



Comment-Response Document (CRD) 2018-06(B)

RELATED NPA: 2018-06(B) — RELATED ED DECISION: 2022/007/R — RMT.0379
31.1.2022

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1. Summary of the outcome of the consultation

Following the public consultation of NPA 2018-06(B)¹, a total of 252 comments were received on the proposed amendments to CS-AWO Issue 2. The comments that were received came from a wide variety of stakeholders including industry, air navigation service providers, and national aviation authorities. Two dedicated comment-review workshops were arranged with the stakeholders to review the comments and prepare the responses. The comments covered a multitude of topics, but there were some common themes which included the following:

- Clarifications on the eligible technologies that can be used for SA CAT I.
- Misunderstands on the concept of SA CAT I.
- Requests to clarify the need to recalculate landing distance when using a HUD (including for EFVS imagery) that includes a flare cue (prompt or guidance).
- Requests to include flexibility in the provision of the means to identify the position of the runway (such as a synthetic runway) when conducting EFVS landings.
- Concerns regarding the stringent nature of the requirements for SVGS.
- The need to better define the term 'xLS' and what navigation means could be included in this definition.
- Requests to align with the ICAO SARPs and guidance, and also with the FAA regulations and guidance.
- Comments to complement or correct the various models that can be used for certification.

¹ <https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2018-06>



2. Individual comments and responses

In responding to the comments, the following terminology is applied to attest EASA's position:

- (a) **Accepted** — EASA agrees with the comment and any proposed change is incorporated into the text.
- (b) **Partially accepted** — EASA either partially agrees with the comment or agrees with it but the proposed change is partially incorporated into the text.
- (c) **Noted** — EASA acknowledges the comment, but no change to the text is considered necessary.
- (d) **Not accepted** — EASA does not agree with the comment or proposed change.

(General Comments)

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comment

30

comment by: FAA

GeneralThe FAA is revising the airworthiness guidance in AC 120-28D and AC 120-29A for low visibility takeoff, Category II, and Category III instrument approaches. The FAA is also moving the AC 120-28D and AC 120-29A guidance to a new advisory circular, AC 20-191. The FAA is also in the process of updating the enhanced vision and synthetic vision guidance in AC 20-167A and AC 20-185. The FAA will open these new and revised ACs for public comment in the fall/winter 2018 timeframe.

If you would like to review the current draft of AC 20-191, please contact Mr. Hamza Abduselam at Hamza.Abduselam@faa.gov. If you would like to review the current draft of AC 20-167B or AC 20-185A please contact Mr. Trent Prange at Trent.Prange@faa.gov.

response

Noted

The input, comments and contribution from the FAA are always welcome.

comment

34

comment by: FAA

Section 3

General Comment While it is good that Section 3 is largely harmonized with FAA AC 20-167 and RTCA DO-315 the level of detail found in this section is not appropriate for a regulatory document. By incorporating advisory means of compliance into a regulatory document EASA is defacto mandating a single means of compliance and eliminating industry flexibility to meet operational requirements. Furthermore this section increase the chance that a system that could be successfully certified in the US would not be acceptable in Europe. The bulk of the content of Section 3 should be moved to an advisory document similar to FAA AC 20-167 or just reference industry standards like RTCA DO-315. EASA should harmonize with 14 CFR 1.1, 2x.773(e) and 91.176.



	<p>Replace section 3 with a section that harmonizes with 14 CFR 1.1, 2x.773(e) and 91.176 and move the rest of Section 3 to an advisory document.</p>
response	<p>Not accepted</p> <p>Unfortunately, due to the regulatory structure of the EASA system, it is not possible to issue stand-alone advisory material in the same manner as the FAA does. Therefore, there is a need to develop dedicated certification specifications.</p> <p>At the time of development of the CSs for SVGs, EASA had not gained sufficient experience in the certification of SVGs, and this is reflected in the conservative nature of Section 3.</p>
comment	<p>45 comment by: FAA</p> <p>CS AWO.A.SVGs</p> <p>General Comment While it is good that Section 3 is largely harmonized with FAA AC 20-185 and RTCA DO-359 the level of detail found in this section is not appropriate for a regulatory document. By incorporating advisory means of compliance into a regulatory document EASA is defacto mandating a single means of compliance and eliminating industry flexibility to meet operational requirements. Furthermore this section increase the chance that a system that could be successfully certified in the US would not be acceptable in Europe. The bulk of the content of Section 3 should be moved to an advisory document similar to FAA AC 20-167 or just reference industry standards like RTCA DO-315</p> <p>EASA should use the content of 14 CFR 2x.773(e) and 91.176 as a model to up level the regulatory requirements of an EFVS system as a model to develop an SVGs regulation.</p>
response	<p>Not accepted</p> <p>Please see the response to comment #34.</p>
comment	<p>57 comment by: Garmin International</p> <p>General:</p> <p>There is a lot of material from RTCA documents. For example, Subpart A Section 4 has a lot of material that is the same or slightly modified from RTCA/DO-359. This is just an example. There are many similar occurrences in the other Subpart A sections.</p> <p>It is recommended that the material be referenced instead of copied.</p>
response	<p>Not accepted</p> <p>The spirit of the requirements in some RTCA documents has been captured in CS-AWO. However, due to the EASA regulatory structure, there is a need to have certification specifications to capture the requirements.</p>



comment 82

comment by: AIRBUS

The definition of **xLS** should be homogenous across all the document. There are many different wordings across the document including in OPS and Airport parts. It should be defined once and for all in the "definition section" and then only xLS term should be used.

Please add a definition for xLS applicable to all subparts and add similar definition in other domain when requirement is operationally equivalent to ILS.

Suggested definition "xLS : A navigation means that provides to crew and aircraft system deviations from approach lateral and vertical trajectories equivalent to an ILS. It includes Instrument Landing System (ILS), Microwave Landing System (MLS), Ground-based augmented (GBAS) Landing System, Space Based augmented Landing System (SBAS/LPV) or any other system (or combination of systems) that has demonstrated equivalent performances."

The proposed wording is consistent with new definition
GM18 Annex Definitions
INSTRUMENT APPROACH OPERATIONS

(a) Depending on the instrument approach procedure (IAP) in use, the lateral and vertical navigation guidance for an instrument approach operation may be provided by:

(1) a ground-based radio navigation aid;
or (2) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of them.

We suggest to remove any explicit of ILS or MLS, GLS and to refer to xLS definition.

CS AWO.A.ALS.101

CS AWO.B.SACATI.101

AMC AWO.A.ALS.101(a)

AMC AWO.B.CATII.101(a)

AMC AWO.B.CATII.113

APPENDIX 1 TO AMC AWO.B.CATII.113

AMC AWO.B.CATIII.101(a) in particular add an item after "The ground guidance system is either:"(4) any demonstrated equivalent system.

AMC AWO.C.TOO.101 in particular reword "The requirements are based on the assumption that, if the take-off guidance system is based on ILS or MLS information, operational precautions are taken to ensure that the localiser signal is suitable (e.g. in each case the ILS, the localiser is Category III, or the airborne system has been shown to perform satisfactorily on that installation)."

AMC AWO.C.TOO.106

response Accepted

A definition of 'xLS' has been provided in CS AWO.B.CATI.102 and in AMC AWO.B.CATI.102, and a review of the consistent use of the term 'xLS' has been conducted.



comment	<p>88</p> <p style="text-align: right;">comment by: <i>EUROCONTROL</i></p> <p>All sections :</p> <p>Contrary to what is said in the introduction, this subpart of the NPA does not seem to consider all systems in use for AWO, but only those in use for LVO. This creates confusion as regards the treatment of systems that allow operational credit, for instance if a Type A operation becomes a type B operation (LPV200) or if enhanced/synthetic/combined vision systems allow operations below the published minima (EFVS200). In that case neither CS-ACNS nor CS-AWO fully cover the entire context.</p> <p>Review overlaps between CS's especially for systems allowing operational credits , ensuring full coverage of systems and their operations. Consider detailed comments below that express concern about this gap.</p>
response	<p>Accepted</p> <p>A definition of 'xLS' has been provided in CS AWO.B.CATI.102 and in AMC AWO.B.CATI.102, and a review of the consistent use of the term 'xLS' has been conducted. It is expected that this will improve the clarity of the scope of CS-AWO.</p>

comment	<p>89</p> <p style="text-align: right;">comment by: <i>EUROCONTROL</i></p> <p>All sections :</p> <p>An initial scan has not revealed significant differences to the draft AC 20-19, containing the FAA airworthiness requirements for AWO. However a check should be repeated with the final version.</p> <p>Check final version of FAA AC 20-19 before publication.</p>
response	<p>Noted</p> <p>No significant harmonisation issues have been identified.</p>

comment	<p>210</p> <p style="text-align: right;">comment by: <i>Finnish Transport Safety Agency</i></p> <p>Trafi has no comments and supports the proposal.</p>
response	<p>Noted</p> <p>The support of the Finnish Transport Safety Agency is welcomed.</p>

comment	<p>226</p> <p style="text-align: right;">comment by: <i>EUROCONTROL</i></p>
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	As GLS can also be used for Type A operations, review of CS-ACNS would also be necessary for complete coverage
	Proposed change: to be performed, but out of scope for current task
response	Not accepted
	This activity is outside the scope of this rulemaking task.

comment	244	comment by: AIRBUS
	In AWO.C.TOO.xxx & AMC AWO.C.TOO.xxx	
	AC 20-191 of low visibility takeoff guidance material provides significant amount of details in §3.4 that EASA proposal does not contain.	
	Harmonization between FAA/EASA guidance materials on low visibility take off guidance would be welcome.	
response	Not accepted	
	The primary focus of this rulemaking activity was not on take-offs in low-visibility conditions. An applicant can propose or use material, such as AC 20-191, if considered and found to be acceptable to EASA when it is published.	

2. Proposed amendments to CS-AWO

p. 5-7

comment	80	comment by: AIRBUS
	The current title of the section is confusing:	
	<i>"Section 1: Airworthiness certification of aeroplanes for Type B operations with decision heights/altitude below 250 ft down to 200 ft — Category 1 operations (CAT I)"</i>	
	There is no need to exclude CAT I operation based on ILS with DH higher than 250ft. In particular current APV SBAS ("LPV 250") should be in the scope of this section.	
	In addition the title definition is inconsistent with CS AWO.B.CATI.101 wording (page 36).	
	Airbus suggests to reword as follows:	
	<i>"Section 1: Airworthiness certification of aeroplanes for operations with decision heights/altitude down to 200 ft — Category 1 operations (CAT I)"</i>	
	This will be consistent with CS AWO.B.CATI.101.	



response Not accepted

The text to which this comment relates is in the explanatory note of the NPA. EASA does not intend to republish the NPA.

comment 81 comment by: AIRBUS

"Particular emphasis is placed on the need to assess the effect on the aircraft from external navigation means that may not be as robust as a Category 2 or 3 facility."

The above statement is true but it also applies to lighting, and all other elements of ground environment (RVR, glide slope range, LOC offset, pre-threshold terrain, runway slope variation....).

Airbus suggests to reword as follows:

"Particular emphasis is placed on the need to assess the effect on the operation of ground environment (lighting, RVR, glide slope range, LOC offset, pre-threshold terrain irregularities, runway slope variations...) and external navigation means that may not be as robust as a Category 2 or 3 facility."

response Noted

The text to which this comment relates is in the explanatory note of the NPA. EASA does not intend to reissue the text of the NPA.

comment 93 comment by: EUROCONTROL

p. 5 - Despite what is said here, CS-AWO Issue 2 does not include any provision for Type A operations as a baseline for any applicable operational credit, although EFVS A or L systems could be used on Type A operations.

Include a section in subpart 2 covering the type A operations in support to EFVS A or L.

response Not accepted

The scope of CS-AWO is limited to Type B operations. The EFVS section can be used as the basis for the certification of a Type A EFVS operation although operational credit for Type A operations is outside the scope of CS-AWO.

comment 94 comment by: EUROCONTROL

p. 6 - In the table there is no mention of SA CAT II although it should be similar to CAT II.

Include SA CAT II in Sub part 2 section 3.



response Not accepted

SA CAT II is not within the scope of CS-AWO as there are no differences in the certification of the aircraft.

However, the following text has been added to AMC AWO.B CATII.101:

‘Depending upon the applicable operational regulations, aeroplanes that are certified in accordance with this section may also be eligible to conduct SA CAT II operations.’

comment 95 comment by: EUROCONTROL

p. 6 - It is not clear if Type B operations include SBAS CAT I or not as it refers to CS 25 and not CS ACNS.

Clarify the case of SBAS CATI Sub part 2 section 1.

response Accepted

The definition of ‘xLS’ now includes ‘SBAS’.

Section 1. automatic landing systems (ALS) — CS AWO.A.ALS.101 Applicability and terminolo

p. 9

comment 58 comment by: Garmin International

CS AWO.A.ALS.101 Applicability and terminology (Page 9):

The term xLS is defined in-line in paragraph (a).

It is recommended that the term “xLS” be formally defined.

response Accepted

A definition of ‘xLS’ has been provided in CS AWO.B.CATI.102 and in AMC AWO.B.CATI.102, and a review of the consistent use of the term ‘xLS’ has been conducted.

comment 83 comment by: AIRBUS

The intend of this following requirement is unclear:

"If a head-up display (HUD) — or equivalent — is used, then it shall meet the performance and integrity requirements applicable to the type of operation intended."



Rationale:

- If the use of HUD is mandatory in combination with Automatic Landing System, then Subpart A section 1 applies and HUD is expected to be included in AFM as per CS AWO.A.ALS.113 (d) and intended operation performance demonstration (Subpart B Section 2,3 or 4) is already considered.
- If HUD is not mandatory for the use of the Automatic System, then requesting to fulfill, for the HUD, Subpart B might be over design.

Please remove this requirement or clarify its intend.

response Partially accepted

The text of CS AWO.A.ALS.101(b) has been amended to read:

‘If a head-up display (HUD) — or equivalent — is required to be used to complement the Automatic Landing System, then it shall meet the performance and integrity requirements applicable to the type of operation intended.

Refer to CS-AWO Section 2 SA CAT I, Section 3 CAT II or Section 4 CAT III.’

comment 162 comment by: *The Boeing Company*

THE PROPOSED TEXT STATES:

“(b) If a head-up display (HUD) — or equivalent — is used, then it shall meet the performance and integrity requirements applicable to the type of operation intended. Refer to CS-AWO Section 2 SA CAT I, Section 3 CAT II or Section 4 CAT III.”

REQUESTED CHANGE:

We recommend deleting this paragraph.

JUSTIFICATION:

This paragraph appears to be out-of-place in an automatic landing system section, and is redundant to CS AWO.HUD.107 (b), which states:

“(b) The HUD (or equivalent) shall meet the performance and integrity requirements applicable to the type of operation intended. Refer to CS-AWO Subpart B Section 2 SA CAT I, Section 3 CAT II or Section 4 CAT III.”

Similar statements in CS AWO.A.EFVS.109 (i), CS AWO.A.SVGS.105, and CS AWO.A.CVS.101 (c) appear to be appropriate because the EFVS, SVGS and CVS produce images that could be displayed on the HUD.

response Not accepted



Although redundant, the philosophy of CS-AWO Issue 2 is that each section should maintain linkages, particularly between subparts.

comment

241

comment by: ESSP SAS

Attachment [#1](#)

xLS concept is introduced throughout the NPA 2018-06 (B), as “*instrument landing system (ILS), microwave landing system (MLS), and/or ground-based augmentation system (GBAS) landing system (GLS)*”; excluding SBAS system in this definition. SBAS performance in Europe, through EGNOS service, is compliant with the aviation requirements for Approach with Vertical Guidance (APV-I) and Category I precision approach as defined by ICAO in Annex 10.

In addition, to support this statement it is worth mentioning that, Airbus has recently introduced the term “xLS concept”, which expands the ILS operational benefits to all types of approaches, including SBAS; using similar displays whatever the modes and similar guidance mode and flight control laws. Indeed, SLS (SBAS Landing System) is included in the Airbus xLS concept.

CONCLUSION

SBAS approaches shall be incorporated in the “xLS concept” because they are compliant with the aviation requirements for CAT I approaches according to ICAO in Annex 10, as ILS, MLS and GLS.

This comment is only included in this page, although it refers and applies to all NPA 2018-06 (B).

response

Accepted

A definition of ‘xLS’ has been provided in CS AWO.B.CATI.102 and in AMC AWO.B.CATI.102, and a review of the consistent use of the term ‘xLS’ has been conducted.

comment

256

comment by: GSA

xLS concept is introduced throughout the NPA 2018-06 (B), as “*instrument landing system (ILS), microwave landing system (MLS), and/or ground-based augmentation system (GBAS) landing system (GLS)*”; excluding SBAS system in this definition. SBAS performance in Europe, through EGNOS service, is compliant with the aviation requirements for Approach with Vertical Guidance (APV-I) and Category I precision approach as defined by ICAO in Annex 10. Airbus has recently introduced the term “xLS concept”, which expands the ILS operational benefits to all types of approaches, including SBAS



	SBAS approaches shall be incorporated in the “xLS concept” because they are compliant with the aviation requirements for CAT I approaches according to ICAO in Annex 10, as ILS, MLS and GLS.
response	Accepted The amended definition of ‘xLS’ now includes ‘SBAS’.

CS AWO.A.ALS.102 Safety level

p. 9

comment	59 comment by: <i>Garmin International</i>
	CS AWO.A.ALS.102 Safety Level (Page 9): There is a second “may” in the last sentence. It is recommended that this “may” be a “shall” too.
response	Accepted Text changed as suggested.

CS AWO.A.ALS.103 Control actions

p. 9

comment	16 comment by: <i>FAA</i>
	CS AWO.A.ALS.103; page 9 Requirement is not clear. The two conditions under which the aeroplane path is not supposed to contain unusual feature are under no failure and extreme conditions. The extreme conditions for the automatic landing system are not defined. please define extreme conditions or provide examples of extreme conditions. Rationale: Adds clarity to the requirement.
response	Not accepted This is original text from JAR-AWO, which was then adopted in CS-AWO Initial Issue and has been utilised on multiple certification programmes without any issues.

CS AWO 106 Out-of-trim forces at disengagement

p. 10



comment	17	comment by: FAA
	<p>CS AWO 106 and CS AWO 107; page 10 Why are these requirements deleted? The pilot's ability to disengage the automatic landing system, and manual override capability of the autothrottle are crucial requirements. The commenter could not find other these requirements being covered anywhere else in the NPA. Re-instate the requirements Rationale: Covers missing requirements in the NPA</p>	
response	<p>Not accepted</p> <p>CS-AWO 107 was deleted based upon JAA NPA 16-4.</p> <p>CS AWO 106 and CS AWO 107 were deleted as they are now covered by CS 25.1329 and the associated AMC.</p>	

CS AWO.A.ALS.105 Automatic throttle control
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p. 10

comment	19	comment by: FAA
	<p>CS AWO.A.ALS.105, a(3); page 10 The statement “the touchdown performance is not critically affected by reasonable errors in speed control.” Is not clear. What does “critically affected” mean? Does this mean to land outside the touchdown box? If so, modify it to say “the touchdown performance does not result in landing outside the safe landing zone due to reasonable errors in speed control.” Modify this requirement as follows: “the touchdown performance does not result in landing outside the safe landing zone due to reasonable errors in speed control.”, or define what you mean by “critically affected”.</p> <p>Rationale: Adds clarity to the intent of the statement.</p>	
response	<p>Not accepted</p> <p>The requirement has not been changed compared to the previous CS-AWO (CS AWO.123(3)) with the relative explanation of the touchdown performance in CS AWO.131(b) <i>Performance demonstration</i>.</p> <p>The new CS AWO.A.ALS.106 <i>Performance demonstration</i> paragraph (c) already explains the meaning of critical performance.</p>	

comment	20	comment by: FAA
	<p>CS AWO.A.ALS.105 Automatic throttle control (b2); Page 10 Additional requirements on the automatic throttle system should be added. Add the following conditions</p> <ul style="list-style-type: none"> · Modulate thrust or throttle application at a rate consistent with, and with activity consistent with typical pilot expectation, considering speed error to be corrected, and any 	



	<p>particular conditions or circumstances (e.g., flare retard, go-around thrust application, response to wind gradients);</p> <ul style="list-style-type: none"> · Respect maximum limits, minimum limits, and any limits necessary for specific conditions (e.g., anti-ice, approach idle). <p>Rationale: Completeness</p>
response	<p>Not accepted, for the following reasons:</p> <ul style="list-style-type: none"> - The requirement has not been changed compared to the previous one (CS AWO.123(b)(2)); paragraph (b) already states that 'An automatic throttle system shall provide safe operation taking into account the factors listed in CS-AWO 131 CS AWO.A.ALS.106(a).', which specifies anyhow that the applicable limits for the specific conditions need to be respected. - The meaning of the term 'typical pilot expectation' is not clear. In the text of CS AWO.A.ALS.105, it is clearly specified that the rate of the throttle application should be 'consistent with the recommendations of the appropriate engine and airframe manufacturers'. - In general terms, the intent of the suggested additional requirements is already captured in the current text.

comment	76	comment by: AIRBUS
	<p>Airbus suggests to change "Automatic Throttle" to "Automatic Thrust" to include certified designs without moving throttles.</p> <p>Where mentioned, please make the following replacements:</p> <p>"automatic throttle control" to be replaced by "automatic speed control" "automatic control of throttles" to be replaced by "automatic control of throttle/thrust" "manual control of throttles" to be replaced by "manual control of throttle/thrust" "automatic throttle system" to be replaced by "automatic throttle/thrust system" "adjust throttles" to be replaced by "adjust throttle/thrust" "provide throttle application" to be replaced by "provide throttle/thrust application"</p>	
response	<p>Accepted</p> <p>All terms in CS-AWO have been changed as suggested.</p>	

CS AWO.A.ALS.106 Performance demonstration

p. 10-11

comment	206	comment by: Rick Theriault
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response	<p>AMC AWO.A.ALS.106</p> <p>An alternate means of compliance should be acceptable for autoland certification as well as HUDLS. The statement and associated tables should allow most critical cases to be demonstrated to a safe landing, not necessary to meet a probability requirement.</p> <p>Not accepted</p> <p>The purpose of the alternative AMC is to conduct a pragmatic assessment of the system with a pilot in the loop. For an automatic landing system assessment, a pilot in the loop is not required and this pragmatism is, therefore, not required.</p>
comment	<p>248 comment by: <i>Embraer S.A.</i></p> <p>Lateral touchdown performance should also consider narrower runways.</p> <p>Rationale In order to account for not only wider runways, but also for narrower ones, the following text changes are suggested.</p> <p>Suggestion From: (3) lateral touchdown with the outboard landing gear more than 21 m (70 ft) from runway centre line. (This value assumes a 45 m (150 ft) runway. It may be appropriately increased if operation is limited in the AFM to wider runways, or to runways with load-bearing shoulders); To: (3) lateral touchdown with the outboard landing gear more than 21 m (70 ft) from runway centre line. {This value assumes a 45 m (150 ft) runway. It may be appropriately increased changed if: (i) operation is limited in the AFM to wider runways, or to runways with load-bearing shoulders}; or (ii) operation is allowed in narrower runways.</p>
response	<p>Partially accepted</p> <p>The proposed text has been reworded to read: ‘operation to narrower runways is requested and permitted’</p>

CS AWO.A.ALS.107 Aerodrome conditions	p. 11
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comment	<p>18 comment by: <i>FAA</i></p> <p>CS AWO 106 and CS AWO 107; page 10 Why are these requirements deleted? The pilot’s ability to disengage the automatic landing system, and manual override capability of the</p>
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	<p>autothrottle are crucial requirements. The commenter could not find other these requirements being covered anywhere else in the NPA. Re-instate the requirements Rationale: Covers missing requirements in the NPA</p>
response	<p>Not accepted</p> <p>Please see the response to comment #17.</p> <p>CS AWO.107 was deleted based upon JAA NPA 16-4.</p> <p>CS AWO.106 and CS AWO.107 were also deleted as they are now covered by CS 25.1329 and the associated AMC.</p>
comment	<p>50 comment by: <i>Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)</i></p> <p>Page 11 and several other places</p> <p>“Must” has been replaced by “shall” in several places. It is suggested to keep “must”.</p> <p>Rationale: Basic Regulation EU 2018/1139 has changed from "shall" to "must" in several places and CS 25 uses "must".</p>
response	<p>Not accepted</p> <p>During the development of the CS-AWO update, the emphasis on ‘shall’ and the use of ‘must’ have been consistent to differentiate between obligations placed upon an applicant and the system itself.</p>
comment	<p>87 comment by: <i>AIRBUS</i></p> <p>The "<i>ground profile under the approach path</i>" is not defined consistently in CS AWO (Part B) and (Part D) and no criteria nor guidance are provided to operators to determine the suitability of a given ground profile with a certified system.</p> <p>AMC AWO.A.ALS.106 § 5.2 Ground profile introduces the notion of "terrain irregularities" that are specifically described based on "Examination of a number of airports used for automatic landing". Description of acceptable irregularities is very specific : b. hilltop runway — 12.5 % slope up to a point 60 m prior to the threshold; or c. sea-wall — 6 m (20 ft) step up to threshold elevation at a point 60 m prior to the threshold.</p> <p>AMC1 ADR.OPS.A.A.005 Aerodrome data (e) requests "where detailed terrain information is required by operators to enable them to assess the effect of terrain on the decision height DH determination by the use of radio altimeters"</p>



	<p>However in GM1 CS-ADR-DNS.B.205 (a) the definition of "Radio Altimeter operation area" differs "Where slope changes cannot be avoided, the rate of change between two consecutive slopes should not exceed 2 % per 30 m".</p> <p>As the intend of CS AWO.A.ALS.107 is to define an AFM limitation on possible particular ground profile (if any), Airbus suggests to define what is considered as up today a "Regular ground profile". Any ground profile not meeting this criteria would then be classified as "irregular" requiring specific assessment.</p>
<p>response</p>	<p>Partially accepted</p> <p>As a result of comments #26 and #81 in the Air Operations NPA 2018-06(C), the text of CS AWO.A.ALS.107 has been amended to include the need for information relating to runway and airport conditions to be included in the AFM. This will allow the operator to assess what runway and airport conditions were assessed and demonstrated during certification.</p>

<p>comment</p>	<p>141 comment by: AIRBUS</p> <p>Attachment #2</p> <p>The definition of Runway Slope is not clear.</p> <p>"Runway slope" Definition relevant for landing system is understood as landing area slope. Usual definition of runway slope publish in approach charts is difference of elevation between runway threshold and runway end. This can lead to significant discrepancy of interpretation. As a supporting example find attached EGGD (Bristol).</p> <p>Airbus suggests to add a definition of "landing area slope" in a general section applicable to all landing systems (Autoland, HULDLS and EVFL):</p> <p>"The landing area slope is the slope of the runway between threshold up to 900m from runway threshold"</p> <p>Please replace « runway slope » by « landing area slope » in CS –AWO for Automatic Landing Systems (CS AWO.A.ALS.107 Aerodrome conditions AMC AWO.A.ALS.106 Performance demonstration)</p>
<p>response</p>	<p>Partially accepted</p> <p>‘Runway slope’ replaced by ‘touchdown zone slope’, and the definition of ‘touchdown zone slope’ added to the AMC.</p>



comment	<p>47</p> <p style="text-align: right;">comment by: <i>MITSUBISHI AIRCRAFT CORPORATION</i></p> <p>[Comment/Reason for Change] CS AWO.A.ALS.108(d) states “crosswinds in each direction greater than 18.5 Km/h (10 kt); and”. The use of great than is ambiguous and should be “not less than”. Less than is used throught the document with respect to crosswinds and sets a clear threshold, whereas greater than presents a subjective level for actual crosswinds demonstrated.</p> <p>[Change Proposal] CS AWO.A.ALS.108(d) should be “crosswinds in each direction not less than 18.5 km/h (10 kt); and”.</p>
response	<p>Accepted</p> <p>Text changed, as suggested, to ‘crosswinds in each direction not less than 18.5 km/h (10 kt); and...’.</p>

comment	<p>84</p> <p style="text-align: right;">comment by: <i>AIRBUS</i></p> <p>The item (e) includes weight but not centre of gravity as relevant factor. It appears explicitly in several AMCs.</p> <p>Please add centre of gravity as a factor in (e).</p>
response	<p>Accepted</p> <p>‘weight and CG of aircraft’ added to paragraph (e).</p>

CS AWO.A.ALS.112 xLS navigation means (including signal-in-space) failure p. 13

comment	<p>85</p> <p style="text-align: right;">comment by: <i>AIRBUS</i></p> <p>Time to alert is missing as a relevant factor to be considered.</p> <p>Airbus suggests to complement list of failure with "time to alert":</p> <p>"(e.g. including monitor thresholds, time to alert, and transmitter changeover or shut down times)".</p>
response	<p>Accepted</p> <p>‘time to alert’ added to the examples of factors to be considered.</p>



CS AWO.A.ALS.115 Approach and automatic landing with an inoperative engine

p. 14

comment 86

comment by: AIRBUS

An AMC CSAWO.A.ALS.115 should be added to this requirement as no limit is established on acceptable number of flights test and/or simulation is required to demonstrate acceptable performance of the system one engine inoperative.

Please add an AMC.

response Not accepted

AMC AWO.A.ALS.108 already addresses the number of landings performed and the statistical analysis. Therefore, there is no need to repeat this information in the AFM.

CS AWO.A.HUD.101 Applicability and terminology

p. 15

comment 31

comment by: FAA

Section 2, page 15

CS AWO.A.HUD.101 Section (a) (1) say that take-off functionality is part of a HUD landing system. A take-off application has nothing to do with a landing system. Either revise the terminology of HUDLS to something else that is either broader or create another term to capture takeoff functionality. A broader or term would be more inclusive of the potential applications of HUDS.

response Accepted

The definitions of 'HUDLS' have been revised in CS AWO.A.HUD.101.

comment 60

comment by: Garmin International

CS AWO.A.HUD.101 Applicability and terminology (Page 15):

The term "HUDLS" is defined in-line in paragraph (a).

It is recommended that the term "HUDLS" be formally defined.

response Accepted

Please see the response to comment #31.



comment	<p>61</p> <p style="text-align: right;">comment by: <i>Garmin International</i></p> <p>CS AWO.A.HUD.101 Applicability and terminology (Page 15):</p> <p>It is not clear what constitutes a HUDLS in terms of sensors, how it relates to xLS, and the performance requirements.</p> <p>It is recommended that the HUDLS definitions define the sensors, relationship to xLS, and the performance requirements (or reference to the applicable standards).</p>
response	<p>Accepted</p> <p>Please see the response to comment #31.</p>

CS AWO.A.HUD.103 HUD (or equivalent) information below decision height	p. 15-16
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comment	<p>5</p> <p style="text-align: right;">comment by: <i>THALES</i></p> <p>The wording '...shall not mislead, distract or jeopardise the safety of the landing.' is not clear. The word 'distract' should not apply to the 'safety' but to the pilot.</p> <p><u>Thales Proposal :</u> To replace by '...shall not mislead or distract the pilot, and shall not jeopardise the safety of the landing. '</p>
response	<p>Accepted</p> <p>Text changed to '...shall not mislead or distract the pilot, and shall not jeopardise the safety of the landing.'</p>

CS AWO.A.HUD.105 Presentation of information to the flight crew	p. 16
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comment	<p>6</p> <p style="text-align: right;">comment by: <i>THALES</i></p> <p>(a) (4) the wording '...An additional aural indication is desirable.' It should not be used at CS level. It is not a specification with a 'shall'. It is only a recommendation for implementation.</p> <p><u>Thales proposal:</u> To move this text "An additional aural indication is desirable' in a Guidance Material (GM) section.</p>
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response

Accepted

'An additional aural indication is desirable' removed and added to AMC AWO.A.ALS.110.

comment

146

comment by: AIRBUS

Please precise the meaning of the "*HUDLS is used for primary guidance*". Does it relate only to HUD manual landing?

If applicable, please replace "*HUDLS is used for primary guidance*" by "*HUDLS is used for primary guidance (HUD manual landing)*".

response

Accepted

Text changed to '*HUDLS is used for primary guidance (HUD manual landing)*'.

comment

200

comment by: Rick Theriault

Statement(b)(2) reads "(2) The pilot who is not flying the aeroplane shall be provided with a display of the adequacy with which the flying pilot is tracking the HUDLS commands.". This seems to imply that the PM must be presented with the same guidance that PF is using for monitoring purposes. This will pose a problem (if this is the case) for certain STC's.

This conversation has recently taken place as part of All Weather Operations Subgroup in Savannah meeting On February 8, 2018. The Subgroup, after discussion, agreed to the following wording "the information necessary to support effective crew tasks for the operation is appropriately available to both pilots where the crew consists of more than one pilot".

Suggest rewording this section to align with AWO SG conclusion.

response

Partially accepted

'CS AWO.A.HUD.105(b)(2)' amended to clarify that the purpose is to support effective flight crew tasks for the operation to take account of ICAO SARPs and AWO SG:

'Where the flight crew consists of more than one pilot, the pilot who is not flying the aeroplane shall be provided with a display of the information necessary to support effective crew tasks for the operation.'

'AMC AWO.A.HUD.105(b)' inserted to clarify the type of information that should be provided.



comment	<p>225</p> <p style="text-align: right;">comment by: <i>THALES</i></p> <p>Typo : it should be CS 25.1459(e) instead of CS 25.1549(e)</p> <p><u>Thales proposal:</u></p> <p>To replace CS 25.1549(e) by CS 25.1459(e)</p>
response	<p>Accepted</p> <p>Text changed to read 'CS 25.1459(e)'.</p>

comment	<p>234</p> <p style="text-align: right;">comment by: <i>Embraer S.A.</i></p> <p>The modes of the HUD operation should be recorded instead of "HUD in use".</p> <p>Rationale</p> <p>It is not defined anywhere what is a "HUD in use" parameter. And even if this parameter is about the HUD that is stowed and in use, it is assuming a dual HUD installation – which may not always be true. It makes more sense to record the modes of the HUD operation, since the other flight parameters are already required to be recorded per CS 23.2545/25.1459 (and not 25.1549, as the original text) and is corresponding operational rules.</p> <p>Suggestion</p> <p>To change the text from:</p> <p><i>Where a HUD (or equivalent) is installed, a 'HUD in use' parameter shall be recorded on the flight data recorder in accordance with CS 25.1549(e).</i></p> <p>To:</p> <p><i>Where a HUD (or equivalent) is installed, a 'HUD in use' parameter shall be recorded on the flight data recorder in accordance with CS 25.1549(e).</i></p> <p><i>The modes of the HUD operation must be made available to the flight data recorder as required.</i></p>
response	<p>Partially accepted</p> <p>Text changed in CS AWO.A.HUD.106 to read:</p> <p>'Where a HUD (or equivalent display) is installed, a "HUD in use" parameter and, if applicable, the mode of the HUD operation shall be recorded on the flight data recorder in accordance with CS 25.1459(e) when a flight data recorder is required to be installed.'</p>



CS AWO.A.HUD.107 Performance demonstration

p. 17

comment

96

comment by: EUROCONTROL

p. 17 - Should it not refer to Section 1 Type B , and to SA CAT II.

Add reference to subpart 2 part 1.

response

Not accepted

The added value of referring to Section 1 for CATI is limited and would simply refer back to the basic IFR certification for the aircraft. In addition, SA CATII does not require any additional certification requirements and is, therefore, not addressed by these CSs.

However, the following text has been added to AMC AWO.CATII.101:

‘Depending upon the applicable operational regulations, aeroplanes that are certified in accordance with this section may also be eligible to conduct SA CATII operations.’

comment

142

comment by: AIRBUS

HUDLS and EVS-L requires flare/prompt guidance, but no mention of Runway slope nor pre-threshold to be considered in performance assessment.

Note similar comment apply to Operational assessment.

Airbus suggests the following modifications:

- In CS AWO.A.HUD.107 Performance demonstration:

Add « landing area slope and Pre-threshold » as factors to be considered for flare guidance (HUD and EFVS-L)

- In CS AWO.A.EFVS.109 EFVS performance (h):

Add « the effects of aerodrome conditions (e.g. elevation, landing area slope and ground profile under the approach path) are to be investigated »

- In AMC AWO.A.EFVS.103 EFVS depiction:

Add « the effects of aerodrome conditions (e.g. elevation, landing area slope and ground profile under the approach path) are to be investigated »

Flare cue : add « When demonstrating performance of flare cue, effect of landing area slope and ground profile under the approach path should be considered »

response

Accepted



The following text has been added to CS AWO.A.HUD.107:

‘(4) landing area slope and pre-threshold ground profile if flare cue is provided.’

EFVS aspects have been removed and added to the HUD section.

comment 146 ❖

comment by: AIRBUS

Please precise the meaning of the "*HUDLS is used for primary guidance*". Does it relate only to HUD manual landing?

If applicable, please replace "*HUDLS is used for primary guidance*" by "*HUDLS is used for primary guidance (HUD manual landing)*".

response Accepted

Text changed to read: ‘HUDLS is used for primary guidance (HUD manual landing).’

CS AWO.A.HUD.108 Fail-operational hybrid landing system

p. 17

comment 235

comment by: Embraer S.A.

Typographical error.

Rationale

Typographical error.

Suggestion

To change the text from:

Where a HUDLS is fitted as part of a hybrid system, its performance need not meet the same criteria as the primary system provided that it:

To:

*Where a HUDLS is fitted as part of a hybrid system, its performance **does not need to not** meet the same criteria as the primary system provided that it:*

response Accepted

Text changed to read: ‘Where a HUDLS is fitted as part of a hybrid system, its performance does not need to meet the same criteria as the primary system, provided that it:...’



CS AWO.A.HUD.109 Head-up display landing systems

p. 18

comment 32

comment by: FAA

Section 2 CS AWO.A.HUD.109(d) It is unclear what would be considered a "false" height for radio altimeters. RA have long known to have non-accurate readings (i.e. water, terrain, water) Add clarity what is meant by a false height vs normal short comings of RA.

response Partially accepted

CS AWO.A.HUD.109(d) has been deleted as this is a duplication of the principles of CS 25.1309.

comment 48

comment by: MITSUBISHI AIRCRAFT CORPORATION

[Comment/Reason for Change]

CS AWO.A.HUD.109 is ambiguous for failure rates and flight phase. "(a) Failure conditions resulting in the inability to complete the landing from the DH using the HUDLS, shall not have a frequency of occurrence of more than once every thousand approaches." Terms like "complete the landing" should be replaced with something like "until touchdown", as landing phase can mean until full stop, etc.

[Change Proposal]

"(a) Failure conditions resulting in the inability to complete the landing from the DH until touchdown using the HUDLS, shall not have a frequency of occurrence of more than once every thousand approaches."

response Accepted

Text changed by adding 'until touchdown' using the HUDLS.

comment 146 ❖

comment by: AIRBUS

Please precise the meaning of the "*HUDLS is used for primary guidance*". Does it relate only to HUD manual landing?

If applicable, please replace "*HUDLS is used for primary guidance*" by "*HUDLS is used for primary guidance (HUD manual landing)*".

response Accepted

Text changed to read: '*HUDLS is used for primary guidance (HUD manual landing)*.'



comment

236

comment by: Embraer S.A.

To clearly indicate that system failure conditions that may affect the HUDLS shall have an occurrence of less than one in one thousand approaches.

Rationale

It may not be clear to the reader that failure conditions that the text is referring to is in regards to system failures, rather than operational and/or design failure contributions.

Suggestion

To change the text from:

In addition, for HUDLSs that are used for primary guidance during Category 3 operations (see Subpart B Section 4), the following are also required:

(a) Failure conditions resulting in the inability to complete the landing from the DH using the HUDLS, shall not have a frequency of occurrence of more than once every thousand approaches

To:

In addition, for HUDLSs that are used for primary guidance during Category 3 operations (see Subpart B Section 4), the following are also required:

*(a) **System F** failure conditions resulting in the inability to complete the landing from the DH using the HUDLS, shall not have a frequency of occurrence of more than once every thousand approaches*

response

Accepted

System failure conditions are considered to refer to on-board failures. Failures relating to the navigation means are addressed in the relevant sections for SA CATI, CATII, and CATIII.

comment

237

comment by: Embraer S.A.

HUD alignment should not be significantly affected between scheduled maintenance activities.

Rationale

It makes more sense to assure that alignment is maintained between scheduled maintenance activities, rather than not specify a timeframe.

Suggestion

To change the text from:

In addition, for HUDLSs that are used for primary guidance during Category 3 operations (see Subpart B Section 4), the following are also required:

(...)



(c) Wear in mechanical components, e.g. pivots, to be expected in normal service use shall not significantly affect the alignment of the HUDLS display.

To:

In addition, for HUDLSs that are used for primary guidance during Category 3 operations (see Subpart B Section 4), the following are also required:

(...)

(c) ~~Wear in mechanical components, e.g. pivots, to be expected in normal service use shall not significantly affect the alignment of the HUDLS display~~ Alignment should not be significantly affected in normal operation between scheduled maintenance activities.

response

Accepted

The text has been changed to read:

‘Alignment should not be significantly affected in normal operations between scheduled maintenance activities.’

CS AWO.A.HUD.110 Head-up displays used for enhanced flight vision systems (EFVSs)

p. 18

comment

97

comment by: EUROCONTROL

p. 18 - Only EFVS is treated, not EVS, which are separate definitions in other subparts of the NPA.

Consider section for EVS or include here and in EFVS section 3.

response

Not accepted

CS-AWO is limited to those systems that are used for low-visibility operations or are eligible for operational credit. Therefore, EVS is not within the scope of CS-AWO.

comment

238

comment by: Embraer S.A.

Misleading indication or confusion may occur, since no development process is infallible.

Rationale

The way this requirement is written it might give the impression that misleading information is never to occur. Although this objective is sought by every developer, no development process is infallible. What the industry does to address this issue is to determine function/system/items necessary development assurance level that is necessary to comply with the proper objectives and develop the function/system/items with the corresponding rigors.

Suggestion



To change the text from:

(b) Where the EFVS image is superimposed on the HUD (or equivalent display) symbology and is used in combination with other aircraft systems, then the EFVS image and installation shall:

(...)

(5) not be misleading and not cause confusion or any significant increase in pilot workload;

To:

(b) Where the EFVS image is superimposed on the HUD (or equivalent display) symbology and is used in combination with other aircraft systems, then the EFVS image and installation shall:

(...)

*(5) not **normally** be misleading or ~~and not~~ cause confusion or any significant increase in pilot workload;*

response

Partially accepted

Text changed to read:

‘(b) Where the EFVS image is superimposed on the HUD (or equivalent display) symbology and is used in combination with other aircraft systems, then the EFVS image and installation shall, in the absence of any failure:...’

CS AWO.A.HUD.111 Head-up displays used for synthetic vision guidance systems (SVGs)

p. 18-19

comment

7

comment by: *THALES*

Brightness is not the only parameter that could be used in order to separately tune the readability of the scene versus symbology. Should be better to use a more generic term than brightness.

Thales proposal:

To replace the word 'brightness' by 'contrast/brightness'.

Note : the terminology 'contrast/brightness' is already used in another requirement : CS AWO.A.EFVS.106

response

Not accepted

In this context, 'brightness' is considered to be the correct parameter to adjust to ensure readability of the scene.

comment

214

comment by: *Dassault-Aviation*



Text:

CS AWO.A.HUD.111 page 18, 19

"(a) provide a means to control the SVGS scene brightness that is independent of the HUD (or equivalent display) symbology brightness control. This control shall be operable without causing excessive pilot workload, distraction or fatigue;

(b) provide a readily accessible control to enable the pilot to remove and reactivate the SVGS image from the HUD (or equivalent display) without requiring the pilot to remove their hands from the primary flight controls and thrust control;"

Comment:

Why are these requirements considered only for the SVGS, and not for EFVS

Proposed change:

a) and b) proposed to be added in CS AWO.A.HUD.110

response

Accepted

The following text has been added to CS AWO.A.HUD.110:

'(9) provide a means to control the EFVS scene brightness that is independent of the HUD (or equivalent display) symbology brightness control. This control shall be operable without causing excessive pilot workload, distraction or fatigue;

(10) provide a readily accessible control to enable the pilot to remove and reactivate the EFVS image from the HUD (or equivalent display) without requiring the pilot to remove their hands from the primary flight controls and thrust control;'

CS AWO.A.HUD.112 Head-up display landing distance

p. 19

comment

33

comment by: FAA

Section 2 CS AWO.A.HUD.112 While it makes sense that degrade aircraft/system performance should be documented in an AFM, it is not understandable how a HUD application that decreases capability would be acceptable. This is not consistent with the approach taken by the FAA in regards to 14 CFR 2x.773 or the airworthiness guidance for existing vision system applications that make use of the HUD. Delete CS AWO.A.HUD.112 or change to read that the HUD application cannot degrade system/aircraft performance compared to the aircraft without a HUD installation.

response

Partially accepted

CS AWO.A.HUD.112 has been reworded to clarify that the requirement relates to the use of a flare cue:

'If there is any feature of the HUD (e.g. flare cue) or the associated procedures intended to support the flare manoeuvre for landing which would result in an increase to the landing distance, the appropriate increment shall be established and scheduled in the AFM.'



CS AWO.A.EFVS.101 General

p. 20

comment

62

comment by: *Garmin International*

CS AWO.A.EFVS.101 General (Page 20):

Paragraph (d) limits EFVS to a HUD. It is possible that there are EFVS operations that would not require a HUD.

It is recommended that this paragraph and those that follow in subsequent sections not limit EFVS use to a HUD.

response

Not accepted

The EFVS that is provided to the pilot flying shall be displayed on a HUD or equivalent display.

comment

221

comment by: *Dassault-Aviation*Text:

CS AWO.A.EFVS.101 page 20

"(b) The EFVS shall **provide a demonstrated vision performance** in low-visibility conditions and a level of safety suitable for the proposed operational procedure that will allow the required visual references to become visible in the image before they are visible naturally out-the-window."

Comment:

Method for visual advantage demonstration should be detailed in an AMC of the NPA. Method should reflect as much as possible the real operation (slant versus horizontal distance, at appropriate height...)

Consistency with conditions described in GM2 SPA.LVO.105(f) should be considered.

nota: wording must be harmonized for visual advantage (vision performance, visual advantage... are used in the current NPA)

Proposed change:

AMC to be created

response

Accepted

AMC that enables the visual advantage to be demonstrated and quantified has been developed and referenced.



comment	254	comment by: <i>ERA Operations Group</i>
	Benefit offered when using Enhanced Vision may be undone by the installation of LED-lighting on runways and taxiways as not all EV systems can detect LED-lighting. To mitigate this, AIPs and charts will need to show what light sources are being used in runway and taxiway lighting systems.	
response	Noted	
	The requirements for AIPs and charts are not within the scope of CS-AWO. In addition, the requirements for aerodrome LED lighting are also not within the scope of CS-AWO.	
	The visual references that need to be seen by an EFVS at DH/DA are clearly defined in the Air Operations Regulation, and any issues of incompatibility with LED lighting should be identified during the performance demonstration. It is expected that this will be articulated in the AFM.	
	CS AWO.A.EFVS.111 contains the following requirement:	
	‘The demonstrated capability and any specific EFVS limitations shall be included within the relevant AFM.’	

CS AWO.A.EFVS.102 EFVS designation

p. 20

comment	51	comment by: <i>Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)</i>
	Touchdown zone elevation (TDZE) is used as in FAA documents. Suggest changing to “threshold elevation” in all places.	
	Rationale: Europe refers to threshold elevation, e.g. in GM4 SPA.LVO.100 (c) of this NPA.	
response	Not accepted	
	The term ‘touchdown zone elevation’ is aligned with the latest proposed amendments to the Air Operations Regulation.	

CS AWO.A.EFVS.104 EFVS display

p. 21-23

comment	65	comment by: <i>Garmin International</i>
	CS AWO.A.EFVS.104 EFVS display (Page 21-23):	



	<p>The standards specified in this section are very detailed. This level of detail seems inconsistent with other regulations.</p> <p>It is recommended that the detailed requirements be included in other standards documents (i.e. EUROCAE EDs) and invoked by ETSOs rather than including the standards in the regulations.</p>
response	<p>Not accepted</p> <p>At the time of development of the CSs for EFVSs, EASA had not gained significant experience in the certification of EFVSs, and this is reflected in the conservative nature of the EFVS requirements.</p> <p>The EFVS display requirements are intended to be at high level, leaving the applicant to adapt/align them with the requirements for HUDs or equivalent displays. Actually, other certifying authorities have defined the EFVS display requirements with the same principle.</p>
comment	<p>98 comment by: <i>EUROCONTROL</i></p> <p>p. 21 - EFVS200 is not considered, although it may be used in situations below CAT I DH and RVR.</p> <p>Explanation needed?</p>
response	<p>Not accepted</p> <p>The proposed CSs will be used to certify EFVSs as either EFVS-Approach (EFVS-A) or EFVS-Landing (EFVS-L). According to the Air Operations Regulation, either system will be suitable for EFVS 200 operations as the pilot will not be relying on EFVS below a height of 200 ft (natural visual reference is required below 200 ft). Therefore, there are no specific certification requirements for EFVS 200 operations.</p>
comment	<p>219 comment by: <i>Dassault-Aviation</i></p> <p><u>Text:</u> page 22 "(t) The EFVS-A display providing imagery to the pilot monitoring shall: ... (2) provide an image of the visual scene over the range of aircraft attitudes and wind conditions for each mode of operation and enable the pilot monitoring to see and identify visual references and to verify that all visual requirements for the approach and landing are satisfied;"</p> <p><u>Comment:</u> During flights it was shown that the objective of the display for the pilot monitoring is not to identify visual references, but to keep him in the loop of the approach. Secondary display</p>



shall ensure that the pilot monitoring is kept in the 'loop' and crew resource management (CRM) does not break down

Proposed change:

"(t) The EFVS-A display providing imagery to the pilot monitoring shall:
...

(2) provide an image of the visual scene over the range of aircraft attitudes and wind conditions for each mode of operation and enable the pilot monitoring to see and identify visual references and to verify that all visual requirements for the approach and landing are satisfied; **is kept in the 'loop' and crew resource management (CRM) does not break down."**

response

Partially accepted

Text changed to align with ICAO Working Paper FLIGHT OPERATIONS PANEL/WG (FLTOPSPWG/5) Montreal, 7-11 May 2018:

'...support effective flight crew tasks for the operation.'

comment

269

comment by: THALES

Item (t) and (e) requires a display EFVS sensor imagery for PM for EFVS-A operation. There is no equivalent requirement in the FAA regulation for equivalent operation. It would be interesting to have the rationale to interpret the discrepancy between the two regulations.

Thales proposal:

To detail the rationale for requirement to have a display EFVS sensor imagery for PM for EFVS-A operation.

response

Not accepted

This requirement comes from the current Air Operations Regulation (point SPA.LVO) and the PM repeater is required for EFVS operations down to 100 ft and it is seen as a means to ensure that the PM is kept in the 'loop' and the CRM does not break down.

In the past, EASA had issued CRIs on EFVSs (for operations down to 100 ft) which required the installation of a PM repeater. A PM repeater (co-pilot monitor) is not required by the FAA (AC 20-167A) for operations within the United States for EFVS Approach, but it does not preclude its installation.

The intended function of the repeater is to provide the PM with access to the same image that the PF uses to adjust flight progress and decision-making, thus increasing the overall situational awareness in the cockpit.

The installation should be such that it must be suitable to enable cross-check of the correct interpretation of the image by the PF, particularly when the image of the required visual landing cues is first identified.



CS AWO.A.EFVS.105 HUD EFVS symbology

p. 23-24

comment 37

comment by: FAA

CS AWO.A.EFVS.105.(6) In the US a Rad Alt is only required for EFVS Landing Systems. Clarify that Rad Alt is only a requirement for EFVS Landing System applications. The inclusion with EFVS Approach Systems are optional.

response Accepted

'CS AWO.A.EFVS.105(6)' deleted.

The requirement for a Rad Alt for EFVS-L is contained in CS AWO.A.EFVS.103(d).

comment 38

comment by: FAA

CS AWO.A.EFVS 105 (b) A geo-referenced runway outline is not a requirement for US EFVS applications nor is it a common feature on HUDs in general. Most HUDs that have a runway outline feature are displayed based on the localizer and not a database. Keeping this requirement would disallow most of the currently certified EFVS systems in current operation. Remove the requirement for a geo-referenced runway outline.

response Partially accepted

'CS AWO.A.EFVS.105(b)' has been completely revised and no longer contains the term 'geo-referenced'.

comment 39

comment by: FAA

CS AWO.A.EFVS.105.(c) Harmonize with the FAA 91.176 and associate the regulatory definitions of EFVS operations to "approach" (still requires natural vision to complete the landing) and "landing" (can rely on the EFVS all the way to touchdown.) rather than on RVR. Harmonized with 14 CFR 91.176 and push the rest of CS AWO.A.EFVS into an advisory document or to the OPS document rather than an airworthiness regulation document.

response Not accepted

Unfortunately, due to the regulatory structure of the EASA system, it is not possible to issue stand-alone advisory material in the same manner as the FAA does. Therefore, there is a need to develop dedicated certification specifications.



The approach taken by EASA is to link the certification of EFVSs with the requirements for operations. The EFVS will be certified for the intended operation and the performance of the EFVS will be published in the AFM in terms of RVR and visual advantage.

comment

99

comment by: EUROCONTROL

p. 23 - AGL display is required in two sections: (a)(6) and (c)(1). Is the duplication intentional?

Verify

response

Accepted

Requirement for Rad Alt deleted from (a)(6).

Please see the response to comment #37.

comment

147

comment by: AIRBUS

In the Airbus design, in case of cross-wind, the pilot can use declutter mode in order to reduce clutter in certain flight phases, where acquisition of external cues is more important: vertical speed and heading are not displayed in this mode.

Is it acceptable for an EFVS operation?

Airbus suggests to amend the requirement to indicate that all the information may not be necessary displayed in declutter mode (by nature the declutter mode aims at removing some information to reduce the cluttering and ease external cues acquisition).

response

Not accepted

The list of flight instrument data recalled as a minimum in the requirement refers to the normal mode of HUD/EFVS where all parameters can be displayed. In specific conditions, such as crosswind, the data clutter can be reduced to ease the PF tasks to look for visual reference acquisition. For EFVS operations, it can be acceptable, provided that specific evaluation for the declutter mode will be performed in the context of the certification activities.

comment

215

comment by: Dassault-Aviation

Text:

Page 23

"(c) (1) height AGL such as that provided by the use of a radio altimeter or other device capable of providing equivalent performance and integrity level; and



(a) (6): height above ground level (AGL) such as that provided by a radio altimeter or other device capable of providing equivalent performance and integrity level;"

Comment:

requirement (c)(1) is redundant with (a)(6) . Suggest to remove (C)(1)

response Partially accepted

Please see the response to comment #37.

CS AWO.A.EFVS.107 EFVS safety assessment

p. 24

comment 15

comment by: *THALES*

This section refers several times to CS 23.1309 for normal category aeroplanes but as CS 23 has been modified since 2017 (amendment 5), this paragraph no longer exists and has been replaced by CS 23.2510 Equipment, systems, and installations Same comment with reference made to CS 23.1523 at (f)

Thales proposal:

To replace CS 23.1309 and CS 23.1523 with propoer references. (Several requirement in the document are concerned).

response Accepted

The references to CS-23 have been amended to align with CS-23 Amendment 5.

CS AWO.A.EFVS.109 EFVS performance

p. 25-26

comment 8

comment by: *THALES*

(f) The wording ' ...shall not mislead, distract or jeopardise the safety of the landing and roll-out' is not clear. The word 'distract' does not apply to the 'safety'.

Thales Proposal :

To replace by '...shall not mislead or distract the pilot, and shall not jeopardise the safety of the landing and roll-out '

response Accepted

Text changed to read: '...shall not mislead nor distract the pilot, nor jeopardise the safety of the landing and roll-out'



comment	40	comment by: FAA
	CS AWO.A.EFVS.109.(c) Harmonize with FAA and require measuring Visual advantage for aircraft requiring special operating approvals like an FAA OpsSpec. Only associate a measured visual advantage Ops Approval in order to harmonize with US EFVS operations.	
response	Accepted	
	AMC that enables the visual advantage to be demonstrated and quantified has been developed and referenced, which has been prepared in the context of a joint programme with RTCA and EUROCAE (WG-79 and SC-213), where the FAA and industry have been also involved.	
comment	41	comment by: FAA
	CS AWO.A.EFVS.109.(f)&(g) These requirements should be common to all EFVS systems and not just EFVS landing systems. Remove the reference to EFVS-L and make it a common requirement for all EFVS.	
response	Accepted	
	The requirements of (f) and (g) have been made applicable to both EFVS-A and EFVS-L.	
comment	142 ❖	comment by: AIRBUS
	<p>HUDLS and EVS-L requires flare/prompt guidance, but no mention of Runway slope nor pre-threshold to be considered in performance assessment.</p> <p>Note similar comment apply to Operational assessment.</p> <p>Airbus suggests the following modifications:</p> <ul style="list-style-type: none"> - In CS AWO.A.HUD.107 Performance demonstration: <p>Add « landing area slope and Pre-threshold » as factors to be considered for flare guidance (HUD and EFVS-L)</p> <ul style="list-style-type: none"> - In CS AWO.A.EFVS.109 EFVS performance (h): <p>Add « the effects of aerodrome conditions (e.g. elevation, landing area slope and ground profile under the approach path) are to be investigated »</p> <ul style="list-style-type: none"> - In AMC AWO.A.EFVS.103 EFVS depiction: <p>Add « the effects of aerodrome conditions (e.g. elevation, landing area slope and ground profile under the approach path) are to be investigated »</p>	



response

Flare cue : add « When demonstrating performance of flare cue, effect of landing area slope and ground profile under the approach path should be considered »

Partially accepted

Reference to AMC AWO.A.HUD.107 has been added to AMC AWO.A.EFVS.103 *EFVS depiction*.

This text has also been added to AMC AWO.A.EFVS.103 and resulted in the following text in AMC AWO.A.EFVS.112:

‘The following minimum information should be provided in the AFM:

- (a) the approved limits established as a result of consideration of any other factor that the certification has shown to be appropriate;
- (b) the normal and abnormal procedures, including airspeeds;
- (c) the minimum required equipment;
- (d) any additional aeroplane performance limitations;
- (e) if appropriate, the type approaches and the xLS navigation means (facilities external to the aircraft) and associated limitations (if any) which have been used as the basis for certification;
- (f) any related limitations and/or assumptions on the runway or airport conditions that are affected by the use of the EFVS; for EFVS-L, this should also consider:
 - (1) runway elevation;
 - (2) approach path slope;
 - (3) touchdown zone slope;
 - (4) ground profile under the approach path;
- (g) the type and mode of operation/configuration of the approach lights (i.e. LED or incandescent) that have been used or assumed during certification demonstration;
- (h) the demonstrated performance in accordance with CS.AWO.A.EFVS.109;
- (i) wind speed limitations that are affected by the use of the EFVS;
- (j) any applicable assumptions that have been made during the certification demonstration of the EFVS.’



comment	<p>148</p> <p>The mode of operation can be interpreted as:</p> <ul style="list-style-type: none"> - ON/OFF of the EFVS system display - Activate/deactivate of EFVS display - Level of contrast (high, low, auto) <p>Airbus suggests to precise the meaning of "mode of operation".</p>	comment by: AIRBUS
response	<p>Accepted</p> <p>Text changed to read:</p> <p>‘(a) The mode of operation (display status (e.g. displayed/not displayed), and any mode that could impact on the EFVS performance (e.g. level of contrast or resolution of the image) of the EFVS shall be:</p> <ol style="list-style-type: none"> (1) annunciated on the flight deck; (2) visible to the flight crew; and (3) recorded by the flight data recorder, if required to be installed.’ 	

CS AWO.A.SVGS.101 Applicability and terminology

p. 28

comment	<p>1</p> <p>General comment to Section 4: The requirements for Synthetic Vision Technology (SVT) previously covered by CRIs went into CS-AWO. There is many SVT equipment already in the market for General Aviation (GA) and rotorcraft (RC). Will in future CS-AWO also apply to all GA projects utilizing SVT? What happens to SVT in RC projects? Some notes for clarification would be appreciated.</p>	comment by: Luftfahrt-Bundesamt
response	<p>Noted</p> <p>The applicability of CS-AWO is based upon anticipated applications for certification to EASA. The requirements of the SVGS section are a means of achieving certification of an SVGS with the intention of gaining some operational credit. It is not certain whether this is foreseen for GA and RC.</p>	

CS AWO.A.SVGS.102 SVGS scene depiction

p. 28-29



comment	100	comment by: EUROCONTROL
	<p>p. 28 - The list does not include a requirement that elements of the display that are provided by different sensors must provide a consistent view of the position, speed, attitude and flight guidance information. For example it should not be permissible that a pilot has to determine whether lateral and vertical path offset indicators ("diamonds") or the synthetic runway display are correct, should they differ. This determination has to be performed by the system and present as a consistent display.</p> <p>Consider adding such a requirement, or expanding (f).</p>	
response	<p>Not accepted</p> <p>The requirements of (f) already address the intent of this comment. In addition, monitors are already required to ensure consistency.</p>	

comment	150	comment by: AIRBUS
	<p>As it is formulated, the requirement may be interpreted as requiring the same depiction in Primary Flight Display and in Navigation display in case of TAWS alerts.</p> <p>"consistent displayed" would be more generic than "consistently depicted" and we suggest the following modification of (g) :</p> <p>"The SVGS primary display at each pilot station shall provide: [...] (g) a consistent display of terrain awareness warning system (TAWS) (or terrain warning system) terrain alerts across all displays;"</p>	
response	<p>Accepted</p> <p>Text changed to read: 'a consistent display of terrain awareness warning system (TAWS) (or terrain warning system) terrain alerts across all displays'</p>	

CS AWO.A.SVGS.103 SVGS flight instrument display minimum requirements	p. 29
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comment	212	comment by: THALES
	<p>In RTCA DO-359 §1.2.1 , it is mentioned : ' Deviations from trajectory are depicted using conventional path deviation and command guidance is provided by either an FPV based, or attitude based command guidance system (flight director)'. </p> <p>Thus for CS AWO.A.SVGS.103 '(c) Command guidance display', it would valuable to make the link with the 2 options presented in TRCA DO-359.</p>	



	<p><u>Thales proposal:</u></p> <p>To replace CS AWO.A.SVGS.103 '(c) Command guidance display' by CS AWO.A.SVGS.103 '(c) Command guidance display (trajectory based or attitude based)'</p> <p>OR</p> <p>To create an AMC to CS AWO.A.SVGS.103 to indicate that in accordance with RTCA DO-359, the 'Command guidance display' is either trajectory based or attitude based.</p>
response	<p>Not accepted</p> <p>CS AWO.A.SVGS.104 defines the requirement for the command guidance while CS AWO.A.SVGS.103 only defines the minimum requirements for the display and requires the presence of a display for the command guidance.</p> <p>The requirement for the guidance is in CS AWO.A.SVGS.104.</p>
comment	<p>213 comment by: THALES</p> <p>In RTCA DO-359 §1.2.1 , it is mentioned : ' Deviations from trajectory are depicted using conventional path deviation and command guidance is provided by either an FPV based, or attitude based command guidance system (flight director)'. </p> <p>Thus for CS AWO.A.SVGS.103 '(h) Characteristics and dynamics that are suitable and effective to enable manual control of the aircraft', it would valuable to make the link with the 2 options presented in TRCA DO-359.</p> <p><u>Thales proposal:</u></p> <p>To replace CS AWO.A.SVGS.103 '(h) Characteristics and dynamics that are suitable and effective to enable manual control of the aircraft' by CS AWO.A.SVGS.103 '(h) Characteristics and dynamics that are suitable and effective to enable manual control of the aircraft (trajectory based or attitude based)'</p> <p>OR</p> <p>To create an AMC to CS AWO.A.SVGS.103 to indicate that in accordance with RTCA DO-359, the '(h) Characteristics and dynamics that are suitable and effective to enable manual control of the aircraft' is either trajectory based or attitude based.</p>
response	<p>Not accepted</p> <p>The addition of 'trajectory based or attitude based' is considered to be nugatory and not required.</p>



comment	216	comment by: <i>Dassault-Aviation</i>
	<p><u>Text: page 29</u> "Command guidance cues (flight director) shall meet the required flight technical error performance and accuracy for the intended operation (see CS-AWO Subpart B Section 2 SA CAT I or Section 3 CAT II)."</p> <p><u>Comment:</u> why is CAT III excluded from CS AWO.A.SVGS.104 (only SA CAT I & CAT II are mentioned), whereas CAT III is considered in CS AWO.A.SVGS.105 ?</p> <p><u>Proposed change:</u> Command guidance cues (flight director) shall meet the required flight technical error performance and accuracy for the intended operation (see CS-AWO Subpart B Section 2 SA CAT I or Section 3 CAT II or section 4 for CATIII).</p>	
response	<p>Accepted</p> <p>Text changed to read:</p> <p>'Command guidance cues (flight director) shall meet the required flight technical error performance and accuracy for the intended operation (see CS-AWO Subpart B Section 2 SA CAT I or Section 3 CAT II or Section 4 for CAT III (for manual CAT III landings using a HUD or equivalent display)).'</p>	
comment	220	comment by: <i>Dassault-Aviation</i>
	<p><u>Text:</u> CS.AWO.A.SVGS.105 page 29 "The HUD (or equivalent) shall meet the performance and integrity requirements applicable to the type of operation intended. Refer to CS-AWO Subpart B Section 2 SA CAT I, Section 3 CAT II or Section 4 CAT III."</p> <p><u>Comment:</u> Section CAT II and section CAT III should be removed as SVGS is intended to 150ft.</p> <p><u>Proposed change:</u> "The HUD (or equivalent) shall meet the performance and integrity requirements applicable to the type of operation intended. Refer to CS-AWO Subpart B Section 2 SA CAT I, Section 3 CAT II or Section 4 CAT III."</p>	
response	<p>Not accepted</p> <p>The HUD should be capable of supporting the intended performance of the intended operation and should not be limited to the current scope.</p>	



CS AWO.A.SVGS.105 SVGS — using a head-up display (or equivalent displays)

p. 29

comment

52

comment by: *Swedish Transport Agency, Civil Aviation Department
(Transportstyrelsen, Luftfartsavdelningen)***CS AWO.A.SVGS.105 and other**

“HUD or equivalent display” is used parallel with “HUD or equivalent”. Suggest using “HUD or equivalent display” through the document

Rationale: HUD or equivalent display is used in US and ICAO documents.

response

Accepted

‘or equivalent display’ added throughout CS-AWO.

CS AWO.A.SVGS.107 Head-down display minification

p. 30

comment

101

comment by: *EUROCONTROL*

p. 30 - The term "minification" may need explanation, as not clear in the context (Wikipedia: Minification (also minimisation or minimization), in computer programming languages and especially JavaScript, is the process of removing all unnecessary characters from source code without changing its functionality.)

Consider definition, as a websearch has lead to multiple incompatible defininitions of "minification ratio".

response

Accepted

AMC AWO.A.SVGS.101 *General* amended to include the following definitions:

Minification – Perceived visual compression effect stemming from the display of imagery with a wider field of view than the conformal field of view of the display device.

Minification Ratio – Field of view of the imagery being displayed to the pilot divided by the conformal field of view of the display.

CS AWO.A.SVGS.110 SVGS fault detection and alerting

p. 30

comment

102

comment by: *EUROCONTROL*

	p. 30 - Alerting always is linked to a TTA. Here none is provided. Add reference that TTA must be compatible with the operation performed or define.
response	Accepted The following text has been added: 'The Time to Alert shall be compliant with the intended operation as defined by ICAO Annex 10 paragraph 3.1.5.7.3.1.'

CS AWO.A.SVGS.113 Navigation system error

p. 30-31

comment	103 comment by: EUROCONTROL p. 30 - How can the integrity be ensured by monitoring only? Clarify the action required to ensure integrity.
response	Not accepted Monitoring is one means of ensuring integrity and has been shown to be acceptable for many previous applications. Other means of ensuring integrity can be proposed by an applicant.
comment	104 comment by: EUROCONTROL p. 30 - An integrity target is linked to the performed operations. Provide reference to appropriate integrity target values as done for FTE in CS AWO.A.SVGS.112.
response	Partially accepted The following text has been added: 'The accuracy shall be suitable for the intended operation (see CS AWO.B.SACATI.113, CS AWO.B.CATII.113, and CS AWO.B.CATIII.115) and integrity shall meet the relevant safety objectives of CS 25.1309 and CS 23.2510.'

CS AWO.A.SVGS.114 Databases general

p. 31



comment	<p>105</p> <p style="text-align: right;">comment by: EUROCONTROL</p> <p>p. 31 - Is ED-76 sufficient for addressing the data quality requirements of SVGS?</p> <p>Clarify in the guidance material or as an exploratory note where this has been demonstrated.</p>
response	<p>Partially accepted</p> <p>Text changed to:</p> <p>‘For any database such as terrain, runway or obstacle that are used for SVGS scene depiction, a consistent set of data quality requirements (DQRs) shall be established to support the intended function of the equipment. Any requirements for the databases must be described to enable operators to conduct checks before using the database. The means of processing and maintaining the database shall be defined.’</p> <p>‘AMC AWO.A.SVGS.101 <i>General</i>’ also inserted to further explain:</p> <p>‘Further guidance on the integration of an SVGS is contained within RTCA DO-3579.</p> <p>Databases provided by a Type 2 DAT provider certified in accordance with Regulation (EU) 2017/373 or equivalent and that are compliant with the Data Quality Requirements (DQRs) are considered to be an acceptable means of compliance to CS AWO.A.SVGS.114.</p> <p>Note: For databases, the applicant should identify the DQRs during the airworthiness approval and demonstrate that are consistent with the intended function of the equipment.’</p>

comment	<p>106</p> <p style="text-align: right;">comment by: EUROCONTROL</p> <p>p. 31 - The requirement only covers tracability, but not recency of the data.</p> <p>Clarify how recency must be demonstrated.</p>
response	<p>Partially accepted</p> <p>Please see the response to comment #105.</p> <p>Timeliness and recency are part of the DQR (as per ED-76A).</p>



comment	<p>217</p> <p>comment by: <i>Dassault-Aviation</i></p> <p>Text: CS AWO.A.SVGS.116 page 31</p> <p><u>Comment:</u> What is the need for CS AWO.A.SVGS.116 as the word “shall” is used – meaning this is a mandatory requirement ? As this is mandatory, it should be included in CS AWO.A.SVGS.103 which purpose is to list minimum requirements.</p> <p><u>Proposed change:</u> Requirement proposed to be added in CS AWO.A.SVGS.116</p>
response	<p>Accepted</p> <p>The text of CS AWO.A.SVGS.116 has been combined with that of CS AWO.A.SVGS.103.</p>

CS AWO.A.SVGS.124 Aircraft positioning monitoring and alerting	p. 32
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comment	<p>107</p> <p>comment by: <i>EUROCONTROL</i></p> <p>p. 32 - Alerting always is linked to a TTA. Here none is provided.</p> <p>Add reference that TTA must be compatible with the operation performed or define.</p>
response	<p>Accepted</p> <p>The following text has been added:</p> <p>‘The Time to Alert shall be compliant with the intended operation as defined by ICAO Annex 10 paragraph 3.1.5.7.3.1.’</p>

CS AWO.A.SVGS.127 Determination of the missed approach point (MAPt)	p. 33
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comment	<p>149</p> <p>comment by: <i>AIRBUS</i></p> <p>Because for most approaches the actual decision gate is linked to passing certain height/altitude (rather than a geographic point), it may be preferable to reword this requirement to make it more generic.</p> <p>Airbus suggests to reword as follows:</p> <p>"The SVGS shall provide a clear and unambiguous means to inform the pilot when he is</p>
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	passing through the point/altitude at which the visual external cues shall be acquired to continue the approach"
response	Accepted Text changed to read: 'The SVGS shall provide a clear and unambiguous means to inform the pilot when they pass through the point/altitude at which the visual external cues shall be acquired to continue the approach'.

CS AWO.A.SVGS.135 Flight data recorder

p. 34

comment	49 comment by: <i>MITSUBISHI AIRCRAFT CORPORATION</i>
	[Comment/Reason for Change] "CS AWO.A.SVGS.135 Flight data recorder The modes of the SVGS operation shall be recorded by the flight data recorder.". Does this apply to Part 23 as well? Some smaller aircraft may have FDRs that are not capable of this, so there should be some allowance to not have these parameters recorded based on aircraft classification. This is more of a concern for older aircraft with retrofit systems where the SVGS is part of a retrofit or avionics upgrade and AWO is sought. Same for CS AWO.A.EFVS.110 and CS AWO.A.HUD.106. [Change Proposal] "CS AWO.A.SVGS.135 Flight data recorder The modes of the SVGS operation shall be recorded by the flight data recorder if the FDR has the means to record these parameters.", or alternately based on aircraft FDR requirements.
response	Accepted Text changed to read: 'If a flight data recorder is required to be installed, then the modes of the SVGS operation shall be recorded by the flight data recorder.' Text also added to CS AWO.A.EFVS.110, CS AWO.A.HUD.106 and CS AWO.A.SVGS.134.

CS AWO.A.CVS.101 General

p. 35

comment	42 comment by: <i>FAA</i>
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response	<p>CS AWO.A.CVS The CVS section is missing language that would make it clear that a CVS that is used for operational credit should also meet the requirements of an EFVS.</p> <p>Accepted</p> <p>Paragraph (d) added:</p> <p>‘(d) CVS that are used for operational credits must also meet the requirements of an EFVS or SVGS.’</p>
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CS AWO.B.CATI.101 Applicability	p. 36
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comment	<p>53 comment by: <i>Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)</i></p> <p>Subpart B, Section 1, the title</p> <p>Propose to change as follows: AIRWORTHINESS CERTIFICATION OF AEROPLANES FOR TYPE B OPERATIONS WITH DECISION HEIGHTS/ALTITUDE BELOW 250 FT DOWN TO NOT LESS THAN 200 FT – CATEGORY I OPERATIONS (CAT I).</p> <p>Rationale: These certification criteria are understood as being applicable to any DH not less than 200 ft. Type B does not appear to be relevant here. Also, this should be height not altitude. Otherwise a runway below MSL, which exists, may be unduly negatively affected.</p>
response	<p>Partially accepted</p> <p>Text changed to read:</p> <p>‘AIRWORTHINESS CERTIFICATION OF AEROPLANES FOR OPERATIONS WITH DECISION HEIGHTS/ALTITUDES NOT LOWER THAN 200 FT — CATEGORY I (CAT I) OPERATIONS’</p>

comment	<p>80 ❖ comment by: <i>AIRBUS</i></p> <p>The current title of the section is confusing:</p> <p><i>"Section 1: Airworthiness certification of aeroplanes for Type B operations with decision heights/altitude below 250 ft down to 200 ft — Category 1 operations (CAT I)"</i></p> <p>There is no need to exclude CAT I operation based on ILS with DH higher than 250ft. In particular current APV SBAS ("LPV 250") should be in the scope of this section.</p> <p>In addition the title definition is inconsistent with CS AWO.B.CATI.101 wording (page 36).</p> <p>Airbus suggests to reword as follows:</p>
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	<p>"Section 1: Airworthiness certification of aeroplanes for operations with decision heights/altitude down to 200 ft — Category 1 operations (CAT I)"</p> <p>This will be consistent with CS AWO.B.CATI.101.</p>
response	<p>Partially accepted</p> <p>Text changed to read:</p> <p>‘AIRWORTHINESS CERTIFICATION OF AEROPLANES FOR OPERATIONS WITH DECISION HEIGHTS/ALTITUDES NOT LOWER THAN 200 FT — CATEGORY I (CAT I) OPERATIONS’</p>

comment	<p>108 comment by: <i>EUROCONTROL</i></p> <p>p. 36 - SBAS CAT I case should be addressed.</p> <p>Add referecne to CS ACNS.</p>
response	<p>Accepted</p> <p>The definition of ‘xLS’ now includes ‘SBAS’. A reference to CS-ACNS has been added to AMC AWO.B.CATI.101.</p>

CS AWO.B.SACATI.102 Safety level	p. 37
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comment	<p>21 comment by: <i>FAA</i></p> <p>CS AWO.B.SACATI.102 Safety level; Page In the statement The safety level for precision approaches with DHs below 60 m (200 ft.) down to 45 m (150 ft) shall not be less than the average safety level achieved in precision approaches with DHs of 60 m (200 ft) and above” What does “average safety level” mean? Is the intent of this requirement to mean there will be no reduction in safety level? Define “average safety level” as the safely level under normal, fault free condition. Rationale: clarifies the intent of the requirements</p>
response	<p>Partially accepted</p> <p>Please see the response to comment #22.</p>

CS AWO.B.SACATI.119 General	p. 40
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comment	10	comment by: <i>THALES</i>
	<p>The 'on-board navigation receivers ' are not include in the 'flight guidance system ' but in the 'The approach guidance system'</p> <p><u>Thales proposal:</u> To replace 'flight guidance system ' by 'The approach guidance system'</p>	
response	<p>Not accepted</p> <p>The term 'flight guidance system' is used throughout CS-AWO and CS-25.</p>	

CS AWO.B.SACATI.120 xLS navigation means (including signal-in-space) failure

p. 40

comment	85 ❖	comment by: <i>AIRBUS</i>
	<p>Time to alert is missing as a relevant factor to be considered.</p> <p>Airbus suggests to complement list of failure with "time to alert":</p> <p>"(e.g. including monitor thresholds, time to alert, and transmitter changeover or shut down times)".</p>	
response	<p>Accepted</p> <p>'time to alert' added to the examples of factors to be considered.</p>	

comment	109	comment by: <i>EUROCONTROL</i>
	<p>p. 40 - SBAS CAT I not included in xLS.</p> <p>Consider SBAS CAT I case</p>	
response	<p>Accepted</p> <p>A definition of 'xLS' has been provided in CS AWO.B.CATI.102 and AMC AWO.B.CATI.102, which includes 'SBAS'.</p>	

CS AWO.B.CATII.101 Applicability and terminology

p. 42



comment	110	comment by: EUROCONTROL
	<p>p. 42 - SA CAT II is not mentioned in the CSAWO. It should be clarified whether aircraft systems have to conform to CAT II or other requirements.</p> <p>Consider SBAS CAT I case.</p>	
response	<p>Not accepted</p> <p>SA CATII does not affect the DH or the aircraft installation and, therefore, does not require any specific requirements for CS-AWO.</p>	

CS AWO.B.CATII.102 Safety level
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p. 42

comment	22	comment by: FAA
	<p>CS AWO.B.CATII.102 Safety level; page 42. In the statement The safety level for precision approaches with decision height DHs below 60 m (200 ft) down to 30 m (100 ft) must shall not be less than the average safety level achieved in precision approaches with decision height DHs of 60 m (200 ft) and above. What does “average safety level” mean? Is the intent of this requirement to mean there will be no reduction in safety level? Define “average safety level” as the safety level under normal, fault free condition. Rationale: clarifies the intent of the requirements</p>	
response	<p>Partially accepted</p> <p>AC 120-28D Appendix 3 paragraph 7.2 has similar text as a means to have a top-level safety requirement — the intent of which is to not allow any degradation in safety due to the change in DH from 200 ft. The safety level is not for fault-free operation but takes into account the effect of a failure during the approach below 200 ft.</p> <p>The safety level of CATII operations is achieved by both the ability of the system to maintain the aircraft on the right trajectory (performance) and the integrity and continuity of the system (failures). The objective of this requirement is to ensure a safety level equivalent to or better than CATI operations. This means that, when showing compliance to performance and failure requirements, it should be considered that CATII operations are systematically conducted in order to avoid compensating a lower safety level of one type of operation by a better safety level of the other.</p> <p>AMC AWO.B.CATII.102 has been amended to provide further clarification:</p> <p>‘The safety level, achieved by complying with the performance and failure requirements of this section, should be equivalent to or better than the safety level for operations with DH of 60 m (200 ft) or above. Hence, in showing compliance, ...’</p> <p>Similar text has been added to AMC.AWO.B.SACATI.102 for consistency.</p>	



CS AWO.B.CATII.106 Control of speed

p. 43

comment 77

comment by: AIRBUS

Airbus suggests to change "Automatic Throttle" to "Automatic Thrust" to include certified designs without moving throttles.

Please replace "Automatic throttle control" by "Automatic throttle/thrust control"

response Accepted

Please see the response to comment #76.

CS.AWO.B.CATII.121 Flight director system

p. 46

comment 207

comment by: Rick Theriault

CS AWO.B.CATII.121

Section CATIII.113 (a)(5) mentions that excess dev indication must be available, yet this has not been accepted as being necessary and sufficient to define aircrew/system actions in the event of an excessive deviation indication. Further elaboration should be here to define whether or not system capability status is required to default to a degraded state or whether a go-around is required prior to recognition of runway visual references.

response Not accepted

Excessive deviation alerts for CATII operations are required by CS AWO.A.CATII.115 and no change has been made to this concept in this NPA.

CS AWO.B.CATIII.102 Safety level

p. 49

comment 23

comment by: FAA

CS AWO.B.CATIII.102 Safety level, page 49 In the statement The safety level for precision approaches with decision height DHs below 60 m (200 ft) down to 30 m (100 ft) must shall not be less than the average safety level achieved in precision approaches with decision height DHs of 60 m (200 ft) and above. What does "average safety level" mean? Is the intent of this requirement to mean there will be no reduction in safety level?

Define "average safety level" as the safety level under normal, fault free condition.

Rationale: clarifies the intent of the requirements



response Partially accepted

Text added to AMC AWO.B.CATIII.102 as follows:

‘The safety level, achieved by complying with the performance and failure requirements of this section, should be equivalent to or better than the safety level for operations with DH of 60 m (200 ft) or above. Hence, in showing compliance,...’

Please see the responses to comments #21 and #22.

CS AWO.B.CATIII.106 Control of speed p. 50

comment 208 comment by: Rick Theriault

CS AWO.B.CATIII.106 Control of speed

Not harmonized with Page 10 ALS 105a. ALS 105 lists additional criteria as requirement for autothrottle. Sections should be consistent with one another.

response Not accepted

CS AWO.A.ALS.105 is directly referenced in CS AWO.B.CATIII.106 and the control of speed should, therefore, be in accordance with CS AWO.A.ALS.105.

CS AWO.B.CATIII.113 Installed equipment p. 51-53

comment 78 comment by: AIRBUS

Airbus suggests to change "Automatic Throttle" to "Automatic Thrust" to include certified designs without moving throttles.

Please replace "Automatic throttle control" by "Automatic throttle/thrust control" or "Automatic speed control" (several occurrences).

response Accepted

Please see the response to comment #76.

CS AWO.B.CATIII.115 Performance demonstration p. 54



comment	146 ❖	comment by: AIRBUS
	Please precise the meaning of the " <i>HUDLS is used for primary guidance</i> ". Does it relate only to HUD manual landing?	
	If applicable, please replace " <i>HUDLS is used for primary guidance</i> " by " <i>HUDLS is used for primary guidance (HUD manual landing)</i> ".	
response	Accepted	
	Text changed to read: ' <i>HUDLS is used for primary guidance (HUD manual landing)</i> '	

comment	205	comment by: Rick Theriault
	CS AWO.B.CATIII.115 (d)	
	The following text was struck out on CS AWO.B.CATII.113. (e.g. wind speed, ILS and/or MLS ground facility characteristics, aeroplane configurations, weight, centre of gravity, etc.). However, the CAT III section did not have the same strikeout. Seems that both sections should be consistent with one another since they are both LVOs.	
response	Accepted	
	'(e.g. wind speed, ILS and/or MLS ground facility characteristics, aeroplane configurations, weight, centre of gravity, etc.)' deleted for consistency with CS AWO.B.CATII.113.	

CS AWO.B.CATIII.117 Automatic ground roll control
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p. 54-55

comment	116	comment by: AIRBUS
	70 ft is converted into 21.3 m whereas in other part of the document (AMC AWO.A.ALS.106, CS AWO.A.ALS.106) it is converted into 21 m.	
	Airbus suggests to replace 21.3 m by 21 m.	
response	Accepted	
	Text changed to read '21 m'.	

CS AWO.B.CATIII.123 Fail-operational landing system (automatic or hybrid)
--

p. 56



comment 163

comment by: *The Boeing Company***THE PROPOSED TEXT STATES:**

“(a) For a fail-operational landing system, the probability of total loss of the landing system below the alert height shall be extremely emote.”

REQUESTED CHANGE:

(a) For a fail-operational landing system, the probability of total loss of the landing system below the alert height shall be extremely ~~emote~~ remote.

JUSTIFICATION:

Typographical error.

response Accepted

Typo corrected; it now reads ‘remote’.

CS AWO.B.RRVR.101 Applicability

p. 59

comment

54

comment by: *Swedish Transport Agency, Civil Aviation Department
(Transportstyrelsen, Luftfartsavdelningen)***Subpart B, Section 5,
CS AWO.B.RRVR.101****Suggest the following change:**

An aeroplane shall be considered to be eligible to apply for certification for operational credit ~~for the visual segment of approach and landing in reduced runway visual range (RRVR) conditions~~ if the aeroplane has demonstrated compliance with Subpart A Section 3 (EFVS) of this certification specification and by inference the applicable provisions of Subpart A Section 2 (HUD).

Rationale: The text is unclear as to what is meant by “eligible to apply for certification for operational credit Operational credit is an operational approval based on use of appropriately certified equipment. The first part of the paragraph creates uncertainty and should be changed for better clarity as suggested. Also, and editorially, the text may be read as if the aeroplane were to make the application.



response

Accepted

Text changed to read:

‘An aeroplane shall be considered to be eligible for operational credit if the aeroplane has demonstrated compliance with Subpart A Section 3 (EFVS) of this certification specification and, by inference, with the applicable provisions of Subpart A Section 2 (HUD).’

CS AWO.C.TOO.101 Applicability and terminology

p. 60

comment

222

comment by: *Dassault-Aviation*Text:

CS AWO.C.TOO.101 page 60

"This Subpart 4 C of this airworthiness code certification specification is applicable to aeroplanes for which certification is sought to allow the performance of take-off in lower visibilities than those which are sufficient to ensure that the pilot will at all times have sufficient visibility to complete or abandon the take-off safely. It is only concerned with directional guidance during the ground-borne portion of the take-off"

Comment:

Why to have not considered a credit on visibility based on EFVS ? EFVS could be used to get the minimum visibility to permit to take-off. The group RTCA SC213 has recently released ED-257/ DO-374 "ED-257DO-374 - Safety, Performance and Interoperability Requirements Document Defining Takeoff Minima by Use of Enhanced Flight Vision Systems" which addresses this topic. In this DO, they consider two cases : case 1 : EFVS only , case 2 EFVS + directional guidance. Authorized visibility reduction is more important in case 2.

response

Noted

This is not currently within the scope of the subject NPA, but will be considered for the next phase of the CS-AWO development.

CS AWO.C.TOO.103 Guidance information

p. 60

comment

55

comment by: *Swedish Transport Agency, Civil Aviation Department (Transportstyrelsen, Luftfartsavdelningen)***CS.AWO.C.TOO.103**

Change "loss of visibility" to "loss of visual references".



response	Rationale: This reflects the actual hazard
	Accepted
	Text changed to read: 'loss of visual references'

AM CAWO.A.ALS.101(a) Applicability and terminology p. 63

comment	112	comment by: <i>EUROCONTROL</i>
	<p>p. 63 - The use of "Localizer" for GLS and MLS differs from ICAO terminology. There " final approach course" is used.</p> <p>Consider explaining the difference.</p>	
response	<p>Agreed</p> <p>The following text has been added to AMC AWO.A.ALS.101(a):</p> <p>'...and are intended to indicate where lateral and vertical deviation is provided to the aircraft navigation systems.'</p>	

AM CAWO.A.ALS.106 Performance demonstration p. 63-77

comment	24	comment by: <i>FAA</i>
	<p>AFM elevation value from flight test and validated simulation, Page 76. Table associated with Figure 2 Typo: The first three rows from each columns should be combined.</p> <p>Rationale: Correction</p>	
response	<p>Accepted</p> <p>The first three rows of the table have been combined.</p>	
comment	79	comment by: <i>AIRBUS</i>
	<p>Airbus suggests to change "Automatic Throttle" to "Automatic Thrust" to include certified designs without moving throttles.</p> <p>Please replace "Automatic throttle speed holding" by "Automatic speed holding"</p>	



response Accepted

‘Automatic Throttle’ changed to ‘Automatic Throttle/Thrust’, and ‘Automatic throttle speed holding’ changed to ‘Automatic speed holding’.

comment 121 comment by: EUROCONTROL

p. 74 - Section 4.2 should also contain a reference to "APPENDIX 1 TO AMC TO SUBPART A ‘MODELS’" currently only the wind models are references in this AMC.

Add reference to end of section 4.2.

response Accepted

Reference to ‘APPENDIX 1 TO AMC TO SUBPART A “MODELS”’ added.

comment 143 comment by: AIRBUS

HUDS demonstration requires a go-around rate lower than 20% (limiting wind conditions). Why is there a requirement about HUD in the automatic landing section?

We suggest to remove this requirement about HUDLS.

response Partially accepted

The following text has been added to AMC AWO.HUD.107:

‘AMC AWO.ALS.106 contains additional performance demonstration aspects for HUDLS.’

comment 164 comment by: The Boeing Company

Page: 64

Paragraph: 2018-06(B) AMC AWO.A.ALS.106 1.4 b. (i).

THE PROPOSED TEXT STATES:

“Longitudinal touchdown beyond the end of the TDZ lighting, 823 m (2 700 ft) from the treshold.”

REQUESTED CHANGE:

“Longitudinal touchdown beyond the end of the TDZ lighting, 823 m (2 700 ft) from the **treshold threshold**.”

JUSTIFICATION:

Typographical error.



response Accepted

Typo corrected.

comment 165

comment by: *The Boeing Company*

Page: 66

Paragraph: 2018-06(B) AMC AWO.A.ALS.106 2.1 b.

THE PROPOSED TEXT STATES:

“b. mean wind recorded by the flight test instrumentation, i.e. average of the wind recorded for 20 sec around the touchdown point and recomputed at 33 ft, with the following additional considerations:

ÿ Additional credit can be taken for the max average wind demonstrated during flight test if the gust encountered during flight test shows a higher intensity than the one tested during simulation (meaning the wind increase to the average wind is higher during flight test compared to the simulation).

ÿ In this case, to give a revised max average wind demonstrated during flight test, the mean wind recorded by the flight test instrumentation may be increased by the difference between flight tested and simulation tested gust intensity.”

REQUESTED CHANGE:

It is requested that the proposed text be replaced with the methodology for determining mean wind, recorded by flight test instrumentation, as provided in the JAR-25 Flight Test Guide, Change 16, or the FAA AC 25-7C (both of which have been endorsed by the Aviation Rulemaking Advisory Committee (ARAC) Flight Test Harmonization Working Group (FTHWG) final report of 2017.

JUSTIFICATION:

The methodology identified in the requested change addresses both takeoff and landings and provides industry with the elegance of a single wind calculation that can be adapted to fit various measurement methods which may have differing minimum useful speeds.

response Not accepted

AMC AWO.A.ALS.106 paragraph 2.1(c) has been added (please see the response to comment #251), which considers the wind recorded by the flight test instrumentation and defines a method for the determination of the maximum gust.

comment 166

comment by: *The Boeing Company*



Page: 66
Paragraph: 2018-06(B) AMC AWO.A.ALS.106 2.1 b.

THE PROPOSED TEXT STATES:

“b. mean wind recorded by the flight test instrumentation, i.e. average of the wind recorded for 20 sec around the touchdown point and recomputed at 33 ft, with the following additional considerations:

ÿ Additional credit can be taken for the max average wind demonstrated during flight test if the gust encountered during flight test shows a higher intensity than the one tested during simulation (meaning the wind increase to the average wind is higher during flight test compared to the simulation).

ÿ In this case, to give a revised max average wind demonstrated during flight test, the mean wind recorded by the flight test instrumentation may be increased by the difference between flight tested and simulation tested gust intensity.”

REQUESTED CHANGE:

It is requested that the proposed text be replaced with the methodology for determining mean wind, recorded by flight test instrumentation, as provided in the JAR-25 Flight Test Guide, Change 16, or the FAA AC 25-7C (both of which have been endorsed by the Aviation Rulemaking Advisory Committee (ARAC) Flight Test Harmonization Working Group (FTHWG) final report of 2017.

JUSTIFICATION:

The methodology identified in the requested change addresses both takeoff and landings and provides industry with the elegance of a single wind calculation that can be adapted to fit various measurement methods which may have differing minimum useful speeds.

response Partially accepted

Please see the response to comment #165.

comment 167

comment by: *The Boeing Company*

Page: 75
Paragraph: 2018-06(B) AMC AWO.A.ALS.106 5.1.1.2

THE PROPOSED TEXT STATES:

“5.1.1.2 The minimum required altitude or elevation for the flight test which is used to demonstrate a desired AFM elevation value, by this method, is shown in Figure 6 and the accompanying table, below. For example, the applicant may document an AFM elevation value of 8 000 ft, by a successful flight demonstration at 8 000 ft, or by a flight demonstration at a minimum elevation of 5 000 ft with a simulation to the desired 8 000 ft. (Note: The lines in Figure 6 converge at 11 000 ft, indicating that credit for simulation is not available at 11 000 ft or above.)”

REQUESTED CHANGE:

5.1.1.2 The minimum required altitude or elevation for the flight test which is used to demonstrate a desired AFM elevation value, by this method, is shown in **Figure 6 Figure 2** and the accompanying table, below. For example, the applicant may document an AFM elevation value of 8 000 ft, by a successful flight demonstration at 8 000 ft, or by a flight demonstration at a minimum elevation of 5 000 ft with a simulation to the desired 8 000 ft. (Note: The lines in **Figure 6 Figure 2** converge at 11 000 ft, indicating that credit for simulation is not available at 11 000 ft or above.)

JUSTIFICATION:
Typographical error.

response Accepted

Typo corrected.

comment

168

comment by: *The Boeing Company*

Page: 76
Paragraph: 2018-06(B) AMC AWO.A.ALS.106 5.1.1.2 Figure 2

THE PROPOSED TEXT STATES:
The label “Flight test demonstrated elevation”, in Figure 2, is duplicated on the plot.

REQUESTED CHANGE:
Delete the redundant label.

JUSTIFICATION:
Typographical error.

response Not accepted

The additional label clarifies what the horizontal axis depicts.

comment

169

comment by: *The Boeing Company*

Page: 76
Paragraph: 2018-06(B) AMC AWO.A.ALS.106 5.1.1.2 Table associated with Figure 2

THE PROPOSED TEXT STATES:
The column header for the Table associated with Figure 2 is split across three rows.



response	<table border="1"> <tr> <td data-bbox="359 185 1364 324"> <p>REQUESTED CHANGE: Reformat the column headers into a single row.</p> </td> </tr> <tr> <td data-bbox="359 324 1364 414"> <p>JUSTIFICATION: Typographical error.</p> </td> </tr> </table> <p>Accepted</p> <p>The rows in the table combined into single headers.</p>	<p>REQUESTED CHANGE: Reformat the column headers into a single row.</p>	<p>JUSTIFICATION: Typographical error.</p>
<p>REQUESTED CHANGE: Reformat the column headers into a single row.</p>			
<p>JUSTIFICATION: Typographical error.</p>			
comment	<p>249 comment by: <i>Embraer S.A.</i></p> <p>The term “sizing conditions” is not defined.</p> <p>Rationale Section 2.1 states “<i>sizing conditions as defined in the certification flight test programme</i>”, but does not define “sizing conditions”.</p> <p>Suggestion Please, clarify the intended use of this term.</p>		
response	<p>Accepted</p> <p>The following text has been added:</p> <p>‘in terms of the unfavourable combination of weight and CG’</p>		
comment	<p>250 comment by: <i>Embraer S.A.</i></p> <p>The fourth bullet of section 2.1 mixes simulation with flight and it is not clear why the “steady state wind” should be calculated from flight-test if the last bullet is about simulation.</p> <p>Rationale The fourth bullet requires a simulation at the requested wind limit. The following paragraph defines the “steady state wind” calculation from the flight test data, which is not related to the demonstration asked in the fourth bullet. Embraer proposes to change the paragraph order for better understanding.</p> <p>Suggestion The text “<i>The steady state wind value can be determined by either of the following: (...)</i>” should be rearranged to be after the text “<i>Data taken during demonstration flight tests should be used to validate the simulation(s). The objective of a flight test programme</i>”</p>		



should be to demonstrate performance of the system to 100 % of the steady state wind limit values that are used in the simulation statistical performance analysis."

response

Not accepted

The logic of this section should be maintained as proposed in the NPA.

comment

251

comment by: Embraer S.A.

Change steady state wind value to be calculated including the gust component, according to the Flight Test Harmonization Working Group.

Rationale

The text about "average wind value" states that such value will be reported on AFM, but according to recent discussions in the Flight Test Harmonization Working Group (FTHWG), the AFMs of all major aircraft manufacturers will report only "maximum demonstrated crosswind - gust included", which is calculated using a 3sec filer moving average from the calculated wind (calculated from aircraft sensors such as inertial and anemometric systems and corrected to tower height). As a result, the correction on the "average" wind value is not useful or meaningful.

According to the (FTHWG), the following text is proposed in the guidances of 25.237:

"(d) The crosswind component included in AFM, whether limiting or not, should be provided as a single gust included value i.e."XX kt (Gust included)". A set of two values, such as "Average XX kt with gusts up to YY kt", is acceptable although not preferred. Other formats, in particular those not providing information related to gusts, should not be used."

Suggestion

Change the text:

From:

The steady state wind value can be determined by either of the following:

a. mean wind value + half gust, as reported by air traffic control (ATC);

b. mean wind recorded by the flight test instrumentation, i.e. average of the wind recorded for 20 sec around the touchdown point and recomputed at 33 ft, with the following additional considerations:

- Additional credit can be taken for the max average wind demonstrated during flight test if the gust encountered during flight test shows a higher intensity than the one tested during simulation (meaning the wind increase to the average wind is higher during flight test compared to the simulation).



- In this case, to give a revised max average wind demonstrated during flight test, the mean wind recorded by the flight test instrumentation may be increased by the difference between flight tested and simulation tested gust intensity.

To:

The steady state wind value that will be reported on AFM is the calculated mean wind plus maximum gust recorded by flight test instrumentation throughout the landing.

The maximum gust may be calculated using a 3 seconds moving average filter in the instantaneous calculated wind from a height of 50ft to termination of the test event or any low speed above which all data necessary to the computation are available and of sufficient accuracy. The measured wind should be corrected from the height of the measurement device to a height of 33ft.

response

Partially accepted

Text added as '(c)' in AMC AWO.A.ALS.106 as follows:

'The steady state wind value that will be reported on the AFM is the calculated mean wind plus maximum gust recorded by the flight test instrumentation throughout the landing.

The maximum gust may be calculated using a 3-second moving average filter in the instantaneous calculated wind from a height of 50 ft to termination of the test event or an airspeed such that all data necessary to the computation is available and of sufficient accuracy. The measured wind should be corrected from the height of the measurement device to a height of 33 ft.'

AMCAWO.A.ALS.109 Automatic landing distance

p. 78

comment

247

comment by: *Embraer S.A.*

The text about landing distance calculation should be more general, asking, for instance, to consider the 3-sigma variation over the full landing distance.

Rationale

In the landing distance calculation, the suggested use of three-sigma for touchdown speed and three-sigma for air distance may be overly conservative. These variables are probably correlated, as higher air distances are generally correlated with a decrease in touchdown speed.

The following proposed change address this issue by adding an alternative way of calculating the landing distance required, considering the three-sigma variation over the full landing distance calculated for each statistical data point.

Suggestion

Add the following text:



(e) Alternatively, landing distance required may be calculated using a statistical inference over the total landing distance calculated for each statistical data point. The total landing distance for each of these points should be calculated as the distance from the runway threshold to the touchdown point plus the ground roll distance. The landing distance required should be determined as the mean of the total landing distances plus the three-sigma variation of the total landing distances, multiplied by 1.15.

Change the following text:

(e) (f) The landing distance required should include corrections for variations in glide-slope angle and variations in glide-slope height at the threshold. Alternatively, these effects may be included by use of conservative assumptions in the basic presentation of data, with the applicable ranges stated in the flight manual.

Note: The landing distance as derived under (a) to **(e)-(f)** above should be compared with the normal landing distance according to CS 25.125.

response Not accepted

There is no fundamental difference between this method and that in paragraph (c). Therefore, the proposed change has not been included.

AMC AWO.A.HUD.101 Applicability and terminology

p. 82

comment

56

comment by: *Swedish Transport Agency, Civil Aviation Department
(Transportstyrelsen, Luftfartsavdelningen)*

AMC TO SECTION 2 HEADS UP DISPLAY (HUD)

Suggest changing title to **HEAD UP DISPLAYS (HUD)**

Rationale: Normal terminologi

response Accepted

Error corrected as suggested.

AMC AWO.A.HUD.105(a)(i) Failure alerting

p. 82

comment

145

comment by: *AIRBUS*

These requirements are already covered by CS25.



	Qirbus suggests to remove these requirements or clarify the deletion of the requirement CS.AWO.A.ALS.111.
response	Accepted This paragraph has been deleted as it is already addressed in CS-25.

AMC AWO.A.HUD.105(a)(iii) Monitoring pilot indications	p. 82-83
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comment	145 ❖ comment by: AIRBUS
	These requirements are already covered by CS25.
	Qirbus suggests to remove these requirements or clarify the deletion of the requirement CS.AWO.A.ALS.111.
response	Not accepted Although it is found in CS-25, it is felt to be beneficial to reiterate this requirement.

AMC AWO.A.HUD.107 Performance demonstration	p. 82
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comment	146 ❖ comment by: AIRBUS
	Please precise the meaning of the " <i>HUDLS is used for primary guidance</i> ". Does it relate only to HUD manual landing?
	If applicable, please replace " <i>HUDLS is used for primary guidance</i> " by " <i>HUDLS is used for primary guidance (HUD manual landing)</i> ".
response	Accepted Text changed to read: ' <i>HUDLS is used for primary guidance (HUD manual landing)</i> '

AMC AWO.A.HUD.112 Head-up display landing distance	p. 83
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comment	<p data-bbox="352 212 400 237">255</p> <p data-bbox="1046 212 1425 237">comment by: Dassault-Aviation</p> <p data-bbox="352 293 416 318"><u>Text:</u></p> <p data-bbox="352 327 1015 351">AMC AWO.A.HUD112 Head-up display landing distance</p> <p data-bbox="352 398 480 423"><u>Comment:</u></p> <p data-bbox="352 432 1074 456">The way to establish the landing distance should be clarified</p> <p data-bbox="352 504 568 528"><u>Proposed change:</u></p> <p data-bbox="352 537 1417 607">(a) The flare guidance provided by the HUD during landing and any procedure associated with using the HUD may result in an increase to the landing distance as per CS 25.125.</p> <p data-bbox="352 616 1214 640">(b) The required HUD landing distance should be established as follows:</p> <p data-bbox="549 649 1385 745">(1) The requirements of CS 25.125 should be applied, except that the configuration, procedure and speed should be those recommended in the associated procedures for using a HUD.</p> <p data-bbox="549 754 1417 1032">(2) The landing distance as derived under (a) above should be compared with the normal landing distance as per CS 25.125 factored in accordance with the relevant operating regulation. If the required HUD landing distance is longer than without using a HUD, then the required HUD landing distance should be established and articulated in the AFM. This required landing distance may not be shorter than the CS 25.125 factored landing distance established in accordance with CS 25.125 without using a HUD.</p> <p data-bbox="549 1041 1425 1173">(3) The operating procedures, aeroplane configuration, approach speed, thrust management, piloting control techniques and the landing distance data applicable for HUD landings should be established and articulated in the AFM.</p>
response	<p data-bbox="352 1279 568 1303">Partially accepted</p> <p data-bbox="352 1339 1425 1408">AMC AWO.A.HUD.112 has been completely revised to provide the means to establish the effect on landing distance from the use of a flare cue.</p>

AMC AWO.A.EFVS.103 EFVS depiction	p. 84
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comment	<p data-bbox="352 1668 427 1693">142 ❖</p> <p data-bbox="1169 1668 1425 1693">comment by: AIRBUS</p> <p data-bbox="352 1753 1425 1823">HUDLS and EVS-L requires flare/prompt guidance, but no mention of Runway slope nor pre-threshold to be considered in performance assessment.</p> <p data-bbox="352 1861 1026 1886">Note similar comment apply to Operational assessment.</p> <p data-bbox="352 1933 882 1957">Airbus suggests the following modifications:</p>
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	<p>- In CS AWO.A.HUD.107 Performance demonstration:</p> <p>Add « landing area slope and Pre-threshold » as factors to be considered for flare guidance (HUD and EFVS-L)</p> <p>- In CS AWO.A.EFVS.109 EFVS performance (h):</p> <p>Add « the effects of aerodrome conditions (e.g. elevation, landing area slope and ground profile under the approach path) are to be investigated »</p> <p>- In AMC AWO.A.EFVS.103 EFVS depiction:</p> <p>Add « the effects of aerodrome conditions (e.g. elevation, landing area slope and ground profile under the approach path) are to be investigated »</p> <p>Flare cue : add « When demonstrating performance of flare cue, effect of landing area slope and ground profile under the approach path should be considered »</p>
response	<p>Accepted</p> <p>Please see the other responses to comment #142 in this CRD.</p>

AMC AWO.A.EFVS.105 HUD EFVS symbology	p. 89
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comment	<p>35</p> <p style="text-align: right;">comment by: <i>FAA</i></p> <p>CS AWO.A.EFVS.105.(6) In the US a Rad Alt is only required for EFVS Landing Systems. Clarify that Rad Alt is only a requirement for EFVS Landing System applications. The inclusion with EFVS Approach Systems are optional.</p>
response	<p>Accepted</p> <p>Please see the response to comment #37.</p>

AMC AWO.A.EFVS.107 EFVS safety assessment	p. 90
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comment	<p>198</p> <p style="text-align: right;">comment by: <i>Elbit Systems</i></p> <p>“The applicant may need to demonstrate by flight test or simulation combinations of EFVS malfunctions that are not shown to be extremely improbable (10⁻⁹ per FH).”</p>
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	<p>The meaning of this sentence is not clear. What the applicant need to do with this information? Suggest to delete it</p>
response	<p>Partially accepted</p> <p>Text changed to read:</p> <p>‘The applicant may need to assess by flight test or simulation the effects of combinations of EFVS malfunctions that are not shown to be extremely improbable (10^{-9} per FH).’</p>

comment	<p>239 comment by: <i>Embraer S.A.</i></p> <p>To indicate that failure conditions should be determined according to the intended function and the correspondent FHA.</p> <p>Rationale The original text gives the reader the impression that the EFVS system should always be developed to address a catastrophic failure criticality. But this assumption is not correct, depending on the intended function (for instance, EFVS-A is not expected to have catastrophic failures).</p> <p>Suggestion To change the text from:</p> <p><i>The applicant may need to demonstrate by flight test or simulation combinations of EFVS malfunctions that are not shown to be extremely improbable (10^{-9} per FH).</i></p> <p>To:</p> <p><i>The applicant may need to demonstrate by flight test or simulation combinations of EFVS malfunctions that are not shown to be extremely improbable (10^{-9} per FH) (if the FHA conducted in accordance with CS 23.2500(a),23.2500(b), 23.2510, 23.2605 or CS 25.1309, as applicable, establishes a catastrophic failure depending on the intended function and its corresponding malfunction).</i></p>
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response	<p>Partially accepted</p> <p>Text changed to read:</p> <p>‘The applicant may need to assess by flight test or simulation the effects of combinations of EFVS malfunctions that are not classified as Catastrophic by the FHA (to support compliance demonstration to 23.2500(a), 23.2500(b), 23.2510, 23.2605 or CS 25.1309, as applicable).’</p>
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comment 199

comment by: *Elbit Systems*

“The minimum detection EFVS range (Figure 1 below) can be derived by using an assumed minimum distance of the aircraft at the nominal Category I (200 ft) DA before which the EFVS should image the **runway threshold**. On a 3-degree glideslope, the horizontal distance from the aircraft to the runway threshold is approximately 2 816 ft (3 816 ft from the precision TDZ markers) based upon the visual cues required by AMC7 SPA.LVO.105(c) point (e).”

The runway threshold is not the **one and only** visual cue required by AMC7 SPA.LVO.105(c) point (e), it can be the “the approach light system” which is much more closer.

Suggest rephrasing:

“The minimum detection EFVS range (Figure 1 below) can be derived by using an assumed minimum distance of the aircraft at the nominal Category I (200 ft) DA before which the EFVS should image visual cues required by AMC7 SPA.LVO.105(c) point (e). An example is: On a 3-degree glideslope, the horizontal distance from the aircraft to the runway threshold is approximately 2 816 ft (3 816 ft from the precision TDZ markers) based upon the visual cues required by AMC7 SPA.LVO.105(c) point (e).”

response Accepted

Text changed to read:

‘The minimum detection EFVS range (Figure 1 below) can be derived by using an assumed minimum distance of the aircraft at the nominal Category I (200 ft) DA before which the EFVS should image visual cues required by AMC7 SPA.LVO.105(c) point (e). An example is: On a 3-degree glideslope, the horizontal distance from the aircraft to the runway threshold is approximately 2 816 ft (3 816 ft from the precision TDZ markers) based upon the visual cues required by AMC7 SPA.LVO.105(c) point (e).’

comment 201

comment by: *Rick Theriault*

AMC AWO.A.EFVS.109

Statements read "The minimum detection EFVS range (Figure 1 below) can be derived by using an assumed minimum distance of the aircraft at the nominal Category I (200 ft) DA before which the EFVS should image the runway threshold. On a 3-degree glideslope, the horizontal distance from the aircraft to the runway threshold is approximately 2 816 ft (3 816 ft from the precision TDZ markers) based upon the visual cues required by AMC7 SPA.LVO.105(c) point (e). This range should be used as a minimum performance value.". Although this is true, this should not be the range at which EFVS performance is measured. In actuality, it is the over-the-nose visual range (much steeper) that should be cited in this paragraph. For example, at 200 feet, the EFVS sensor may have the necessary performance to image the ALS while not being able to image the touchdown zone, as required here. In



	<p>this instance, the pilot would be allowed to continue the approach to 100 feet where the landing zone visual references would then need to be seen with natural vision.</p>
response	<p>Accepted</p> <p>Please see the response to comment #199.</p>

AMC AWO.A.EFVS.109 EFVS performance—landing distan

p. 94

comment	<p>218</p> <p>comment by: <i>Dassault-Aviation</i></p> <p><u>Text:</u> AMC AWO.A.EFVS.109 page 93 "(d) All touchdowns in the TDZ. Lateral touchdown performance should be demonstrated to be no worse than that achieved in visual operations for the specific aircraft. Longitudinal touchdown performance must be demonstrated within the TDZ which is the first one third, or the first 3 000 ft, of the usable runway, whichever is more restrictive, and demonstrated to be equivalent to or better than that achieved in visual operations for the specific aircraft."</p> <p><u>Comment:</u> in (d) the wording "than that achieved in visual operations" is not appropriate (2 instances) as using EFVS below DA/DH is considered as being a visual operation. Suggest to talk about "visual operations with natural vision" instead.</p> <p><u>Proposed change:</u> "(d) All touchdowns in the TDZ. Lateral touchdown performance should be demonstrated to be no worse than that visual operations with natural vision achieved in visual operations for the specific aircraft. Longitudinal touchdown performance must be demonstrated within the TDZ which is the first one third, or the first 3 000 ft, of the usable runway, whichever is more restrictive, and demonstrated to be equivalent to or better than that achieved in visual operations with natural vision for the specific aircraft."</p>
response	<p>Accepted</p> <p>'with natural vision' added to the text.</p>

AMCAWO.A.SVGS.101 General

p. 98

comment	<p>211</p> <p>comment by: <i>THALES</i></p> <p>Typo in the document reference : it should be RTCA DO-359 instead of RTCA DO-379.</p>
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response	<p><u>Thales proposal:</u></p> <p>To replace RTCA DO-379 by RTCA DO-359</p> <p>Accepted</p> <p>Typo corrected.</p>
comment	<p>223 comment by: <i>Dassault-Aviation</i></p> <p>Text: Page 98 "Further guidance on the integration of an SVGS is contained within RTCA DO-379"</p> <p><u>Comment:</u> RTCA DO-359</p> <p><u>Proposed change:</u> Further guidance on the integration of an SVGS is contained within RTCA DO-359</p>
response	<p>Accepted</p> <p>Typo corrected.</p>
comment	<p>240 comment by: <i>Embraer S.A.</i></p> <p>1) Typographical error. DO-379 does not exist. 2) Development of acceptable means of compliance to address SVGS on a HUD.</p> <p>Rationale 1) DO-359 should be referenced, as well as FAA AC 20-185 (which is the current Advisory Circular for SVGS on head down display – HDD). 2)As a matter of fact, acceptable means of compliance to address SVGS on a head up display – HUD – should also be developed.</p> <p>Suggestion Item 1: To change the text from:</p> <p><i>Further guidance on the integration of an SVGS is contained within RTCA DO-379.</i> To:</p> <p><i>Further guidance on the integration of an SVGS is contained within RTCA DO-3579 and FAA AC 20-185.</i></p> <p>Item 2:</p>



	EASA to develop acceptable means of compliance to address SVGS on a head up display – HUD.
response	Partially accepted Typographical error corrected to read 'DO-359'. The added value of referring to FAA AC 20-185 is not supported. Currently, the concept of CS-AWO is to allow the combination of technologies through the different sections and parts of the CSs. Therefore, it is possible to combine an SVGS with a HUD using CS-AWO. DO-359 is currently viewed as being an acceptable AMC for the CS-AWO section on SVGSs.

2 ILS CAT I/II/III signal-in-space model

p. 99-103

comment	3 Reference to ICAO Annex 10 is obsolete (does not include latest amendment). Replace the wording by "ICAO Annex 10, Volume 1, six Edition dated July 2006 at Amendment No. 91".	comment by: DGAC/DSNA/DTI/CNS/NAV
response	Accepted Reference amended.	
comment	4 In the first sentence, delete "CATII" to be consistent with the title of the paragraph.	comment by: DGAC/DSNA/DTI/CNS/NAV
response	Not accepted The reference to Category II is deliberate.	
comment	9 The wording of § 2.1.1 is quite confusing. Our understanding is that the intent is : (a) that glide slope angle considered in the demonstration are defined (b) to recommend glide range to be considered. Propose to reword as follow : 2.1.1 Glide Path Angles. It should be assumed that the operationally preferred glide path angle is 3°. Minimum and maximum glides path angle slope considered in the demonstrations should be defined and the system should meet all applicable requirements with the defined limits.	comment by: DGAC/DSNA/DTI/CNS/NAV



response	<p>- For CAT I operations it is recommended to cover at least 2.5° to 3.5° glide slope range - For CAT II or CAT III operations it is recommended to cover 2.5° to 3° glide slope range</p> <p>Accepted</p> <p>Text changed as suggested.</p>
comment	<p>11 comment by: DGAC/DSNA/DTI/CNS/NAV</p> <p>There is an error in §2.2.1. The value of the standard deviation of the course line for Facility Performance Type I is 3.5 m (12 ft) since the value in Annex 10 is 10.5 m (35 ft) and it is defined as a 3 x standard deviation ("to be reach at very rare occasions" Note 1 in §3.1.3.6.2 in Annex 10).</p>
response	<p>Accepted</p> <p>Text changed to '3.5 m (12 ft)'.</p>
comment	<p>12 comment by: DGAC/DSNA/DTI/CNS/NAV</p> <p>The proposed definition of "Displacement sensitivity" is not consistent with ICAO Annex 10 definition. Value is specified at point T. Replace the wording by "Displacement Sensitivity. It should be assumed that the nominal displacement sensitivity at the ILS reference datum (Point "T") has the value of 0.00145 DDM/m."</p>
response	<p>Accepted</p> <p>The text 'at the ILS reference datum (Point "T")' added to the sentence.</p>
comment	<p>68 comment by: DGAC/DSNA/DTI/CNS/NAV</p> <p>§2.1.3 : It should be noted that the alignment accuracy required by ICAO Annex 10 for Facility Performance Category (FPC) III Glide Path is better than the value given here (which is required for FPC I/II Glide Path). The exact ICAO standard is : "The glide path angle shall be adjusted and maintained within: a) 0.075 θ from θ for Facility Performance Categories I and II — ILS glide paths; b) 0.04 θ from θ for Facility Performance Category III — ILS glide paths."</p>
response	<p>Not accepted</p> <p>Text has been added to explain that the two-sigma level value of filter output should be set according to the minimum class of ILS considered as per the Table.</p>



comment	<p>71</p> <p style="text-align: right;">comment by: DGAC/DSNA/DTI/CNS/NAV</p> <p>§2.2.1 : ICAO Annex 10 imposes separate alignment accuracy values for Facility Performance Category (FPC) II and III Localizer at 3 standard deviations :</p> <p>"The mean course line shall be adjusted and maintained within limits equivalent to the following displacements from the runway centre line at the ILS reference datum:</p> <p>a) for Facility Performance Category I localizers: plus or minus 10.5 m (35 ft), or the linear equivalent of 0.015 DDM, whichever is less;</p> <p>b) for Facility Performance Category II localizers: plus or minus 7.5 m (25 ft);</p> <p>c) for Facility Performance Category III localizers: plus or minus 3 m (10 ft)"</p> <p>The value given in CS-AWO for FPC CAT 2 and 3 Localizer is 4.5 m at 3 standard deviations which is too low for CAT 2 LOC and too high for CAT 3 LOC compared to ICAO Annex 10 values.</p> <p>The values from ICAO Annex 10 should be retained because the ILS model should take into account every kind of Localizer which complies with Annex 10 even the least performant.</p>
response	<p>Accepted</p> <p>Please see the response to comment #11.</p>

comment	<p>72</p> <p style="text-align: right;">comment by: DGAC/DSNA/DTI/CNS/NAV</p> <p>§2.2.2 : This paragraph should be aligned with ICAO Annex 10 standards in order to take into account the least performant Localizers as well in the ILS model.</p> <p>Indeed, the Annex 10 authorizes a range of variation around the nominal value depending on the Facility Performance Category (FPC) :</p> <p>"The lateral displacement sensitivity shall be adjusted and maintained within the limits of plus or minus:</p> <p>a) 17 per cent of the nominal value for Facility Performance Categories I and II;</p> <p>b) 10 per cent of the nominal value for Facility Performance Category III."</p> <p>Therefore, a FPC CAT I and II can have a minimum displacement sensitivity of 0.00120 DDM/m and a maximum displacement sensitivity of 0.00170 DDM/m.</p> <p>A FPC CAT III can have a minimum displacement sensitivity of 0.00131 DDM/m and a maximum displacement sensitivity of 0.00160 DDM/m.</p>
response	<p>Not accepted</p> <p>The value of 0.00145 DDM/m was selected as the <u>nominal</u> displacement sensitivity and, therefore, provides a median value.</p>

comment	<p>73</p> <p style="text-align: right;">comment by: DGAC/DSNA/DTI/CNS/NAV</p>
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§2.1.4 : This paragraph should be aligned with ICAO Annex 10 standards in order to take into account the least performant Glide Path as well in the ILS model.

Indeed, the Annex 10 displacement sensitivity standards depend on the Facility Performance Category (FPC) :

"3.1.5.6.1 For Facility Performance Category I — ILS glide paths, the nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at angular displacements above and below the glide path between 0.07θ and 0.14θ . Note.— The above is not intended to preclude glide path systems which inherently have asymmetrical upper and lower sectors.

3.1.5.6.3 For Facility Performance Category II — ILS glide paths, the angular displacement sensitivity shall be as symmetrical as practicable. The nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at an angular displacement of:
a) 0.12θ below path with a tolerance of plus or minus 0.02θ ;
b) 0.12θ above path with a tolerance of plus 0.02θ and minus 0.05θ

3.1.5.6.4 For Facility Performance Category III — ILS glide paths, the nominal angular displacement sensitivity shall correspond to a DDM of 0.0875 at angular displacements above and below the glide path of 0.12θ with a tolerance of plus or minus 0.02θ "

response

Not accepted

The values were selected as being the most appropriate to model the performance of the systems.

comment

74

comment by: DGAC/DSNA/DTI/CNS/NAV

Attachment [#3](#)

§2.2.3 :

First sentence : The representation of the Localizer noise by a white noise passed through a low-pass first-order filter of time constant 0.5 sec may not be adequate as too different from reality. Indeed, the Localizer signal perturbation often looks like a bend of a lower frequency than a white noise. A more realistic noise model would be the sum of a low frequency component and a high frequency component.

Note : MLS noise model includes a low frequency component (2nd order filter) and a high frequency component (1st order filter).

Therefore, this sentence should be modified to include a more realistic noise model.

The rest of the paragraph is not aligned with ICAO Annex 10 standards.

We propose to replace the text by "The two-sigma level value of filter output should be set according to minimum class of ILS considered as per Table 1" and a table which would include ICAO Localizer structure standards. One example of a table is enclosed.

response

Partially accepted



The intent of the comment is supported; however, it is difficult to define the exact value to include. CATI is not considered to be representative. The figures that have been included come from ICAO Annex 10.

After further consideration, the following text has been added:

‘Note: For CATI ILS, a combination of high-frequency and low-frequency noise would be more representative of the actual noise experienced in-service.’

comment 75

comment by: DGAC/DSNA/DTI/CNS/NAV

§2.1.5 :

First sentence : The representation of the Glide Path noise by a white noise passed through a low-pass first-order filter of time constant 0.5 sec may not be adequate as too different from reality. Indeed, the Glide Path signal perturbation often looks like a bend of a lower frequency than a white noise. A more realistic noise model would be the sum of a low frequency component and a high frequency component.

Note : MLS noise model includes a low frequency component (2nd order filter) and a high frequency component (1st order filter).

Therefore, this sentence should be modified to include a more realistic noise model.

The rest of the paragraph is not aligned with ICAO Annex 10 standards :

- The zone at which these values apply should be included.
- Facility Performance CAT II/III structure values vary depending on the zone which is not reflected in CS-AWO.

response Partially accepted

The following text has been added:

‘Note: For CATI ILS, a combination of high-frequency and low-frequency noise would be more representative of the actual noise experienced in-service.’

For the whole of the approach path, the output of the filter should be set to a two-sigma level of:

— 0.035 DDM up to point ‘C’ for facility performance Type I; and

— 0.023 DDM up to ILS reference datum (point ‘T’) for facility performance Type II or III.

Note: ICAO Annex 10 section 3.1.5.4 defines higher value prior point ‘B’ for Type II or Type III facilities. Since the model is intended to be used only below 500 ft, the increase value prior point B may not be considered.’

comment 118

comment by: AIRBUS

The following text is not consistent with the content as it includes all ILS categories :

"The values given are derived from the performance characteristics for Category II ILS"



response	<p>Please reword it as follows :</p> <p>"The values given are derived from the performance characteristics for Category II ILS"</p> <p>Accepted</p> <p>'Category II' deleted.</p>
comment	<p>119 comment by: AIRBUS</p> <p>Reference to ICAO Annex 10 is obsolete (not the latest amendment).</p> <p>Please correct as follows:</p> <p>ICAO Annex 10, Volume 1, six Edition dated July 2006 at Amendment No. 90</p>
response	<p>Accepted</p> <p>Reference amended.</p>
comment	<p>120 comment by: AIRBUS</p> <p>2.1.1 Glide path angles</p> <p>The wording of § 2.1.1 is quite confusing. Our understanding of the intend is:</p> <p>(a) that glide slope considered in the demonstration are defined (b) to recommend glide range to be considered.</p> <p>We propose to reword as follows :</p> <p>2.1.1 Glide Path Angles.</p> <p>It should be assumed that the operationally preferred glide path angle is 3°. Minimum and maximum glides path angle slope considered in the demonstrations should be defined and the system should meet all applicable requirements with the defined limits.</p> <ul style="list-style-type: none"> - For CAT I operations it is recommended to cover at least 2.5° to 3.5° glide slope range - For CAT II or CAT III operations it is recommended to cover 2.5° to 3° glide slope range
response	<p>Accepted</p> <p>Text changed to read:</p> <p>'It should be assumed that the operationally preferred glide path angle is 3°. The system should be shown to meet all applicable requirements with promulgated glide path angles from 2.5° to 3°. Minimum and maximum glide path angle slopes considered in the demonstrations should be defined and the system should meet all applicable requirements</p>



within the defined limits. Where certification is requested for the use of a larger beam angle, the performance on such a beam should be assessed.'

comment 122

comment by: EUROCONTROL

p. 102 - Just testing a linear ramp is rather simplistic and unlikely to be representative of actual, most challenging ILS errors encountered in operations. Supporting autopilot cert would have to distinguish between capture and tracking. Most of the problems we hear about are with capture, sometimes on ILSes which are fully in line with Annex 10.

response Not accepted

The selected means of testing using a linear ramp is considered to provide a suitable means to determine the response of the system.

comment 125

comment by: AIRBUS

The note "*This model is primarily intended to simulate the characteristics of beams at low altitude, and therefore results derived from its use should not be relied on for heights above 150 m (500 ft).*" is located in a § 2.1.5 Glide path structure.

Therefore one can believe that the ILS model for LOC is not concerned by this note. Experts in ILS have expressed concerns that LOC model proposed in this Appendix suggest to make this note applicable also to LOC signal as proposed model in particular for CAT I Localizer course structure.

We propose to move the Note before §2.1 (Page 100) to make it applicable to Glide and LOC.

response Accepted

This is also applicable to the LOC.

Note added to (1):

'This model is primarily intended to simulate the characteristics of beams at low altitude and, therefore, results derived from its use should not be relied on for heights above 150 m (500 ft).'

comment 131

comment by: AIRBUS

2.2.2 Displacement sensitivity

The propose definition is not consistent with ICAO Annex 10 definition. Value is specified at _____ point _____ T.



response	<p>It should be assumed that the nominal displacement sensitivity at the threshold has the value of 0.00145 DDM/m.</p> <p>Airbus suggests to change wording to:</p> <p>It should be assumed that the nominal displacement sensitivity at the ILS reference datum (Point "T") has the value of 0.00145 DDM/m.</p> <p>Accepted</p> <p>Please see the response to comment #12.</p>
comment	<p>135 comment by: AIRBUS</p> <p>Attachment #4</p> <p>The proposed wording may be confusing, and not always aligned with ICAO Annex 10, in particular for low class ILS, the localiser performance is unknown and no assumption can be made on the signal quality.</p> <p>Airbus suggest to change wording to:</p> <p>2.2.3 Course Structure.</p> <p>For the purposes of simulation, the noise spectrum of ILS localizers may be represented by a white noise passed through a low pass first order filter of time constant 0.5 sec. The two-sigma level value of filter output should be set according to minimum class of ILS considered as per the following Table 1. (in attachment)</p>
response	<p>Accepted</p> <p>The following text and table have been added:</p> <p>‘The two-sigma level value of filter output should be set according to minimum class of ILS considered as per the following Table’</p>



ILS Class	Point B	Point C	Point T	Point D	Point E
I.A.x I.B.x	0.015 DDM	Unknown Localiser signal performance			
I.C.x	0.015 DDM	Unknown Localiser signal performance			
I.T.x	0.005 DDM		Unknown Localiser signal performance		
I.D.x	0.005 DDM			Unknown Localiser signal performance	
I.E.x	0.005 DDM				
II.T.x	0.005 DDM	Unknown Localiser signal performance			
II.D.x	0.005 DDM			Unknown Localiser signal performance	
II.E.x or III.E.x	0.005 DDM				

comment 170

comment by: *The Boeing Company*

Page: 100

Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 2.1.6

THE PROPOSED TEXT STATES:

“2.1.6 Glide fault mode”

REQUESTED CHANGE:

Delete this section.

JUSTIFICATION:

This is a significant change to the glideslope model which has served well for over 40 years. Service experience includes large numbers of automatic landings at type I, type II and type III ILS facilities with no known reports of glideslope faults as described in this section, nor are we aware of any analysis that shows a plausible failure mode that would exhibit this kind of effect. A low rate glideslope ramp failure, as described in this section, may be difficult to detect and could be confused with minor deviations caused by external disturbances such as thermals, winds, etc.

response Not accepted

There is a need to consider this type of failure in the glideslope model. There are currently no identified alternatives to this methodology that takes this failure into account.

ICAO Annex 10 Section 3.1.5.7 *Monitoring* and in particular Section 3.1.5.7.3.1 take into account the glideslope.



comment 171

comment by: *The Boeing Company*

Page: 102

Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A "Models" 2.2.4

THE PROPOSED TEXT STATES:

"2.2.4 Localiser fault mode"

REQUESTED CHANGE:

Delete this section.

JUSTIFICATION:

This is a significant change to the localizer model which has served well for over 40 years. Service history includes large numbers of automatic landings at type I, type II and type III ILS facilities with no known reports of localizer faults as described in this section, nor are we aware of any analysis that shows a plausible failure mode that would exhibit this kind of effect. A low rate localizer ramp failure, as described in this section, may be difficult to detect and could be confused with minor deviations caused by external disturbances such as asymmetric reverse thrust, asymmetric speedbrake deployment, asymmetric braking, nose wheel steering failures, winds, etc.

response Not accepted

There is a need to consider this type of failure in the localiser model. There are currently no identified alternatives to this methodology that takes this failure into account.

comment 252

comment by: *Embraer S.A.*

CAT I course alignment error should be based on ICAO standards.

Rationale

ICAO Annex 10 paragraph 3.1.3.6 states that CAT I localizers shall be adjusted and maintained within limits of 35ft. ICAO Annex 10 paragraph 3.1.3.6 even states that a shift more than 35ft requires initiation of monitoring action. The following proposal considers 35ft as three-sigma deviations for course alignment of CAT I localizers (one-sigma deviation of 11.7ft), instead of one-sigma as 15ft.

Suggestion

Proposed changes:

From:

2.2.1 Course alignment accuracy

It should be assumed that at the threshold the standard deviation of the course line about the centre line is:

- 4.5 m (15 ft) for facility performance type I; and.
- 1.5 m (5 ft) for facility performance types II or III.



	<p>To:</p> <p>2.2.1 Course alignment accuracy It should be assumed that at the threshold the standard deviation of the course line about the centre line is:</p> <ul style="list-style-type: none"> — 4.5 m (15 ft) 4.0 m (12 ft) for facility performance type I; and. — 1.5 m (5 ft) for facility performance types II or III.
response	<p>Partially accepted</p> <p>Value changed to '3.5 m (12 ft)' (please see the response to comment #11).</p>

4 GLS-in-space model	p. 103-120
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comment	<p>25</p> <p>GLS Signal in space Model; fault mode generator, Page 110 Recommend: Fix the broken bookmarks.</p>	comment by: <i>FAA</i>
response	<p>Accepted</p> <p>Bookmark links fixed.</p>	

comment	<p>26</p> <p>4.8 Integrity and Continuity, second sentence, page 113 Typo: delete "is" from "guidance is can be..."</p>	comment by: <i>FAA</i>
response	<p>Accepted</p> <p>Typo corrected.</p>	

comment	<p>70</p> <p>Appendix 1 section 4.7 Fault mode generator (Page 110): There is a broken cross-reference. It contains the text "[Error! Bookmark not defined.]".</p>	comment by: <i>Garmin International</i>
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response Accepted
Cross reference repaired.

comment 123 comment by: EUROCONTROL

p. 103 - GLS signal model : Errors in cross-references (2 instances).

To correct.

response Accepted
Cross references repaired.

comment 172 comment by: The Boeing Company

Page: 104
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.1 Figure 4: GLS NSE generator

THE PROPOSED TEXT STATES:

“NSE_{atr}” and “NSE_{ver}”

REQUESTED CHANGE:

Replace NSE_{atr} with NSE_{atr} and replace NSE_{ver} with NSE_{vert}

JUSTIFICATION:

Typographical error.

response Accepted
Figure 4 terminology corrected.

comment 173 comment by: The Boeing Company

Page: 106
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.3

THE PROPOSED TEXT STATES:

“where the parameters of the function are dependent on the GBAS approach service type as given in Table 3:”

REQUESTED CHANGE:



where the parameters of the function are dependent on the GBAS approach service type as given in ~~Table 3~~ **Table 4**:

JUSTIFICATION:
Typographical error.

response Accepted
Typo corrected.

comment 174

comment by: *The Boeing Company*

Page: 106
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.3 Table 4

THE PROPOSED TEXT STATES:
Table 4 column header: “ K_{xtrk_max} , $K_{atrk\ max}$ ”

REQUESTED CHANGE:
Please add an underscore between atrk and max: ~~$K_{atrk\ max}$~~ with K_{atrk_max}

JUSTIFICATION:
Typographical error.

response Accepted
Typo corrected.

comment 175

comment by: *The Boeing Company*

Page: 106
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.3

THE PROPOSED TEXT STATES:
“If the random pick from a distribution between 0 and 1 results in $K_{xtrk} > K_{xtrk_max}$ or $K_{xttrk} > K_{xtrk_max}$,”

REQUESTED CHANGE:
If the random pick from a distribution between 0 and 1 results in $K_{xtrk} > K_{xtrk_max}$ or ~~$K_{xttrk} > K_{xtrk_max}$~~ $K_{atrk} > K_{atrk_max}$,

JUSTIFICATION:



	Typographical error.
response	Accepted Typo corrected.

comment	176	comment by: <i>The Boeing Company</i>
	<p>Page: 108 Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.7</p> <p><u>THE PROPOSED TEXT STATES:</u> “4.7 Fault Mode Generator”</p> <p><u>REQUESTED CHANGE:</u> Insert the following text below the section title: The limit case or fault mode generator is illustrated in Figure 6.</p> <p><u>JUSTIFICATION:</u> Provides the reference to Figure 6.</p>	
response	Accepted The text ‘The limit case or fault mode generator is illustrated in Figure 6.’ has been added to paragraph 4.7.	

comment	177	comment by: <i>The Boeing Company</i>
	<p>Page: 109 Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.7</p> <p><u>THE PROPOSED TEXT STATES:</u> Unlabeled figure at the top of page 109.</p> <p><u>REQUESTED CHANGE:</u> Delete the figure as redundant to Figure 7 on page 111.</p> <p><u>JUSTIFICATION:</u> Typographical error.</p>	



response Accepted
Spurious Figure 7 removed.

comment 178 comment by: *The Boeing Company*

Page: 110
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.7

THE PROPOSED TEXT STATES:
Unlabeled figure at the top of page 110.

REQUESTED CHANGE:
Delete the figure as redundant to Figure 7 on page 111.

JUSTIFICATION:
Typographical error.

response Accepted
Spurious Figure 7 removed.

comment 179 comment by: *The Boeing Company*

Page: 110
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.7

THE PROPOSED TEXT STATES:
“the Pmd performance constrain with conditional probability (reference [Error! Bookmark not defined.],”

REQUESTED CHANGE:
the Pmd performance ~~constrain~~ **constraint** with conditional probability (reference ~~[Error! Bookmark not defined.]~~ [i],

JUSTIFICATION:
Typographical error.

response Accepted



Typo corrected.

comment 180

comment by: *The Boeing Company*

Page: 110

Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.7

THE PROPOSED TEXT STATES:

“The calculations to produce the plot in Figure 8 are described in detail in reference [Error! Bookmark not defined.]”

REQUESTED CHANGE:

The calculations to produce the plot in Figure 8 are described in detail in reference [Error! Bookmark not defined.] [x].

JUSTIFICATION:

Typographical error.

response Accepted

Typo corrected.

comment 181

comment by: *The Boeing Company*

Page: 112

Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.7

THE PROPOSED TEXT STATES:

“maximum values can be obtained by using additional geometry screening per reference [Error! Bookmark not defined.]”

REQUESTED CHANGE:

maximum values can be obtained by using additional geometry screening per reference [Error! Bookmark not defined.] [x]

JUSTIFICATION:

Typographical error.



response Accepted
Reference repaired.

comment 182 comment by: *The Boeing Company*

Page: 113
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.8

THE PROPOSED TEXT STATES:
“The probability of losing GLS guidance is can be assumed to be:”

REQUESTED CHANGE:
The probability of losing GLS guidance ~~is~~ can be assumed to be:

JUSTIFICATION:
Typographical error.

response Accepted
Typo corrected.

comment 183 comment by: *The Boeing Company*

Pages: 114-119
Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models” 4.9.2 to 4.9.7

THE PROPOSED TEXT STATES:
Figures 9 to 14

REQUESTED CHANGE:
Please correct the axis labels in the Figures.

JUSTIFICATION:
Typographical error.

response Accepted
The axis labels have been made more clear.



comment

253

comment by: *Embraer S.A.*

Typographical error.

Rationale

There are reference link errors on pages 110, 112 and 165.

Suggestion

Correct reference link errors on pages 110, 112 and 165.

response

Accepted

Reference link errors repaired.

Wind models for approach and landing simulation

p. 121

comment

44

comment by: *FAA*

2.1.3.2 Vertical component of turbulence, σ

Definition, Page 121 Incorrect value for σ is given. 2.8 km/h is 1.5kt, not 15kt.

The value for σ should be changed from 2.8km/h (15kt) to 2.8km/h (1.5 kt)

Rationale: correction

response

Accepted

Error corrected and figure changed to '1.5 kt'.

2.1 Windmodel number1

p. 121-127

comment

91

comment by: *Embraer S.A.*

Embraer suggests to delete the V20 speed unit (ft/sec) for the " $\sigma_W = 0.1061 V_{20}$ " equation. The correct units for this equation should be:

Where V_{20} is expressed in knots
Where σ_W is expressed in ft/sec

Embraer recommends to change the current text to the following one:

APPENDIX 1 TO AMC TO SUBPART A 'MODELS'

Wind models for approach and landing simulation



	<p>2.2 Wind model number 2</p> <p>2.2.3.2 Turbulence intensities and scale lengths</p> <p><i>At or above an altitude h1, turbulence is considered to be isotropic, i.e. the statistical properties of the turbulence components are independent. This means that one can consider the turbulence components to have equal intensities.</i></p> <p><i>Below h1, turbulence varies with altitude. In this case, intensity and scale length are expressed as functions of V20 (ft/sec) and altitude.</i></p> <p><u>Turbulence intensities</u></p> <p>$\sigma W = 0.1061 V20$</p> <p>Where V20 is expressed in knots Where σW is expressed in ft/sec</p>
response	<p>Accepted</p> <p>Text amended as suggested, and the units clarified by inserting the following:</p> <p>‘Where V20 is expressed in knots</p> <p>Where σW is expressed in ft/s</p>

comment	<p>92 comment by: Embraer S.A.</p> <p>Embraer suggests to include the correct units for the "$\sigma W = 0.0625 V20$" equation as following:</p> <p>Where V20 is expressed in knots Where σW is expressed in ft/sec</p> <p>Embraer recommends to change the current text to the following one:</p> <p>APPENDIX 1 TO AMC TO SUBPART A ‘MODELS’</p> <p>Wind models for approach and landing simulation</p> <p>2.3. Wind model number 3 (b) Para 2.2.3.2. Change $\sigma w = 0.1061 V20$ to $\sigma w = 0.0625 V20$ Where V20 is expressed in knots Where σW is expressed in ft/sec</p>
response	<p>Accepted</p> <p>The following text has been added:</p> <p>‘Where V20 is expressed in knots</p>



Where σ_W is expressed in ft/s'

comment

113

comment by: AIRBUS

The definition of Ω is incorrect. It should be Ω = spatial frequency [radians/metre].

Please replace the definition.

response

Not accepted

The unit for Ω is correct.

comment

114

comment by: AIRBUS

The definition of σ contains an incorrect unit conversion: 2.8km/h is converted in 15kt instead of 1.5kt

Please correct the definition.

response

Accepted

Text changed to '1.5 kt'.

comment

115

comment by: AIRBUS

Attachment [#5](#)

After Figure 15, Airbus suggests to add an acceptable approximate Gaussian distribution.

Please add the sentence "These cumulative probabilities could be approximate by a Gaussian distributions with characteristics as below" followed by the table in attachment.

response

Accepted

'These cumulative probabilities could be approximate by a Gaussian distribution with characteristics as below:...' added below Figure 15 and table added.

comment

184

comment by: The Boeing Company

Page: 121

Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A "Models", "Wind models for approach and landing simulation", 2.1.3.2



THE PROPOSED TEXT STATES:

“It may be assumed that the vertical component of turbulence has a spectrum of the form defined by equation (2) in paragraph 3.1.3.1. The following values have been in use:”

REQUESTED CHANGE:

It may be assumed that the vertical component of turbulence has a spectrum of the form defined by equation (2) in paragraph ~~3.1.3.1~~ **2.1.3.1**. The following values have been in use:

JUSTIFICATION:

Typographical error.

response Accepted

Text changed to read ‘2.1.3.1’.

comment 185

comment by: *The Boeing Company*

Page: 124

Paragraph: 2018-06(B) Appendix 1 to AMC to Subpart A “Models”, “Wind models for approach and landing simulation”, 2.2.3.3

THE PROPOSED TEXT STATES:

Turbulence intensity table.

REQUESTED CHANGE:

Align the columns in the turbulence intensity table.

JUSTIFICATION:

Typographical error.

response Accepted

Table columns realigned.

comment 209

comment by: *Rick Theriault*

Appendix 1 Models, Wind models for approach and landing simulation, 2.3 (c)

The comment on the wind in this section only mentions HUD approaches. AWOG 904A wind model should also be applicable to use during autoland certification. AC 20-191 (out



for public release) references AWOG 904A as appropriate for all Cat III flight guidance demonstrations, even though developed for manually flown pilot-in-the-loop operations. Wording in AC 20-191 reads as "Wind Model C is therefore more appropriate for use in Category III HUD certification programs; however, this does not preclude its use for other types of landing system."

response

Not accepted

The wind models that have been included in CS-AWO have been used on previous applications and have been shown to be appropriate for this usage.

AMC AWO.B.SACATI.101(a) Applicability and terminology

p. 129-130

comment

2

comment by: *Luftfahrt-Bundesamt*

Even for parts of CS-AWO which are applicable to CS-23, the guidance material in Book 2 refers in many cases to CS-25, we see a break in proportionality.

response

Not accepted

The AMC and supporting material refer in many cases to CS-25 due to the fact that equivalent material can often not be found in CS-23.

comment

13

comment by: *THALES*

What does the (e) visibility conditions mean? It shall not be part of a list of 'list of approach systems'. It may be a typo.

Thales proposal:

To remove (e)

response

Accepted

Paragraph (e) deleted (please see the response to comment #129).

comment

67

comment by: *THALES*

Bullet (f) may be confusing as the 'ILS or equivalent' is understood as ILS, MLS and GLS. It may include GNSS approaches....' as it may be understood that the GNSS approaches are limited to GLS whereas the intention is to have cover larger GNSS approaches possibilities.

Thales proposal:

To replace '(f) 'ILS or equivalent' is understood as ILS, MLS and GLS. It may include GNSS approaches if



response	<p>by : '(f) 'ILS or equivalent' is understood as ILS, MLS and GLS. It may include <u>other</u> GNSS approaches if</p> <p>Accepted</p> <p>Text changed to read: '(f) "ILS or equivalent" is understood as ILS, MLS and GLS. It may include other GNSS approaches if ...'</p>
comment	<p>124 comment by: EUROCONTROL</p> <p>p. 129 - There is not level of precision, integrity and continuity of an ILS CAT II at DH 150ft.</p> <p>Please specify the requirements.</p>
response	<p>Noted</p> <p>Assuming that the question relates to ILS CATI, then this will be part of the evaluation and the applicant would have to select the assumed precision, integrity and continuity at DH 150 ft.</p>
comment	<p>126 comment by: EUROCONTROL</p> <p>p. 129 - Typo: integriy -> integrity.</p> <p>To correct</p>
response	<p>Accepted</p> <p>Text corrected to 'integrity'.</p>
comment	<p>127 comment by: EUROCONTROL</p> <p>p. 129 - "The principle of SA CAT I operations is to provide a lower DH than the standard CAT I operation by mitigating ILS category 1 beam and reduced runway lighting by additional approach system requirements. These requirements intend to compensate for lower accuracy, integrity and time to alert of category 1 beams compared to those of category 2 beams, and provide assistance to acquire the visual cues required to complete the landing with reduced lighting." Several issues:</p> <p>1) section should not use terms "CAT I beam", but reference ILS facility performances according to ICAO Annex 10;</p> <p>2) CAT II TTA is lower, not higher that CAT I.</p> <p>Rephrase as: "The principle of SA CAT I operations is to provide a lower DH than the standard CAT I operation by mitigating ILS performance Category characteristics</p>



insufficient for CAT II operations and reduced runway lighting by additional approach system requirements. These requirements intend to compensate for lower accuracy and integrity and longer time to alert than those required for Category II operations and provide assistance to acquire the visual cues required to complete the landing with reduced lighting."

response Agreed

Text modified as suggested to read:

'The principle of SA CATI operations is to provide a lower DH than the standard CATI operation by mitigating xLS performance category characteristics that may be not suitable for CATII operations and reduced runway lighting by additional approach system requirements. These requirements intend to compensate for lower accuracy and integrity and longer time to alert than those required for CATII operations, and provide assistance to acquire the visual cues required to complete the landing with reduced lighting.'

comment 128 comment by: EUROCONTROL

p. 130 - (b) SVGS, as a combination of a synthetic vision system (SVS) and flight guidance based on ILS (or equivalent) displayed on the primary flight display or HUD (or equivalent), and high-precision position assurance monitoring. Several issues:

1) SVS is not defined.

Rephrase in line with CS AWO.A.SVGS.101

response Accepted

Paragraph reworded to read:

'(b) SVGS with flight guidance based on xLS displayed on the primary flight display or HUD (or equivalent), and high-precision position assurance monitoring.'

comment 129 comment by: EUROCONTROL

p. 130 - (e) refers to visibility condition as a system.

Please clarify what system is meant here.

response Accepted

Paragraph (e) deleted as it was an error.

comment 186 comment by: The Boeing Company



	<p>Page: 130 Paragraph: 2018-06(B) Subpart B AMC to Section 2, AMC AWO.B.SACATI.101(a)</p> <p>THE PROPOSED TEXT STATES: “(d) Automatic landing system alone, provided it is demonstrated that failures linked to category 1 beam can be recognised by pilot in low-visibility conditions. (e) visibility conditions.”</p> <p>REQUESTED CHANGE: (d) Automatic landing system alone, provided it is demonstrated that failures linked to category 1 beam can be recognised by pilot in low-visibility conditions. (e) visibility conditions.</p> <p>JUSTIFICATION: Typographical error.</p>
response	<p>Accepted</p> <p>Please see the response to comment #129.</p>

comment	<p>224 comment by: Dassault-Aviation</p> <p><u>Text:</u> AMC AWO.B.SACATI.101(a) page 130 "Due to low-visibility procedures being required to be in place for SA CAT I operations, the following non-exhaustive list of approach systems may be considered for SA CAT I operation: ... (e) visibility conditions ..."</p> <p><u>Comment:</u> "Visibility conditions" is not an approach system</p> <p><u>Proposed change:</u> To remove the (e) proposal in the list of approach systems possible to do ILS SA CAT1</p>
response	<p>Accepted</p> <p>Please see the response to comment #129.</p>

comment	<p>242 comment by: ESSP SAS</p>
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SBAS approaches have not been included in the term 'ILS or equivalent' which only refers to ILS, MLS and GLS. SBAS performance in Europe, through EGNOS service, is compliant with the aviation requirements for Approach with Vertical Guidance (APV-I) and Category I precision approach as defined by ICAO in Annex 10.

CONCLUSION

SBAS approaches shall be incorporated in the "ILS or equivalent" because they are compliant with the aviation requirements for Category I precision approach according to ICAO in Annex 10, as ILS, MLS and GLS.

response Accepted

The definition of 'xLS' has been amended to be more inclusive of other technologies.

comment 243

comment by: *ESSP SAS*

SA-CAT I are operations for performing approaches on authorised Category 1 ILS with DHs below 60 m (200 ft) down to 45 m (150 ft) with additional approach system requirements (HUD, SVGS, Automatic approach systems,...). These system requirements intend to compensate for lower accuracy, integrity and time to alert of category 1 beams and provide assistance to acquire the visual cues required to complete the landing with reduced lighting.

If a CAT I is flown by the aircraft in a SA CAT I approach, there is no need to have a signal similar to ILS CAT II, as it is indicated in the definition, because this is supported by additional approach system requirements.

CONCLUSION

For this reason, we propose to modify the term 'ILS or equivalent' for being referred to CAT I instead of CAT II operations.

response Partially accepted

'ILS or equivalent' changed to 'xLS' with the category stated afterwards.

comment 257

comment by: *GSA*

The term 'ILS or equivalent' should be modified to refer to CAT I instead of CAT II, and SBAS should be added as well.

According to the introductory text, SA-CAT I are operations for performing approaches on authorised Category 1 IRE with DHs below 60 m (200 ft) down to 45 m (150 ft) with additional approach system requirements (HUD, SVGS, Automatic approach systems,...). These system requirements intend to compensate for lower accuracy, integrity and time



to alert of Cat 1 beams and provide assistance to acquire the visual cues required to complete the landing with reduced lighting.

Therefore If a CAT I is flown by the aircraft in a SA CAT I approach, there would be no need to have a signal similar to ILS CAT II, because this is supported by additional approach system requirements. For this reason, we propose to modify the term 'ILS or equivalent' for being referred to CAT I instead of CAT II operations.

In fact, the current text includes GLS approaches in the term 'ILS or equivalent', when GBAS does not currently support operations to CAT II. If the text refers to CAT I, both GLS and SBAS should be included.

response

Accepted

The definition of 'xLS' includes 'GLS' and 'SBAS', and the references to 'ILS or equivalent' have been changed to 'xLS' where appropriate.

AMC AWO.B.SACATI.111 Installed equipment p. 130-131

comment

14

comment by: THALES

1) As for AMC AWO.B.SACATII.111 (it is added in this NPA for CAT II). The standard ' (5) 'Combined ILS/MLS/GPS/GLS receivers,...' shall be added in the list.

2) This addition shall include the standalone GLS receiver.

3) When there is a issue of the document mentioned, the tag 'or later revision' shall be added in order the regulation to be ready for future issues of standards.

Thales proposal:

To add the following standard in the list:

'(5) GLS receivers, or combined ILS/MLS/GPS/GLS receivers, or combined ILS/GPS/GLS receivers, complying with the minimum performance standards of EUROCAE ED-88, RTCA DO-246E or later revision, and RTCA DO-253D or later revision, or equivalent standards.'

response

Accepted

The following text has been added:

'(5) GLS receivers, or combined ILS/MLS/GPS/GLS receivers, or combined ILS/GPS/GLS receivers, that comply with the minimum performance standards of EUROCAE ED-88, RTCA DO-246E or later revision, and RTCA DO-253D or later revision, or equivalent standards.'

comment

69

comment by: THALES



response	<p>The sentence ' (a) ILS and MLS airborne equipment standards' is too limiting and not in accordance with the modifications proposed for the equivalent CAT II AMC AWO.B.CATII.111 ' (a) xLS airborne equipment standards'</p> <p><u>Thales proposal:</u> To replace for coherency: ' (a) ILS and MLS airborne equipment standards' by ' (a) xLS airborne equipment standards'</p> <p>Accepted</p> <p>Text changed to 'xLS'.</p>
comment	<p>130 comment by: <i>EUROCONTROL</i></p> <p>p. 130 - (a) does not mention GBAS receivers although GLS is allowed is equivalent ILS performance can be demonstrated.</p> <p>Please add : Combined ILS/MLS/GPS/GLS receivers, or combined ILS/GPS/GLS receivers, complying with the minimum performance standards of EUROCAE ED-88, RTCA DO-246E, and RTCA DO-253D, or equivalent standards.</p>
response	<p>Accepted</p> <p>Please see the response to comment #14.</p>
comment	<p>187 comment by: <i>The Boeing Company</i></p> <div style="border: 1px solid black; padding: 5px;"> <p>Page: 130 Paragraph: 2018-06(B) Subpart B AMC to Section 2, AMC AWO.B.SACATI.111(a)</p> <p><u>THE PROPOSED TEXT STATES:</u> The proposed text provides ILS and MLS airborne equipment standards.</p> <p><u>REQUESTED CHANGE:</u> Replace the text of AMC AWO.B.SACATI.111(a) with the text of AMC AWO.B.CATII.111(a).</p> <p><u>JUSTIFICATION:</u> The text of AMC AWO.B.CATII.111(a) is identical to that of AMC AWO.B.SACATI.111(a) with the exception that it addresses xLS airborne equipment standards, and contains an additional paragraph (5) which provides the minimum performance standards for combined ILS/MLS/GPS/GLS receivers, or combined ILS/GPS/GLS receivers.</p> </div>



response Accepted

Please see the response to comment #14.

comment 227

comment by: EUROCONTROL

AMC AWO.B.SACATI.111

(a) does not mention GBAS receivers although GLS is allowed is equivalent ILS performance can be demonstrated.

Proposed change

Please add : Combined ILS/MLS/GPS/GLS receivers, or combined ILS/GPS/GLS receivers, complying with the minimum performance standards of EUROCAE ED-88, RTCA DO-246E, and RTCA DO-253D, or equivalent standards.

response Accepted

Please see the response to comment #14.

AMCAWO.B.SACATI.120 xLS navigation means (including signal-in-space) failure

p. 132-133

comment 188

comment by: The Boeing Company

Page: 132

Paragraph: 2018-06(B) Subpart B AMC to Section 2, AMC AWO.B.SACATI.120

THE PROPOSED TEXT STATES:

“Navigation means (including signal-in-space) should ensure a minimum vertical clearance of 1 m (3 ft) from the obstacle clearance surface including height loss during the missed approach if applicable in the event of a failure (detected or undetected). If crew action is required to trigger a missed approach procedure, a standard delay of 1 s should be considered after crew detection. Probability of exceeding the 1 m (3 ft) clearance from the obstacle clearance surface due to navigation means shall be demonstrated lower than 10⁻⁷ per approach.”

REQUESTED CHANGE:

It is requested that this requirement be clarified.

JUSTIFICATION:

It is not clear as to whether this requirement applies to the non-aircraft system, or the aircraft system. It is also not clear as to how compliance to this requirement could be shown.



response

Accepted

The text of 'CS SACATI.120' changed to include '(facilities external to the aircraft)'.

'facilities external to the aircraft' also added to all occurrences of 'Navigation means', where appropriate.

comment

189

comment by: *The Boeing Company*

Page: 132

Paragraph: 2018-06(B) Subpart B AMC to Section 2, AMC AWO.B.SACATI.120

THE PROPOSED TEXT STATES:

"In addition, if automatic landing is provided, it should be demonstrated that the probability of landing outside the limits that define a safe landing due to navigation means is lower than 10^{-7} ."

REQUESTED CHANGE:

~~In addition, if automatic landing is provided, it should be demonstrated that the probability of landing outside the limits that define a safe landing due to navigation means is lower than 10^{-7} .~~ **In addition, if the landing weather minima are predicated on use of the automatic landing system, then the automatic landing system performance should be demonstrated to meet the performance criteria of AMC AWO.A.ALS.106.**

JUSTIFICATION:

AMC AWO.A.ALS.106 provides the performance criteria for an automatic landing system.

response

Not accepted

The ALS should already comply with AMC AWO.A.ALS.106, and this requirement is added to consider the failure of the navigation means which are not required by AMC.AWO.A.ALS.106.

AMC AWO.B.CATII.111 Installed equipment

p. 135

comment

132

comment by: *EUROCONTROL*

	<p>p. 135 - Item (5): references to DO-246E and DO-253D should be verified prior to publication, as they may be replaced by a new version by that time.</p> <p>Verify DO versions before publication.</p>
response	<p>Not accepted</p> <p>Later amendments of standards are not automatically accepted by EASA.</p>

comment	<p>228 comment by: EUROCONTROL</p> <p>AMC AWO.B.CATII.111 Item (5): references to DO-246E and DO-253D should be verified prior to publication, as they may be replaced by a new version by that time</p> <p>Verify DO versions before publication</p>
response	<p>Not accepted</p> <p>Later amendments of standards are not automatically accepted by EASA.</p>

AMC AWO.B.CATII.112 Minimum equipment	p. 135
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comment	<p>27 comment by: FAA</p> <p>AMC AWO.B.CATII.112 Minimum equipment, page 135 Not sure what the intent of the statement One xLS receiver may be unserviceable if it is justified by an SSA. Should “unserviceable” change to “acceptable”? Update the statement to clarify its intent.</p>
response	<p>Not accepted</p> <p>The current wording expresses the possibility to have a loss of a single xLS receiver. The acceptability of only having a single xLS receiver remaining is a different case.</p>

AMC AWO.B.CATII.113 Flight demonstration	p. 135-139
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comment	<p>43 comment by: FAA</p> <p>Page 137 Section 1.3, first par, line 2 Typo correct “to demonstated “ to “to demonstrate”</p>
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response Accepted
Text changed to read 'to demonstrate'.

comment 46 comment by: FAA
Page 136 section 1.1.1 part c Correct the equation; alpha is not shown in the equation

response Accepted
Equation in paragraph (c) corrected.

comment 133 comment by: EUROCONTROL
p. 135 - Flight path control- change "ILS and/or MLS ground facility" to "xLS Ground facility" is required, as GLS also has a facility classification with different levels.
Change.

response Accepted
Text changed to read 'xLS ground facility'.

comment 190 comment by: The Boeing Company

Page: 139
Paragraph: 2018-06(B) Subpart B AMC to Section 3, AMC AWO.B.CATII.113 1.2 Figure 2

THE PROPOSED TEXT STATES:
Figure 2

REQUESTED CHANGE:
Make numbers on x-axis visible. Two of the scaling numbers were blocked by the X-axis title.

JUSTIFICATION:
Typographical error.

response Accepted
The latest version does not have any blocked numbers on the X-axis.



comment	197	comment by: <i>The Boeing Company</i>
	Attachment #6	
	Due to the limitation of the EASA CRT tool of transferring equation, we have included the attached file with multiple places that had equations.	
response	Accepted	
	Equations and diagrams amended as suggested.	

comment	229	comment by: <i>EUROCONTROL</i>
	AMC AWO.B.CATII.113	
	Flight path control- change "ILS and/or MLS ground facility" to "xLS Ground facility" is required, as GLS also has a facility classification with different levels	
	To be changed	
response	Accepted	
	Text changed to read 'xLS ground facility'.	

APPENDIX 1 TO AMC AWO.B.CATII.113

p. 140

comment	134	comment by: <i>EUROCONTROL</i>
	p. 140 - Item (2): replace ILS and/or MLS by xLS throughout (3 instances).	
	To replace.	
response	Accepted	
	Three instances of 'ILS and/or MLS' changed to 'xLS'.	

comment	230	comment by: <i>EUROCONTROL</i>
	APPENDIX 1 TO AMC AWO.B.CATII.113	
	item (2): replace ILS and/or MLS by xLS throughout (3 instances)	
response	Accepted	



Please see the response to comment #134.

2 Numerical analysis

p. 140-145

comment 197 ❖

comment by: *The Boeing Company*

Due to the limitation of the EASA CRT tool of transferring equation, we have included the attached file with multiple places that had equations.

response Accepted

Equations and diagrams amended as suggested.

AMC AWO.B.CATIII.101(a) Applicability and terminology

p. 148-151

comment 63

comment by: *UK CAA*

Page No: 150

Paragraph No: AMC AWO.B.CATIII.101(a), Characteristics of the types of operation, paragraph (a), 1st sub-paragraph

Comment: The statement as written is slightly confusing. It is suggested the sentence is amended for easier understanding.

Justification: Clarity

Proposed Text:

The RVR required by a pilot to make the decision to land from a DH below 30 m (100 ft) is less than ~~that needed~~ **the RVR required for a DH** at 30 m (100 ft).

response Accepted

The text 'the RVR required for a DH' added to the sentence.

comment 64

comment by: *UK CAA*

Page No: 150

Paragraph No: AMC AWO.B.CATIII.101(a), Characteristics of the types of operation, paragraph (a), midway through 2nd sub-paragraph



Comment: The term 'visibility conditions' would be more appropriate in this context.

Justification: Clarity

Proposed Text:

... The RVR limit is set by the responsible national authority in accordance with applicable operating regulations and provides ~~visibility~~ **an assessment of the visibility conditions** at and below the DH so that, if either the landing system or the xLS ground facility fails when the aeroplane is below the DH, the pilot can carry out a manual landing with an acceptable safety level.

response

Accepted

'an assessment of the visibility conditions' added to the sentence.

comment

66

comment by: UK CAA

Page No: 150

Paragraph No: AMC AWO.B.CATIII.101(a), Characteristics of the types of operation, paragraph (b), midway through 2nd sub-paragraph)

Comment: RVR and visibility are used interchangeably.

Justification: Accuracy

Proposed Text:

... The main purpose of the DH is so that the pilot can assess the adequacy of the visibility **conditions** before touchdown and prepare to take over visual manual control. It is desirable that the DH be late in the flare after the major pitch changes have taken place, and that an automatic go-around system be fitted. There exists an unknown probability that, although the ~~visibility~~ **RVR** is reported to be adequate, denser patches of fog may lie on the runway, and it is thought prudent to add a margin to the bare minimum required to control the ground roll. ...

response

Accepted

'conditions' and 'RVR' added as proposed.

comment

136

comment by: EUROCONTROL

p. 150 - Characteristics of the types of operation : "(1) a Category III or a Category II ILS complying with the Category III standards of ICAO Annex 10, Chapter 3-1 in respect of all significant performance parameters, at least down to ILS point D, 900 m (3 000 ft) from the runway threshold"



response	<p>Annex10 is replacing the above by Facility Performance Category. This should be done here as well.</p> <p>Change to "(1) a Facility Performance Category III or a Facility Performance Category II ILS complying with the Facility Performance Category III standards of ICAO Annex 10, Chapter 3-1 in respect of all significant performance parameters, at least down to ILS point D, 900 m (3 000 ft) from the runway threshold".</p> <p>Accepted</p> <p>'Facility Performance' added in three instances.</p>
comment	<p>137 comment by: EUROCONTROL</p> <p>p. 150 - (3) a GAST D GLS complying with the requirements of ICAO Annex 10.</p> <p>Typo: 10 before ICAO to be removed.</p>
response	<p>Accepted</p> <p>Please see the response to comment #191.</p>
comment	<p>138 comment by: EUROCONTROL</p> <p>p. 151 - Last phrase - use Facility Performance Category for ILS.</p> <p>Change to "The ground guidance system (Facility Performance Category III ILS, or Category III MLS or GAST D GLS)..."</p>
response	<p>Accepted</p> <p>'Facility Performance' added to the sentence.</p>
comment	<p>139 comment by: EUROCONTROL</p> <p>p. 151 - Last phrase - additional continuity requirement.</p> <p>GLS does not have a Ground Subsystem only continuity requirement to this level, but a total system requirement; rephrase: "...and an ILS/MLS continuity of service objective of 1-(2 x 10-6) or a GLS continuity of service objective as stated in Annex 10 Appendix B 3.6.7.1.3.2."</p>
response	<p>Accepted</p> <p>Text has been added as follows:</p>



‘...and an ILS/MLS continuity of service objective of $1-(2 \times 10^{-6})$ or a GLS continuity of service objective as stated in Annex 10 Appendix B section 3.6.7.1.3.2.’

comment 191

comment by: *The Boeing Company*

Page: 150

Paragraph: 2018-06(B) AMC to Section 4, AMC AWO.B.CATIII.101(a) (a) (3)

THE PROPOSED TEXT STATES:

“(3) a GAST D GLS complying with the requirements of 10 ICAO Annex 10.”

REQUESTED CHANGE:(3) a GAST D GLS complying with the requirements of ~~10~~ ICAO Annex 10.**JUSTIFICATION:**

Typographical error.

response Accepted

Typo corrected.

comment 192

comment by: *The Boeing Company*

Page: 151

Paragraph: 2018-06(B) AMC to Section 4, AMC AWO.B.CATIII.101(a) (b)

THE PROPOSED TEXT STATES:

“The ground guidance system (xLS) is as described in point (a)(1) above,”

REQUESTED CHANGE:The ground guidance system (xLS) is as described in point (a)(~~1~~) above,**JUSTIFICATION:**

Typographical error.

response Accepted

Text changed to ‘(a)’.



comment	231	comment by: EUROCONTROL
	AMC AWO.B.CATIII.101(a) Characteristics of the types of operation typo: 10 before ICAO to be removed (3) a GAST D GLS complying with the requirements of ICAO Annex 10.	
response	Accepted Type of operation deleted (please see the response to comment #191).	

comment	232	comment by: EUROCONTROL
	AMC AWO.B.CATIII.101(a) Characteristics of the types of operation last phrase - additional continuity requirement GLS does not have a Ground Subsystem only continuity requirement to this level, but a total system requirement; rephrase: "...and an ILS/MLS continuity of service objective of 1-(2 x 10 ⁻⁶) or a GLS continuity of service objective as stated in Annex 10 Appendix B 3.6.7.1.3.2."	
response	Accepted The following text has been added: '...and an ILS/MLS continuity of service objective of 1-(2 × 10 ⁻⁶) or a GLS continuity of service objective as stated in Annex 10 Appendix B section 3.6.7.1.3.2.'	

AMC AWO.B.CATIII.113 Installed equipment

p. 152-153

comment	140	comment by: EUROCONTROL
	p. 152 - Item (5): references to DO-246E and DO-253D should be verified prior to publication, as they may be replaced by a new version by that time. Verify DO versions before publication.	
response	Not accepted Later versions of standards are not automatically accepted by EASA.	

comment	233	comment by: EUROCONTROL
	AMC AWO.B.CATIII.113	



	<p>Item (5): references to DO-246E and DO-253D should be verified prior to publication, as they may be replaced by a new version by that time</p> <p>Verify DO versions before publication</p>
response	<p>Not accepted</p> <p>Later versions of standards are not automatically accepted by EASA.</p>

AMC1 AWO.B.CATIII.121 Flight demonstrations of failure conditions

p. 158

comment	<p>246</p> <p>comment by: AIRBUS</p> <p>FAA AC 20-191 includes the following statement in §5.2.11.1.7: "Malfunction cases may be considered under nominal environmental conditions."</p> <p>AIRBUS suggests that a similar statement is added in AMC1 AWO.B.CATIII.121 for harmonization.</p>
response	<p>Not accepted</p> <p>It is considered that the term 'nominal environmental conditions' introduces more ambiguity and does not help to understand the requirement.</p>

AMC2 AWO.B.CATIII.122(a) Safety of the manual landing and go-around manoeuvres following loss of automatic control capability for super fail-passive systems

p. 158-161

comment	<p>245</p> <p>comment by: AIRBUS</p> <p>AMC2 AWO.B.CATIII.122(a) §4.1</p> <p>EASA requests safe landing to be demonstrated of any single engine failure at any point during the approach. FAA AC 20-191 does not request this demonstration.</p> <p>AIRBUS requests harmonization on this topic. AIRBUS would agree on demonstrating "safe landing or safe go around".</p>
response	<p>Not accepted</p> <p>AC 120-28D requires the demonstration of a safe landing and a safe go-around following any failure condition not shown to be Extremely Improbable. This applies to engine failure.</p>



AMC2 AWO.B.CATIII.122(a) paragraph 4.1 actually clarifies that if the system provides automatic control of the rudder pedal, this automatic control should operate safely without pilot intervention after an engine failure. This should apply to both scenarios after an engine failure: continuation of automatic landing or an automatic go-around.

AMC AWO.B.CATIII.127(a) Aeroplane flight manual

p. 161

comment 204

comment by: *Rick Theriault*

AMC2 AWO.B.CATIII.122(a), Section 4

This section is under the heading specific to "Super Fail Passive" systems. It also prescribes that the system must be able to automatically land following an engine failure. Some existing systems can land for any failures following Alert Height, but are not allowed to proceed with a Autoland if the OEI happens prior to it. This section 1) seems overly prescriptive than expected and 2) only seems to pertain to Super-Fail Passive systems that also control the rudder/rollout. Shouldn't there be guidance for Fail-Operational that include rudder control?

response

Partially accepted

The title of AMC2 AWO.B.CATIII.122(a) has been amended to delete 'Super' and retains the term 'fail passive'.

APPENDIX 1 TO AMC AWO.B.CATIII.115

p. 162-167

comment 193

comment by: *The Boeing Company*

Page: 165

Paragraph: 2018-06(B) Appendix 1 to AMC AWO.B.CATIII.115 1.2

THE PROPOSED TEXT STATES:

"For a derivation of these expressions, see reference [Error! Bookmark not defined.] of Appendix 1 to AMC to Subpart A."

REQUESTED CHANGE:

For a derivation of these expressions, see reference [Error! Bookmark not defined.] [x] of Appendix 1 to AMC to Subpart A.

JUSTIFICATION:

Typographical error and references are not currently listed in Appendix 1 to AMC to Subpart A, but are on the last page (page 178).



response Accepted
 Error corrected (please see the response to comment #253).

AMC AWO.C.TOO.101 Applicability and terminology p. 168-169

comment 194 comment by: *The Boeing Company*

Page: 168
 Paragraph: 2018-06(B) Subpart C Takeoff, AMC to Section1, AMC AWO.C.TOO.101

THE PROPOSED TEXT STATES:
 “The requirements are based on the assumption that, if the take-off guidance system is based on ILS or MLS information”

REQUESTED CHANGE:
 The requirements are based on the assumption that, if the take-off guidance system is based on xLS ~~ILS or MLS~~ information

JUSTIFICATION:
 GLS may also be used for take-off guidance.

response Accepted
 Text changed to ‘xLS’.

AMC AWO.C.TOO.106 Performance p. 169

comment 28 comment by: *FAA*

AMC AWO.C.TOO.106 Performance (See also Figure 1), Page 169 Typo: change
 “maybe begun” to “may begin”

response Accepted
 Text changed to read ‘may begin’.



comment 195

comment by: *The Boeing Company*

Page: 169

Paragraph: 2018-06(B) Subpart C Takeoff, AMC to Section1, AMC AWO.C.TOO.106

THE PROPOSED TEXT STATES:

“The factors affecting the behaviour of the aeroplane include, for example, wind conditions, ILS and/or MLS ground facility characteristics“

REQUESTED CHANGE:

The factors affecting the behaviour of the aeroplane include, for example, wind conditions, ~~xLS ILS and/or MLS~~ ground facility characteristics

JUSTIFICATION:

GLS may also be used for take-off guidance.

response Accepted

Text changed to 'xLS'.

comment 196

comment by: *The Boeing Company*

Page: 169

Paragraph: 2018-06(B) Subpart C Takeoff, AMC to Section1, AMC AWO.C.TOO.106

THE PROPOSED TEXT STATES:

“For ILS- and/or MLS-based systems, compliance may be shown using an ILS and/or MLS, which complies with the requirements for Category III operations in relation to centring error and beam bends along the runway. Allowance may be made for long-term perturbations of the ILS or MLS localiser.“

REQUESTED CHANGE:

For ~~xLS ILS and/or MLS~~-based systems, compliance may be shown using an ~~xLS ILS and/or MLS~~, which complies with the requirements for Category III operations in relation to centring error and beam bends along the runway. Allowance may be made for long-term perturbations of the ~~xLS ILS or MLS~~ localiser.

JUSTIFICATION:

GLS may also be used for take-off guidance.

response Accepted

Text changed to 'xLS'.



comment	203	comment by: Rick Theriault
	AMC AWO.C.TOO.106	
	(b) does not indicate the number of EFC takeoffs - previous version of CS-AWO stated 3. Recommend updating AMC AWO.C.TOO.106 to include specific mention of the requirement to perform 3 engine fail continue takeoffs (AMC AWO 431).	
response	Accepted	
	Typo corrected to the original <i>CS-AWO Initial Issue</i> text.	

AMC AWO.C.TOO.111 Aeroplane flight manual — general
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p. 170

comment	29	comment by: FAA
	Attachment #7	
	Update Figure 1 on page 170 Replace the figure Update Figure 1 with the figure attached;	
	Rationale: The 14m lateral region addresses tracking on the runway surface. The pilot is expected to position the aircraft on the runway centerline. The takeoff guidance system, in addition to enabling satisfactory centerline tracking on the ground, should also lead to a combination of the airplane's position and track at the point of liftoff that would not result in significant deviations after liftoff.	
response	Accepted	
	Figure 1 replaced with the suggested figure.	

comment	117	comment by: AIRBUS
	Attachment #8	
	The value from Figure 1 (+/-14m) to be maintain up to 35ft after liftoff are difficult or impossible to achieve with asymmetrical thrust or cross wind. To maintain a straight trajectory while airborne with asymmetrical thrust or cross wind, bank angle or sideslip is required (with or without visibility). In good visibility condition, crew will never perform such maneuver at low altitude/low speed. Hence this criterion is never achieved in good visibility in such conditions when subject to asymmetrical thrust or cross wind.	



Requesting the crew to perform such a maneuvers in low visibility (apply significant bank and/or maintain significant sideslip after liftoff) does not seem to be beneficial for safety. When airborne, safe operation remains even if aircraft deviates from centerline thanks to lateral “inner transitional” surface clearance.

Therefore, Airbus suggests to replace Figure 1 by the one in attachment or harmonize with new AC20-191

Note: draft AC 20-191 Figure 3-1 request performance to be assess until V_{LOF}

In addition the following additional comment is included:
 3.2.3.6.7 When demonstrating compliance, the applicant can take into consideration testing techniques such as normal pilot technique for responding to engine failure, application of rudder, maintaining safe bank angles, rotating to suitable pitch attitudes, and compensating for crosswind, as necessary.

response

Accepted

Please see the response to comment #29.

comment

202 comment by: Rick Theriault

AMC AWO.C.TOO.108

Figure 1 depicts takeoff performance requirements following liftoff to 35 feet AGL. This previously was an FAA requirement that is being removed in the newly released version of AC120-28D based upon AWOHWG work in the development of AHI 1004. Recommend removing liftoff to 35 feet AGL quantitative performance requirements. Here are words from AHI 1004 for this topic: "Note 1: The application of the 14m lateral region is intended to address tracking on the runway surface. At the point of liftoff, the airplane track should not be diverging from the runway centerline. After liftoff, the system must enable the pilot to detect a divergence of the airplane’s track from the runway heading and, at least, to be able to arrest further deviation. Some additional deviation from runway centerline due to the effect of wind drift while the pilot is arresting the divergence would be acceptable. " In addition, AC 20-191 (Cat II/III airworthiness requirements) has been released for public review. The chart contained within AHI 1004 is duplicated in the AC. Recommend updating performance requirement in AMC AWO.C.TOO.108 to reflect harmonized performance criteria delineated in AHI 1004 and subsequently AC 20-191.

response

Accepted

Please see the response to comment #29.



3. Appendix — Attachments

 [AIRBUS on SBAS.pdf](#)

Attachment #1 to comment [#241](#)

 [EGGD \(Bristol\).PNG](#)

Attachment #2 to comment [#141](#)

 [Localizer structure.png](#)

Attachment #3 to comment [#74](#)

 [Two sigma level.PNG](#)

Attachment #4 to comment [#135](#)

 [Gaussian.PNG](#)

Attachment #5 to comment [#115](#)

 [B-H020-REG-18-TDS-43 - Cmts EASA NPA 2018-06.pdf](#)

Attachment #6 to comment [#197](#)

 [Figure1.JPG](#)

Attachment #7 to comment [#29](#)

 [Figure 1.PNG](#)

Attachment #8 to comment [#117](#)

