European Union Aviation Safety Agency

Notice of Proposed Amendment 2020-11

in accordance with:

Article 6 - 9 (*Standard procedure*) MB Decision No 18-2015

Regular update of CS-25

RMT.0673

EXECUTIVE SUMMARY

The objective of this Notice of Proposed Amendment (NPA) is to reflect the state of the art of large aeroplane certification and improve the harmonisation of CS-25 with the Federal Aviation Administration (FAA) regulations. To that end, this NPA proposes amendments to CS-25 following the selection of non-complex, non-controversial, and mature subjects.

In particular, this NPA proposes amendments in the following areas:

Item 1: AMC 25 Subpart H: corrections of references in the correlation table;

Item 2: Turbo-propeller vibrations;

Item 3: Fabrication methods;

Item 4: Windshield – Failure conditions with structural effects;

Item 5: Cabin safety – references to FAA AC 25-17A ‘Transport Airplane Cabin Interiors Crashworthiness Handbook’.

The proposed amendments are expected to provide a moderate safety benefit, would have no social or environmental impacts, and would provide some economic benefits by streamlining the certification process.

Action area:	Regular updates/review of rules		
Affected rules:	CS-25		
Affected stakeholders:	Design approval holders — large aeroplanes		
Driver:	Efficiency/proportionality	**Rulemaking group:**	No
Impact assessment:	No	**Rulemaking Procedure:**	Standard

Table of contents

1. About this NPA

1.1. How this NPA was developed

The European Union Aviation Safety Agency (EASA) developed this NPA in line with Regulation (EU) 2018/1139[1] (the 'Basic Regulation') and the Rulemaking Procedure[2]. This rulemaking activity is included in the European Plan for Aviation Safety (EPAS) 2020-2024 https://www.easa.europa.eu/document-library/general-publications/european-plan-aviation-safety-2020-2024 under Rulemaking Task (RMT).0673. The text of this NPA has been developed by EASA. It is hereby submitted to all interested parties[3] 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/**[4].

The deadline for submission of comments is **1 March 2021**.

1.3. The next steps

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

Considering the comments received, EASA will develop a decision that amends the Certification Specifications (CSs) and Acceptable Means of Compliance (AMC) for Large Aeroplanes (CS-25).

The comments received on this NPA and the EASA responses to them will be reflected in a comment-response document (CRD). The CRD will be published on the EASA website[5].

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

[2] EASA is bound to follow a structured rulemaking process as required by Article 115(1) of Regulation (EU) 2018/1139. Such a process has been adopted by the EASA Management Board (MB) and is referred to as the 'Rulemaking Procedure'. See MB Decision No 18-2015 of 15 December 2015 replacing Decision 01/2012 concerning the procedure to be applied by EASA for the issuing of opinions, certification specifications and guidance material (http://www.easa.europa.eu/the-agency/management-board/decisions/easa-mb-decision-18-2015-rulemaking-procedure).

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

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

[5] https://www.easa.europa.eu/document-library/comment-response-documents

2. In summary — why and what

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

The aviation industry is complex and rapidly evolving. CSs and AMC need to be updated regularly to ensure that they are fit for purpose, cost-effective, and can be implemented in practice.

Regular updates are issued when relevant data is available following an update of industry standards, feedback from certification activities, or minor issues raised by the stakeholders.

Item 1: AMC 25 Subpart H

EASA identified errors among the references in the table providing the correlation between CS-25 Subpart H and CS-25 Amendment 4.

Item 2: Turbo-propeller vibrations

a) Vibration indication system

CS 25.1305(d)(3) requires 'An indicator to indicate rotor system unbalance' for 'turbojet engine-powered aeroplanes' only.

This requirement was first created by the FAA final rule Amdt 25-35 effective: 3/1/1974.

In Europe, before the creation of EASA, JAR 25.1305 was introduced at Change 3 of JAR-25 in 1976, and it was only at Change 8 (Nov 1981) that a subparagraph JAR 25.1305(d)(3) appeared with the requirement for a rotor system unbalance indicator for turbojet aeroplanes (identical to FAR 25.1305(d)(3)).

The FAA final rule addressing turbojet aeroplanes states that a vibration indicator is necessary in the interest of safety: "a rotor system failure can be catastrophic and the contributions to flight safety gained from a vibration monitoring system that provides the flight with an appropriate vibration warning far outweighs any difficulties that may be experienced".

It also mentions voluntary installation, saying that at that time: "The value of the system has been recognized by the aviation industry in that vibration monitoring systems have been voluntarily installed in most turbine powered transport category airplanes currently in production".

Nevertheless, the FAA final rule does not explain why turbo-propeller aeroplanes are excluded from the scope. Some reasons may be, for instance, the absence of voluntary installation of such systems by the industry on turbo-propeller aeroplanes, the technical difficulties faced at that time in separating and treating the different vibration sources on a turbo-propeller aeroplane, the reliability issues due to high vibrations from propellers in normal condition at that time, and the increasing popularity of turbojet aeroplanes.

The Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civil (BEA) in France investigated an incident to ATR 72-212A, registered as 9Y-TTC, dated 4 May 2014, which involved strong propeller vibrations encountered during descent. The final investigation report (published in September 2019) found that alternative overloads resulted in the rupture of a trunnion pin of one of the blades and damage to the propeller blade actuator forward yoke plate.

Six other similar incidents are mentioned in the report.

Section 4.3 of the BEA investigation report states the following:

"Airplanes equipped with turbojets are for the most part equipped with vibration detectors placed on each engine. The information on the levels of certain vibrations is sent to an indicator placed in the cockpit. This system alerts pilots when the vibration level exceeds the design limits and allows them to identify the engine concerned.

The regulations do not require that turboprop aircraft be equipped with them. ATR offers optional installation of accelerometers at both engines for maintenance purposes but the information provided by these sensors is not usable by the crews. In general, the vibrations generated in a turboprop / propeller assembly can sometimes be very different from those that propagate in the cockpit. Relying on what crews feel is not an effective way of identifying the engine or propeller concerned.

Consequently, the BEA recommends that:

EASA assess the benefit of imposing the installation of vibration level indicators for each propeller-engine assembly in the cockpits of commercial air transport aeroplanes equipped with turboprop engines. [Recommendation 2019-018]"

b) Investigation of propeller vibration behaviour

The BEA investigation report (on the incident to ATR 72-212A, registered as 9Y-TTC) also analysed how the ATR propeller vibrations were investigated for the certification of the aeroplane. Section 4.4 provides the following:

"Certain choices and hypotheses meant that the tests carried out during the propeller certification campaign in 1994-1995 did not show certain phenomena observed during the flight tests in 2014 and 2016, in particular the friction at the blade root bearings (ball bunching) and the cyclic loads on the forward yoke plate of the propeller pitch change mechanism when the aeroplane is in descent at a speed close to VMO, with the power levers in the flight idle position.

The FAA circular currently in force, and proposing an assessment method for the vibration stresses borne by a propeller during its certification, recommends incorporating descents at flight idle at various speeds in the flight test programme. Its systematic implementation at various speeds around VMO would allow the existence of vibration phenomena, such as those observed during tests in 2014 and 2016, to be checked for.

Consequently, the BEA recommends that:

EASA and the FAA impose that the initial certification of propellers includes the carrying out of an in-depth study of the actual vibration behaviour of each propeller in flight idle with speeds around VMO. [EASA: Recommendation 2019-019] [FAA: Recommendation 2019-034]"

Note: The mentioned FAA (AC) 20-66B, Propeller Vibration and Fatigue, indeed provides the above mentioned recommendation, but in Appendix 3, which provides 'typical propeller vibration test conditions for part 23 installations with reciprocating and turbine engines'. There is, however, no equivalent appendix for part 25 aeroplanes.

Item 3: Fabrication methods

Historically, the fabrication methods used to produce complex aviation products have typically been defined by the mechanical assembly of parts with simple forms (e.g. complex structures produced using mechanically fastened and formed metal sheets).

In the present context, the term ‘fabrication method’ means the manufacturing and assembly methods, including the consideration of materials and materials processes.

Integrated material, process, manufacturing, and assembly technologies have evolved, and have recently made possible the production of complex products with unique material and engineering properties. These properties, used to substantiate the design of a product and its compliance with the certification specifications, are defined by a specific combination of materials, processes, and manufacturing (or repair) methods.

The CS-25 specifications, and the associated AMC, have evolved piecemeal to address the evolution of some technologies (e.g. castings and composites). However, EASA considers that the more recent proliferation of new materials and integrated material process technologies (e.g. advanced bonding, advanced alloys, new composite materials and processes, and additive manufacturing) requires applicants to formally address, during certification, a range of properties that is potentially broader than the one addressed by more conventional methods. This, therefore, needs to be reflected in CS-25 to better support the development of performance-based specifications and to support compliance with point 21.A.31(a)2 of Part 21.

Item 4: Windshield - Failure conditions with structural effects

On 14 May 2018, a serious incident occurred to an Airbus A319-133, registered B-6419, in China. The right-hand windshield ruptured and departed from the aeroplane, leading to a rapid depressurisation. Fortunately, the two pilots had their safety belts fastened. Nevertheless, the body of the co-pilot was instantly pulled away from the seat by the strong leaking airflow, and he then returned himself to the seat; he suffered from minor injuries.

The investigation report (No. SWCAAC-SIR-2018-1) issued by the Chinese civil accident investigation authority (CAAC) concluded that the most probable cause of this event was:

“the possible damaged sealants (weather seal or silicon seal) of B-6419 RH windshield and existing cavities inside the windshield lead to external moisture ingress and retention in the windshield lower periphery. Due to long-term immersion in wet condition, the insulation of the braid degraded, causing a continuous arc discharge in humid environment (located in the corner at the bottom left of the windshield), generating local overheating, which caused the windshield double layer structure glass plies to rupture. The windshield was unable to withstand the internal and external differential pressure of the cockpit after the rupture of the double layer structure glass plies, resulting in the RH windshield departing from the fuselage.”

The CAAC issued the following safety recommendation to EASA:

CHIN-2020-001: “SWCAAC-ASR-2018-1-6 Recommends that EASA consider revision of AMC 25.775(d)[particularly section 7.c (6)] to require the relevant FHA/SSA, and their documentation, in order to evaluate the consequences of windshield heating system failures in terms of the structural integrity of the windshield and the potential subsequent effect(s) at aircraft level, including, as needed, the necessary testing to support and validate these evaluations. This recommendation also includes considering the practicality of updating AMC 25.775(d) Section 7.c (6) to extend the notion of transparency among the effects associated with loss of the windshield, rather than only to the loss of the heating function.”

Item 5: Cabin safety – references to FAA AC 25-17A 'Transport Airplane Cabin Interiors Crashworthiness Handbook'

For harmonisation purposes and to reflect certification practices, references to FAA Advisory Circular (AC) 25-17A should be added in the AMC material corresponding to CS 25.801 (ditching) and CS 25.1541 (markings and placards).

2.2. What we want to achieve — objectives

The overall objectives of the EASA system are defined in Article 1 of the Basic Regulation. This proposal will contribute to the achievement of the overall objectives by addressing the issues outlined in Section 2.1.

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

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

Item 1: AMC 25 Subpart H

EASA proposes amendments to reflect the correct subparagraph references.

Item 2: Turbo-propeller vibrations

a) Vibration indication system

EASA considers that from a safety point of view, large aeroplanes equipped with turbo-propellers do not present a lower risk than turbojet or turbofan equipped aeroplanes regarding the consequences of failures of propeller-engine rotating parts. Comparable threats exist from mechanical system or structural failures than can lead to a rotor failure (and potential uncontained debris) or to a separation of the propeller, the engine, or both.

In the absence of a cockpit indication of vibration levels, the detection of damage to the propeller system or to the engine relies on evaluation by the flight crew and their reports of the events. There is no objective means for quantifying the vibration level (for example, with a vibration sensor) at each engine-propeller assembly. However, the vibrations generated by a propeller or an engine can sometimes be very different from those which propagate in the cockpit. The vibration assessment method, based solely on what the flight crew or maintenance crew feels, does not ensure objective quantification of the intensity and the location of the vibrations. Therefore, it does not guarantee the effective detection of existing damage or its quantification.

On some turbo-propeller aeroplanes, a vibration measurement system is available, but it is designed for maintenance purposes only (e.g. on ATR 72, Saab 2000, DHC-8 aeroplanes) and no indication or alert is provided to the flight crew in flight.

However, on some more recent turbo-propeller aeroplane types, for instance the A400M in Europe, a system provides cockpit indications of the vibration levels of the engine (compressor, turbine) and of the propeller gearbox, and alerts (cautions or warnings) are also triggered when the vibration levels exceed certain thresholds. The system, therefore, helps the pilots to identify an engine or propeller problem at an early stage when the vibrations increase. This contributes to limiting the possible mechanical damage and the risk of a failure of an engine rotor or propeller. This can also ease the maintenance troubleshooting work, as the flight-crew report is supported by vibration data, thereby preventing the re-dispatch of an aeroplane with existing damage.

EASA considers that such installations that provide cockpit indications of vibration levels represent the state of the art, and that future turbo-propeller aeroplane designs should also benefit from this technology and the associated safety improvement. The technical concerns that may have existed at the time of the creation of FAR 25.1305(d)(3) are nowadays no longer valid. Extensive experience with vibration measurement systems has been gathered on turbojet/turbofan aeroplanes, as well as on rotorcraft gearboxes. The industry has moved to develop and integrate aircraft health monitoring systems that include vibration monitoring functions. In addition to improving safety, such systems entail economic benefits, as they allow, for instance:

— savings in maintenance-related costs, e.g. early detection of issues leading to abnormal vibrations, thereby limiting the ensuing damage and allowing the continuing airworthiness management organisation to plan corrective actions,

— saving time spent on investigation by maintenance organisations,

— providing support to maintenance tasks such as rotor or propeller balancing,

— eliminating the need to purchase and manage separate maintenance vibration measurement systems;

— saving time and costs to propeller, engine, and aeroplane TC holders for the investigation and correction of continued airworthiness issues.

EASA proposes to amend CS 25.1305 to require a system providing cockpit indications of the vibrations from engine rotors and propellers (when applicable) to be installed on all new turbine engine powered aeroplane designs.

b) Investigation of propeller vibration behaviour

EASA agrees that the experience gathered with the ATR incidents mentioned above should be taken into account during the certification of future turbo-propeller aeroplanes.

EASA proposes to create a new AMC 25.907 that refers to FAA (AC) 20-66B 'Propeller Vibration and Fatigue', and that recommends that the investigation of the actual vibration behaviour of each propeller should include operating conditions corresponding to descent with the power levers in the flight idle position, and with speeds around VMO.

This provision would not create additional certification costs (as investigations of descent operational conditions are already performed). It would allow applicants to identify any unacceptable loading conditions at an early stage before entry into service, thereby improving safety and saving costs from investigations and corrective actions for the TC holders, operators and EASA when the aeroplane is in service.

Item 3: Fabrication methods

EASA proposes to amend CS 25.605, amend AMC 25.603, create AMC 25.605(b), and amend AMC 25.613.

The intent is to ensure that the material and other properties are fully defined and controlled by applicants, taking into account the unique combinations of materials and/or processes and/or methods of manufacture and assembly that are specific to the product.

Item 4: Windshield - failure conditions with structural effects

EASA proposes to amend AMC 25.775 to ensure that applicants better address failure conditions that may have structural effects, and take into account the above-mentioned service experience.

A new sub-paragraph 8 is proposed. The proposal from the CAAC to amend sub-paragraph 7(c) was not retained because this sub-paragraph focuses on fail-safe strength capability after a single failure.

Item 5: Cabin safety – references to FAA AC 25-17A 'Transport Airplane Cabin Interiors Crashworthiness Handbook'

It is proposed to create AMC 25.801 and amend AMC 25.1541 so that they both refer to FAA AC 25-17A as an acceptable means of compliance.

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

The proposed amendments reflect the state of the art of large aeroplane certification. Overall, this would provide a moderate safety benefit, would have no social or environmental impacts, and would provide some economic benefits by streamlining the certification process.

3. Proposed amendments and rationale in detail

The text of the amendment is arranged to show deleted, new or amended, and unchanged text as follows:

— deleted text is ~~struck through~~;

— new or amended text is highlighted in blue;

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

3.1. Draft certification specifications and acceptable means of compliance (draft EASA decision)

Item 1: AMC 25 Subpart H

Amend AMC 25 Subpart H as follows:

AMC 25 Subpart H - Correlation with previous amendment of CS-25

(…)

Subpart H paragraph	Subparagraph	Based on previous CS-25 paragraph
(…)	(…)	(…)
CS 25.1705 Systems and functions; EWIS	(…) (b)(3) (b)(4) (b)(5) (b)(6) (b)(7) (b)(8) (b)(9) (b)(10) (b)(11) (b)(12) (b)(13) (b)(14) (b)(15) (b)(16) ~~(b)(17)~~ ~~(b)(18)~~	(…) CS 25.85~~5~~8 CS 25.~~857~~981 CS 25.~~858~~1165 CS 25.~~981~~1203 CS 25.~~1165~~1303(b) CS 25.~~1203~~1310 CS 25.~~1303(b)~~1316 CS 25.~~1310~~1331(a)(2) CS 25.~~1316~~1351 CS 25.~~1331(a)(2)~~1355 CS 25.~~1351~~1360 CS 25.~~1355~~1362 CS 25.~~1360~~1365 CS 25.~~1362~~1431(c) & (d) ~~CS 25.1365~~ ~~CS 25.1431(c) & (d)~~
(…)	(…)	(…)
CS 25.1709	~~(1)(i)~~(a)(1)	CS 25.1309(b)(1)

System safety; EWIS	~~(1)(ii)~~(a)(2) ~~(2)~~(b)	CS 25.1309(b)(1) CS 25.1309(b)(2)
(…)	(…)	(…)
CS 25.1715 Electrical bonding and protection against static electricity; EWIS	(…) (b) ~~(b)(12)~~ ~~(b)(13)~~ ~~(b)(14)~~ ~~(b)(15)~~ ~~(b)(16)~~ ~~(b)(17)~~ ~~(b)(18)~~	(…) ~~none~~CS 25.1353(e) ~~CS 25.1331(a)(2)~~ ~~CS 25. 1351~~ ~~CS 25. 1355~~ ~~CS 25.1360~~ ~~CS 25.1362~~ ~~CS 25.1365~~ ~~CS 25.1431(c)~~ ~~CS 25.1431(d)~~
(…)	(…)	(…)

(…)

Item 2: Turbo-propeller vibrations

a) Vibration indication system

Amend CS 25.1305 as follows:

CS 25.1305 Powerplant instruments

(See AMC 25.1305)

The following are required powerplant instruments:

(…)

(c) *For turbine engine-powered aeroplanes.*

(…)

(9) A vibration indication system that indicates unbalances of engine rotor systems, and, when applicable, propeller systems.

(…)

(d) *For turbo-jet engine-powered aeroplanes*.

(…)

~~(3) An indicator to indicate rotor system unbalance.~~

(…)

b) Investigation of propeller vibration behaviour

Create AMC 25.907 as follows:

AMC 25.907 Propeller vibration

FAA Advisory Circular (AC) 20-66B, 'Propeller Vibration and Fatigue', dated 24 March 2011, is accepted by EASA as providing acceptable means of compliance with CS 25.907 for the evaluation of vibratory stresses on propellers. This evaluation uses fatigue and structural data obtained in accordance with CS-P.

The investigation of the actual vibration behaviour of each propeller should include the operating conditions corresponding to descent with the power levers in the flight idle position, and with speeds around VMO. Experience has shown that, with such conditions, cyclic loads and vibrations may develop that may lead to excessive stress being generated on some parts of the propeller. Aerodynamic loads differ, depending on the position of the engine-propeller assembly on the aeroplane, therefore the investigation should be conducted for all engine-propeller positions.

Item 3: Fabrication methods

Amend AMC 25.603 as follows:

AMC 25.603 Suitability and durability of materials

The material strength and other properties used in design data (including damage tolerance characteristics when applicable) are governed by, and can be significantly sensitive to, the associated material production process parameters (including raw material considerations). Furthermore, these properties may also be influenced by other fabrication processes (manufacturing and assembly), e.g. casting, bonding, or complex additively manufactured parts. Therefore, the selection of the appropriate experience and/or tests, and the necessary material and material process specifications, considered necessary to comply with CS 25.603, requires careful consideration in order to be representative of stable material and process combinations as appropriate for the design data to be used for any particular product.

Note: When the material strength and other properties used in design data are defined by manufacturing and assembly processes and not directly by the constituent material and/or material processes, demonstration of representative stable material and material process control continues to provide important support for the development of the final design data. This should be a consideration when using simple shared database data to support a complex product test and analysis pyramid.

AMC 25.603(b) ~~Approved Material Specifications~~ Suitability and durability of materials

The approved material and material process specifications should be representative of the application, defining stable materials and processes, including the specifications necessary to support the management of raw materials/feedstock/unfinished materials as appropriate to the technology (e.g. the feedstock powder used in additive manufacturing, or pre-impregnated composites).

These specifications should identify all the acceptable types of production defects and in-service repair process defects (including size limitations) which could prevent repeated production and safe operation of a product throughout its operational lifetime. This information is important for the characterisation of the effect of defects in the development of the product test and analysis pyramid, as necessary to support the demonstration of compliance with other specifications, e.g. CS 25.571.

The potential for anisotropy and competing damage modes (taking into account the effects of the environment) should be considered when defining the specifications.

Noting the increasing use of integrated material technologies which define the strength and other properties at the complex product level during production or repair, the applicant is encouraged to discuss with EASA early in the certification project the potential details supporting the means of compliance with CS 25.603 and CS 25.605 .

Note: Approved material specifications and material process specifications can be, for example, industry or military specifications, or European Technical Standard Orders.

Amend CS 25.605 as follows:

CS 25.605 Fabrication methods

(See AMC 25.605)

(a) The methods of fabrication used (i.e. the manufacturing and assembly methods, including consideration of the material and material processes) must produce the strength and other properties necessary to ensure a consistently safe product ~~a consistently sound structure~~. If a fabrication method includes processes ~~(such as gluing, spot welding, or heat treating,)~~ which require~~s~~ close control to reach this objective, then ~~the~~ those processes must be performed under ~~an~~ representative and stable approved fabrication process specifications, supported by appropriately approved material specifications (including consideration of the raw/feedstock/unfinished material specifications).

(b) Each new ~~aircraft~~ fabrication method must be substantiated by a test programme that is representative of the application, as necessary to support the approved specifications.

Create AMC 25.605(a) as follows:

AMC 25.605(a) Fabrication methods

Fabrication method processes may include, for example, composite resin transfer methods, bonding, welding, heat-treating, or additive manufacturing methods.

Create AMC 25.605(b) as follows:

AMC 25.605(b) New fabrication methods

The strength and other properties resulting from each new fabrication method (which may result from a change of material, material or fabrication process, see also CS 25.603) should initially be assumed to be anisotropic and to be affected by the environment, unless the applicant can demonstrate different characteristics.

The test programme required for new fabrication methods should be used to evaluate the critical process parameters which govern the final strength and other properties of the product at the time of production and throughout the operational lifetime. The sensitivity of the strength and other properties of the structure to these parameters, including the effect of defects, should be evaluated to ensure that the resulting fabrication process can deliver a consistently safe structure.

All the critical inspection and/or process-controlled steps used in the fabrication method should be clearly identified and substantiated. In particular, all the inherent product features and defects resulting from the fabrication method that affect the strength and other properties require thorough characterisation and correlation with non-destructive inspection (NDI) and/or process control parameters in order to ensure that safety is maintained at the aeroplane and occupant levels. Furthermore, the equipment used to support process critical manufacturing steps (particularly for those steps that are not directly supported and controlled by inspection) should be demonstrated to be under adequate process control. Guidance from internationally recognised standardisation bodies may be used to support the definition of these activities.

Amend AMC 25.613(b) as follows:

AMC 25.613 Material Strength Properties and Material Design Values

(…)

3. *General*. CS 25.613 contains the requirements for material strength properties and material design values. Material properties used for fatigue and damage tolerance analysis are addressed by CS 25.571 and AMC 25.571(a).

The development of material strength properties and material design values should include consideration of potential anisotropy and ensure all properties and design values relevant to the application of the material are established.

(…)

4.2. *Statistically Based Design Values*.

(…)

~~The Agency~~ EASA may approve the use of other material test data after review of test specimen design, test methods, and test procedures that were used to generate the data.

The use of some materials and processes may allow the design of complex parts for which the strength and other properties are produced at the point of production or repair, such that use of simple material test coupons (as would typically be produced, independent of the product) may not be representative. When complex higher pyramid testing is required, then the number of specimens may need to be reduced (for practical reasons) below the levels normally expected for the generation of statistically significant values. Therefore, other mitigating substantiation actions are likely to be necessary (e.g. coupon testing of prolongations and/or testing of coupons taken from sections of production parts, or more intensive NDI). Until industry standards exist for such situations, the need for (and the approach taken to) the use of higher test pyramid test articles and the use of small datasets to generate design data should be agreed with EASA.

(…)

Item 4: Windshield - Failure conditions with structural effects

Amend AMC 25.775 as follows:

AMC 25.775(d) Windshields and Windows

(…)

8. OTHER FAILURE CONDITIONS WITH STRUCTURAL EFFECTS

AMC 25.1309, Chapter 10, paragraph (c) on 'Considerations When Assessing Failure Condition Effects', states that the severity of failure conditions should be evaluated taking into account the effects on the aeroplane from potential or consequential effects on structural integrity.

The applicant should therefore carefully take into account the potential effects on the windshield structural integrity when assessing any failure condition related to systems associated with the windshield (such as windshield heating systems).

Unless otherwise demonstrated by the applicant, a failure condition that leads to a structural failure of a windshield should be classified as at least hazardous.

In addition, CS 25.365(e)(3) requires the consideration of the maximum opening caused by aeroplane or equipment failures (such as windshield failures) that is not shown to be extremely improbable.

Service experience has shown that the failure or the deterioration of some windshield installation components (such as a degraded seal), combined with environmental conditions (such as the accumulation of water or moisture ingress) or with manufacturing/installation issues, may lead to the failures of other components of a system associated with the windshield (such as degradation of, or damage to, the insulation of a heating system wire). The combination of these failures may then lead to a malfunction or failure of the associated system that may then lead to a structural failure of the windshield.

The applicant should therefore pay particular attention to common cause and cascading failures, and identify appropriate design, manufacturing, installation and maintenance precautions for the installation of windshields and the associated systems that mitigate the risk of any failure condition adversely affecting other adjacent systems or components that may lead to a structural failure of the windshield. Such considerations are generally expected to be addressed through zonal safety analysis (refer to AMC 25.1309, Appendix 1).

Item 5: Cabin safety – references to FAA AC 25-17A 'Transport Airplane Cabin Interiors Crashworthiness Handbook'

Create AMC 25.801 as follows:

AMC 25.801 Ditching

The relevant parts of FAA AC 25-17A, *Transport Airplane Cabin Interiors Crashworthiness Handbook*, dated 24 May 2016, are accepted by EASA as providing an acceptable means of compliance with CS 25.801(d).

Note: 'the relevant parts' means 'the parts of AC 25-17A that address the applicable FAR/CS-25 paragraph.

Amend AMC 25.1541 as follows:

AMC 25.1541 Markings and Placards - General

Markings or placards should be placed close to or on (as appropriate) the instrument or control with which they are associated. The terminology and units used should be consistent with those used in the Flight Manual. The units used for markings and placards should be those that are read on the relevant associated instrument.

Publications which are considered to provide appropriate standards for the design substantiation and certification of symbolic placards may include, but are not limited to, 'General Aviation Manufacturers Association (GAMA) Publication No. 15 — Symbolic Messages', Initial Issue, 1 March 2014.

Also, the relevant parts of FAA AC 25-17A, *Transport Airplane Cabin Interiors Crashworthiness Handbook*, dated 24 May 2016, are accepted by ~~the Agency~~ EASA as providing an acceptable means of compliance with CS 25.1541.

Note: 'the relevant parts' means 'the parts of AC 25-17A that address the applicable FAR/CS-25 paragraph.

4. Impact assessment (IA)

The proposed amendments are expected to contribute to updating CS-25 to reflect the state of the art of large aeroplane certification. Overall, this would provide a moderate safety benefit, would have no social or environmental impacts, and would provide some economic benefits by streamlining the certification process. There is no need to develop a regulatory impact assessment (RIA).

5. Proposed actions to support implementation

N/A

6. References

6.1. Related regulations

N/A

6.2. Related decisions

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

6.3. Other reference documents

N/A

7. Appendix

N/A

8. Quality of the document

If you are not satisfied with the quality of this document, please indicate the areas which you believe could be improved, and provide a short justification/explanation:

— the technical **quality** of the draft proposed rules and/or regulations and/or the draft proposed amendments to them;

— the clarity and readability of the text;

— the quality of the impact assessment (IA);

— application of the 'better regulation' principles[6]; and/or

— others (please specify).

Note: Your replies and/or comments in reply to this section will be considered for internal quality assurance and management purposes only and will not be published in the related CRD.

[6] for guidance see:
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox_en
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how_en)
- https://ec.europa.eu/info/law/law-making-process/planning-and-proposing-law/better-regulation-why-and-how/better-regulation-guidelines-and-toolbox/better-regulation-toolbox_en)