

Question to stakeholders
Stakeholders are also especially invited to comment on this IA and to provide any other quantitative information they consider necessary to bring to the attention of EASA. As a result, the relevant parts of the IA might be adjusted on a case-by-case basis.

5. Proposed actions to support implementation

EASA is committed to providing support for the implementation of the new CS-FSTD. The range of activities developed in this regard will vary depending on the complexity of the rules, the affected stakeholders, as well as on the amount and type of resources allocated by stakeholders to ensure compliance with the new rules.

The feedback from stakeholders is crucial in determining the type of activities that will be developed. In that respect, any constructive feedback provided via different communication channels (e.g. regular meetings with the EASA Advisory Bodies (ABs), development of a related 'frequently asked questions' page on the EASA website, or a combination of the above) will be taken into consideration once the new rules are applicable.

6. References

6.1. Affected regulations

N/a

6.2. 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

— Decision N° 2011/016/R of the Executive Director of the European Aviation Safety Agency of 15 December 2011 on Acceptable Means of Compliance and Guidance Material to 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 'Acceptable Means of Compliance and Guidance Material to Part-FCL'

— Decision N° 2012/006/ Directorate R of the Executive Director of the Agency of 19th April 2012 on Acceptable Means of Compliance and Guidance Material to 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 'Acceptable Means of Compliance and Guidance Material to Part-ARA'

6.3. 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) in particular 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

— ED Decision 2015/012/R of 4 May 2015 amending the Acceptable Means of Compliance and Guidance Material to Part-Definitions and Part-ORO of Regulation (EU) No 965/2012 'GM to Part-Definitions — Amendment 3' 'AMC and GM to Part-ORO — Issue 2, Amendment 2', in particular on UPRT

— Opinion 03/2015, Revision of operational approval criteria for Performance-Based Navigation (PBN), 31 March 2015

- ICAO Doc 9625, Manual of Criteria for the Qualification of Flight Simulators, fourth 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
- EASA CAs Common-Training Initiative Group, Airworthiness Inspectors Qualification Criteria, Issue 2
- Aeronautical Radio, Incorporated (ARINC) Report 432-2 Training Requirements for Flight Training Equipment Support Personnel, 19 November 2014, especially Appendix A
- Joint Aviation Authorities (JAA) Administrative & Guidance Material, Section Six: Synthetic Training Devices (STD/FSTD), Part Two: Procedures, Chapter 3
- International Organization for Standardization (ISO) 10015:1992, Quality management — Guidelines for training’, Edition 1, December 1999
- Finish Transport Safety Agency (Trafi) internal work instructions on FSTD inspector experience and training requirements
- The National Institutes of Health (NIH), Competency Proficiency Scale of the Office of Human Resources (https://hr.od.nih.gov/workingatnih/competencies/proficiencyscale.htm)
- IATA, Evidence Based Training Implementation Guide, Appendix A, 1st Edition, July 2013

7. Appendices

N/a