European Aviation Safety Agency

Advance Notice of Proposed Amendment 2015-06

Reorganisation of Part 23 and CS-23

RMT.0498 — 27.03.2015

EXECUTIVE SUMMARY

This A-NPA precedes the issuance of an NPA (planned publication date: 2015/Q4) that will propose a reorganisation of Certification Specifications 'CS-23' — Certification Specifications for Normal, Utility, Aerobatic, and Commuter Category Aeroplanes.

Through this reorganisation of the current CS-23, a new concept will be introduced. The EASA certification specifications will be replaced by objective requirements that are design-independent and applicable to the entire range of aeroplanes within CS-23. These objective requirements, due to their higher abstract level, will become also suitable for current CS-VLA aeroplanes.

These objective requirements will be accompanied by acceptable Airworthiness Design Standards (ADSs), where the design-specific details are captured, and will also include the requirements originating from CS-VLA for simple two-seater aeroplanes. The new concept of objective rules accompanied by ADS allows the use of appropriate and proportionate standards as Acceptable Means of Compliance (AMC) to CS-23. This flexibility is intended to encourage the introduction of safety-enhancing features and reduce certification costs for these types of aeroplanes.

By transposing the design-specific elements to the ADSs, future amendments of these ADSs will have to follow an industry consensus process, which will allow for a faster adoption of new technologies and better up-to-date standards. Acceptance of these standards as AMC to the objective rules will remain the Agency's responsibility.

This A-NPA explains this new concept in more detail. Stakeholders are invited to comment on the A-NPA with respect to this new concept and provide, in particular, their feedback on the draft objective requirements anticipated for CS-23 Book 1.

Applicability	
Affected regulations and decisions:	ED Decision 2003/14/RM; CS-23.
Affected stakeholders:	General Aviation stakeholders
Driver/origin:	Safety; Economic.
Reference:	[Report from the 14 CFR Part 23 Reorganization ARC to the FAA]

Process map	
Concept Paper:	No
Terms of Reference:	31.10.2013
Rulemaking group:	Yes
RIA type:	Light
Technical consultation during NPA drafting:	No
Duration of NPA consultation:	3 months
Review group:	Yes
Focussed consultation:	Yes
Publication date of the Decision:	2016/Q2

Table of contents

1. Procedural information

1.1. The rule development procedure

The European Aviation Safety Agency (hereinafter referred to as the 'Agency') developed this Advance Notice of Proposed Amendment (A-NPA) in line with Regulation (EC) No 216/2008[1] (hereinafter referred to as the 'Basic Regulation') and the Rulemaking Procedure[2].

The text of this A-NPA has been developed by the Agency based on the input of the Rulemaking Group RMT.0498 on the objective rules, of the ASTM International Committee F44 on General Aviation Aircraft and of the Part 23 Reorganization Aviation Rulemaking Committee (ARC). It is hereby published to provide an opportunity to share the new CS-23 concept and seek feedback from stakeholders. This A-NPA is introduced into this rulemaking task in order to timely share this novel idea and receive feedback on the actual rulemaking; the related amendments will be proposed in an NPA planned to be published in the fourth quarter of 2015. The Agency does not intend to issue a separate Comment-Response Document (CRD) that addresses the feedback on this A-NPA, however, input is highly appreciated and will be utilised and taken into account in drafting the Explanatory Note of the NPA proposing the actual amendment to CS-23.[3]

The process map on the title page contains the major milestones of this rulemaking activity to date and provides an overview of the timescale of the next steps.

1.2. The structure of this A-NPA and related documents

The subject of the A-NPA and the key questions to stakeholders are addressed in Chapter 2.

Since this new concept introduces a substantial change to the current CS-23, this A-NPA addresses the following topics in Chapter 2:

— 2.1. The reasons for the reorganisation of CS-23 and for issuing this A-NPA;

— 2.2. How does the new concept appear and how does it address the issues?;

— 2.3. What changes compared to the current Certification Specifications?;

— 2.4. Harmonisation and global picture;

— 2.5. Key questions and considerations; and

— 2.6. Regulatory Impact Assessment (RIA).

Chapter 3 contains the following main parts of the structure of the CS-23 new concept:

— 3.1. Draft CS-23 Book 1 Objective rules. All draft objective rules are provided in an Appendix A.

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1 Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.3.2008, p. 1).

2 The Agency is bound to follow a structured rulemaking process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as the 'Rulemaking Procedure'. See Management Board Decision concerning the procedure to be applied by the Agency for the issuing of Opinions, Certification Specifications and Guidance Material (Rulemaking Procedure), EASA MB Decision No 01-2012 of 13 March 2012.

3 In accordance with Article 52 of the Basic Regulation and Articles 14 of the Rulemaking Procedure.

— 3.2. Draft Airworthiness Design Standard (ADS). An example from the new ADS that are being developed by ASTM F44 is provided in Appendix B.

— 3.3. Draft Guidance Material to CS-23 Book 1. Some examples of guidance material to the objective rules are provided in Appendix C.

1.3. How to comment on this A-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 **27 May 2015.**

The stakeholders are invited to provide their opinions and views to the issues, and in particular the issues listed in Chapter 2.5.

1.4. The next steps in the procedure

Following the closing of the A-NPA public consultation period, the Agency will review all comments.

The outcome of the A-NPA public consultation will be considered in the development of the rule proposal under RMT.0498. The Explanatory note of that NPA will reflect the highlights and lessons learned of this A-NPA and how these have been taken into account in the process. The NPA on the introduction of the new CS-23 concept is planned to be issued in the fourth quarter of 2015. The aim is to issue an Agency Decision amending CS-23 according to the new concept by 2017/Q1. This planning could however be subject to change since the Agency aims for the highest possible degree of harmonisation with the FAA change to Part-23. The NPA will provide stakeholders the opportunity to comment on the enhanced proposed objective rules as well as the technical details and specific wording of the referenced Airworthiness Design Standards (ADSs).

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

2. Explanatory note and key questions to stakeholders

The objective of this A-NPA is to indicate the state of development of the reorganised CS-23, the potential development of RMT.0498 'Reorganisation of Part 23 and CS-23' and to receive feedback from stakeholders. Therefore, questions are raised and considerations and views are expressed in Chapter 2 inviting the stakeholders to provide their feedback.

2.1. The reason for the reorganisation of CS-23 and for issuing this A-NPA

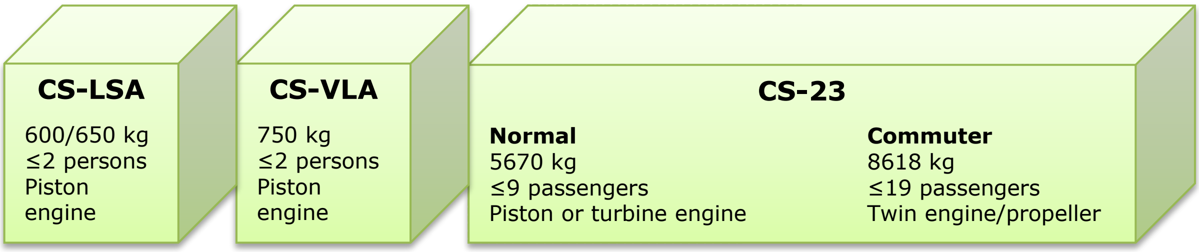
The background and origin of as well as the reason for the reorganisation of CS-23 are provided in the following chapters.

2.1.1. Issue and reasoning for regulatory change

A number of issues related to the certification process of General Aviation (GA) aeroplanes is described in the following chapters. These issues contribute to the need for regulatory change.

2.1.1.1The diversity of aeroplane designs

The diversity of aeroplanes in the category up to 19 passengers and with a maximum take-off weight below 8 618 kg is high in respect of performance, complexity, technology and intended operation. The Certification Specifications (CSs) that are today available for this wide scope of aeroplanes (CS-LSA (Light Sport Aeroplanes), CS-VLA (Very Light Aeroplanes) and CS-23) provide a number of 'boxes' that in turn aim at providing standard means for demonstrating compliance with the essential requirements. These 'boxes' are primarily defined by weight, passenger numbers, or propulsion types as schematically shown below.



When the requirements of the applicable CSs do not contain adequate or appropriate safety standards for a particular application, special conditions are prescribed. For applications of aeroplanes that are basically in the scope of CS-LSA and CS-VLA, special conditions are regularly needed. When CS-23 will be used as the applicable certification specification for small aeroplanes instead of CS-VLA or CS-LSA, it will cause the issues described in the following chapters.

2.1.1.2Appropriateness of requirements

As it can already be seen from the criteria used to define the 'boxes', weight and type of propulsion are the main drivers to establish applicability in the current CSs. For a long time, these criteria have proven to be appropriate because there used to be a clear relation between the weight of the aeroplane and its performance and complexity. Due to technological developments, this relation is, however, not always valid anymore. High-performance and complex aeroplanes nowadays exist within the weight 'box' that used to cover light and simple aeroplanes. This development has over time introduced more stringent and demanding requirements for high-performance and complex aeroplanes in the lower weight boxes; however, with a detrimental effect on the simpler and low-performance aeroplanes in the same weight box. As a result, some of the current requirements have become overdemanding and, therefore, not appropriate for these simple and low-performance aeroplanes.

2.1.1.3 The development rate of new technologies

The development and use of new technologies has increased and expanded dramatically in the last decade. This increase on the other hand is not visible on the actual use of the new technologies. New composites, computers, software, glass cockpit, etc. are rapidly becoming available, while it takes years for the rulemaking process to follow these changes. As a consequence, CSs are becoming outdated and special conditions and certification memoranda are being developed at an ad hoc basis for individual products to bridge this gap. The incorporation of these ad hoc requirements in the certification process is a burdensome and costly process that in particular slows down the introduction of new technologies in the lower end of General Aviation (GA).

2.1.1.4 Aviation authority resources

The aviation authority resources to develop special conditions and amend CSs for the aforementioned reasons are limited. It is already clear that some authorities need to introduce sequencing in the handling of applications in order to cope with limited resources. Spending a high number of resources on development of special conditions is also not very efficient. The resource problem is even bigger taking into account the fact that the actual number of applications is not particularly high in the current economic climate and that the current certification process does not encourage or motivate the industry. A more structured follow-up to technological developments would require that these types of developments are introduced in CS-23 or CS-VLA. This is, however, a rulemaking process that requires even more time and resources, resulting again in a backlog of amendments to the CS.

2.1.1.5 Conclusion on the necessity of the change to a new concept

Establishing the certification basis founded on the applicable CSs and required special conditions for a product has become a time-consuming and complicated process due to the issues described above. Therefore, the certification basis has become less predictable at the start of a certification project, which entails a higher risk of changes in the process as well as in the design. This has serious cost and resource consequences in certification projects for both the applicant and the authorities. The effort to introduce something not appropriately covered by the CSs can even discourage designers from developing innovations.

For low-performance non-complex aeroplanes, another negative factor are the sometimes overdemanding requirements (see Chapter 2.1.1.2 above).

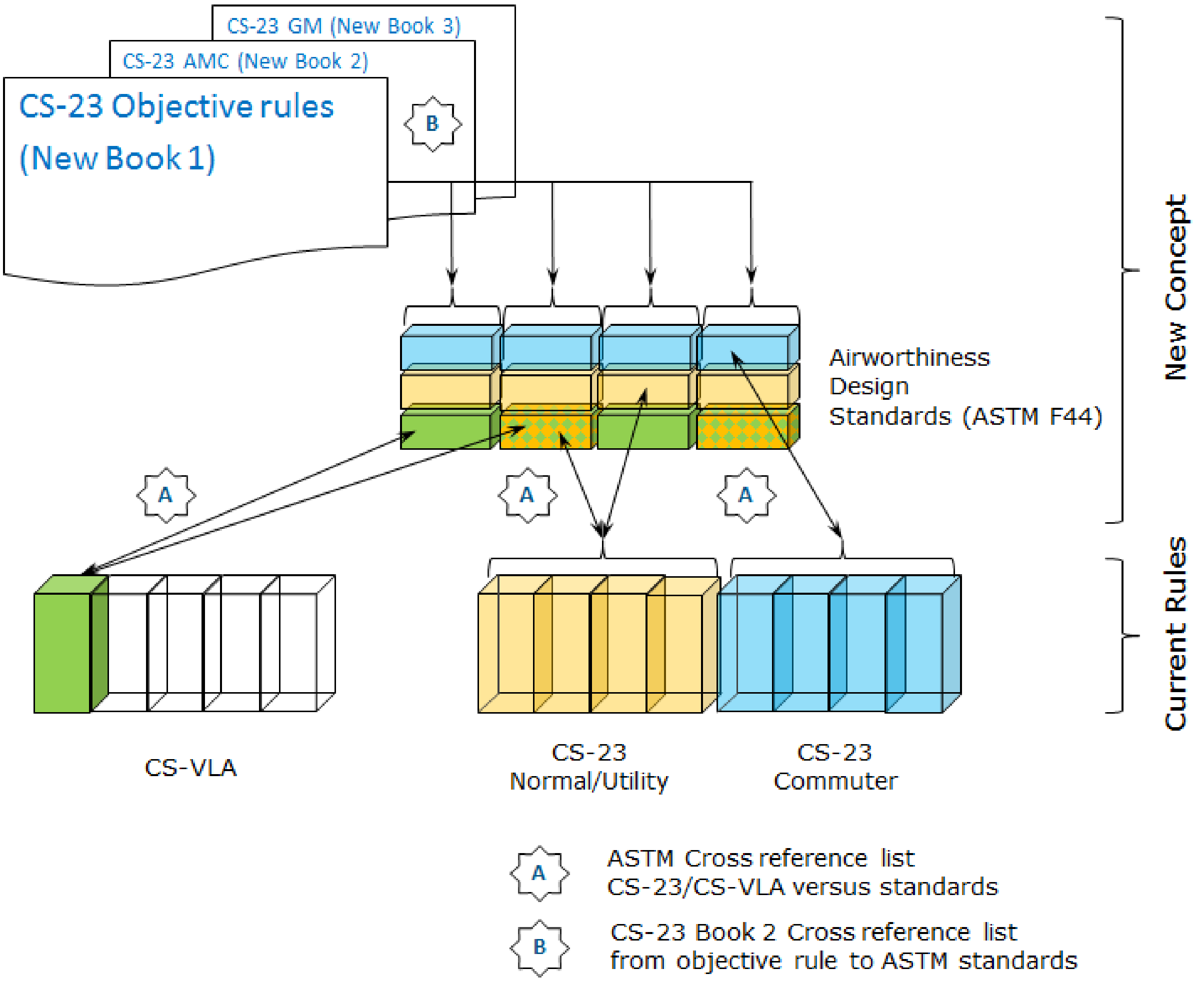
It is expected that these complications in the certification process could be a significant factor in the decline of GA and decelerate innovation.

The lower innovation rate is also expected to have a negative effect on the introduction of new safety-enhancing features in certified aeroplanes. This task is, therefore, important for both safety and economic reasons.

2.2. How does the new concept appear and how does that achieve the objectives?

2.2.1. Developing the structure of the new concept

The new CS-23 concept is created from existing requirements by reorganising the content of CS-23 and adding requirements from CS-VLA in a completely new arrangement. The following illustration represents the reorganisation and creation of the new CS-23.



The existing requirements of CS-23 are transposed by the ASTM Committee F44 on General Aviation Aircraft into ADS in an ASTM Consensus Standard format. Standards are created for a number of technical areas (e.g. crew interface, structural durability, fuel systems etc.), and cover the existing requirements for such a topic. When possible, additional proportionate requirements from CS-VLA (green box) are included to provide easier but proportionate means for 'simple VLA' aeroplanes. In certain areas, the CS-VLA and CS-23 requirements are similar and, therefore, included in the green/light yellow boxes. Although initially also CS-LSA was considered a 'box' that could be merged in the reorganised CS-23, it was for now decided not to be included. The reason is that CS-LSA is using ASTM standards applied in the US Light Sport Rules. This is in the US a completely differently organised deregulated part of aviation and merging it with the certified CS-23 could be too controversial to be included in this change. It was decided to maintain this separation and perhaps opt for further merging in the future. The result of merging requirements from CS-23 and CS-VLA within one standard is that a so-called 'tiering' develops that provides options varying from application for simple VLA aeroplanes up to high-performance 19-passenger ones.

The current aeroplane categories (Normal/Utility and Commuter) that were weight-, occupant- and performance-based categories are no longer used in the new concept since the weight criteria are considered inappropriate for today's designs. These categories are replaced by a specific technical/operational applicability (e.g. stall speed, VFR operation, turbine-engine-driven etc.) that represent the actual technical drivers for specific requirements. These types of technical/operational criteria that are design specific can be found in the new ADS. At the same time, there was the need to capture the different safety levels that exist today and are related to the level of protection of people on-board the aeroplane. The following division was, therefore, introduced as airworthiness levels that capture these existing weight-driven categories (see CS-23 Book 1, Appendix A — Draft objective rules, CS-23.5(d)).

Future airworthiness level divider	Current divider	Typical aeroplane
Level 1 — seating configuration of 2 or less	VLA and current small CS-23 (missing tier)	DV 20, Cessna 152, etc.
Level 2 — seating configuration of 2 to 6, not including the pilot(s)	Up to 2 722 kg/6 000 lb	GA8, Piper PA-44 Seminole DA50
Level 3 — seating configuration of 7 to 9, not including the pilot(s)	Up to 5 670 kg/12 500 lb 9 persons or less (without pilot(s))	King Air C90GTx Pilatus PC 12
Level 4 — seating configuration of 10 to 19, not including the pilot(s)	Up to 8 618 kg/19 000 lb 19 persons or less (without pilot(s))	Beech B300 Pilatus PC 24, Cessna CJ4

Furthermore, a new definition of 'High-speed/Low-speed' is introduced to provide a criterion that is currently applied in special conditions to capture the specific risk for 'high-performance' aeroplanes.

This reorganisation of the different drivers for specific requirements, as well as the new concept, require that a link is created between the new concept and the existing rules. This link will be developed by ASTM as a cross-reference list (See 'A' in the illustration on page 9), showing where existing requirements are covered by the new standards.

As clearly shown in the illustration, on top of the new ASTM standards, a new CS-23 is developed that consists of three books instead of today's two. There are new objective rules (Book 1), as well as AMC (Book 2) and GM (Book 3) to the objective rules.

Book 1 will contain new objective rules, <u>derived from the intent</u> of the current requirements. As a consequence, all design-specific details have been removed, and, as far as foreseeable, anticipated new technologies were taken into consideration when the text was being drafted. For example, instead of fuel systems, the objective rule mentions 'energy systems' in order to also cover future electric propulsion. This higher abstract level of the new objective rules can, therefore, not be compared on a one-to-one basis with the current requirements.

Book 2 (Acceptable Means of Compliance (AMC)) will contain a listing of the ASTM standards that are accepted standards that can be applied for demonstrating compliance with the objective rules. When and if referenced standards are not acceptable for the entire content of a standard, deviations from these standards will be specified in Book 2. This will be visible in a 'Table of deviations from the accepted standards'.

Book 3 will contain Guidance Material (GM) to the objective rules (Book 1). Due to the sometimes high abstract level of the objective rules, it was considered that guidance reflecting the current state of technology or today's practical interpretation of the rule would be helpful.

2.2.2. Building-block approach for a certification basis in the new concept

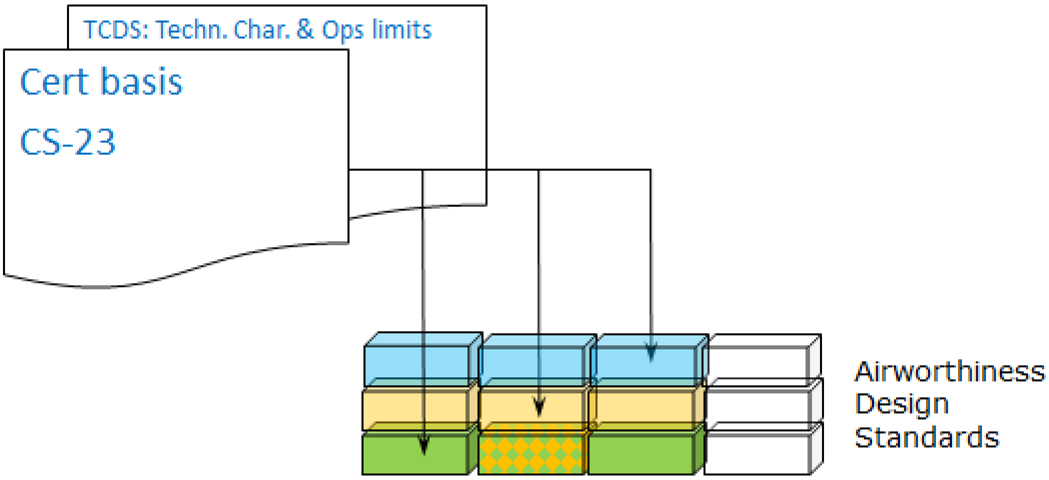
When the new CS-23 concept is applied for the certification basis of a Type Certificate (TC) or change to a TC, the certification basis will be CS-23 itself. Instead of using aeroplane categories, the 'Technical Characteristics and Operational Limitations' will remain to identify the aeroplanes characteristics that also define which ADSs are applicable. The illustration below demonstrates how the flexibility of the AMC building blocks provides the AMC to the certification basis. The acceptable AMC can, for example, be build up from the:

— green box — Occupant protection two-seater low stall speed;

— yellow box — Turbine-engine-powered;

— blue box — Pressurised, high-altitude IFR operation; or

— white boxes — Not all ADS are applicable to a design.



2.2.3. How the new concept addresses the objectives

Appropriateness of requirements

The objective rules are drafted at such an abstract level that they capture the intent of the full scope of CS-23 from e.g. simple two-seater to complex 19-passenger aeroplanes with different types of operation and risk. When appropriate, the objective rules identify four safety levels based on the protection of the number of occupants (see proposed CS-23.5). This enables CS-23 to identify that different safety levels are considered acceptable within the wide range of aeroplanes falling under the scope of CS-23. The example below shows that occupant protection is commensurate with the number of people on-board via the 'airworthiness levels determined in CS 23.5'.

CS 23.335 Emergency conditions. (Example new objective rule)
The aeroplane, although it may be damaged in emergency landing conditions, provides reasonable protection to the occupants against serious injury and allows for timely evacuation of the occupants appropriate to the airworthiness level determined in CS 23.5.

This high abstract level of the objective rule, therefore, allows for all kind of aeroplane design and operation without setting inappropriate requirements. Design flexibility is not ruled out, and when applicable, different levels in the objective are captured. As a result, contrary to today's separate CSs', one CS-23 with build-in proportionality is created for simple two-seater aeroplanes up to 19-passenger 19 000 lbs aeroplanes.

The flexibility to set appropriate requirements is also improved due to the building-block approach in the referenced standards as explained in 2.2.2.

<u>The development rate of new technologies</u>
By removing the design-specific elements from the objective rules, rulemaking for Book 1 is no longer required. Criteria that determined rulemaking (resources, priorities in rulemaking programming) and the lengthy rulemaking process itself will not continue to create backlog when faced with new developments. What remains is updating or adding references to ADSs in Book 2 whenever applicable. These changes to the referenced or new alternative ADS will be treated as a 'Regular update of CS-23', when appropriate stakeholders' consultation has taken place within the development process of such an ADS. 'Regular update of CS-23' is in the rulemaking process treated as a recurring task that follows a shorter process and can be performed whenever information needs to be included.

Technological developments in design and new methods of compliance demonstration will be embedded in ADSs. The actual discussion and development will be taking place in the consensus process of the ADSs development and not anymore scoped under rulemaking activities. Experience in the use of, and changes to, industry consensus standards in CS-LSA have shown that the Agency can participate in said process and faster follow-up changes to referenced standards. It is expected that this will lead to more up-to-date ADSs that better capture today's technology.

<u>Aviation authority resources</u>
The shift from rulemaking to involvement and acceptance of ADS process will result in a change from considerable administrative activities (e.g. setting up rulemaking projects, drafting and review groups) to more technical involvement when appropriate. This allows the Agency to more efficiently dedicate their limited resources to priority topics. The effect of more up-to-date ADSs (to be used whenever applicable) is also expected to reduce the need for development of special conditions for individual projects. This will also enhance efficiency for both the Agency and the applicants. Experience in the acceptance of industry standards in CS-LSA has already shown that, when stakeholders are sufficiently involved in the development of these standards, the rulemaking and consultation process can be streamlined which has already resulted in shortened lead times for such rulemaking tasks (10 months from the Terms of Reference (ToR) publication to the ED Decision 2013/015/R[5]).

<u>Safety enhancements and cost reduction</u>

[5] Decision 2013/015/R of the Executive Director of the Agency of 29 July 2013 adopting Amendment 1 of the Certification Specifications for Light Sport Aeroplanes (CS-LSA).

The technological developments have increased over the last years and provided new solutions to safety issues. However, certification of these new features has not proven to be easy or cheap. Lack of standardised and harmonised acceptance of these features has hampered their introduction, contrary to e.g. Light Sport Aviation in the US or non-EU regulated aviation in the scope of Annex II to the Basic Regulation. It is expected that a higher level of safety can be achieved for general aviation through new and modified aeroplanes that have safety enhancements such as pilot awareness augmentation systems or new methods of occupant protection.

2.3. What are the changes compared to the current certification specifications?

The current CS-23 and CS-VLA have been developed over the years by incorporating 'lessons learned' from accident investigations. This has resulted in certification specifications that specify in detail how certain risks are mitigated by design. The outcome is certification specifications that support the design and production of airworthy and safe aeroplanes. Accident statistics show that design and production are not the main causes of accidents in certified aviation. With that said, is there an actual need for changes? The answer is a clear yes, the current certification specifications are commonly accepted, but at the same time do not support innovation and do not yet include the potential safety-enhancing possibilities. This change to CS-23 is, hence, aiming to find the balance between keeping the current content and making changes to introduce safety enhancements. The following topics are, therefore, in addition to the transposition of the existing content, included in the introduction of the new concept.

2.3.1. Safety improvements

The number one accident cause in all areas of GA is Loss of Control (LOC) in flight. To address LOC accidents, the Agency is focussed on establishing safety objectives in the rules that will enable and support the development of ADSs that can contribute to preventing these types of accidents. Since no pilot is intentionally involved in an LOC accident, two main issues are the potential contributors to these accidents: pilot awareness, aeroplane handling, and any combination of the two. Most fatal LOC accidents occur at relatively low altitudes shortly before landing or after take-off. Stall recovery and spin recovery are in most cases irrelevant because of the low altitude and, therefore, focus should be laid on prevention and awareness as important safety improvement factors. Although clear solutions are not yet all defined, the specific areas that require the flexibility to allow new developments are identified and, as such, reconfigured in the objective rules. The new rules for stall characteristics stall warning, and spins (see CS 23.215) aim for designs where the focus is on the aeroplanes' tendency to inadvertently depart controlled flight, instead of recovery requirements. This will allow for new ADSs that detail how safer characteristics can be tested and demonstrated. Another element in LOC is the element of awareness. There are new or existing technologies that could assist in increasing the pilots' awareness. Today, the certification of these systems is burdensome. Therefore, the proportionality to the level of safety (captured by airworthiness levels in the new rules, see CS-23.5) is a change that would allow for a balance between the level of certitude, the appropriate level of safety, and the acceptable risk for each segment of GA.

Other safety-enhancing technologies (e.g. envelope protection/warning, moving map technology etc.) can also benefit from the introduction of these proportionality drivers captured by these airworthiness levels. They will provide the possibility to lower the threshold for certifying these types of systems when the overall safety level has been reached.

Moreover, occupant protection is seen as a further area for improvement. The current CS-23 is based on the seat and restraint technology as protection for the occupants. Looking at other industries and sports, improvements in occupant protection have been reached by introducing 'safe cell' concepts combined with energy absorption and crush zones. The objective rules are drafted at such a level so that they will not hamper developments in these directions.

2.4. Harmonisation and global picture

The new CS-23 concept is a development that has its origins in the Agency's participation in the Part 23 Reorganization Aviation Rulemaking Committee (hereinafter referred to as 'Part 23 ARC').

In 2011, based on the results of the Part 23 — Small Airplane Certification Process Study (CPS) and Part 23 Regulatory Review, the FAA formed the Part 23 ARC. The committee's chartered tasks included considering the recommendation of CPS to reorganise Part 23 based on aeroplane performance and complexity versus the existing weight and propulsion divisions. The Part 23 ARC was also tasked to investigate the use of industry standards as methods of compliance with the newly structured Part 23.

The Part 23 ARC included, apart from the Agency, also other observers from several foreign National Aviation Authorities (NAAs) as well as international representatives of almost every GA manufacturer of both aeroplanes and avionics. It furthermore included several Light Sport Aircraft (LSA) manufacturers who are interested in transitioning into Part 23 with their products. These manufacturers shared their insights from the GA manufacturers' perspective. This perspective was focussed on the need to certify safer aeroplanes, both new and modified, by taking advantage of new safety-enhancing technologies.

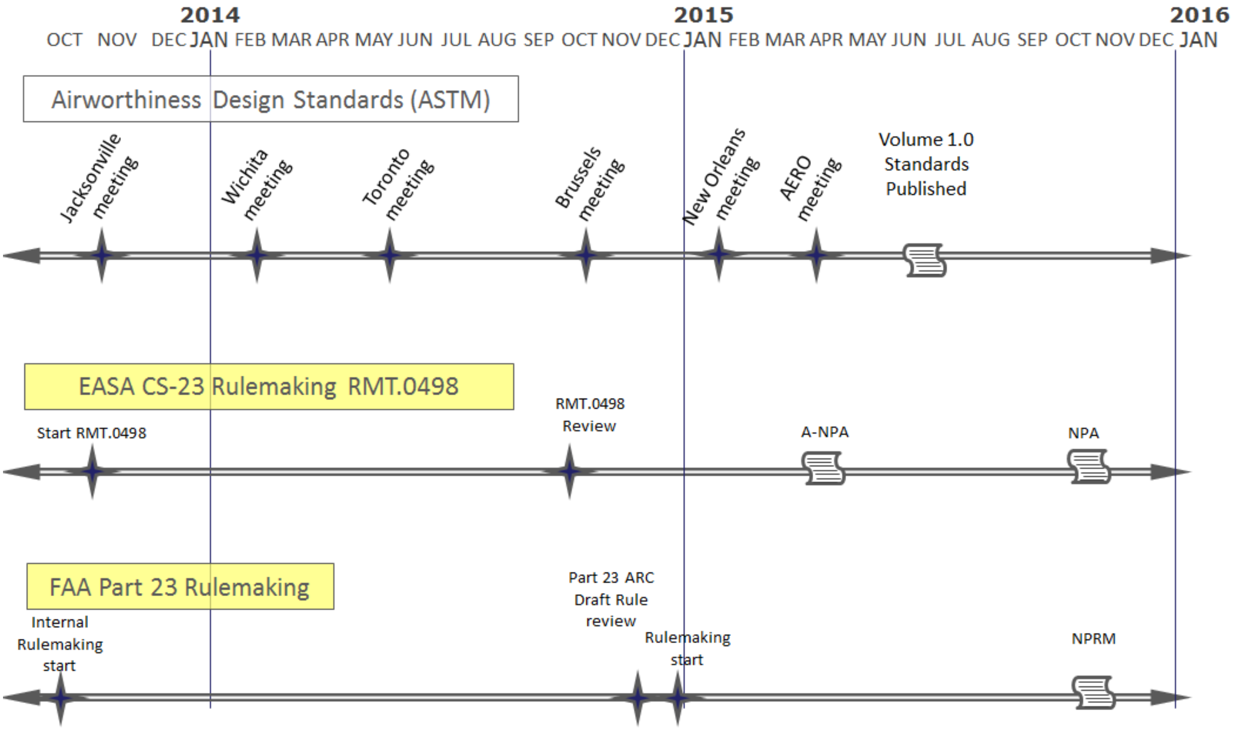
The final report from the Part 23 ARC (5 June 2013) comprised recommendations on the concept, but also to work with the international regulatory community on the Part 23 ARC reorganisation recommendations to assure that there is a globally acceptable approach for certifying Part 23 aeroplanes.

In line with the Rulemaking Cooperation Guidelines for FAA and the Agency, it was decided to pursue the Part 23 ARC recommendations as a pilot project for rulemaking cooperation. As identified in the Terms of Reference (ToR) RMT.0498, the rulemaking task aims for global harmonisation at the highest possible level. It should be noted that the EU and US regulatory systems, and more specifically CS-23 and Part 23, are different. Whereas CS-23 consists of certification specifications ('soft law'), providing the standard means to comply with the essential requirements in Annex I to the Basic Regulation, Part 23 in the US constitutes a rule ('hard law'), and in that respect, is different from CS-23. Despite this difference, as will be visible in the wording of the rules, the intent is to draft CS-23 and Part 23 as closely harmonised as possible. The use of a common consensus Airworthiness Design Standards (ADSs) that contain all the specific details plays, therefore, an important role in terms of harmonisation. The new ADSs that are currently being developed by the ASTM F44 Technical Committee (hereinafter referred to as 'ASTM F44') are using Part 23 Amendment 62 as a basis. Owing to the fact that the Agency is participating in this development, the other planned CS-23-related rulemaking task (ToR RMT.0039) for harmonisation with Part 23 is in fact included in this task already. The anticipated outcome of these new ADSs is a higher harmonisation degree between CS-23 and Part 23.

During the Part 23 ARC, options for a standards body to develop these ADSs were reviewed. It was agreed in the ARC to charter ASTM to develop the new ADSs for Part 23. ASTM was primarily selected for its experience in setting up standards for the Light Sport Rules (the ASTM F37 Technical Committee has 10 years of experience), robust development processes, global involvement and its low-cost access to standards. Late 2012, a new ASTM F44 was set up.

It was obvious that the new standards that had to be developed play a key role in the new concept, and even more important is the participation of global stakeholders. It is, therefore, vital for this initiative that stakeholders from around the globe participate from the very start. Today, the ASTM F44 has approximately 260 members and develops standards that are intended to fully cover the existing content of Part 23/CS-23 and of the applicable CS-VLA requirements.

Three main processes are currently underway to support a new concept that is potentially suitable for global use. All three aim to result in draft rules and supporting standards ready for public consultation in a synchronised time schedule as described below.



2.5. Key questions and considerations

During the development of this new concept, various issues have been raised and discussed. This A-NPA is intended to expand the stakeholders' involvement to a wider audience and get feedback on and reactions to this new approach. Therefore, apart from introducing the theoretical concept, this A-NPA provides more concrete material, e.g. the draft objective rules.

It seeks the stakeholders' feedback on the new concept as well as their questions related thereto and in particular their comments on the draft objective rules. You are kindly invited to provide your specific comments/feedback on the following:

<u>The new objective rules (see Appendix A)</u>

These objective rules should already cover the safety intent of the current CS-23. Design-specific requirements have been replaced by the safety intent of these requirements. Stakeholders are invited to review these objective rules (covering the current safety objectives of CS-23) for completeness.

Please also indicate if you can foresee future technologies (and their specific safety issues) that are not already covered by these objective rules.

The Airworthiness Design Standards (ADSs) (see Appendix B)
Please submit your opinion on the new concept according to which detailed technical standards are developed through a consensus process with a broader representation of stakeholders.

You are kindly requested to raise questions or specific concerns regarding the future development process of changes to these ADSs.

In the following chapters, some of the issues and discussions that shaped this project have been summarised for your information.

Due to the intent of this new concept to improve safety by allowing safety-enhancing features via requirements that are proportionate to the targeted safety levels, there is the need to change the current content of CS-23. On the other hand, the aim is to accomplish a clear transition from today's CS-23 into a new format and to ensure that important lessons learned are not lost and that the achieved safety mitigations are maintained. This could create some controversy between preserving in general today's content (no need to change the concept) and performing a more radical change. The aim of this rulemaking task is to identify the right balance between innovation and recognisable transposition of the existing requirements.

Owing to the fact that this project on Part 23 was initiated through ARC in the US, and that said Committee chose to charter ASTM F44 to develop the new standards, some fear the risk of too much US-oriented standards. Even though meetings are held 'where the action takes place' (sofar in the US and Europe), a more balanced participation is beneficial for the global support of this concept. It is, however, important to realise that the new standards are actually an AMC to the objective rules and, for that reason, by definition a means, but not the only one to demonstrate compliance. Therefore, options for future standards and project-specific (or proprietary) means can still be proposed. New in the concept for CS-23 is also, due to the split between CS-23 and referenced ADS, that not all detailed information is directly provided (for free) by the Agency. What used to be AMC has been moved to the ADS. This is, however, not entirely novel since the referencing to industry standards (that need to be purchased) is also used in CS-ETSO and CS-LSA, taking into account that the fees for becoming ASTM F44 member and through that membership getting access to these ADS are reasonable.

There are differences among the CSs/airworthiness codes used by different aviation authorities. Because of the initiation of the new standards, starting from Part 23 amendment 62, a fully harmonised set of standards with the current CS-23 is not expected. However, in the ASTM F44 drafting group discussions the technical detailed positions are being discussed. On certain topics, consensus has been achieved and it is expected that a higher level of harmonisation will be reached. This is not yet visible in detail in this A-NPA, but will be fully provided in the related future NPA. Remaining differences between the Agency's CSs and the referenced ASTM standards will anyway be captured in the new AMC tables of differences. Because of the ASTM consensus process, the Agency has decided to put the initially launched rulemaking task RMT.0039 (ToR RMT.0039 'Incorporation of standard Special Conditions in CS-23 and harmonisation with FAR-23’) on hold, and to first await the outcome of this reorganisation.

2.6. Regulatory Impact Assessment (RIA)

As indicated on the first page of this A-NPA, a ‘Light RIA’ is anticipated for the related NPA under this rulemaking task. Although the aim and ambition of the new concept is to improve safety by launching innovations to the market at lower cost while at the same time reducing certification costs through better and proportionate rules for various designs, quantifying the anticipated results is challenging. The transposition of the current content of CS-23, supplemented with the lower and proportionate requirements of CS-VLA, will not create substantial differences from the current rules at the initial application of the new concept. Therefore, a detailed RIA is not anticipated during this rulemaking task.

The intent of this task is in line with the European General Aviation Safety Strategy and aims at providing a revitalisation impulse to General Aviation in Europe. The concept itself is an example of safety objective rules supported by industry standards.

3. Proposed reorganised CS-23.

In order to support the understanding of the new CS-23 concept, the following is provided:

- the draft objective rules (Appendix A);
- an example abstract from the ADSs under development by ASTM F44 (Appendix B); and
- an example of GM to the objective rules (Appendix C).

3.1. Draft CS-23 Book 1 — Objective rules (Draft EASA Decision)

The draft objective rules (CS-23 Book 1) are developed from FAA draft objective rules for Part 23 that was shared with stakeholders at the end of the Part 23 ARC process. Further enhancement of the FAA draft objective rules has been introduced, and in particular when these requirements were still containing design-specific elements. A new numbering system is applied that is also used by the FAA and will provide a better comparison between FAA rules and EASA CSs if kept harmonised (see Appendix A).

3.2. Draft Airworthiness Designs Standards (ADSs)

The ADS are being developed by the ASTM F44 with participation of the Agency. In order to provide a better 'sense' of the standards' content, a draft section of a standard has been provided. Technical details are still being discussed in the ASTM F44 and will be made available for final review with the proposed new CS-23 in the related NPA (RMT.0498). In this draft section of a standard, the references to the Part 23, CS-23 and CS-VLA requirements are provided in brackets. The intent is that ASTM F44 will separately provide this kind of cross-reference information as a cross-reference list that covers the full content of Part 23/CS-23 (see Appendix B).

3.3. Draft Guidance Material (GM) to CS-23 Book 1(Draft EASA Decision)

Appendix C contains an example of the anticipated Guidance Material to be developed for CS-23. This GM will elaborate on the objective rules that constitute the new Book 1 of CS-23. This GM aims, therefore, to explain the high-level objectives, not the details of the AMC. If needed, additional guidance or practices will be captured by future standards.

4. References

4.1. Affected Decisions

Decision 2003/14/RM of the Executive Director of the Agency of 14 November 2003 on certification specifications, including airworthiness codes and acceptable means of compliance for normal, utility, aerobatic and commuter category aeroplanes ('CS-23'), as last amended by Decision 2012/012/R of 13 July 2012.

4.2. Affected CSs

CS-23 — Certification Specifications for Normal, Utility, Aerobatic, and Commuter Category Aeroplanes.

4.3. Reference documents

Report from the 14 CFR Part 23 Reorganization Aviation Rulemaking Committee (ARC) to the Federal Aviation Administration (FAA) — Recommendations for increasing the safety of small general aviation airplanes certificated to 14 CFR Part 23, 5 June 2013.

5. Appendix A — Draft objective rules CS-23 Book 1

Subpart A — General

CS 23.1 Applicability

This Certification Specification is applicable to aeroplanes in the Normal Category.

CS 23.5 Normal Category aeroplane

(a) The Normal Category is limited to aeroplanes with a seating configuration of 19 or less, not including the pilot(s), and a maximum certificated take-off weight of 8 618 kg (19 000 pounds) or less.

(b) Aeroplanes intended for non-aerobatic operations include:

(1) any manoeuvre incident to normal flying;

(2) stalls (except whip stalls); and

(3) lazy eights, chandelles and steep turns, in which the angle of bank does not exceed the operational limitations.

(c) Aeroplanes intended for aerobatics comply with the Certification Specifications dedicated to aeroplanes intended for aerobatics and have no manoeuvring restrictions, other than those shown to be necessary by analysis or flight tests.

(d) Certification Specifications specify the following aeroplane airworthiness levels:

(1) Level 1 — seating configuration of 2 or less;

(2) Level 2 — seating configuration of 2 to 6, not including the pilot(s);

(3) Level 3 — seating configuration of 7 to 9, not including the pilot(s);

(4) Level 4 — seating configuration of 10 to 19, not including the pilot(s).

(e) Certification Specifications are divided into the following performance levels:

(1) Low-speed — V_C or $V_{MO} \leq 250$ KCAS (or $M_{MO} \leq 0.6$);

(2) High-speed — V_C or $V_{MO} > 250$ KCAS (or $M_{MO} > 0.6$)

Subpart B — Flight

Flight — Performance

CS 23.100 Weight and centre of gravity

(a) For the safe operation of the aeroplane, weight and centre-of-gravity limits are established.

(b) Compliance with each specification of this Subpart is shown at each appropriate combination of weight and centre of gravity within the range of loading conditions using tolerances appropriate for the airworthiness level and performance level of the aeroplane.

CS 23.105 Performance

(a) Unless otherwise prescribed, the aeroplane meets the performance specifications of this subpart in:

(1) still air and standard atmosphere for Low-speed, Airworthiness Level 1 and 2 aeroplanes; and

(2) ambient atmospheric conditions for all High-speed aeroplanes and all performance-level 3 and 4 aeroplanes.

(b) Unless otherwise prescribed, the required performance data includes the following ranges of conditions:

(1) aerodrome altitudes from sea level to 3 050 m (10 000 ft); and

(2) temperature from standard to 30°C above standard, or the maximum ambient atmospheric temperature needed for the propulsion cooling in climb, if lower.

(c) The procedures for achieving the take-off and landing distances determined in this Subpart are executable consistently by pilots of average skill in atmospheric conditions reasonably expected to be encountered in service.

(d) Performance data determined in accordance with paragraphs (a) and (b) of this Section accounts for losses due to atmospheric conditions, cooling needs and other demands on the power source.

CS 23.110 Stall speed

(a) The aeroplane stall speed or the minimum steady flight speed is determined for the configurations appropriate for each stage of flight (take-off, climb, cruise, approach and landing) used in normal operations.

(b) Stall speed or minimum steady flight speed is determined under the most adverse conditions for the configuration.

CS 23.115 Take-off performance

(a) The aeroplane take-off performance is determined, including appropriate safety margins, for stall speeds, minimum control speeds, and minimum climb gradients.

(b) Aeroplane take-off performance includes:

(1) the distance required for take-off; and

(2) the initial climb to an altitude anticipated to be safe.

(c) The distance required for take-off and climb is determined, after the sudden, critical loss of thrust on High-speed multi-engine Airworthiness Level 1, 2, and 3 aeroplanes, and multi-engine Airworthiness Level 4 aeroplanes, including:

(1) an aborted take-off at critical speed;

(2) the take-off path;

(3) the take-off distance; and

(4) the net take-off flight path.

CS 23.120 Climb

(a) The aeroplane meets minimum climb performance appropriate for the airworthiness level and performance level of the aeroplane for the following conditions:

(1) all engines operating including balked landing; and

(2) after a critical loss of thrust for Airworthiness Level 3 and 4 multi-engine aeroplanes.

(b) The climb/descent performance of the aeroplane is determined:

(1) following a critical loss of thrust on take-off;

(2) for all engines operating and after a critical loss of thrust, during the en-route phase of flight; and

(3) for single engine aeroplanes, after the complete loss of propulsion.

CS 23.125 Landing

For standard temperatures at each weight and altitude within the operational limits established for landing, the following is determined:

(a) the horizontal distance, starting from a height of 15 meters (50 feet) above the landing surface, required to consistently and safely land and come to a stop, or satisfactory low speed for water operations; and

(b) the approach and landing speeds, configurations, and procedures that allow landing distance to be safely and consistently met.

Flight — Flight Characteristics

CS 23.200 Controllability

(a) The aeroplane is safely controllable and manoeuvrable:

(1) without requiring exceptional piloting skills and strength;

(2) within the complete operating envelope (including configuration changes and applicable flight control and propulsion system failures); and

(3) at all loading conditions.

(b) The aeroplane is able to make a safe landing at a safe margin to V_{REF}, using the steepest approach approved for landing and in the landing configuration.

(c) For multi-engine Airworthiness Level 1 and 2 aeroplanes that cannot climb after a critical loss of thrust it is demonstrated that Visual Meteorological Conditions (VMC) do not exceed V_{S1} or V_{S0} for all practical weights and configurations.

(d) Aeroplanes intended for aerobatics can demonstrate the aerobatic manoeuvres within the manoeuvring restrictions. Entry speeds for these manoeuvres are provided.

CS 23.205 Trim

When account is taken of the stages of flight and their duration:

(a) The aeroplane maintains longitudinal, lateral, and directional trim without further force upon, or movement of, the primary controls or its corresponding trim controls by the pilot, or the automatic flight control system. This applies to normal operation and, if applicable, to those conditions associated with the most critical loss of thrust.

(b) If residual forces exceed those considered appropriate for prolonged application, those forces are not fatiguing or distracting the pilot.

CS 23.210 Stability

As appropriate for the type of operation, the aeroplane is statically and dynamically stable longitudinally, laterally, and directionally in normal operations. Aeroplanes provide a stable control 'feel' throughout the operating envelope.

CS 23.215 Stall characteristics, stall warning, and spins (see GM 23.215)

(a) The aeroplane has satisfactory stall characteristics in straight, turning, and accelerated turning flight stalls with a clear and distinctive stall warning that provides sufficient margin for the pilot to avoid departure from controlled flight.

(b) Aeroplanes not intended for aerobatic manoeuvres are designed to have:

(1) a benign behaviour when departing controlled flight, or

(2) have a system preventing departure from controlled flight.

(c) Aeroplanes intended for aerobatics have the ability to recover from any manoeuvre, without exceeding limitations or exhibiting unsafe characteristics.

CS 23.220 Ground handling characteristics

(a) The aeroplane has satisfactory longitudinal and directional ground handling characteristics during taxi, take-off, and landing operations.

(b) The aeroplane can safely taxi, take-off and land with a 90-degree cross component of wind velocity.

(c) For a seaplane or amphibian:

(1) water spray is not dangerously interfering with the operations or damaging the aeroplane at any time; and

(2) wave heights for safe operation are established.

CS 23.225 Vibration, buffeting, and high-speed characteristics

(a) Vibration and buffeting do not interfere with safe operations up to V_D/M_D.

(b) If a maximum operating speed V_{MO}/M_{MO} is established, there is no perceptible buffeting in cruise configuration in straight flight at any speed up to V_{MO}/M_{MO}, except stall buffeting.

(c) For High-speed aeroplanes or aeroplanes with a maximum operating altitude greater than 7 625 m (25 000 ft) pressure altitude, the boundary of perceptible buffet is determined in the cruise configuration within the operational envelope. A probable inadvertent excursion beyond this boundary does not result in unsafe conditions.

(d) High-speed aeroplanes have satisfactory recovery characteristics following:

(1) an inadvertent speed increase; and

(2) a high-speed trim upset, both beginning at any likely speed up to V_{MO}/M_{MO}.

CS 23.230 Performance and flight characteristics specifications for flight in icing conditions

Aeroplanes intended for flight in icing conditions:

(a) operate safely in the environment specified in the operational limitations;

(b) provide a means to the flight crew to determine icing conditions outside the safe operational limitations and have the ability to safely avoid or safely exit those conditions;

(c) meet each specification of this Subpart in the approved operational environment, except spinning and those specifications that are demonstrated at speeds in excess of:

(1) 250 knots CAS;

(2) V_{MO}/M_{MO}; or

(3) a speed at which the airframe will be free of ice accretion; and

(d) provide consistent stall warning for flight in icing conditions and non-icing conditions.

Flight — Information

CS 23.250 Operating limitations

The following flight information is established:

(a) operating limitations, procedures and instructions necessary for the safe operation of the aeroplane;

(b) essential speed and performance information;

(c) essential loading information;

(d) the need for instrument markings or placards; and

(e) any additional information necessary for the safe operation of the aeroplane.

Subpart C—Structure

CS 23.300 Structures — General

(a) The structure is able to support:

(1) limit loads without interference with safe operation, or detrimental permanent deformation at each critical condition applicable for the structure; and

(2) ultimate loads.

(b) Limit loads are the maximum loads to be expected in service, to include flight, ground, water, inertia, and external loads.

(c) Ultimate loads are the limit loads multiplied by a factor of safety of 1.5, unless otherwise provided.

(d) Some strength specifications are specified in terms of ultimate loads only, when permanent detrimental deformation is acceptable.

(e) If deflections under load would significantly change the distribution of external or internal loads, this redistribution is taken into account.

(f) Loads resulting from the combination of any applicable load (e.g. flight loads, pressurisation loads, engine torque, thrust and gyroscopic loads, system induced loads etc.) are considered.

CS 23.305 Mass and mass distribution

Mass variations and distributions over the applicable weight and centre of gravity envelope, within the operating limitations, are determined.

CS 23.310 Interaction of systems and structures

For aeroplanes equipped with systems that affect structural performance, directly or as a result of failure or malfunction, the influence and failure conditions of these systems are taken into account in the specifications of subparts C and D.

CS 23.315 Flight loads

(a) Critical flight loads are established for symmetrical and asymmetrical loading from all combinations of airspeeds and load factors at and within the boundaries of the manoeuvre and gust envelope:

(1) at each altitude within the operating limitations, where the effects of compressibility are taken into account when significant;

(2) at each weight from the design minimum weight to the design maximum weight; and

(3) at any practical but conservative distribution of disposable load within the operating limitations for each altitude and weight.

(b) Vibration and buffeting does not result in structural damage up to dive speed.

(c) Loads resulting from a likely failure of an aeroplane system, component, or engine are determined.

CS 23.320 Design airspeeds

(a) Structural design airspeeds are determined for which the aeroplane structure is designed to withstand the corresponding manoeuvring and gust loads.

(b) The design speeds are sufficiently greater than the stalling speed of the aeroplane to safeguard against loss of control in turbulent air.

(c) The design speeds provide sufficient margin for the establishment of practical operational limiting airspeeds.

CS 23.325 Taxi, take-off and landing loads

Loads, including taxi (conventional or unconventional), take-off, landing, and handling loads, expected in service under the anticipated operating conditions are determined for:

(a) the applicable critical weight(s);

(b) the acceptable descent velocity (V);

(c) the appropriate landing surface; and

(d) normal and adverse landing attitudes and configurations.

CS 23.330 Aeroelasticity

(a) The aeroplane is free from flutter, control reversal, and divergence:

(1) at all speeds within and sufficiently beyond the design envelope;

(2) for any configuration and condition of operation;

(3) considering critical degrees of freedom; and

(4) taking into account any critical failures or malfunctions.

(b) Tolerances are established for all quantities that affect flutter.

CS 23.335 Emergency conditions

(a) The aeroplane, although it may be damaged in emergency landing conditions, provides reasonable protection to the occupants against serious injury and allows for timely evacuation of the occupants appropriate to the airworthiness level determined in CS 23.5 when:

(1) proper use of safety equipment and features provided for in the design is made;

(2) the occupant experiences ultimate static inertia loads likely to occur in an emergency landing; and

(3) the items of mass as part of the aeroplane (e.g. engines, batteries, APUs etc.) or carried on-board (baggage and cargo) that could injure an occupant experience the ultimate static inertia loads likely to occur in an emergency landing.

(b) The considered emergency landing conditions include conditions that are likely to occur (e.g. retracted landing gear or turnover position if likely).

(c) The restraint system does not prevent rapid occupant egress or interference with the operation of the aeroplane when not in use.

(d) Each baggage and cargo compartment is:

(1) designed for its placarded maximum weight of contents and for the critical load distributions at the appropriate maximum load factors corresponding to the flight and ground load conditions of this part.

(2) designed to prevent the contents of any compartment from becoming a hazard by shifting, and protects any controls, wiring, lines, equipment or accessories whose damage or failure would affect safe operations.

CS 23.340 Structure durability

(a) The aeroplane structure is designed, fabricated and subject to reliable and appropriate procedures during the life of the aeroplane to prevent structural failures due to foreseeable causes of strength degradation, which could result in large reductions in safety margins or functional capabilities, serious or fatal injuries, or loss of the aeroplane.

(b) The aeroplane is designed to successfully complete a flight during which likely structural damage occurs due to anticipated system failures or in-flight occurrences appropriate to the airworthiness level of the aeroplane.

CS 23.345 Structure information

The following structure information is established:

(a) any limitations, procedures or instructions necessary for safe operation;

(b) inspections or maintenance to assure continued safe operation; and

(c) weight and centre of gravity information needed for safe operation.

Subpart D — Design and Construction

CS 23.400 Design and Construction — General

(a) Each part or assembly is designed for the anticipated operating conditions.

(b) Design data is providing adequate definition of configuration, design features, and materials and processes.

(c) The suitability of each design detail and part having an important bearing on safety in operations is determined.

(d) The control system is free from jamming, excessive friction and excessive deflection when:

(1) the control systems and its supporting structure is subjected to loads corresponding to the limit air loads;
(2) the primary controls are subjected to the lesser of the limit air loads or limit pilot forces; and
(3) the secondary controls are subjected to loads not less than those corresponding to the maximum pilot effort.

(e) The complete pressurised cabin, including doors, windows, canopy and valves, is tested as a pressure vessel for the maximum relief valve setting multiplied by a factor of 1.33, without considering other loads.

CS 23.405 Materials and processes (see GM 23.405)

(a) The suitability and durability of materials used for parts the failure of which could adversely affect safety is determined, accounting for the effects of likely environmental conditions expected in service.

(b) The methods and processes of fabrication and assembly used produce consistently sound structures. If a fabrication process requires close control to reach this objective, the process is performed under an approved process specification.

(c) Design values are chosen to minimise the probability of structural failure due to material variability. Except as provided in paragraphs (e) and (f) of this section, compliance with this paragraph is shown by selecting design values that ensure material strength with probabilities appropriate to the criticality of the structural element.

(d) If material strength properties are required, they are based on enough tests of material meeting specifications to establish design values on a statistical basis.

(e) Design values, greater than the guaranteed minimums required by this section, may be used where only guaranteed minimum values are normally allowed if a ‘premium selection’ of the material is made in which a specimen of each individual item is tested before use to determine that the actual strength properties of that particular item will equal or exceed those used in the design.

(f) Other material design values may be used if specifically approved.

CS 23.410 Protection of structure

(a) Each part of the aeroplane, including small parts such as fasteners, is suitably protected against deterioration or loss of strength due to any cause likely to occur in the expected operational environment.

(b) Each part of the aeroplane must have adequate provisions for ventilation and drainage.

(c) For each part that requires maintenance, preventive maintenance, inspection or other servicing, appropriate means are incorporated into the aircraft design to allow such servicing to be accomplished.

CS 23.415 Special factors of safety

(a) Special factors of safety are established and applied in the design for each part of the structure whose critical design value is:

(1) uncertain;

(2) likely to deteriorate in service before normal replacement; or

(3) subject to appreciable variability because of uncertainties in manufacturing processes or inspection methods.

(b) Special factors of safety are determined using quality controls and specifications, suitable to the risk exposure, accounting for (as applicable):

(1) inspection methods;

(2) structural test specifications;

(3) sampling percentages; and

(4) process and material controls.

(c) The factor of safety in CS 23.300(c) of this part is multiplied by the highest pertinent special factors of safety.

CS 23.420 Flight control systems

(a) Aeroplane flight control systems and related equipment are designed to account for the prevention of likely:

(1) hazards to the aircraft and occupants, including the possibility of failure in, or disruption of, any aircraft system and related equipment; and

(2) human errors which could contribute to the creation of hazards.

(b) Primary flight controls are only those used for the immediate control of pitch, roll and yaw.

(c) Trim systems counteract aerodynamic forces to stabilise the aeroplane in a particular desired attitude without the need for the operator to constantly apply control force. They are designed to:

(1) prevent inadvertent or abrupt trim operation; and

(2) provide information on:

(i) trim control operation relative to aeroplane motion,

(ii) trim position and safe range,

(iii) trim range limitations and warnings when applicable; and

(3) for Airworthiness Level 1 aeroplanes above 750 kg (1 654 pounds) and Airworthiness Level 2, 3, and 4 aeroplanes designed with trim systems, those systems must provide adequate control for safe flight and landing when any one connecting or transmitting element in the primary flight control system fails.

(d) High-airspeed Airworthiness Level 3 and Airworthiness Level 4 aeroplanes must include a take-off configuration warning system if lift or longitudinal trim devices out of an approved take-off position would prevent rotation or would cause an immediate stall after rotation.

CS 23.425 Landing gear systems

(a) The landing gear includes the parts and systems necessary to support and control the aeroplane during surface operation and to make a safe transition from flight to surface operation and vice versa.

(b) The landing gear is designed to:

(1) protect the aeroplane and occupants during take-off, landing and surface operation taking into account:

(i) sufficient margin to the loads expected in flight and surface operation; and

(ii) likely system failures and likely operation circumstances (including anticipated limitation exceedances and emergency procedures);

(2) provide stable support and control to the aeroplane during surface operation; and

(3) absorb energy and support loads from take-off, landing and surface operation.

(c) Operations of the landing gear system, or aeroplane operation with the landing gear system in flight, surface or any transition position, do not require exceptional flight crew skill or strength.

(d) For aeroplanes that have a system that operates the landing gear, there is:

(1) information provided when the landing gear is not in a safe landing or flight position;

(2) information provided when the aeroplane configuration with an extended landing gear is unsafe; and

(3) an alternative means available to bring the landing gear in the landing position when a non-deployed system position would be hazardous.

CS 23.430 Means of egress and emergency exits

(a) When in the take-off or landing configuration, the aeroplane is designed to:

(1) facilitate rapid evacuation of the aeroplane in conditions likely to occur following an emergency landing;

(2) have means of egress (openings, exits or emergency exits), that can be readily located and opened from the inside and outside;

(3) have easy access to emergency exits when present.

(b) Aeroplanes approved for aerobatics must have a means to egress the aeroplane in flight.

CS 23.435 Occupant physical environment

(a) The aeroplane design must allow clear communication between the flight crew and passengers.

(b) The pilot location shall consider hazard areas associated with the powerplant.

(c) Each passenger and crew compartment must provide for adequate breathable air that is free of harmful or hazardous concentrations of gases and vapours during normal operation and probable failures.

(d) Pressurised aeroplanes:

(1) provide a safe cabin pressure altitude throughout the operating envelope;

(2) provide cabin pressure altitude, pressure differential, and rate of change of cabin pressure altitude information in flight above 12 500 feet MSL; and

(3) account for any probable failure that could affect cabin pressurisation and provide appropriate warnings to the flight crew necessary to maintain safe operation.

(e) An oxygen system and supply:

(1) provide occupants the oxygen and equipment appropriate to the maximum certified altitude and contain dispensing units which:

(i) do not interfere with flight crew duties,

(ii) are available to each occupant in a timely manner , and

(iii) include operating information and instructions;

(2) are free from hazard in its method of operation and its effect upon other components;

(3) provide a means to allow the flight crew to readily determine, on the ground and in flight, the quantity of oxygen available in each source of supply and to determine whether oxygen is being delivered; and

(4) provide a means to isolate the oxygen supply in flight to mitigate hazards.

CS 23.440 External environmental hazards

(a) For bird strike protection:

(1) internal panels of windshields, windows and canopies are constructed of a material that does not cause a hazard to occupants when damaged taking into account pressurisation when applicable; and

(2) each windshield directly in front of the pilot and the windshield’s supporting structure in Airworthiness Level 4 aeroplanes must allow for continued safe flight and landing after a bird strike.

(b) For direct lightning:

(1) Airworthiness Level 4 aeroplanes are designed so that the direct effects of lightning will not result in a structural failure preventing safe flight and landing; and

(2) Airworthiness Level 1, 2 and 3 aeroplanes likely to encounter lightning conditions are designed so that the direct effects of lightning will not result in a structural failure preventing safe flight and landing.

CS 23.445 Fire protection

(a) The aeroplane is designed to minimise the risk of fire initiation due to:

(1) anticipated heat or energy dissipation or system failures or overheat that are expected to generate heat sufficient to ignite a fire;

(2) ignition of flammable fluids, gasses or vapours; and

(3) fire propagating or initiating system characteristics (e.g. oxygen systems).

(b) The aeroplane is designed to minimize the risk of fire propagation by:

(1) providing adequate fire or smoke awareness and extinguishing means when practical;

(2) application of materials that are adequate for fire resistance of extinguishing properties; and

(3) specifying designated fire zones that meet the specifications of CS 23.865.

CS 23.450 Designated fire zones

(a) Designated fire zones are zones where catastrophic consequences from fire in that zone are mitigated by containing the fire within that zone.

(b) Designated fire zones are constructed and sealed to:

(1) adequately contain fire within that zone; and

(2) provide sufficient time and continued functions or emergency procedures for the aeroplane to avoid a catastrophic effect.

(c) The heat within that zone also has no catastrophic failure effect on parts or systems exposed to it.

CS 23.455 Design and construction information

The following design and construction information is established:

(a) operating limitations, procedures and instructions necessary for the safe operation of the aeroplane;

(b) the need for instrument markings or placards;

(c) any additional information necessary for the safe operation of the aeroplane; and

(d) inspections or maintenance to assure continued safe operation.

CS 23.460 Crew interface

(a) The pilot compartment and its equipment must allow each pilot to perform his duties without unreasonable concentration or fatigue.

(b) Information related to unsafe system operation must be provided in a timely manner and designed to minimise crew member errors that could create additional hazards.

(c) Information necessary for any required crew member to monitor parameters during a phase of flight are located in a way that the crew member can safely monitor parameters and trends if appropriate for:

(1) safe operation; or

(2) exceedances of a limitation unless it is shown that the limitation will not be exceeded in all intended operations.

(d) Indication systems which integrate the display of flight or powerplant parameters required to safely operate the aeroplane:

(1) do not inhibit the primary display of flight or powerplant parameters needed by any flight crew member in any normal mode of operation; and

(2) when considering other aeroplane systems, are designed so that information essential for continued safe flight and landing will be available to the flight crew in a timely manner after any single failure or likely combination of failures.

(e) Each pilot compartment view is:

(1) sufficiently extensive, clear and undistorted to enable the pilot to safely taxi, take-off, approach, land and perform any manoeuvres within the operating limitations of the aeroplane;

(2) free from distracting glare and reflections that could interfere with the pilot's vision; and

(3) designed so that moderate rain conditions do not unduly impair the pilot's view of the flight path in normal flight and while landing.

(f) Cockpit controls are designed so that their operation is logic and consistent with acceptable conventions.

(g) Cockpit controls essential to the safe operation must:

(1) be obvious in function and located and identified to provide convenient operation and to prevent confusion and inadvertent operation;

(2) be located and arranged so that the pilot, when seated, has full and unrestricted movement of each control without interference; and

(3) provide for accurate and consistent operation.

(h) In addition, powerplant controls are located to prevent confusion as to the engines they control.

(i) In addition, propulsion energy supply:

(1) indicates to the flight crew when energy supply cannot be ensured for maximum engine power under all likely operating conditions;

(2) controls are visible to the pilot in the normal flying position;

(3) indicates the ‘off’ or ‘closed’ position with the use of the colour red; and

(4) indicates emergency shut-off controls with the use of the colour red, if equipped.

(j) The operating limitations, instrument markings, placard information and other information necessary for safe operation are made available to the crew members.

(k) The aeroplane displays, in a conspicuous manner, any informational placard and instrument marking when necessary for safe operation.

(l) The instrument marking and placard information is furnished in the Aeroplane Flight Manual.

(m) Information necessary for the inspection or maintenance of the aeroplane as well as on its limitations is furnished in the Instructions for Continued Airworthiness.

(n) Information related to safety equipment is easily identifiable and its method of operation is clearly marked.

Subpart E — Powerplant

CS 23.500 Powerplant installation specifications

(a) For the purpose of this part, the aeroplane powerplant installation includes each component that:

(1) is necessary for propulsion or for providing auxiliary power to the aeroplane (APU); and

(2) affects the safety of the aeroplane powerplant.

(b) Each powerplant component (e.g. engine, propeller, APU, battery etc.) meets specific Certification Specifications if applicable.

(c) The installation of powerplant component that deviates from the components limitations or installation instructions is safe.

(d) The powerplant installation is constructed and arranged to ensure safe operation:

(1) under all likely operating conditions;

(2) taking into account installation effects; and

(3) taking into consideration likely expected environmental conditions and foreign object threats.

(e) The moving parts of powerplant systems have sufficient clearance to other aeroplane parts or their surroundings to prevent interference or damage during operation.

CS 23.505 Thrust and drag augmentation systems

(a) Thrust and drag augmentation systems are systems that intervene — manually or automatically — with the power selection commanded by the direct power settings.

(b) Any single failure or malfunction during normal operation of a system intended to augment the thrust or drag has no catastrophic effect.

(c) Inadvertent operation of the system by flight crew is prevented or can be restored without resulting in an unsafe condition.

(d) Unless failure of a thrust or drag augmentation system is ‘Extremely Remote’, any automatic thrust or drag augmentation system must:

(1) provide a means for the flight crew to verify that the system is in an operating condition;

(2) provide a means for the flight crew to deactivate the automatic function; and

(3) prevent inadvertent deactivation.

CS 23.510 Powerplant hazard mitigation

(a) The powerplant must not have adverse operational characteristics, including vibration, which would create a hazard to the aircraft or to the propulsion system itself during likely operating conditions.

(b) In addition to the aircraft level systems requirements covered by CS 23.600, the following specific powerplant system installation hazards are considered and mitigated.

(c) In case of multiple powerplants, they are arranged and isolated from each other to allow operation, in at least one configuration, so that the likely operation, failure or malfunction of any powerplant system will not:

(1) prevent the continued safe operation of the remaining powerplant system; and

(2) require immediate action by any crew member for continued safe operation of the remaining powerplant system.

(d) Likely foreign object damage on a powerplant component is not resulting in any unsafe condition.

(e) There must be means to isolate and minimise hazards to the aircraft in the event of a powerplant system fire or overheat in operation.

CS 23.515 Energy storage and distribution system hazard mitigation

(a) The fuel/energy system, containing high amount of energy, is designed to minimise hazards to the occupants in case of survivable emergency landings. For Airworthiness Level 4 aircraft, failure due to overload of the landing system is taken into account.

(b) Hazardous accumulations of fluids, vapours or gases are isolated from the aeroplane and personnel compartments and are safely contained, vented or drained.

(c) Powerplant system hazards in maintenance activities and during ground handling or operation are mitigated by design or procedures.

(d) For Airworthiness Level 4 aeroplanes, overloading the main landing gear during take-off or landing (assuming the overloads are acting in the upward and aft direction) does not cause the release of a hazardous amount of high energy.

(e) Any likely single failure of an accessory directly interacting with the propulsion system does not create a hazard to the propulsion system.

CS 23.520 Powerplant support systems

(a) Powerplant support systems are all systems whose direct purpose is to support the powerplant or the energy storage device in its intended function as part of the powerplant system.

(b) Powerplant support systems that have a direct effect on the engine are considered in the engine reliability.

(c) Powerplant support systems are designed for the operating conditions applicable to the location of installation.

(d) Systems must be capable to operate under the conditions likely to occur.

(e) No hazard should result from uncontained high energy fragments

(f) Mounting provisions must be designed to withstand the loads imposed on the system.

(g) Resulting hot airflow from heat exchangers (source: intercooler) must not cause a hazard to the aircraft.

(h) System function and characteristics that have an effect on the powerplant performance are established.

(i) Prevent ingestion of likely foreign objects that would be hazardous to the engine

(j) The pilot must be aware of the air intake configuration and able to influence it.

(k) Any likely single failures that have a direct effect on availability of thrust are mitigated. (source: no internal exhaust blockage)

CS 23.525 Powerplant operational characteristics

(a) It is possible to safely shut down and, if necessary, stop continued rotation after shut down and safely restart an engine in flight.

(b) Any techniques and associated limitations for engine starting and stopping are established.

CS 23.530 Fuel or energy system — General

(a) Each energy storage and supply system is able to appropriately retain the energy under all permitted and likely environmental and operating conditions.

(b) Each energy storage and supply system provides energy to the thrust system or powerplant (meaning also APUs) with adequate reserves to ensure safe functioning under all permitted and likely operating conditions, considering possible other energy consumers.

(c) Uninterrupted energy supply is provided when usable energy is available in the system when correctly operated, also considering likely energy fluctuations.

(d) Safe removal or isolation of the energy stored within the system for safe maintenance is provided.

(e) Each energy storage device is able to withstand, without failure, the vibration, inertia loads, system loads, other structural loads and installation condition that it subjected to in operation.

CS 23.535 Energy system independence (see GM 23.535)

Independence within multiple energy storage and supply systems installed is provided so that a failure of any one component in one system will not result in the loss of energy storage or supply of another system.

CS 23.540 Energy storage and supply system lightning protection

For Airworthiness Level 2, 3, and 4 aeroplanes or for aeroplanes likely exposed to lightning due to operation, the energy storage and supply system is designed and arranged to prevent catastrophic events due to lightning strikes taking into account direct and indirect effects.

CS 23.545 Energy transfer

Hazards or loss of stored energy caused by energy transfer between interconnected energy storage devices or by return flow must be avoided in normal operation.

CS 23.550 Energy storage

The energy storage system must accommodate at least such a minimum amount of energy necessary for safe operation.

CS 23.555 Energy storage and supply systems installation

(a) Each energy storage and supply system must be installed in such a way to:

  (1) avoid hazard to occupants or other persons due to damage to the storage during landing taking into account partial or full retracted landing gear;

  (2) be protected against hazards due to unintended temperature influence;

  (3) be isolated to avoid hazard to occupants; and

  (4) allow continued energy supply in case of a likely component failure.

(b) Likely omissions during ground handling of the aircraft must not lead to a hazardous loss of stored energy.

CS 23.560 Energy medium pollution within storage and supply system

Positive separation and possibility of removal of energy medium pollution must be provided prior to any use of the energy medium if required for proper function.

CS 23.565 Energy storage refill/recharge

(a) Filling/charging points must be designed to avoid wrong filling or charging.

(b) They must be designed to reasonably avoid the possibility of contamination of the energy stored during likely operation.

(a) Hazards to aeroplane or personnel because of refill/recharge must be avoided.

CS 23.570 Energy dump systems

Energy dump systems must be free from hazards to the aircraft or its operation, considering any probable single malfunction under likely operating conditions.

CS 23.575 Powerplant information

(a) The following powerplant information is established:

(1) operating limitations, procedures and instructions necessary for the safe operation of the aeroplane;

(2) the need for instrument markings or placards;

(3) any additional information necessary for the safe operation of the aeroplane;

(4) inspections or maintenance to assure continued safe operation;

(5) information related to the air intake configuration;

(6) techniques and associated limitations for engine starting and stopping; and

(7) energy level information must be provided to support energy management, including consideration of a likely component failure within the system.

(b) Unless failure of an automatic thrust or drag augmentation system is 'Extremely Remote', information related to the availability of the system is provided.

Subpart F — Systems and Equipment

CS 23.600 System and Equipment functional specifications

(a) The specifications in CS 23.600 and CS 23.605 are of a general applicability and do not supersede any other CS-23 specification.

(b) The systems and equipment required for an aeroplane to operate safely in the intended kinds of operations:

(1) are designed and installed to meet the level of safety appropriate to the aeroplane airworthiness level in accordance with CS 23.605; and

(2) performed safely throughout the operating and environmental limits.

(c) The systems and equipment not covered by CS 23.600(b), considered separately and in relation to other systems, are designed and installed so that their operation or failure does not cause a hazard to the aeroplane or occupants.

CS 23.605 System and Equipment failure specifications

(a) Each equipment and system identified in 23.600(b), considered separately and in relation to other aeroplane systems, is designed and installed so that there is a logical and acceptable inverse relationship between the average probability and the severity of failure condition effects, as shown in Figure 1.

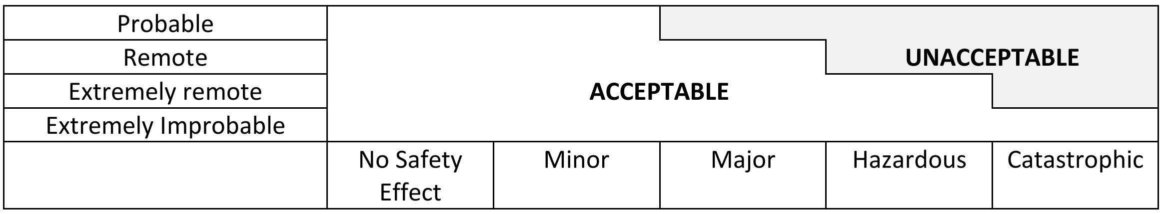


Figure 1: Relationship between probability and severity of failure condition effects

(b) The failure condition probability terms used in CS 23.605(a) are defined as follows:

(1) 'Extremely Improbable' failure conditions are those so unlikely that they are not anticipated to occur during the entire operational life of all aeroplanes of one type;

(2) 'Extremely Remote' failure conditions are those not anticipated to occur to each aeroplane during its total life but which may occur a few times when considering the total operational life of all aeroplanes of the type;

(3) 'Remote' failure conditions are those unlikely to occur to each aeroplane during its total life, but which may occur several times when considering the total operational life of a number of aeroplanes of the type; and

(4) 'Probable' failure conditions are those anticipated to occur one or more times during the entire operational life of each aeroplane.

(c) The severity of a failure condition is determined by the highest effect on aeroplane, occupants or crew in accordance with the table below:

	No Safety Effect	Minor	Major	Hazardous	Catastrophic
Effect on aeroplane	No effect on operational capabilities or safety	Slight reduction in functional capabilities or safety margins	Significant reduction in functional capabilities or safety margins	Large reduction in functional capabilities or safety margins	Normally with hull loss
Effect on occupants	Inconvenience for passengers	Physical discomfort for passengers	Physical distress to passengers, possibly including injuries	Serious or fatal injury to an occupant	Multiple fatalities
Effect on flight crew	No effect on flight crew	Slight increase in workload or use of emergency procedures	Physical discomfort or a significant increase in workload	Physical distress or excessive workload impairs ability to perform tasks	Fatal injury or incapacitation

CS 23.610 System components — General

Each component of a system is:

(a) of a kind and design appropriate to its intended function; and

(b) installed according to limitations specified for that component.

CS 23.615 Flight, navigation, and powerplant instruments

The aeroplane includes installed equipment and instruments necessary to operate safely throughout the specified operating environment.

CS 23.620 Indirect lightning protection

For an aeroplane where the effects of exposure to lightning are not acceptable:

(a) each system susceptible to lightning that performs a function for which a failure condition would prevent the continued safe flight and landing of the aeroplane is designed and installed so that:

(1) the corresponding aircraft level function is not adversely affected during and after the time the aeroplane is exposed to lightning; and

(2) the system automatically recovers normal operation of that function in a timely manner after the aeroplane is exposed to lightning unless the system's recovery conflicts with other operational or functional specifications of the system; and

(b) each system that performs a function for which failure would reduce the capability of the aeroplane or the ability of the flight crew to respond to an adverse operating condition is designed and installed so that the function recovers normal operation in a timely manner after the aeroplane is exposed to lightning.

CS 23.625 High-Intensity Radiated Fields (HIRF) protection

(a) The electrical and electronic systems that perform a function whose failure would prevent the continued safe flight and landing of the aeroplane is designed and installed so that:

(1) the corresponding aircraft level function is not adversely affected during and after the time the aeroplane is exposed to the expected HIRF environment; and

(2) the system automatically recovers normal operation of that function in a timely manner after the aeroplane is exposed to the expected HIRF environment unless the system's recovery conflicts with other operational or functional specifications of the system.

(b) Any HIRF induced system’s function failure behaviour that reduces the capability of aeroplanes approved for instrument flight rule operation, or the ability of the flight crew to respond to an adverse operating condition is designed so that the system recovers normal operation in a timely manner after the aeroplane is exposed to the expected HIRF environment.

CS 23.630 System power generation, storage and distribution

The power generation, storage and distribution for any system must:

(a) enable it to supply the power required for proper operation of connected loads during all intended operating conditions;

(b) be designed such that no single failure or malfunction will:

(1) impair the ability of the system to supply essential loads required for safe flight and landing; and

(2) cause a hazard; and

(c) have enough capacity to supply essential loads, including non-continuous essential loads for the time needed to complete the function, required for safe flight and landing, should the primary power source(s) fail.

CS 23.635 External and cockpit lighting

(a) Lights are designed and installed to minimise any adverse effect on the flight crew.

(b) Position and anti-collision lights are designed and installed with the intensities, flash rate, colours, fields of coverage and other safety related characteristics to provide reasonable time for another aircraft to avoid a collision.

(c) Position lights must be installed such that a red light is shown on the left side, a green light on the right side, spaced laterally as far apart as practicable, and a white light facing aft, located on an aft portion of the aeroplane or wing tips.

(d) Taxi and landing lights are designed and installed so that they provide enough light for night operations if approval for night operations is sought.

(e) For seaplanes, riding lights must provide a white light visible in clear atmospheric conditions.

CS 23.640 Safety equipment — General

Safety and survival equipment, required by operating rule, is safe, reliable, readily accessible, easily identifiable, and its method of operation is clearly marked.

CS 23.645 Pressurised system elements

(a) The minimum burst pressure of hydraulic systems is at least 2.5 times the design operating pressure. The proof pressure is at least 1.5 times the maximum operating pressure.

(b) On multiengine aeroplanes, essential engine-driven accessories are safely distributed among multiple engines.

(c) Pressurisation system elements' burst pressure is at least 2.0 times and proof pressure is at least 1.5 times the maximum normal operating pressure.

(d) Pneumatic system elements' burst pressure is at least 3.0 times and proof pressure is at least 1.5 times the maximum normal operating pressure.

(e) Other pressurised system elements must have acceptable pressure margins taking into account system design and operating conditions.

CS 23.650 Recorders for post-crash investigation

(a) Each recorder required by the operating rules:

 (1) meets the applicable technical specifications;

 (2) is installed so as to ensure safe recording and safeguarding the required items; and

 (3) is powered by the most reliable power source and remains powered for as long as possible without jeopardising service to essential or emergency loads and emergency operation of the aeroplane.

(b) Any single electrical failure external to the recorder does not disable recorders nor pickup devices.

(c) Non-ejectable recorder containers are located and mounted to minimise the probability of rupture of the container, as a result of crash impact, and consequent heat damage to the recorder from fire.

(d) The pickup devices are located in the best position for accurate and undistorted recording, so that the intelligibility of the records is as high as practicable.

(e) Different pickup sources are recorded on separate channels and in a manner that it is clear which channel belongs to which source.

(f) As far as practicable, all resources received are recorded without interruption.

(g) Recorders have independent power sources providing enough power for 10 min ± 1 min. These independent power sources, to which the recorder is switched automatically in case of power loss (intentionally/accidentally), are located as close as possible to the recorder.

(h) An aural or visual means for pre-flight checking of the recorder for proper operation is provided.

(i) There is an automatic means to simultaneously stop the recorder and linked pickup devices and prevent each erasure feature from functioning, within 10 minutes after crash impact.

(j) In case the recorder is equipped with a bulk erasure device, the installation is designed to minimise the probability of inadvertent operation and actuation of the device during crash impact.

(k) Each recorder container is easy to recognise as such and has, when required by the operating rules, an underwater locating device on or adjacent to the container, which is secured in such manner that it is not likely to be separated during crash impact.

CS 23.655 Systems and equipment information

The following systems and equipment information is established:

(a) operating limitations, procedures and instructions necessary for the safe operation of the aeroplane;

(b) the need for instrument markings or placards;

(c) any additional information necessary for the safe operation of the aeroplane;

(d) inspections or maintenance to assure continued safe operation;

(e) systems operating parameters required to safely operate the aeroplane, including warnings, cautions and normal indications;

(f) information concerning an unsafe system operating condition;

(g) any components which include information related to identification, function or operating limitations or any applicable combination of these factors required to assure safe operations and maintenance; and

(h) information related to the location and use of safety equipment.

6. Appendix B (ADS draft ASTM F44 systems standard extract)

Note:
An applicability table is sometimes used within an ASTM standard to simplify the text of the technical specification. An example of such a table is transposed in the following simplified table.

The table below provides correlation between various Aircraft Type Codes (ATC) and the individual requirements contained within this section;

Airworthiness Levels indicate the CS-23 airworthiness levels.

Number of engines indicate “S” for a single-engine aircraft and “M” for a multiengine aircraft.

Type of engine(s) uses “R” for a reciprocating engine and “T” for a turbine engine.

Stall speed indicate: “L” for a stall speed ≤ 83 km/hr [45 knots].
“M” for a stall speed >83 km/hr [45 knots] ≤ 113 km/hr [61 knots].
“H” for a stall speed >113 km/hr [61 knots].

Cruise speed indicate: “L” indicates a cruise speed ≤ 463 km/hr [250 knots].
“H” indicates a cruise speed > 463 km/hr [250 knots].

Meteorological conditions: “D” indicates an aircraft limited to Day VFR conditions only.
“N” indicates an aircraft limited to Day or Night VFR conditions
“I” indicates an aircraft certified for IFR operations.

Altitude: “L” aircraft with a maximum operational altitude ≤7,620 m [25,000 ft].
“H” aircraft with a maximum operational altitude >7,620 m [25,000 ft].

The following three indicators are used:

• An empty cell ( ) in all applicable ATC character field columns indicates that an aircraft must meet the requirements of that subsection.

• A white circle (○) in multiple columns indicates that an aircraft is exempt from the requirements of that subsection *only* if all such ATC character fields are applicable.

• A mark-out (×) in any of the applicable ATC character field columns indicates that an aircraft is exempt from the requirements of that subsection.

Section	Airworthiness Level				No of engines		Type of engine		Stall speed			Cruise speed		Meteo conditions			Altitude	
	1	2	3	4	S	M	R	T	L	M	H	L	H	D	N	I	L	H
5.2																		
5.2.1																		
5.2.1.1				X														
5.2.1.2	X	X	X															
5.2.2																		
5.2.3																		
5.2.4																		
5.2.5																		
5.2.6																		
5.2.7	X	X	X															
5.2.8	X	X	X															
5.2.9	X	X	X															
5.2.10	X	X	X															
5.2.11	X	X	X															
5.3.7									○					○				X
5.3.8									○					○			X	

5.2 Electrical Systems and Equipment [§23.1351]

5.2.1 Electric power sources, their transmission cables, and their associated control and protective devices, must be able to furnish the required power at the proper voltage to each load circuit essential for safe operation. *[§23.1351(a)(1); CS23.1351(a)(1); CS-VLA 1351(a)(1)]*

5.2.1.1 Compliance with **Section 5.2.1** must be shown by an electrical load analysis or by electrical measurements that account for the electrical loads applied to the electrical system in probable combinations and for probable durations. *[§23.1351(a)(2)(i); CS23.1351(a)(2)(i); CS-VLA 1351(a)(2)]*

5.2.1.2 Compliance with **Section 5.2.1** must be shown by an electrical load analysis that accounts for the electrical loads applied to the electrical system in probable combinations and for probable durations. *[§23.1351(a)(2)(ii); CS23.1351(a)(2)(ii)]*

5.2.2 Each electrical system, when installed, must be free from hazards in itself, in its method of operation, and in its effects on other parts of the aircraft.*[§23.1351(b)(1)(i); CS23.1351(b)(1)(i); CS-VLA 1351(b)(1)(i)]*

5.2.3 Each electrical system, when installed, must be protected from fuel, oil, water, other detrimental substances, and mechanical damage. *[§23.1351(b)(1)(ii); CS23.1351(b)(1)(ii); CS-VLA 1351(b)(1)(ii)]*

5.2.4 Each electrical system, when installed, must be designed so that the risk of electrical shock to crew, passengers, and ground personnel is reduced to a minimum. *[§23.1351(b)(1)(iii); CS23.1351(b)(1)(iii); CS-VLA 1351(b)(1)(iii)]*

5.2.5 Electric power sources must function properly when connected in combination or independently. *[§23.1351(b)(2); CS23.1351(b)(2); CS-VLA 1351(b)(2)]*

5.2.6 No failure or malfunction of any electric power source may impair the ability of any remaining source to supply load circuits essential for safe operation.*[§23.1351(b)(3); CS23.1351(b)(3); CS-VLA(b)(*3)]

5.2.7 Each system must be designed so that essential load circuits can be supplied in the event of reasonably probable faults or open circuits including faults in heavy current carrying cables. *[§23.1351(b)(4)(i); CS23.1351(b)(5)(i)]*

5.2.8 A means must be accessible in flight to the flight crewmembers for the individual and collective disconnection of the electrical power sources from the system. *[§23.1351(b)(4)(ii); CS23.1351(b)(5)(ii)]*

5.2.9 The system must be designed so that voltage and frequency, if applicable, at the terminals of all essential load equipment can be maintained within the limits for which the equipment is designed during any probable operating conditions.*[§23.1351(b)(4)(iii); CS23.1351(b)(5)(iii)]*

5.2.10 If any particular system or item of equipment requires two independent sources of electrical power, their electrical energy supply must be ensured by means such as duplicate electrical equipment, throw over switching, or by the use of multichannel or loop circuits separately routed. *[§23.1351(b)(4)(iv); CS23.1351(b)(5)(iv)]*

5.2.11 For the purpose of complying with **Section 5.2.6** through **Section 5.2.10**, the distribution system includes the distribution busses, their associated feeders, and each control and protective device. *[§23.1351(b)(4)(v); CS23.1351(b)(5)(v)]*

5.3.7 In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing electrical power to those loads that are essential to continued safe flight and landing for at least 30 minutes (which includes the time to recognize the loss of generated power and to take appropriate load shedding action). *[§23.1353(h)(1)(i) & §23.1353(h)(2); CS23.1353(h)]*

5.3.8 In the event of a complete loss of the primary electrical power generating system, the battery must be capable of providing electrical power to those loads that are essential to continued safe flight and landing for at least 60 minutes (which includes the time to recognize the loss of generated power and to take appropriate load shedding action). *[§23.1353(h)(1)(ii) & §23.1353(h)(2)]*

7. Appendix C (Example CS-23 Guidance Material)

GM 23.215 Stall characteristics, stall warning, and spins

(a) The aeroplane, by the aerodynamic characteristics or, if needed, supported by systems, will give the pilot sufficient time and margin to react to, and prevent inadvertent departure from controlled flight. The severity of a functional failure of a warning system necessary to achieve this objective is established using CS 23.605, and can be different for aeroplanes that have a benign behaviour or that are equipped with an active departure prevention system.

(b) Aeroplanes are designed so that in case of inadvertent departure from controlled flight, the aeroplane:

(1) can be quickly recovered to a controlled horizontal flight;
(2) does not lose too much height; and
(3) does not require exceptional piloting skills to recover.

When the aeroplane through its flight characteristics cannot provide the benign characteristics, an active system (e.g. envelope protection or stick pusher) must prevent the aeroplane to depart from controlled flight. Acceptable means of compliance contain flight test methods for various aeroplane configurations that are considered to reveal the behaviour characteristics of the aeroplane. When the behaviour of the aeroplane is not within the given time and height loss limits, active systems are required to avoid inadvertent departure from controlled flight.

Failures of such systems necessary to achieve this objective in aeroplanes that have no benign behaviour are considered to have a catastrophic effect. Inadvertent departure from controlled flight for aeroplanes that do not have this benign behaviour likely results in an uncontrolled contact with the ground as in the typical landing and take-off accidents.

(c) Time and height loss as mentioned under (b) are criteria not applicable to aeroplane designed for aerobatics. Aeroplanes designed for aerobatics exhibit safe handling within the flight limitations as specified for the aeroplane.

GM 23.405 Materials and processes

The environmental conditions during normal operation are considered when the suitability and durability of materials is established. For essential structural components and parts essential in the design, the effect of these environmental conditions on the material properties or component characteristics are also considered when significant.

GM 23.535 Energy system independence

Multiple energy storage can be, for instance, multiple fuel tanks or batteries feeding the powerplant. No single failure of any component in one tank/battery and their feeding system will result in:

— losing fuel or power from the other, not affected, energy storage; or
— prevent use of the energy from the not affected energy storage.