European Union Aviation Safety Agency

Comment-Response Document 2019-11

RELATED NPA: 2019-11 — RMT.0713 — 14.6.2021

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1. Summary of the outcome of the consultation

203 comments were received from 17 stakeholders. Table 1 below shows the number of comments received by each commentator:

Table 1

COMMENTATOR	# OF COMMENTS
AIRBUS	18
Airbus Helicopters	36
British Helicopter Association	2
DGAC France	1
European Cockpit Association	7
FAA	62
FOCA Switzerland	1
GAMA	1
Garmin International	15
General Aviation Manufacturers Association	28
HeliOffshore Ltd	1
Luftfahrt-Bundesamt	3
NHF Technical committee	2
Norwegian Helikopter Employee Association	1
Ratan Khatwa (Honeywell)	17
THALES-Avionics	3
UK CAA	5

Total: 203

The table 2 shows the number of comments submitted by stakeholders on each segment of the NPA:

Table 2

NPA 2019-11 SEGMENT	# OF COMMENTS
General comments	14
Executive summary	1
Introduction and explanatory notes	12
CS 29.1302 (including AMC 29.1302)	116
GM1 29.1302	1
GM2 29.1302	2
CS 27.1302	4
AMC 27.1302	51
GM2 27.1302	1
References	1

Total: 203

The majority of the comments submitted were either accepted or partially accepted, as shown in Table 3:

Table 3

	ACCEPTED	PARTIALLY ACCEPTED	NOTED	NOT ACCEPTED	Σ
# of occurrences	66	45	27	65	*203*
percentage	33 %	22 %	13 %	32 %	*100 %*

The individual comments and the EASA responses to them are contained in Chapter 2 of this Comment-Response Document (CRD).

A summary of the main comments received and of the most significant changes made compared with the text proposed in NPA 2019-11 is provided in Section 2.4 of the Explanatory Note to Decision 2021/010/R[1].

[1] https://www.easa.europa.eu/document-library/agency-decisions

2. Individual comments and responses

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

(a) **Accepted** — EASA agrees with the comment and any proposed amendment is wholly transferred to the revised text.

(b) **Partially accepted** — EASA either partially agrees with the comment, or agrees with it but the proposed amendment is only partially transferred to the revised text.

(c) **Noted** — EASA acknowledges the comment, but no change to the existing text is considered to be necessary.

(d) **Not accepted** — The comment or proposed amendment is not agreed by EASA.

(General Comments)	-

comment	*4* comment by: *DGAC France* Please note that DGAC France has no specific comments on this NPA.
response	Noted

comment	*5* comment by: *THALES Avionics* In a general way THALES Avionics thanks EASA for having organized an upstream consultation following RMT.0713 about these new CS requirements and corresponding AMC materials for rotorcraft Human Factors certification.
response	Noted

comment	*6* comment by: *THALES Avionics* THALES Avionics is also satisfied with the way EASA has taken into account our early comments and particularly in AMC 27 and 29.1302 section 3.3.1. "Certification strategy" where in subsection (e) the use of data provided by a supplier – of the applicant – is now allowed for compliance demonstration.
response	Noted

comment	*8* comment by: *UK CAA* **General comment:** Overall, the CAA UK fully supports the consideration of the relevance and appropriate application of 25.1302 to helicopters and the development of a helicopter specific 29/27.1302.
response	Noted

comment	*20* comment by: *British Helicopter Association*

	This NPA should await the report by the NTSB or national AAIB into the 2 x 737 Max accidents. There will be much to learn from the certification aspect on how crew HF played a part in the accidents. Furthermore the US authorities' review into the FAA/Boeing certification process for the aircraft systems and training system will bring many new factors to light. This B737 MCAS system would fall under Para 3.2.3(a)(3)(iv) of this NPA and as such may need some further expansion.
response	Not accepted These activities are different. The recommendations arising from the 737 MAX accidents are under review by EASA. Should any conclusion impact on the contents of CS 27/29.1302, it will be considered at a later stage. If needed, a new rulemaking task will be launched.

comment	*21* comment by: *British Helicopter Association* This NPA mainly deals with the primary HF categories but does not mention physiological effects. Agreed that this this a separate subject but it is very much related. For example: if a systems controls or indicators are position inappropriately then physiological factors come into play. An emergency busbar switch in the roof panel is liable to induce the 'leans' in a pilot if a large head movement is required when autopilot systems have failed as a result of a serious electrical failure. An example of this was the Sea Harrier where the IFF contoller was positioned on the rear of a cockpit side panel. One fatal accident was thought to have occurred when a pilot was given an IFF code change shortly after take-off IMC.
response	Noted The existing text of 3.2.5 already covers the issue described by the commentator.

comment	*71* comment by: *Garmin International* **General:** There is no mention of harmonization or even consultation with the FAA, TCCA or ANAC. Unilateral promulgation of rules has proven to be problematic in the past and there is no reason to believe unilateral promulgation of NPA 2019-11 will be any different, especially without substantiated evidence of safety benefit (see related comment about lack of substantiated benefit). Delay moving forward with NPA 2019-11 until consultation with the other primary authorities occurs and a clear safety case is made.
response	Noted A preliminary consultation with the stakeholders, including EASA international counterparts (such as the FAA and TCCA), has been performed before proceeding with the NPA publication. The comments submitted by the FAA have been largely accepted thus potentially ensuring harmonisation with the future amendments to the FARs. Coordination meetings with the FAA have been conducted after the publication of the NPA to ensure proper understanding of the comments received.

comment	*86* comment by: *LBA* LBA comment: AMC 27/29.1302 includes also a lot of information related other requirements such as CS27/29.771 or CS27/29.1329. Do you also plan to include a note in Book 2 of CS27/29 under each of these requirements to make aware of these information within AMC/GM 27/29.1302?
response	Not accepted Similarly to what has been done for the AMCs to CS-25, the amendment of the other AMCs to the certification specifications (CSs) referred to in AMC to 27/29.1302 is not foreseen.

comment	*87* comment by: *General Aviation Manufacturers Association* The preamble to this proposal does not mention or reference any proposed harmonized approach or consultation with FAA, TCCA or ANAC. Given the challenges experienced with the current EASA-FAA Bilateral Authority Safety Agreement (BASA), we would have expected that a coordinated Authority approach to rulemaking regarding human factors would achieve a bigger impact on safety than not. Further, the proposal does not highlight any safety data to support the claimed safety benefit. GAMA recommends a coordinated approach to the introduction of new regulations supporting the implementation of enhanced human factors requirements within the certification process.
response	Noted Please refer to the response to comment #71.

comment	*141* comment by: *FOCA Switzerland* The Federal Office of Civil Aviation (FOCA) from Switzerland supports the introduction of the ".1302" requirements into the CS29 and CS27 airworthiness standards. The complexity of current technologies and their integration into the aircraft require a structured HF approach. Such an approach has already proven successful with CS 25.1302. That being said, we wonder if a coordination has been made with FAA to develop this NPA. Indeed, some differences with FAA AC27.1 and MG-20 have been identified (SSDs). These differences will generate a significant workload for the US product validations (among other things, EASA will have to provide SSDs). Therefore we recommend reconsidering the need for coordination with other major Aviation Safety Agencies. Finally, the same type of requirements might become applicable to CS-23 products as well. In this case, it would be also essential to ensure proper coordination between CS-23 and FAR-23 requirements.

response | Noted
Please refer to the response to comment #71.

comment | *142* comment by: *HeliOffshore Ltd*

1. **Offer of assistance.** HeliOffshore welcomes this NPA which will make an important contribution to Helicopter Operational Safety. Our members include Helicopter Operators, Manufacturers, Training Organisations and Suppliers. We offer our assistance in the further development and implementation of this important NPA.
2. **Focus on support to safety priorities.** There should be a stronger focus on preventing known safety threats by better supporting effective human performance on safety critical functions. This will include suggestions to adopt a total system approach at all phases the system lifecycle. At present, there is a disproportionate emphasis on details of HMI design at the expense of system design which supports pilot performance on critical tasks.

   Design assumptions and the achievement of operational performance. A mechanism should be developed to communicate, amongst all key stakeholders, the key safety threats and the proposed set of mitigations. This will allow design assumptions and operational needs to be explicitly identified and assessed. This forms a valuable safety management information throughout the system lifecycle. Achievement of this goal may require the implementation of enhanced methods to ensure alignment of design, procedures and training in support of effective safety performance. It is important that this information is documented, tracked and communicated in a usable manner. It should facilitate review and oversight by a range of stakeholders with varying degrees of technical knowledge. This could include:

- identification of a list of priority safety critical scenarios and expected performance in foreseeable operational conditions; that can be used to assess how the combined system achieves safe operational performance. This list should be developed through consultation with operators and use of in-service data.

- a list of known safety related errors or situation developments that have been noticed in piloting on existing designs, supplied to the OEM by trainers and safety data analysts in the Operator and Training organisations.

- a list of designer assumptions about pilot understanding / actions that will be safety critical, supplied by the OEM to the teams producing procedures and training, and should also be available to operators and training organisations.

- Once the system has been certified, operators should monitor and feedback validation of the assumptions and any other pilot performance issues as part of their SMS.

These communication channels may already exist to varying extents, but are there formal mechanisms that allow individual front line experts to raise items in the same way as change

requests are raised under a controlled system? Are there requirements to ensure that it is done and achieved the desired outcome?

5. Simplify AMC. The AMC can be simplified so as not to give a false indication of the complexity of work required and to provide clearer insight into potential means of compliance. There is a large amount of general human factors practice included, which dilutes the message and can be referenced from other sources. The 1302 requirements should remain focused on characteristics of the product and its ability to support safe operations. However, the AMC may be clearer if it is structured around the system lifecycle. For example:

- Early in the requirement phase, operational scenarios and performance criteria should be developed to assess combined system against.
- Design, procedures and training should be developed concurrently to enable assessments of the combined system including the human in meeting operational safety goals.
- During design, systematic assessments of foreseeable human errors and their consequences should be completed. Errors with significant consequences should trigger consideration of additional resilience in design training and procedures. It is also important to consider how well the combined system positively supports effective human performance.
- During test and evaluation, the combined training procedures and design should be evaluated in operational scenarios to help validate that safe operational performance can be achieved.
- Design assumptions should be monitored in service by operators and any issues fed back to the OEMs.

6. When should this apply? Consideration should be given to any safety critical functions and systems a to help prioritise where added resilience in design, training, and procedures would be beneficial. In addition, further scrutiny should be applied to significant changes and considers the extent to which the system is new or novel, complex and/or integrated.

7. How much is enough? More information on ways to determine the extent of the required action would be useful. For example, prioritising based on safety critical functions where human performance should be optimised. It should also include clearer definition of the types of errors to be addressed and the level of action to address them. For example, using lists of know error types from operational experience (e.g., pilot monitoring, data input errors, difficulty quickly remembering actions associated with rare events, etc.). It is not expected that the design can successfully mitigate any action by the pilot, no matter how unlikely.

Specific comments. The positive benefits to human performance of reduced noise and vibration should be proactively considered in addition to their impact on pilot's ability to see and hear displays.

response

Not accepted

1. Noted

At this stage of the rulemaking process, much of the work has already been done. EASA has to evaluate the comments submitted by the stakeholders, but the overall structure of the requirements and of the related AMCs is considered consolidated. Indeed, a workshop involving affected stakeholders and international counterparts was held in 2019 before the NPA publication to discuss the overall concept.

2. Noted

EASA fully appreciates that safety is the result of both global approach and human factors considerations. Only a global approach, taking into account human performance from the very beginning of the design until the final operation phase of the system, could lead to a safer situation. That is the core of CS 29/27.1302, which links the actual system design and its interaction with the crew to the actual expected crew tasks by focusing on the human–machine interface (HMI) elements of the system. EASA believes that the establishment of the human factors requirements in the system design is just one the elements of the global approach.

3. & 4. Noted

AMC 27/29.1302 include considerations about the alignment of design, procedures and training in support of effective safety performance. Indeed, it assumes the usage of a proposed design using associated procedures by an appropriately trained crew. In doing so, assumptions taken into the training are considered while analysing and evaluating the design.

There are currently mechanisms in place to communicate, amongst all key stakeholders, the key safety threats and the proposed set of mitigations (for instance, the HF CAG).

Regarding the review of safety-related errors that occur during in-service life, this activity has already been mandated to manufacturers (ref. to point 21.A.3A of Part 21) and EASA already performs its own investigations of the reported occurrences. Nevertheless, EASA does not publish any list of known safety-related errors or situation developments that have been noticed in piloting on existing designs. Some improvements in this respect would be beneficial.

Manufacturers are, however, responsible for managing their occurrence databases and for implementing any safety improvement identified by the related investigation into the new designs.

EASA agrees with Helioffshore on the fact that further progress can be made to improve these communication channels. However, EASA considers that this is more related to a safety management system. It is, therefore, outside the scope of this rulemaking task that focuses on the implementation of 2x.1302 to rotorcraft.

5. Not accepted

Contrary to what is commonly believed, human factors does not rely on common sense. EASA considers that human factors is a highly complex field and, therefore, disagrees with the Helioffshore statement regarding AMC giving a false impression of complexity. As with any other discipline addressed through the CSs, an appropriate demonstration of compliance implies that the experts in charge have the necessary background and knowledge in human factors. To facilitate such compliance demonstration, the AMC provide applicants with acceptable methods and practices. For this reason, EASA considers it is of great value to add considerations about human factors practices into the AMCs. Nevertheless, the consideration provided in this AMC

is considered as the minimum baseline, and does not aim to substitute human factors expertise.

EASA concurs with the suggestion made by Helioffshore regarding the structure of the AMC and does believe that the current 2x.1302 covers more or less the same aspects. However, ultimately it is the applicant's responsibility to demonstrate compliance of their products with the regulation. In that way, AMC 2x.1302 recommends practices but still keeps the responsibility for compliance demonstration with the applicant. With respect to human factors, the CSs and AMCs are performance based and should not be prescriptive.

6. Not accepted

EASA considers that several layers are discussed in this comment. The classification of the change (significant versus not significant) does not have any impact on the level of scrutiny to be performed in order to demonstrate compliance with CS 27/29.1302 . As per AMC 27/29.1302, the level of scrutiny is defined by assessing the novelty, complexity and integration of the design item to be certified.

7. Noted

EASA considers that AMC 27/29.1302 already puts emphasis on the required human-error analysis. This way, the new AMC 27/29.1302 includes more detailed expected outcomes in terms of human-error analysis structure compared to current AMC 25.1302. However, it is to be noted that several methods, processes and classifications are valid to analyse errors; considering that the AMC is performance based, it is up to the applicant to define and propose a method to EASA.

Specific comments: Noted

The impact of noise and vibration on human performance is covered under 29.771(c) that states: 'Vibration and noise characteristics of cockpit equipment may not interfere with safe operation of the aeroplane.'

AMC 27/29.1302 lists this requirement among those to be considered in relation to CS 27/29.1302 compliance demonstration.

EASA concurs that reduced noise and vibration have a positive impact on human factors.

comment *145* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
All	AMC related to Part 27	Usding the word "crew" or "crews" seems to be vague and misleading that Part 27 require more than one pilot	Suggest to replace the word "crew" to read "pilot"	
All	AMC related to Part 27	Several sections reads "well-trained, qualified, healthy, alert crew	Suggest to clarify what would be the expectation for minimum training	

		members". This statement in the Part 27 implies that formal typer rating training is required. Only rotorcraft with GW of 12,500 lbs would require type traning. For part 27 helicopter pilot the requirments are 40 hr of flight time.	requirements for part 27 pilot?	
AMC	GENERAL	"CS27.1302"	"CS 27.1302" appears repeatedly throughout the AMC. This is unnecessary since this is guidance for a means of showing of compliance to 27.1302. The reference to other impacted regulations is good but repeated citation of 27.1302 is unnecessary	Remove repeated citation references to CS 27.1302
AMC	GENERAL	"CS29.1302"	"CS 29.1302" appears repeatedly throughout the AMC. This is unnecessary since this is guidance for a means of showing of compliance to 29.1302. The reference to other impacted regulations is good but repeated citation of 29.1302 is unnecessary	Remove citation references to CS 29.1302
AMC	(c)	"operationally relevant"	What does "operationally relevant" mean in this context? "Operationally relevant" referenced to 29.1525 "Kind of Operation" or by 29.1301 operation relevant to intended function? Not sure what "Operationally relevant" adds but could create confusion. Additionally (c)(2) covers Operationally relevant. Additionally, there are other "behaviors" that may not be operationally relevant that should be considered.	Suggest removing "Operationally relevant" unless the intent of the term is explained in the AMC material. Suggest new wording: (c) "Behaviour of the installed equipment must"

AMC	(c)	"operationally relevant"	What does "operationally relevant" mean in this context? "Operationally relevant" referenced to 27.1525 "Kind of Operation" or by 27.1301 operation relevant to intended function? Not sure what "Operationally relevant" adds but could create confusion. Additionally (c)(2) covers Operationally relevant. Additionally, there are other "behaviors" that may not be operationally relevant that should be considered.	Suggest removing "Operationally relevant" unless the intent of the term is explained in the AMC materia . Suggest new wording: (c) "Behaviour of the installed equipment must"

response Partially accepted

— (applicable to CS-27 and CS-29) Reference to 'crew' or 'crews' rather than 'pilot'. The FAA suggested 'pilot' should be used. This FAA comment does not seem to take into account that EASA has included a definition of crew that embodies also operators in the cabin. Therefore, this proposal is not accepted.

— (applicable to CS-27 only) 'well-trained, qualified, healthy, alert crew members'. According to the FAA, these or similar statements imply that there is type rating which is not the case in the US for rotorcraft below 12 500 lb. This is a well-known difference between the FAA and EASA. In the EASA system, a type rating is requested for CS-27 rotorcraft as well. The suggestion to clarify which is the minimum training required for a CS/FAR 27 is not accepted as the training is outside the scope of this NPA. However, the reason why training is mentioned in the NPA is to guarantee that the evaluation is made by personnel that know the system under evaluation to the extent that there is no bias due to the lack of familiarity. Therefore, this proposal is not accepted.

— (applicable to CS-27 and CS-29) The AMC refers repeatedly to CS 27.1302/CS 29.1302 while this is not necessary. Although there are some repetitions, EASA believes that their systematic deletion may create confusion in some cases. Therefore, this comment is partially accepted.

— (applicable to CS-27 and CS-29) 'operationally relevant'. What is meant by 'operationally relevant' is explained in the GM. In addition, the same wording is included within CS 25.1302 to clarify that is what the crew perceive as system behaviour, which is the objective of the rule, and not how the system actually works with its internal logic. The definition of 'operationally relevant behaviour' has been included in the definitions. Therefore, this comment is partially accepted.

comment *169* comment by: *Garmin International*

AMC 29.1302, AMC 27.1302 General:

AMC 29.1302 3.2.4 and AMC 27.1302 3.2.4 indicate that an EASA flight test/human factors team will need to review an applicant's proposed methodology and then determine EASA's level of involvement.

It is common for the same equipment from one equipment manufacturer to be installed on multiple airframes. In these cases, the equipment manufacturer will often have performed several aspects of human factors evaluations including display font size and viewing angles, colors, labels, NVG compatibility, etc. as part of the (E)TSO process and/or an initial STC installation. It is recognized that there are other human factors aspects that are clearly installation dependent such as whether controls can be manipulated from the pilot's seated position, etc.

The AMC lacks clear guidance as to which aspects of previously agreed certification decisions should be accepted versus those aspects that must be evaluated on each installation. Without such guidance, equipment manufacturers and installers will be subject to repeatedly justifying their decisions without enhancing safety. Additionally, because different flight test/human factors teams may arrive at different conclusions, any new installation may be driven to modify previously approved equipment without enhancing safety. Further, without such guidance, CS 27 AML STCs may no longer be feasible and/or cost effective, which is contrary to EASA's rotorcraft safety continuum and net safety benefit concepts.

Add guidance indicating which aspects of previously approved equipment must be reevaluated at each installation and which can be accepted without further scrutiny.

response

Noted

As stated in AMC 27/29.1302 paragraph 3.3.1(e), applicants that are willing to take credits from the supplier for the demonstration of compliance as regards human factors need to share this data with EASA and jointly agree on it as part of the certification programme. Paragraph 5.3.1 has been created in Section 5 'Means of compliance' to provide further guidance in this respect.

comment *210* comment by: *AIRBUS*

Airbus Commercial Aircraft fully supports Airbus Helicopters' comments.
In addition to their comments, Airbus Commercial Aircraft raises the following ones to reinforce Airbus Helicopters position.

Airbus

response

Noted

EXECUTIVE SUMMARY p. 1-2

comment *2* comment by: *NHF Technical committee*

Design also affect the maintenance crews during maintenance of rotorcraft.

response | Not accepted

According to the related Terms of Reference, this NPA only addresses the design of the interface between crew members and rotorcraft. Maintenance personnel is not considered as 'crew members'.

1 About this NPA p. 3

comment | *52* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the NPA Page 3, paragraph 1.1
Comment/Rationale:
EASA indicates the text of the NPA was subject of a preliminary consultation with the most affected stakeholders in a dedicated workshop in March 2019. This is partially true as the CS-27 part of the NPA (page 69 to 129) was not presented during the workshop or before the NPA publication.
Proposal for update of the NPA:
Correct the statement to indicate "a preliminary consultation for the CS-29"

response | Partially accepted

The preliminary consultation performed in March 2019 virtually covered also CS-27 as the technical contents of CS 27.1302 and CS 29.1302 are identical. There are no technical differences between these certification specifications, with the exception of the proportionality provisions contained in paragraph 3.2.9 of AMC 27/29.1302.

2 In summary — why and what p. 4-6

comment | *3* comment by: *NHF Technical committee*

NHF fully support the work on reducing HF related accidents and incidents.

response | Noted

comment | *9* comment by: *UK CAA*

Page No: 5/132

Paragraph No: 2.4

Comment: As a generic observation, the CAA would like to discourage from making sweeping statements based on constructs, and from drawing pseudo-statistical hypotheses which may be heavily challenged in the future, e.g. *'In fact, an improved crew workstation design that is optimised for HFs will contribute to reducing the crew's workload and increasing the crew's situational awareness. It is qualitatively estimated that these benefits could reduce the number of incidents and accidents by between 10 and 20%*'.

Justification: These sentences use two construct titles; 'workload' and 'situation awareness' which are each complex and nuanced – their use should allow for appreciation of the complexity of systems operating in this environment. (This can be observed in an expert testimony to the Max 8 enquiry released recently; it considers automation design issues from a HF perspective and touches upon both subjects.).
Following on, the estimate that incidents and accidents might be reduced by '10-20%' is erroneous and unfounded and may be open to legal challenges if new designs do not produce this kind of safety benefit which is difficult to define and measure.

Proposed Text: The two sentences could be omitted without impact to the rest of the text and substituting it for 'a significant positive impact on safety' would be a useful characterisation.

response Accepted

These two sentences describe the summary of the analysis performed by EASA as part of the preliminary impact assessment for this rulemaking task. While the analysis has been performed at qualitative level, it is appreciated that a quantitative assessment could only be performed by reviewing in-service occurrences once the new CSs are in place. Therefore, EASA agrees to reword these sentences in the explanatory note to the Decision by deleting the quantitative assumptions.

comment *17* comment by: *Ratan Khatwa*

It is indicated in Economic impacts paragraph that costs are not expected to significantly increase. There will be additional development costs as the integration of HF within a commercial systems engineering process does not come cost-free. The text should simplify acknowledge this as this will varying amounts of change to the different OEM and avionics supplier process and infrastructure.

response Noted

Although a specific requirement is not currently included in CS-27/CS-29, human factors considerations are already performed during the design of human–machine interfaces (HMIs). The introduction of 27/29.1302 will provide a systematic approach for such considerations to be performed and to ensure their effectiveness. For this reason, and because a certification review item (CRI) has been systematically issued for the certification of new products for many years, it is estimated that the economic impact will not be significant.

comment *54* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the NPA Page 4, paragraph 2.2
Comment/Rationale:
EASA indicates that "The specific objective of this proposal is to ensure that HFs are systematically taken into account during the design and the certification processes of rotorcraft cockpits." The sentence is incomplete as the NPA proposal also proposes to extend the universally acknowledged definition of cockpit so that the cockpit may now include workstations located in the cabin and used by crew

	members to operate systems that are critical for safety (e.g. rescue hoist control stations, secondary crew stations, as those are used for precision hovering). Having said that, Airbus Helicopters do not agree with the coverage of cabin items as proposed in the NPA. The AH position is further detailed in later comments. Furthermore, there are existing requirements dealing with HF topics. The 1302 is an addition to those requirements. The wording "systematically" is then inapropriate as the HF are already systematically covered, at least partially, "to reinforce" is preferred as it better matches with the state of the art. **Proposal for update of the NPA:** Clarify the full intent of the NPA proposal and indicate that the NPA will reinforce the human factors aspects in the certification of products.
response	Not accepted 'The specific objective of this proposal is to ensure that HFs are systematically taken into account during the design and the certification processes of rotorcraft cockpits.' Airbus Helicopters commented that 'systematically' is not correct, as there are already HFs-related requirements in CS-27 and CS-29, and stated that EASA is extending the rule applicability to working stations in the cabin. EASA does not agree with this position because in fact the new points 27/29.1302 provide a general and structured approach to the HFs assessment while the existing specific certification specifications only cover specific aspects. This is also reflected in the AMC as the relationship between the other HFs-related requirements and 27/29.1302 is clarified. As regards the proposal to limit the applicability of this new CS to the cockpit, EASA does not share Airbus Helicopters' position. However, the extension of the applicability of the new CS to working stations in the cabin has been further clarified by revising the definition of 'crew members'.

comment	*55* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** This comment is on the sentence of the NPA Page 5, paragraph 2.3 **Comment/Rationale:** The second bullet indicates a reference (refer to paragraph 1.3) which is incorrect. **Proposal for update of the NPA:** Correct the reference to paragraph 1.2
response	Accepted The reference has been corrected.

comment	*56* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 6, paragraph 2.4 of the NPA **Comment/Rationale:**

	The economic impact paragraph deduct from the fact HF assessment have been already performed for the most recent rotorcraft certification projects, based on CRI and/or other exisiting paragraphs of the CS related to human factors,that no significant increase of costs for the industry will be caused by the introduction of 1302. This is disregarding the applicability of 1302 in the future on major significant changes for which 1302 will need to be considered because, among other, the criteria of novelty will have to be triggered if the baseline aircraft configuration has not been certified under CS x.1302 (ref AMC paragraph 3.2.3). Having said that, Airbus Helicopters does not agree with the principle of the baseline aircraft configuration determination and our detailed position is further explained in later comments. Another aspect is the complexity of the guidance material proposed and the intrication of its considerations which will cause additional burden to the applicant looking for compliance. Airbus Helicopters is proposing in the comments to the NPA simplifying the AMC & GM content for readability and usability purpose. Furthermore, the need to involve EASA panel expert as proposed in AMC chapter 3 in the early phases of the development means that the application for the TC or the change to TC have to be sent earlier to EASA compared to current practices, in particular for light helicopters, for which the validity of the application to EASA is 3 years instead of 5 for large helicopters. The reduction of the possibility to use flight test as means of compliance and the expanded requirements on the use of scenraio based approach in the frame of iterative HF assessments in the development phase are not without economical consequences. Also the availability and rental of operational pilot is foreseen as a hard point. It will be a difficult and costly exercice if we consider the numbers of pilot available and rated compared to the airplane community. EASA indicates that the expected economic impacts are limited to slight impact on certification costs. This is disregarding the other than certification costs involved.This additional costs have also to be taken into account. In conclusion, Airbus Helicopters estimate that increased costs of development and certification as a result of the introduction of the new paragraph x.1302 are estimated by Airbus Helicopters as significant. **Proposal for update of the NPA:** Revise the economic impact assessment to reflect actual consequences on cost for the industry.
response	Partially accepted 1) Applicability to changes Although it is true that the new requirement will be applicable also to changes, the approach as regards the new human factors requirements is that they already contain an embedded form of proportionality as the effort needed to demonstrate compliance is proportionate to the level of complexity/integration and novelty of the design. Additionally, the AMC contains some alleviations, dedicated to changes, on the level of the effort needed to demonstrate compliance (see AMC 2X.1302 paragraph 3.2.9).

2) Baseline for the determination of the novelty of the design

The AMC has been reworded and the determination of the level of novelty does not rely anymore on the certification basis of the reference product considered to determine the novelty. As a matter of fact, the novelty is now to be determined only in relation to the characteristics of the design features under examination.

However, the certification basis of the reference product could play a role when the applicant decides to take credit from the related demonstration of compliance (see AMC 2X.1302 paragraph 5.3.1). This approach is in line with the procedures normally used in the certification.

3) Complexity of the compliance material

The material has been simplified based on previous EASA experience and taking into account rotorcraft peculiarities.

4) Early involvement of EASA

EASA involvement has been reworded in the AMC taking into account the already published EASA 'Level of Involvement' (LoI) rule (see points 21.A.15, 21.A.93 and 21.B.100 of Part 21).

The adjustments introduced in the AMC on the basis of stakeholders' comments submitted during the NPA consultation contributed to the reduction of the additional burden on applicants. Nevertheless, additional effort in the demonstration of compliance might be foreseen — according to EASA, this additional effort will be compensated by reducing the risk of certifying products, or changes to products, with unidentified HFs issues.

comment *72* comment by: *Garmin International*

Section 2.4 Page 5-6:

It is claimed that introduction of this rule will reduce the number of occurrences and accidents by 10% to 20%. There is no evidence provided for this claim and it is prejudicial in favor of regulation.

Remove unsubstantiated claims of safety benefit that favor additional regulation.

response Accepted

Please see the response to comment #9.

comment *88* comment by: *General Aviation Manufacturers Association*

As previously commented, the safety benefit claimed to reduce the number of accident occurrences of up to 20% are not substantiated within this proposal; either provide the necessary substantiation or remove this statement and assumed safety benefit.

response Accepted

Please see the response to comment #9.

comment	*92* comment by: *AIRBUS* *Economic impacts* The following statement on cost evaluation is considered as not true: “The introduction of new CSs for HFs assessments is not expected to significantly increase the costs for the industry due to the fact that HFs assessments have already been performed for the most recent rotorcraft certification projects, based on the project-related CRIs.” This is disregarding the applicability of 1302 in the future on major significant changes for which 1302 will need to be considered because, among other, the criteria of novelty will have to be triggered if the baseline aircraft configuration has not been certified under CS x.1302 (ref AMC paragraph 3.2.3). Based on CRI HF or CS-25.1302 application, AI confirms that the cost of development and certification significantly increased. Airbus suggests to revise the economic impact assessment to reflect actual consequences for the industry.
response	Partially accepted Please see the response to comment #56.

comment	*97* comment by: *European Cockpit Association* ECA welcomes the new NPA, since ergonomics plays an important role in achieving flight safety. However, even the “soft factors” have to be taken into consideration and the numbers have to reflect reality (like body height). Otherwise the intended effect will not be (fully) achieved.
response	Noted Ergonomics are already addressed by CS 29.777, and this requirement is referenced within 1302. Updating the existing values (percentile) is outside the scope of this rulemaking task and of 27/29.1302.

comment *146* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
5	2.3.1 Proportionate implementation	" . . . Trigger a low level of scrutiny."	What is the meaning of "scrutiny" related to this paragraph. Difficult to discern if you	Define "scrutiny" in context of this NPA and intent in

			mean EASA scrutiny or the applicant's scrutiny of HF and possible HFs in their design.	rule. "Scrutiny" by the regulator or investigation and assessment by the applicant?
6	Economic impacts - second paragraph	The introduction of new CSs for HFs assessments is not expected to significantly increase the costs for the industry due to the fact that HFs assessments have already been performed for the most recent rotorcraft certification projects, based on the project-related CRIs.	The veracity of this statement will depend on how and when the CS is implemented. Is 21.101 the arbiter for application of 1302 for amended TCs or STCs? The MOC's could increase applicant workload particularly for U.S. STC houses.	
6	Economic impacts - third paragraph	This means that flights made during the development and certification phases for other areas of investigation can be given credit for demonstrating compliance with CS 27.1302.	This statement says that the applicant can be given the certification credit to 27.1302 during developmental or certification testing. The wording should be changed from "can" to "may". There are a lot of developmental and certification testing that are not appropriate to provide certification credit towards xx.1302 compliance.	

response | Partially accepted

1. This comment refers to the part introducing the NPA: 'scrutiny' refers here to the applicant's assessment.

2. Please refer to the response to comment #56.

3. Agreed to replace 'can' by 'may'.

3 Proposed amendments | 3.1 Draft CSs (draft EASA Decision) | CS 29.1302 Installed systems and equipment for use by the crew p. 7-57

comment | *1* comment by: *Norwegian Helikopter Employee Association*

For the clarification of whom to include in this new proposal, it seems that it only focuses on pilots and hoist operators.

Suggestion:
On rotorcraft SAR and HEMS operations there are a substantial amount of specialised equipment in the cabin, all personnel carried onboard that are dedicated a specific role in fulfilling of the operation, are defined as "crew members".
As a crew member on a SAR or HEMS, you are exposed to the same implications as the pilots, with regards to the human factors and possible limitations or dégradations when using equipment in flight.

Therefore it is very important for this amendment proposal, to also include the crew members in the cabin of a SAR and HEMS operation.

response | Not accepted

'For the clarification of whom to include in this new proposal, it seems that it only focuses on pilots and hoist operators.'

EASA partially agrees with this interpretation as the definitions of 'crew member' and 'cabin' laid down within the AMC extend the applicability to everyone in the cabin who, as part of their duties, could perform activities interfering with the conduct of the flight. However, the applicability cannot be extended beyond that as CS-27 and CS-29 do not apply to air operations.

comment | *11* comment by: *UK CAA*

Page No: 8

Paragraph No: AMC 29.1302 Table of Contents

Comment: It would be helpful to include GM No 1 on page 58 and GM No 2 on page 64.

Justification: Greater clarity

Proposed Text: Include GM No 1 and GM No 2 to 29.1302 in list of contents.

response

Not accepted

The table of contents of AMC 27/29.1302 provides only the elements included in the AMC itself. Nevertheless, sufficient visibility of the 'whole package' is provided at the CS level as, after the title, all the AMCs/GM referring to it are listed.

comment

12 comment by: *UK CAA*

Page No: 8

Paragraph No: Table of Contents

Comment: The line for page 70 should be titled "AMC 27.1302 Installed systems and equipment for use by the crew".

Justification: Greater clarity. The current contents list for page 70 onwards appears as if it is part of AMC 29.1302.

Proposed Text: See comment above.

response

Noted

The table of contents on page 70 is already titled 'AMC 27.1302 Installed systems and equipment for use by the crew'.

comment

14 comment by: *UK CAA*

Page No: 9

Paragraph No: Table of Contents

Comment: It would be helpful to include GM No 1 on page 119 and GM No 2 on page 126.

Justification: Greater clarity

Proposed Text: Include GM No 1 and GM No 2 to 27.1302 in list of contents.

response

Not accepted

Please see the response to comment #11.

comment

18 comment by: *Ratan Khatwa*

This paragraph should refer specifically to "flight crew" and not use the phrase "crew", it is not clear otherwise. In addition, if the equipment in the cabin is included in this CS, it should be clarified that this is specifically for flight crew tasks.

response	Partially accepted The definition of ‘crew member’ and ‘cabin’ have been improved to provide further clarity.

comment	*19* comment by: *Ratan Khatwa* Paragraph 1.2(b) should refer specifically to "flight crew" and not use the phrase "crew", it is not clear otherwise. In addition, if the equipment in the cabin is included in this CS, it should be clarified that this is specifically for flight crew tasks.
response	Partially accepted Please see the response to comment #18.

comment	*22* comment by: *Ratan Khatwa* 3.2.2(c)(3) asks for intended function of "prominent characteristics". This requirement is not needed as the items (1) and (2) immediately above will cover this. Suggest to remove item (3) in this list. It will add to confusion.
response	Not accepted Indeed, the first two bullets cover the third one. However, the overall objective is to detail the required information in order to support applicants in meeting EASA’s expectations.

comment	*23* comment by: *Ratan Khatwa* 3.2.3(3)(v) states "One positive answer to any of the above questions is sufficient to trigger the novelty criterion." This seems inappropriate as the end goal is to determine the level of scrutiny based on combined impact of level of intergration, complexity and novelty. We suggest removing this statements and reinforcing the more important point that the level of scrutiny should be based on combined impact of level of integration, complexity and novelty.
response	Partially accepted The quoted sentence actually refers to the novelty criteria, not to scrutiny. However, an error in the indentation has been identified that may have contributed to the misunderstanding. The whole paragraph has been reworded to provide further clarity.

comment	*24* comment by: *Ratan Khatwa* 3.2.3 (b) needs to be clarified. The text “If at least one of the above criteria is met” is unclear.
response	Not accepted

	EASA believes that the misunderstanding is linked to comment #23. The commented point has been reworded and it should now read clearly.

comment	*25* comment by: *Ratan Khatwa* 3.2.5 (c) is not clear. At the end of the day, the certification compliance matrix needs to link the prevailing HF related regulations with the new/novel functions being introduced that require the additional level of scrutiny. The convoluted text used does not draw this point out very well.
response	Not accepted This paragraph describes the expected content of the compliance matrix in order to know the design features (not the function) and the HFs-related design requirements (not the HFs-related rules). It should be noted that not only new/novel features (e.g. complex or integrated) need to be introduced in the compliance matrix.

comment	*26* comment by: *Ratan Khatwa* 3.2.7 (a) indicates " scheduling should be provided to EASA for acceptance." It should be noted that in some cases development programmes timelines are based on many considerations. EASA LoI will need to remain flexible with this point in mind.
response	Noted

comment	*27* comment by: *Ratan Khatwa* 3.3.2 (a) Please note that the scenarios are not only intended to uncover any potential flight crew errors – this paragraph is unfortunately heavily biased with that in mind. The design of the scenarios has multiple purposes in mind. For example, collection of compliance data that confirms the crew is able to perform their necessary tasks associated with the intended function both in normal and abnormal situations. Other aspects such as human performance, workload assessments, etc are also aspects that are considered when designing the scenarios – it goes beyond looking at error. Please amend this section with these other aspects in mind.
response	Accepted Point reworded to reflect the intent of this comment.

comment	*28* comment by: *Ratan Khatwa* 3.3.2 (d) There are often multiple assessments done in an iterative manner for each function across the flight deck. This means that in some cases dozens of informal and formal HF evaluations could be performed for all functions across the cockpit. EASA is requiring sign-off on crew selection for all HF evaluations - this does not seem appropriate - EASA should reconsider this assertion – if the assertion remains in the final AMC, EASA should plan for adequate resources to support this level of involvement.

response	Accepted Point reworded to reflect the intent of this comment.

comment	*29* comment by: *Ratan Khatwa* 3.3.2 (g) It should be added to this paragraph that the HF and personal data of all evaluation pilots will follow normal protocols to protect the identity and privacy rights of all pilot subjects. The data are used solely for the purposes of certification. The applicant should consider using an Informed Consent to convey data privacy and protection of pilot data (this is standard practice in human factors).
response	Not accepted As stated in the comment, this is a standard practice in HFs and it is not intended to be stated in the regulatory material.

comment	*30* comment by: *Ratan Khatwa* 3.3.2 (j) 2 We do not agree that subjective data (questionnaire data) are a secondary source of HF assessment data (when compared to objective observation data). Both objective and subjective data collection are important, together they provide a variety of insights and are are a critical piece of the overall HF assessment. The text in this paragraph should be amended to reflect this point.
response	Accepted The primary means of collecting data should be both direct observation (including video) and debriefing in order to collect objective and subjective data respectively. Other tools, such as questionnaires and rating scales, can be used as complementary means. In any case, it is not adequate to merely rely on self-administered questionnaires.

comment	*31* comment by: *Ratan Khatwa* 4.2(2)(ii) Please add “Abbreviations, Acronyms, and Terms for Use on the Flight Deck” SAE ARP4105, as an acceptable means for selection of abbreviations – this is a very common reference.
response	Accepted This standard is already referred to in 4.6(b)(3) and in Appendix 1 ‘Related regulatory material and documentation’.

comment	*32* comment by: *Ratan Khatwa* 4.2(2)(v) The focus of the assessment for use of icons is not really about a comparison with an alternative text label. Overall, the HF assessment should verify that the crew can perform the intended function with the selected icons - that is really the critical point. We suggest the text be updated to reflect that an icon should evaluated with

	respect to supporting the intended function (and not a comparison with alternative labels).
response	Accepted Paragraph 4.2(2)(v) has been deleted.

comment	*33* comment by: *Ratan Khatwa*
	4.3 (d)(3) the description of the use of red and amber seems inconsistent with AMC 25.1322 – it is suggested that this paragraph simply refer to the AMC.
response	Not accepted The use of the red and amber colours for other than alerting functions or potentially unsafe conditions is not recommended. Such use diminishes the attention-getting characteristics of true warnings and cautions. No contradiction with AC 29.1322, § 29.1322 (Amendment 29-12) WARNING, CAUTION, AND ADVISORY LIGHTS.

comment	*34* comment by: *Ratan Khatwa*
	4.3 (e) Please also provide reference to Abbreviations, Acronyms, and Terms for Use on the Flight Deck - SAE ARP4105 as an example for selection of abbreviations.
response	Accepted Please see the response to comment #31.

comment	*35* comment by: *Ratan Khatwa*
	Page 55, (g)(ii)MC Flight Test – This table should also state that in-flight evaluations on non-conformed articles may be used during the design and HF evaluation part of the programme. Some applicants do use their flight test aircraft very effectively to do this and it helps reduce downstream risks with certification.
response	Noted Not in contradiction with the following: Flight tests performed during the development and certification phases for other areas of investigation can be given partial credit for demonstrating compliance with 29.1302 to a certain extent. The acceptability of this approach has, however, to be assessed by EASA on a case-by-case basis. A prerequisite for acceptance by EASA is the respect of the basic HFs methodological principles for data collection and processing. Additionally, this approach should not be used as a substitute for dedicated HFs assessments conducted on simulators or flight test vehicles, and it should only be used as a complementary approach.

comment *36* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the proposed page 7 of the NPA CS x.1302 first paragraph "This point applies to installed equipment intended for use by crew members in the operation of the rotorcraft from their normal seating positions in the cockpit or operating positions in the cabin. "

Comment/Rationale:

Referring to the other requirements that relates to the CS 29/27.1302, none is related to cabin and cargo issue. By the way no guidance in the AMC is specific to cabin and cargo issues. Covering those issues only by mentioning the cabin and the cabin crew in some paragraph of the NPA is not acceptable as some other certification aspects may not have been covered properly. HF in cabin and cargo certification deserve a proper RMT and impact analysis.

Nevertheless, cabin and cargo issues are not out of the concerns from a cockpit certification point of view. It is necessary in this framework to consider the following criteria when mapping the entire cockpit or the modified one against the tasks of the crew and the intended functions of the rotorcraft and systems:
— Installed equipment in the cabin that may physically interfere with the tasks under the responsibility of the cockpit crew (e.g. lights in the cabin/cargo that could affect the cockpit lighting concept efficiency).
— Functions that are allocated to both cockpit and cabin crewmembers, especially when a workstation located in the cabin is used by the cabin crew to operate systems that are critical for safety (e.g. rescue hoist control stations that are used for precision hovering).

AH proposal is to limit the scope of this rule and AMC to the cockpit, removing mentions of "cabin" and "cabin crew" that AH considers as out of the scope, as proposed below.

Proposal for update of the NPA:
Revise the text as follows:
"This point applies to installed equipment intended for use by crew members in the operation of the rotorcraft from their normal seating positions in the cockpit."

response Not accepted

The applicability of this new certification specification to the design items installed in the cabin has been clarified by amending the definition of crew member that has to be used while demonstrating compliance. The AMC provides guidance to demonstrate compliance with CS 2X.1302 for all the crew interfaces in the cockpit and for those applicable in the cabin.

comment *37* comment by: *Airbus Helicopters*

Airbus Helicopters comment:

This comment is on the sentence of the proposed Page 7 of the NPA CS x.1302 first paragraph "To be designed so that trained crew members can safely perform their tasks"
Comment/Rationale:
In the CS25 rules "qualified" is used intead of "trained". Qualified refers to a level of training as set up in the applicable licensing regulations, as explained in NPA GM No 1 to 29.1302 2(c)(1)(v). The NPA refers to qualified crew members in many instances. The consequences of this change of terminology in the text of the CSare not explicitely described in the NPA. Furthermore NPA indicates in § 1.2 Application (c): "This AMC does not apply to crew training, qualification, or licensing requirements."

response

Not accepted

The commented wording has been introduced intentionally by EASA to avoid that only crews that hold a type rating on the specific rotorcraft would be eligible to be involved in the HFs evaluation. The prerequisite to have a type rating is considered a big burden on applicants when new types are developed as, at the time of the evaluation, there will be no pilots holding a type rating on that rotorcraft.

comment

38 comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the proposed CS x.1302 paragraph (d) on PAge 7 of the NPA
Comment/Rationale:

The EASA proposal in this NPA disregards the current 25.1302 (d) paragraph heading condition: “To the extent practicable”. This is however an important aspect in the safety objective definition.
Indeed the ARAC, Human Factors—
Harmonization Working Group
(HFHWG) Final Report, dated June 15,
2004 stipulates that this flexibility provision *is intended to address both economic and operational practicability. The intent is to avoid imposing requirements without considering the economic feasibility and commensurate safety benefit. In addition, it is intended to address operational practicability, i.e., to avoid introducing error management features into the design that would inappropriately impede flight crew actions or decisions in normal and non-normal conditions.*

The consistency with 29.1309 (c) is also at stake.
25.1309(c) and (d) used to be more stringent before Amdt 25-123 dated 12/10/2007. An analysis, and tests where necessary, showing that systems, controls, and associated monitoring and warning means are designed "so that crew errors that would create additional hazards are improbable" were required. As pointed out in the explanation for Proposal 5-22*, the FAA has concluded that requiring a showing of compliance with present Section 25.1309(d) is unreasonably burdensome. In particular, the FAA believes that it is not practicable to quantify the probability of crew errors. The FAA believes that the requirement, "*** to minimize crew errors which would create additional hazards", in proposed Section 25.1309(c) would provide an adequate level of safety. Accordingly, proposed Section 25.1309(c) is*

adopted without substantive change and the lead-in of Section 25.1309(d) is amended to delete the reference to paragraph (c).

The above clearly indicates that the management of crew errors cannot always be exhaustively demonstrated and that the safety objective, as set in 29.1302(c) in a similar manner as in CS 25.1302, is to minimize crew errors. This minimization aspect has to be reflected in 1302(d) by re-introducing at least the "to the extent practicable" in the text.
Proposal for update of the NPA:
Re-instate "To the extent practicable" in paragraph (d)

response

Not accepted

'to the extent practicable' has been removed as this statement is ambiguous and does not provide any criteria for its applicability (such wording is not used in other CSs). The extent of the requested investigation is anyway limited to the HFs errors that can be 'reasonably' expected in service. GM1 provides additional clarifications regarding the interpretation of 'reasonably'.

Therefore, it is to be noted that the deletion of 'to the extent practicable' does not have an impact on the EASA expectations regarding the demonstration of compliance with this paragraph.

comment

39 comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the proposed Page 10 of the NPA 1.2 (b) paragraph and in particular the last sentence.
Comment/Rationale:

Refering to the other requirements that relates to the CS 29/27.1302, none is related to cabin and cargo issue. By the way no guidance in the AMC is specific to cabin and cargo issues. Covering those issues cannot be done only by mentioning the cabin and the cabin crew in some paragraph of the NPA. HF in cabin and cargo certification deserve a proper RMT.

Nevertheless, cabin and cargo issues are not out of the concerns from a cockpit certification point of view. It is necessary in this framework to consider the following criteria when mapping the entire cockpit or the modified one against the tasks of the crew and the intended functions of the rotorcraft and systems:
— Installed equipment in the cabin that may physically interfere with the tasks under the responsibility of the cockpit crew (e.g. lights in the cabin/cargo that could affect the cockpit lighting concept efficiency).
— Functions that are allocated to both cockpit and cabin crewmembers, especially when a workstation located in the cabin is used by the cabin crew to operate systems that are critical for safety (e.g. rescue hoist control stations that are used for precision hovering).

AH proposal is to limit the scope of this rule and AMC to the cockpit, removing mentions of "cabin" and "cabin crew" that AH considers as out of the scope, as proposed.

Proposal for update of the NPA:
Revise the text as follows:

(b) This AMC applies to the crew interfaces and system behaviour for all the installed systems and equipment used by the crew in the cockpit while operating the rotorcraft in normal, abnormal and emergency conditions.

The tasks of the crew members operating from the cabin need to be considered if they may interfere with the ones under the responsibility of the cockpit crew considering the following criteria:
— Installed equipment in the cabin that may physically interfere with the tasks under the responsibility of the cockpit crew (e.g. lights in the cabin/cargo that could affect the cockpit lighting concept efficiency).
— Functions that are allocated to both cockpit and cabin crewmembers, especially when a workstation located in the cabin is used by the cabin crew to operate systems that are critical for safety (e.g. rescue hoist control stations that are used for precision hovering).

response

Partially accepted

Please see the response to comment #36.

comment *41* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the proposed Page 10 of the NPA paragraph 1.2 (d)
Comment/Rationale:

GM 21.A.91 requires all changes to be classified as either major or minor, using the criteria of GM 21.A.91. Then the process to establish the certification basis rely on the GM.21.A.101. The criteria used during this process helps to determine a classification of the design change (substantial, significant, or not significant), affected and unaffected areas, material contribution to safety, and practicability. The following criteria are not mentionned: rotorcraft category, kind of operations, type of approach.
The application of the new CS 29/27.1302 should follow this process and only this process (the latest certification basis being applied only for substantial changes or significant+affected+contribute to safety+practical changes).

AH proposal is to remove this part and to rely on the GM 21.A.91 and GM.21.A.101 to address the applicability of the CS 29/27.1302.

Proposal for update of the NPA:
Delete paragraph (d)
To add a § "appropriate alleviations"
To mention here the notion of "simple changes" which is used further in the document but not defined.
To state that a simple change could be either a non significant change or a significant + unaffected change.
To state that for changes where the CS27/29.1302 will apply, the assessment of the level of scrutiny helps to determine the proportionate effort.

response

Accepted

This comment has been addressed by changing the way the proportionality provisions are presented in the text. In particular:

1. it has been better clarified what is under Part 21 and what is dealt with in the NPA;

2. the proportionality provisions have been moved to another part of the AMC to clarify to which step of the entire HFs evaluation process they apply;

3. the wording has been improved.

comment *42* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the proposed NPA Page 11 chapter 1.3 Definitions. Definition of Alert.
Comment/Rationale:
Reference definition AMC 25.1322 is given. Is it intentional? If yes, CRI MOC should be necessary to apply this AMC.
Proposal for update of the NPA:
Remove hte reference to AMC 25.1322.

response

Accepted

The reference has been removed from the definition.

comment *43* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the proposed NPA Page 11 chapter 1.3 Definitions. Definition of Cockpit
Comment/Rationale:

The cockpit is a cockpit, even if one can remotely find a physical separation, the area is well defined. Nevertheless AH recognize that cabin operations that may affect the cockpit have to be considered. In that perspective, it should be usefull to find all the related criteria grouped in the same § (1.2 Applicability seems to be a good candidate). Hence the definition can be simplified as proposed.

Furthermore this AMC 1302 is also indicated under 2.1 paragraph to be applicable guidance for other paragraph of CS-29 using cockpit terminology in their text, this means that the applicability of the paragraphs 29.777, 29.779, 29.1321 (g), 29.1322, 29.1555 mentioning “cockpit” in their text is extended.
Although it is acknowledged that the human factors have to be taken into account for the design of systems when used by other crew than the pilot, extending the

applicability of the certification specification material previously anticipated for pilot controls and information equipment for use by the flight crew without performing a proper regulatory impact assessment to measure the safety benefit vs. additional costs is not acceptable.

Proposal for update of the NPA:
It is proposed to reduce the scope of the NPA to its initial intent as announced in the EPAS 2019-2023 because of the absence of a proper Regulatory Impact Assessment. A follow-up dedicated rulemaking task to properly assess the topic of HF for other than pilot crew members.
In the meantime, the definition is proposed to be revised as follows:

— Cockpit: The area of the aircraft where the cockpit crew members work and where all the controls are located.

response Accepted

The definition of 'cockpit' has been amended in line with the proposal.

comment *44* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the proposed NPA Page 11 chapter 1.3 Definitions. Definition of Crew Member
Comment/Rationale:

Here examples of operations are given "In the case of rotorcraft, operators in the cabin dedicated to operating the rescue hoist or to helping the crew to control the aircraft in a hover are considered to be crew members". It should be better to find all those examples grouped with the criteria provided in the § applicability (1.2). Hence the definition can be simplified as proposed.

Proposal for update of the NPA:
The definition is proposed to be revised as follows:

— Crew member: A person involved in the operation of the rotorcraft and its systems.

response Partially accepted

The definition of 'crew member' has been revised in order to clarify which operators in the cabin are within the scope of CS 27/29.1302.

comment *45* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the NPA Page 14 2.1 b)
Comment/Rationale:
EASA to confirm that the Miscellaneous Guidance MG-20 'Human Factors' included in the Book 2. AC 29-2 is appropriate to conduct a Human Factor certification.

Proposal for update of the NPA:
Revise the text as follows:

Therefore, adherence to the guidance material included within AC 29-2 and the associated MG-20 is consired sufficient to perform an HF certification even if it is not considered sufficient to demonstrate compliance with CS 29.1302, for which this material provides additional guidance.

response

Accepted

The referenced paragraph has been reworded in order to clarify the relation between MG-20 and CS 27/29.1302.

comment *46* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the NPA Page 17 3.2.1 (c)
Comment/Rationale:
The certification activities against 1302 can only take into account the kind of operations for which the rotorcraft is certified. Therefore, the list of type of approval given as example can only be those considered as per CS 29.1525 and CS 29.1583 (e)
Introducing new kind of operations to be taken into account for certification in an AMC 1302 such as SAR and aerial work, which are not mentioned elsewhere in the CS. Furthermore SAR is explicitely excluded from the EASA scope by Article 2, 3 (a) of the Basic Regulation 2018/1139.
Please clarify what is meant by "assumptions". What kind of ouputs are envisaged ?

Proposal for update of the NPA:
Add clarification to the paragraph (c) by adding references to CS 29.1525 and CS 29.1583 (e)
Clarify what is meant by assumptions

response

Not accepted

The general intent is to render CS 27/29.1302 applicable to all types of air operations that are considered at airworthiness level by CS 27/29.1525 (day/night VFR, IFR, icing conditions) and to all equipment that is subject to airworthiness approval either by specific or dedicated CSs (e.g. 27/29.865) or through special conditions that have been already issued by EASA (e.g. AFCS search and rescue modes).

comment *47* comment by: *Airbus Helicopters*

Airbus Helicopters comment:

This comment is on the sentence of the NPA Page 19 3.2.3 (a) sentence"A function or system that the applicant chooses to refer to as a baseline from which the novelty is derived needs to have been certified by the applicant under CS 29.1302."
Comment/Rationale:
This point is not understandable. Previous certifcations have been made seriously, and some evidences and existing compliance demonstrations have to be considered:
Systems are used for a long time, for those in service events and lessons learned are taken into account.
Systems have been certified applying HF related § including but not only those listed in the table in the § 2.1. which provides an acceptable baseline.
Systems have been certified under HF CRI, which is already an effort that must be recognized, and on which applicants shoudl be able to capitalize.
Furthermore, first certifications with the CSxx.1302 will not be affordable and impossible to complete if everything has to be considered as new.

AH proposal is to establish the baseline from which the novelty is derived case by case, taking into account, the state of the art, in service experience, and previous compliance demonstrations.

Proposal for update of the NPA:
Revise the text as follows:
A function or system that the applicant chooses to refer to as a baseline from which the novelty is derived needs to have been certified by the applicant under CS 29.1302 or equivalent.

response

Partially accepted

The reference to the regulatory material used for the certification of the reference product has been removed and transferred to paragraph 5 where the compliance methods are discussed.

comment *48* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the NPA Page 19 3.2.3 (c)
Comment/Rationale:
To perform a preliminary assessment of not novel features is a loss of time in the process. Anyway, features that are not in the list of novelties requiring an extra scrutiny will be assessed with a normal scrutiny (which is not "nothing has to be done").

In addition, AH still reminds the initial CS25.1302 : "Based on the above criteria, the applicant should characterise features by their novelty. More novel features may require extra scrutiny during certification. Less novel features must still be shown to be compliant with requirements, but will usually follow a typical certification process that may be less rigorous than the process described below."
In that perspective, the master criteria is the novelty that have to be balanced with complexity and integration aspects.

The NPA changes the approach ; even non novel function can be candidate for the scrutiny as soon as it is complex, highly integrated or critical. For AH this is not acceptable as it is not consistent with precedence principle. It is therefore propose to remove this § (b) and to come back to the initial CS25.1302.

Proposal for update of the NPA:

AH proposal is to mention that a normal level of scrutiny has to be applied to the features that are not in the list of those requiring an extra scrutiny as it was done in the the initial CS25.1302.

response

Not accepted

EASA does not concur with the described interpretation. AMC 25.1302 does not imply that the novelty has to be understood as a master criterion. The proposed text clearly describes EASA's position and expectations.

comment *49* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the NPA Page 20 3.2.8 (a)
Comment/Rationale:

Here the notion of experimental protocol is not appropriate as for sure, despite the applicant effort, most of the evaluations cannot be controlled as required by the experimental approach.

Proposal for update of the NPA:
AH proposal is to remove the word "experimental".

response

Not accepted

From a HFs standpoint, even if the deletion would not jeopardise the intent, 'experimental' aims to introduce the notion of scientific approach required and convey the message that HFs methods are not common sense based. For this reason, specialists involved in the implementation of these methods should be properly trained.

It should be noted that in this context, 'experimental protocol' does not mean full control of the test conditions but appropriate identification and control of these variables as far as practicable.

comment *50* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
This comment is on the sentence of the NPA Page 25, 4.1 (a)
Comment/Rationale:

One cannot consider that all relevant aeronautical design standards relating to Cokpit design, HF and HMI in general are summarized here.
Proposal for update of the NPA:
add a clear mention indicating that design standards not identified here can be used.

response

Not accepted

The intent of the AMC is to propose an accepted means to show compliance with CS 27/29.1302. Should the applicant wish to adopt another means, it has to be demonstrated that it provides an equivalent level of safety.

comment *57* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 7, paragraph 3.1 of the NPA

Comment/Rationale:
The FAA tasked the Aviation Rulemaking Advisory Committee (ARAC) through its Human Factors Harmonization Working Group to review existing regulations and recommend measures to address the contribution of design and certification of transport category airplane flight deck to flightcrew error. The ARAC submitted its recommendations to the FAA in a report, Human Factors— Harmonization Working Group (HFHWG) Final Report, dated June 15, 2004.
CS 25 certification specifications were updated in 2006 to integrate HFHWG recommendations. FAR 25 rule was updated in 2013 at Amdt 25-137. The text of 1302 has not been amended since then in CS 25 and FAR 25.
Although it has been used for more than a decade, the text of 1302 verbiage is not reflective of the AMC content. In particular the applicability of the paragraphs of 1302 is not clear in the text of the CS.
As indicated in GM No1 to 29.1302, 2(a), 1302 augments the generally applicable requirements.
Furthermore in chapter 4, 4.1 (a) of the AMC, it is indicated that not all criteria can or should be met by all systems.
This leads us to propose a clarification in the text of 1302 to recognize the selective applicability of 1302 paragraphs in addition to the existing requirements of the certification basis listed in chapter 2, paragraph 2 – Table This is proposed to be achieved by rewording the header paragraph and associating a paragraph letter (a) for easier referencing in certification plans.

Proposal for update of the NPA:
The text of CS 29.1302 and 27.1302 is proposed to be updated as follows:
CS 27/29.1302 Installed systems and equipment for use by the flight crew (Human factors)~~Installed systems and equipment for use by the crew~~
(See AMC 29.1302, GM No 1 and No 2 to 29.1302)

~~This point applies to installed equipment intended for use by crew members in the operation of the rotorcraft from their normal seating positions in the cockpit or operating positions in the cabin. This installed equipment must be shown, individually and in combination with other such equipment, to be designed so that trained crew members can safely perform their tasks associated with the intended function of the equipment by meeting the following requirements:~~
(a) Systems and equipment installed in the cockpit for use by the flight crew must be assessed under the requirements of sub-paragraph (b), (c), (d) and (e) and other paragraphs of this CS-29, as applicable, following one or more human factors evaluation methods as agreed with the Agency.
(b) Installed systems and equipment must be shown, individually and in combination with other such systems and equipment, to be designed so that trained crew members can safely perform their tasks associated with the intended function of the system or equipment.
(~~a~~c) All the controls and information necessary to accomplish these tasks must be provided and must:
(~~b~~c) ~~All the controls and information required by paragraph (a), which are intended for use by the crew, must:~~
(1) be presented in a clear and unambiguous form, at a resolution and with a precision appropriate to the task;
(2) be accessible and usable by the crew in a manner consistent with the urgency, frequency, and duration of their tasks; and
(3) make the crew aware of the effects that their actions may have on the rotorcraft or systems, if they need awareness for safe operation.
(~~c~~d) Operationally relevant behaviour of the installed equipment must be:
(1) predictable and unambiguous; and
(2) designed to enable the crew to intervene in a manner appropriate to accomplish the task.
(~~d~~e) To the extent practicable, ~~i~~installed equipment must enable the crew to manage the errors resulting from the kinds of crew interactions with the equipment that can be reasonably expected in service, assuming the crew is acting in good faith and excluding~~. Paragraph (d) does not apply to~~ skill-related errors associated with the manual control of the rotorcraft.

response

Not accepted

The proposed restructuring does not seem to add clarity as it lacks reference to other paragraphs of CS-27/CS-29 without clarifying how these paragraphs should be used in the framework of a certification process for human factors.

Additionally, paragraph 4 is only intended to provide design criteria that may help meet the CS 27/29.1302 objectives. Within this context, the sentence in paragraph 4.1(a) states that for a given design feature/control not all the design criteria should be met. There is no direct link between this paragraph (that deals with best practices on design criteria to satisfy human factors objectives) and the proposed modification of CS 27/29.1302.

comment

58 comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 13, paragraph 1.4

Comment/Rationale:
LOI is used in the document and not listed in the abbreviations list

Proposal for update of the NPA:
Add LoI to the abbreviation list

response

Noted

'LoI' is already included in the abbreviations list of AMC 27/29.1302.

comment *59* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 14, paragrap 2 Table 1

Comment/Rationale:
The second column indicates in front of 29.1309 (a) that the topic is applicable to intended function of required equipment. The x.1309 (a) actually only applies to equipment required by this CS-29 and not to those equipment required by operational rules.

Proposal for update of the NPA:
Clarify that the 29.1309 (a) applies to equipment required by CS-29

response

Not accepted

The operating conditions should not be confused with the equipment installed to comply with the operational requirements. CS 27/29.1309 is applicable to all installed equipment.

comment *60* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 19, paragrap 3.2.4

Comment/Rationale:
The title of the paragraph indicates "Determination of the list of items requiring extra scrutiny" The text of the paragraph indicates later "a higher level" of scrutiny. Then the text refers to the assessment of the classifications proposed by the applicant.
The activities and deliverables foreseen in the above references can only be taking place as part of the certification activities foreseen in Part-21, 21.A.20, 21.A.97 and 21.A.115.
The sentence "Irrespective of the above, the EASA involvement in the verification of compliance demonstration of the subsequent steps of the human factors process" is therefore not correct, as EASA can only be involved after the application to the TC or change to TC has been sent. There is therefore no such steps preceding the subsequent steps of the human factor process that relates to the demonstration of compliance that are foreseen by Part-21.
Instead, it is proposed that EASA agrees on human factors evaluation methods proposed by the applicant so that EASA human factors and Flight panels experts are comfortable with the approach used by the DOA holder to adequately account for

	the human factors in the design of products. The confidence in the process used by the DOA holder may be gained through audits on the processes, as necessary. **Proposal for update of the NPA:** Delete paragraph 3.2.4 and all other references to a EASA involvement prior to the application to TC/change to TC in chapter 3 of the AMC. In parallel it is also propsoed to modify .1302 text to clarify that the acceptance by EASA of the methods used by the applicant is a requirement. Refer to the related comment on Page 6 of the NPA.
response	Not accepted This proposal is not acceptable from the EASA standpoint. EASA's early involvement after the application is a key notion in both existing and new regulatory material. In no case can EASA request any certification-related activity before the application is submitted. Furthermore, there is no clear link between the body of the comment and the referenced text.

comment	*61* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 20, paragraph 3.2.6 of the NPA **Comment/Rationale:** Guidance on the selection of means of compliance and related codes is redundant with Part 21 AMC 21.A.15(b) and Appendix A to AMC 21.A.15(b) Since CS 25.1302 and its AMC were published, Part-21 AMC & GM have evolved so that the guidance proposed in this paragraph is no longer necessary. Furthermore, the original sentence of AMC 25.1302 "In general, it is expected that the level of scrutiny or rigour represented by the means of compliance should increase with higher levels of novelty, complexity and integration of the design." has been altered so that the relationship between Means of compliance and level of scrutiny is unclear in the proposed paragraph text. This concern is also subject of another Airbus Helicopters comment on paragraph 3.2.3 (c) **Proposal for update of the NPA:** Remove the information duplicated with Part 21.
response	Partially accepted 1. It is appreciated that there is a partial overlap between the guidance on the selection of the means of compliance contained in this AMC and the contents of AMC 21.A.15(b); however, it must be noted that paragraph 5 focuses on HFs demonstration of compliance. Additional information and a standardised approach are, therefore, provided by paragraph 5. This paragraph has also been reworded and simplified to reduce the overlapping. 2. EASA considers that the changes made to 3.2.6 clarify the relationship between novelty, complexity, integration and level of scrutiny, as well as the level of scrutiny and the expected amount of effort. 3. 'criticality' has been removed from the text.

comment	*62* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 27, paragraph 4.2(d)(2)(v) **Comment/Rationale:** The paragraph first sentence indicates “In all cases” and the second sentence “Alternatively”. This creates a logic flaw that needs to be corrected **Proposal for update of the NPA:** Delete “in all cases” in the first sentence.
response	Accepted The commented paragraph has been deleted.

comment	*63* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 27, paragraph 4.2(d)(3) **Comment/Rationale:** The referenced paragraph in the title CS 29.1302 (a)does not seem to be correct. 1302 (b)(3) is more related to the subject of the paragraph **Proposal for update of the NPA:** Correct the reference in the title to indicate the paragraph to 1302 (b)(3)
response	Accepted The commented reference has been amended.

comment	*64* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 28, paragraph 4.2(f) **Comment/Rationale:** The first sentence is incorrect as CS 29.777(b) content differs from CS 25.777(b) and therefore should be removed **Proposal for update of the NPA:** Delete the first sentence of the paragraph 4.2 (f)(2)
response	Partially accepted CS 29.777(b) states that the direction of movement of a cockpit control must comply with CS 29.779. The sentence has been corrected.

comment	*65* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 28, paragraph 4.2(f)
Comment/Rationale:
The second sentence is redundant with AC 29.779 and should be deleted
Proposal for update of the NPA:

Delete the second sentence of the paragraph 4.2 (f)(2)

response

Accepted

The commented sentence has been deleted.

comment *66* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 35, paragraph 4.4 (b)(1)
Comment/Rationale:
The reference in the paragraph to CS 29.1523 should be complemented with a reference to 29.771 (a) that deals with fatigue
Proposal for update of the NPA:

Add reference to 29.771(a)

response

Accepted

The proposed reference has been added.

comment *67* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 10, paragraph 1.2(b) of the NPA

Comment/Rationale:
The wording of proposed paragraph (b) may be ambiguous regardign the applicability to Non-intalled Equipment (NIE). Indeed the sentence ""and equipment used by the crew in the cockpit ...while operating" may be interpretated in a manner that NIE (e.g. EFB) are also affected. This is not the scope envisaged in AMC of the CS 25.1302,where it is specified that “It applies to those aeroplane and equipment design con-siderations within the scope of CS-25 for type certificate and supplemental type certificate (STC)” pro-jects”

Proposal for update of the NPA:
Clarify that the .1302 does not apply to Non-Installed Equipment.

response

Not accepted

EASA considers that the sentence ‘all the installed systems and equipment used by the crew’ is clear as it clearly states ‘installed systems and equipment’.

comment *68* comment by: *Airbus Helicopters*

Airbus Helicopters comment:

	Comment on Page 16, paragraph 3.2.2 chapter (c) **Comment/Rationale:** The level of information provided to EASA at the development stage should be proportionate to the availability of such information, taking into account the industrial constraints. For example, the detailed information provided by a function may not be available. **Proposal for update of the NPA:** Indicate that the steps of the process described in the chapter 3.1. and 3.2 have to be fulfilled with the level of information & system behaviour, intended function and interactions that is known and available at the time the step is accomplished, in an iterative way along the product development.
response	Not accepted EASA considers it is obvious that only the available information could be provided to EASA.

comment	*69* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 20, paragraph 3.2.6 paragraph (a) **Comment/Rationale:** The criteria of criticality has been kept (by error) in the text. **Proposal for update of the NPA:** Delete "criticality"
response	Accepted The commented reference has been deleted.

comment	*70* comment by: *Airbus Helicopters* **Airbus Helicopters comment:** Comment on Page 21, paragraph 3.3.1 paragraph (b) **Comment/Rationale:** It should be clarified if the word “test” include: - Familiarization and demonstration - Evaluation Does it mean that at least two HF evaluations per systems are normally expected for the HF certification strategy? **Proposal for update of the NPA:** Define what "test "corresponds to.
response	Noted ‘Test’ is understood as HFs evaluation. Familiarisation is obviously not a HFs evaluation.

	The adverb 'generally' allows demonstration based on only one test.

comment	*73* comment by: *Garmin International* **CS 29.1302, AMC 29.1302:** The proposed regulation and guidance material do not contain information about the qualifications of the individuals or organizations who will be authorized to make findings of compliance to this regulation. Provide information about the minimum qualifications necessary for a member of EASA staff or other to make a finding of compliance to the proposed rule.
response	Not accepted The definition of 'qualifications' for compliance verification engineers (CVEs) working within design organisations or for HFs experts working at EASA, or at other authorities, is outside the scope of this AMC.

comment	*74* comment by: *Garmin International* **CS 29.1302, AMC 29.1302:** The proposed rules, AMCs, and GMs pass/fail criteria are highly subjective. The similarly subjective CS 25.1302 and AMC have caused significant problems for validation projects since EASA promulgated the rule prior to other authorities. Further, the problems of determining what is an acceptable design to meet 25.1302 continues to occur even after the FAA published a harmonized rule and AC because the different EASA / FAA flight test/human factors teams arrive at different conclusions when reviewing the same installation due to the lack of clear pass/fail criteria. The lack of clear pass/fail criteria will especially cause issues for applicants without access to qualified individuals authorized to make findings of compliance (see related comment about what constitutes a qualified individual). Add clear pass/fail criteria..
response	Not accepted CS 25.1302 (and its associated AMC) is performance based; therefore, by its nature, is not prescriptive. Providing pass–fail criteria would render the rule prescriptive and this is opposite to the EASA strategy. Furthermore, there is an ongoing initiative called 'Certification Authorities for Transport Airplanes' (CATA) involving EASA, the FAA, ANAC and the TCCA with the aim to harmonise the interpretation and practices as regards CS 25.1302.

comment	*75* comment by: *Garmin International* **Section AMC 29.1302 Paragraph 3.2.1(c) Page 16:**

The phrase “Therefore, while mapping the entire cockpit and cabin or the modified one…” is unclear. What is “the modified one”? Should this state “the modified equipment” or “the modified aspects”?

response

Accepted

The commented sentence has been reworded.

comment *76* comment by: *Garmin International*

AMC 29.1302 Paragraph 3.2.3 (b) Page 19:

Include a description of what level of integration, complexity, novelty, or severity will meet the criteria for including in the candidate list of items to be scrutinized. The current wording doesn’t make this clear.

response

Not accepted

EASA has reworded this part to make it clear that all the design items considered in the certification process are to be included in the items to be scrutinised. Design items classified as novel, complex or highly integrated qualify for a higher level of scrutiny.

comment *77* comment by: *Garmin International*

AMC 29.1302 Appendix 1 “FAA Orders and Policy” Page 57:

References Policy Memo ANM-0103 and Notice 8110.98.

Notice 8110.98 was cancelled in 2003 and can only be found through a historical search of the FAA’s http://rgl.faa.gov/ website. It would be better to reference AC 00-74, Avionics Human Factors Considerations for Design and Evaluation, which was published by the FAA in part to fill the gap left by the expiration of Notice 8110.98.

The reference to "Policy Memo ANM-0103" cannot be found on the FAA's http://rgl.faa.gov/ website. However, it can be found by using the policy number “PS-ANM100-01-03A” (see http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgPolicy.nsf/0/4B68CF2DFB0ED36586256D6400548CF5?OpenDocument.

Suggest adjusting the reference to “PS-ANM100-01-03A”, which is also consistent with the reference used in AC 00-74 section 4.3.

response

Accepted

The commented reference has been amended accordingly.

comment *84* comment by: *LBA*

LBA Comment:

	The NPA uses the expressions „simple rotorcraft“ and „simple change to rotorcraft“ unless these expressions are not defined neither in the basic regulations (216/2008 and 2018/1139) nor in Part 21 (see Chapter 2.3.1, Page 5 AND AMC 29.1302, Chapter 3.3.1 (c), Page 21 AND AMC 27.1302, Chapter 3.3.1 (c), Page 83) or in the applicable AMC/GM 29/27.1302. The basic regulation and Part 21 use the expression “complex motor-powered aircraft” which seems to be the correct expression until Part 21 will be revised/updated on the basis of the new basic regulation. Furthermore the expression “simple change to rotorcraft” is not defined. Part 21 uses minor and major changes. Therefore, it is not clear what is a simple rotorcraft nor a simple change to rotorcraft.
response	Accepted The references to ‘simple changes’ or ‘simple rotorcraft design’ have been replaced by more appropriate wording.

comment	*89* comment by: *General Aviation Manufacturers Association* General: CS 29.1302, AMC 29.1302 and CS 27.1302, AMC 27.1302 It would be helpful if the proposal provided material to support the minimum requirements and qualifications required by an organization or individual authorized to find compliance with the proposed regulation. GAMA requests the provision of supporting material to enable the determination of a qualified individual or organization able to make a finding of compliance against the proposed regulation.
response	Not accepted Please see the response to comment #73.

comment	*90* comment by: *General Aviation Manufacturers Association* General: CS 29.1302, AMC 29.1302 and CS 27.1302, AMC 27.1302 This section is an area that requires further Authority coordination and harmonization with FAA, as Industry experience indicates different approaches and determination of levels of acceptance of .1302 requirements, especially during flight test and human factors team evaluations of an installation. In order to reduce the ‘subjectiveness’ and variation in determination of acceptable means of compliance of an equipment installation, GAMA recommends that harmonized pass / fail criteria is developed to improve consistency of regulatory interpretation.
response	Not accepted Please see the response to comment #74.

comment	*91* comment by: *General Aviation Manufacturers Association*

	General: AMC 29.1302, AMC 27.1302 The approach outlined in the AMC for 2x.1302 is of concern as it limits the use of AML STC for part-27 rotorcraft; e.g. equipment is produced under an (E)TSO to be installed and certified on multiple platforms. It is recognized that additional human factor reviews are required to ensure airframe compatibility and pilot use for installation approval. However, the lack of guidance material on the use of previously approved equipment places the use of AML STC in doubt. GAMA recommends the development of guidance material that recognizes the rotorcraft safety continuum and identifies the effective use of previously approved equipment to enable the use of the AML STC mechanism for part-27 rotorcraft installations. Specific detail is required on the additional human factor reviews or re-evaluations required to be performed during the ground and flight testing of installations following the initial STC. Again, this is an area that requires harmonization with FAA and TCCA to reduce unnecessary validation activity.
response	Not accepted The (E)TSO approval does not imply that the article can be installed in any aircraft without demonstrating compliance with the certification basis of that aircraft. As a matter of fact, the introduction of 27/29.1302 does not change this approach.

comment	*93* comment by: *General Aviation Manufacturers Association* AMC 29.1302 Paragraph 3.2.3 (b) Page 19 This section lacks the necessary detail to understand under what level of complexity and when an assessment is required. GAMA recommends additional criteria is developed to clarify when and the level of scrutiny required.
response	Not accepted Please see the response to comment #76.

comment	*98* comment by: *General Aviation Manufacturers Association* Section 1.3, Page 11 Typo: Change to ‘high-level’ or ‘high level’.
response	Accepted The text has been amended accordingly.

comment	*100* comment by: *General Aviation Manufacturers Association* Section 1.3, Page 11

Typo: Ambiguity in the definition for 'Catachresis'. Within the definition, change the word 'use' to 'misuse' to be consistent with its common definition.

response

Not accepted

Catachresis indeed refers to the unplanned use of the equipment, contrary to the prescribed use. It is, however, not the wrong use of the equipment.

comment

104 comment by: *AIRBUS*

Page 7 - §3.1 Draft certification specifications - CS 29.1302 (d)
Page 69 - CS 27.1302 (d)
Compared to the CS 25.1302 (d), the following part of the sentence has been removed: "To the extent practicable…".

This should be consistent with the sentence provided in the GM No 1 to 29.1302 §2 (c) (10) (iv) "*Imposing requirements without considering their economic feasibility or the commensurate safety benefits should be avoided*."
Extract of AMC 25.1302 "*The intent of requiring errors to be manageable only "to the extent practicable" is to address both economic and operational practicability. It is meant to avoid imposing…*.".
Airbus suggests to re-instate "To the extent practicable" in paragraph CS 29.1302 (d) and CS 27.1302(d).

response

Not accepted

Please see the responses to comments #38 and #57.

comment

105 comment by: *General Aviation Manufacturers Association*

Section 1.3,
Page 11

Ambiguity in the definition for 'Clutter'. It is unclear what is meant by 'reduce crew access'. Please clarify the definition.

response

Accepted

An excessive number and/or variety of symbols, colours, or other information that may restrict access to relevant information, increase interpretation time and the probability of interpretation error.

comment

107 comment by: *European Cockpit Association*

4.6 Integration
(d) cockpit environment
page 45

Original text:
(2) The cockpit environment includes the layout, or the physical arrangement of the

controls and information displays. Layouts should take into account the crew requirements in terms of: (i) access and reach (to the controls); (ii) visibility and readability of the displays and labels; and (iii) the task-oriented location and grouping of human–machine interaction elements. An example of poor physical integration would be a required piece of information that is obscured by a control in its normal operating position.

Comment:
Clear visibility of information has to granted during all helicopter operations.

Suggested:
Add behind the last sentence:
Display design should grant the readability / visibility of the information, even if the sun is directly shining onto the instruments/ displays even if they are protected with a blend.

Reasoning:
Our helicopter pilots experience demonstrates that often helicopter windshield and window design allow the sun to shine into the cockpit from multiple angles and in multiple ways. Therefore usual display shields do not work under all circumstances.

response

Partially accepted.

Agreed in principle; nevertheless, according to FAA AC 29.1321 § 29.1321 (Amendment 29-21) ARRANGEMENT AND VISIBILITY that is referred to in CS-29 Book 2, the flight test evaluation should also determine that the flags or malfunction indicators of the instruments should be readily visible in all combinations of lighting for approved types of operations.

This is also applicable to glass cockpit (DO 315-112).

comment *108* comment by: *General Aviation Manufacturers Association*

Section 3.2.8(a),
Page 22

Due to the context of this section, the second usage of the word ‘crew’ should be singular.

We suggest: Change ‘expected crew behaviours’ to expected crew member behaviours’. It may be beneficial to review all uses of the word crew.

response

Accepted

The text has been amended accordingly.

comment *110* comment by: *General Aviation Manufacturers Association*

Section 3.3.2(a),
Page 22

	Typo: 'scenario designers' text should be modified for clarity. We suggest changing to 'scenario-designers'.
response	Accepted The text has been amended accordingly.

comment	*113* comment by: *General Aviation Manufacturers Association* Section 3.3.2(e), Page 22 Typo: Odd and confusing use of the words 'interindividual variability'. We suggest it is changed to: 'crew member dependency'.
response	Not accepted 'interindividual variability' is considered self-explanatory. This term is widely used in Human Factors literature. The meaning is different from 'crew member dependency'.

comment	*115* comment by: *AIRBUS* Page 10 - §1.2 Applicability - (b) Page 71 - §1.2 Applicability - (b) Compared to the AMC 25.1302, the following paragraph has been removed: "It applies to those aeroplane and equipment design considerations within the scope of CS-25 for type certificate and supplemental type certificate (STC) projects." However, this paragraph clearly specifies the scope, that is no more the case in this NPA. Airbus suggests to re-instate the removed paragraph in AMC 29.1302 and AMC 27.1302.
response	Not accepted Covered by paragraph 1.2(d).

comment	*116* comment by: *General Aviation Manufacturers Association* Section 4.1(a), Page 25 Typo: '29.1302' should be 'CS 29.1302'.
response	Accepted The text has been amended accordingly.

comment	*117* comment by: *General Aviation Manufacturers Association* Section 4.1(a), Page 25 Typo: Sentence 'Not all the criteria can or should be met by all systems.' is confusing. Should the word 'criteria' be replaced by 'standard'?
response	Not accepted 'Criteria' here is correct because it refers to the specific criteria of Section 4.

comment	*119* comment by: *General Aviation Manufacturers Association* Section 4.3(b), Pages 30 to 31 Typo: There appears to be missing content or enumeration after '…presentation of information…'
response	Noted The paragraph has been reworded to address other comments. It is structured as follows: Title, introductory sentence (optional), bullet list of criteria

comment	*124* comment by: *European Cockpit Association* 2) Relation between CS 29.1302 and other requirements, and assumptions: **CS-29 Book 1 requirements** **CS 29.771(a) unreasonable concentration or fatigue** (Text of 29.771: CS 29.771 Pilot compartment For each pilot compartment: (a) The compartment and its equipment must allow each pilot to perform his duties without unreasonable concentration or fatigue; (b) If there is provision for a second pilot, the rotorcraft must be controllable with equal safety from either pilot position. Flight and powerplant controls must be designed to prevent confusion or inadvertent operation when the rotorcraft is piloted from either position; (c) The vibration and noise characteristics of cockpit appurtenances may not interfere with safe operation; (d) Inflight leakage of rain or snow that could distract the crew or harm the structure must be prevented.) **Comment:** Fatigue is an important coefficient in human factors. Especially helicopters have many factors which can lead to fatigue, like: vibrations, noise, cockpit seating, temperature etc. Experience shows that these factors have to be addressed and prescribed more precisely. In particular: **Temperatures:** **Suggested:**

For commercial operations it has to be technically assured, that under normal operating conditions it is possible to keep the cockpit temperature above 18°C and below 30°C.
If this can not be technically assured, operational limits have to apply. Payed breaks and exposure limits have to be compulsory, when the cockpit temperature of 30°C is exceeded – in relation to scientifical knowledge and working legislation.
A cockpit-air-thermometer has to be installed to assure the appropriate action for commercial operation.

Reasoning:
Due to the construction of helicopter cockpits (multiple glass panes), helicopters are usually very vulnerable to the high temperature by sun. Cockpit temperatures in flight of more than 50°C are not an exceptional case in many helicopter types. Already temperatures of more than 27°C lead to working restrictions for normal employees. **Since piloting an aircraft - esp. a helicopter - is a very demanding task, cockpit temperatures have to be kept at and below a certain level.** Therefore environmental conditions (cockpit temperature from 18° to 30°C must be possible under any circumstances for commercial operations).

Vibration:

Suggested:
Manufacturers have to prove that the required vibration levels can be kept under all operational circumstances and when the helicopter is at the track and balance limitations – otherwise limitations have to be adjusted and / or a vibration measurement with a warning function has to be implemented. Helicopter seat design should consider vibration absorption.

Reasoning:
Vibration levels / Vibration absorbing seats –
Maximum vibration levels as prescribed in Directive 2002/44/EC – vibration are not appropriate for helicopter vibration levels, as these limits refer to prevent for medical injuries and health. That high levels of vibration lead to premature fatigue is scientifically proved. In a high demanding workplace like a helicopter, there have to be much lower limits, than referred to in directive 2002/44EC. In addition, it is fact, that the vibration levels in most of the helicopters are acceptable if the helicopter is in normal flight and in optimum track and balance. In reality it is also fact, that vibration levels in most of the helicopter types increase over proportional, if the helicopters reach the track and balance limitations.
Therefore ECA demands, that the manufacturers have to prove, that the required vibration levels can be kept und all operational circumstances and when the helicopter is at the track and balance limitations – otherwise limitations have to be adjusted and / or a vibration measurement with a warning function has to be implemented.
Helicopter seat design should consider vibration absorption anyway.

Ergonomic seat design:

Suggestion:

	Height and backrest adjustment of the crew seats have to be compulsory and to follow the flight crew height requirements (1.58 to 1.95m). **Reasoning:** Forced posture due to typical helicopter control arrangement plus vibrations, lead to premature fatigue and back pain. **Seat arrangement of many helicopter types do not reflect to this fact.**
response	Not accepted Temperature: air-conditioning systems do exist in CS-29 helicopter; nevertheless, most of the time, air-conditioning systems are optional due the additional installation costs. When optional air-conditioning systems are fitted to the rotocraft, a cockpit air thermometer is normally installed in order to regulate the temperature. The remark is outside the scope of HFs. Vibration: 'In reality it is also fact, that vibration levels in most of the helicopter types increase over proportional, if the helicopters reach the track and balance limitations.' As written here by the ECA, it seems to be a problem of maintenance or airworthiness but not a HFs problem. Vibration is covered by CS-29. The vibration and noise characteristics of cockpit appurtenances may not interfere with the safe operation of the rotorcraft.

comment	*125* comment by: *European Cockpit Association* 3.3 Certification strategy: In the certification process, active, non-factory/manufacturer pilots should be admitted to test helicopters, allowing for testing with crews with different level of experience (junior, mid-experience and highly experienced).
response	Noted AMC 27/29.1302 already contains considerations regarding the level of experience of the pilots involved in the testing phase. According to paragraph 3.3.2, the criteria used to select the crews involved in the HFs assessments with certification credit should be adequate to the scope of the tests to be conducted and the selection process of the crew members should be recorded. The applicant should ensure that the test participants are representative of the end users.

comment	*126* comment by: *AIRBUS* Page 10 - § 1.2 Applicability - (d) Page 71 - § 1.2 Applicability - (d) The certification basis is defined according to the Part 21 Supbart D rules. Please remove the paragraph (d).
response	Partially accepted

The aim of paragraph (d) was to provide proportionate alleviation for the demonstration of compliance and not to affect the determination of the certification basis that, as properly mentioned in the comment, is defined according to Part 21.

To avoid such misinterpretation, paragraph (d) has been completely reworded.

comment *127* comment by: *AIRBUS*

Page 16 - § 3 Figure 1
Page 78 - § 3 Figure 1
Page 17 - § 3.2.2 (c)
Page 79 - § 3.2.2 (c)
Page 18 - § 3.2.2 (d) (3)&(4)
Page 79 - § 3.2.2 (d) (3)&(4)

The needed information (cockpit controls information & system behavior) necessary to perform the required analysis (to establish the degree of novelty, complexity and integration) are not always available at the beginning of the development and before to write the certification plan.
The level of information provided to EASA at the development stage to determine the level of scrutiny should be proportionate to the availability of such information, taking into account the industrial constraints. For example, the detailed information provided by a function may not be available.

Please clarify the level of information to be provided to EASA.

response Noted

EASA considers it is obvious that only the available information could be delivered to EASA.

comment *128* comment by: *AIRBUS*

Page 17 - §3.2.2 (c)(1)
Page 79 - §3.2.2 (c)(1)

"(c) An applicant should describe the intended function(s) and associated task(s) for:
(1) each item of the cockpit equipment"

It is not necessary to describe all items of the cockpit equipment when they are not affected by the modification.

Please complement the sentence with "each item of the cockpit equipment affected by the modification".

response Accepted

The commented paragraph has been reworded.

comment *129* comment by: *AIRBUS*

	Page 17 - § 3.2.2 (d) Page 79 - § 3.2.2 (d) "As discussed later in paragraph 3.2.3, novel features may require more detail, while previously approved systems and features typically require less detail." The precedence principle has to be kept and previously approved systems and features should not require any detail. Airbus suggests to replace "less detail" by "no detail".
response	Not accepted EASA considers that the precedence principle is not systematically applied due to the integration criteria.

comment	*130* comment by: *AIRBUS* Page 19 - § 3.2.3 (a)(3)(v) Page 80 - § 3.2.3 (a)(3)(v) "A function or system that the applicant chooses to refer to as a baseline from which the novelty is derived needs to have been certified by the applicant under CS-29/27.1302." It is not acceptable that the baseline from which the novelty is derived needs to have been certified under CS-29/27.1302. EASA considers that even already certified function or system on previous programs must be certified against the CS-29/27.1302 without taking credit of previous compliance demonstrations (including CRI HF). Airbus suggests to remove the sentence.
response	Not accepted Paragraph 3.2.3. has been fully reviewed: the reference to the regulatory material used for the certification of the reference product has been removed and transferred to the paragraph describing the means of compliance (refer to AMC 27/29.1302 Section 5).

comment	*131* comment by: *AIRBUS* Page 19 - § 3.2.3 (b) Page 81 - § 3.2.3 (b) It is not acceptable that only one of the above criteria is sufficient to include the item in the list of candidate items to be scrutinised. It means that if a function is complex but not novel (i.e. already certified on previous programs), it must be part of the candidate items. This does not take into account the precedence. Airbus suggests to remove the paragraph 3.2.3 (b).

response

Not accepted

Please see the response to comment #76.

comment

132 comment by: *AIRBUS*

Page 19 - § 3.2.5 (c)(d)
Page 81 - § 3.2.5 (c)(d)
Page 20 - § 3.2.6 (b)
Page 82 - § 3.2.6 (b)
Page 64 - GM No 2 to 29.1302 Example of Compliance matrix
Page 126 - GM No 2 to 27.1302 Example of Compliance matrix

Early in the design process, the HF objectives tables gather manufacturer's solutions and know how that must be kept internally. The HF objectives which are provided to EASA are the ones covered during the assessment campaign for which EASA is invited.
Furthermore, it is important that EASA keeps its own independent view on the design in addition to its own added value.

Please clarify that the HF objectives given in the HF test program are the ones applicable to the assessment campaign for which the EASA is involved.

response

Not accepted

The compliance matrix provides EASA with a global picture of the scope planned to be evaluated by the applicant. Based on this picture, EASA will select the evaluations that will be witnessed/tested with EASA. Therefore, a comprehensive visibility of the applicant's compliance demonstration strategy is required by EASA.

comment

134 comment by: *AIRBUS*

Page 20 - §3.2.6 (a)
Page 81 - §3.2.6 (a)

The level of criticality should be removed to be consistent with § 3.2.3 (a)

Airbus suggests to remove "criticality".

response

Accepted

The level of criticality has been deleted.

comment

135 comment by: *AIRBUS*

Page 20 - § 3.2.8 (a)
Page 82 - § 3.2.8 (a)

It is not always practicable to provide the expected crew behaviours as the expected behaviour may not be unique and several can be acceptable.

	Airbus suggests to remove “the expected crew behaviours”.
response	Not accepted EASA understands that crew behaviour might not be unique and brings some variability; nevertheless, the different behaviours foreseen should be presented in the test programme.

comment	*136* comment by: *AIRBUS* Page 20 - § 3.2.8 (b)(2) This bullet could be understood as data gathered must be sorted by HF objective. The data can be organized in another way which may be more relevant than by HF objective. Airbus suggests to remove “related to every HFs objective”
response	Accepted The commented sentence has been reworded to improve clarity.

comment	*137* comment by: *AIRBUS* Page 21 - § 3.3.1 (b) Page 83 - § 3.3.1 (b) “An HFs certification strategy based only on one test, aimed at demonstrating that the design assumptions are valid, is generally not acceptable.” It should be clarified what the word “test” includes: - Familiarization and demonstration? - Assessments? Does it mean that at least two HF assessments per systems are systematically necessary for the HF certification strategy? Please clarify the word “test”.
response	Partially accepted ‘An HFs certification strategy based only on one test assessment, aimed at demonstrating that the design assumptions are valid, is generally not acceptable.’ The use of the wording ‘generally not acceptable’ aims to allow for some flexibility, meaning that one assessment strategy might be acceptable on a case-by-case basis.

comment	*138* comment by: *AIRBUS* Page 21 - § 3.3.1 (c) Page 83 - § 3.3.1 (c)

	"Since the beginning of the certification process, EASA has to be able to monitor the development process through familiarisation sessions, regular witnessing of the HFs at the system-level and rotorcraft-level assessments, and reviews of test plans and test reports for assessments that will support the determination of the EASA LoI." It is not the mission of EASA to monitor the development process. It is not the purpose of the familiarization sessions to monitor the development process. The familiarization sessions allow EASA to get familiar with the function(s) and to give comments on the design in regards to the regulations. The EASA Level of Involvment is determined through familiarization session and not witnessing of HF assessments. The witnessing of the HF assessments is part of the compliance demonstration. Airbus suggests to replace the sentence with: "Since the beginning of the certification process, EASA has to be able to understand the HF design process and to get familiar with the new design through familiarisation sessions, ~~regular witnessing of the HFs at the system-level and rotorcraft-level assessments, and reviews of test plans and test reports for assessments~~ that will support the determination of the EASA LoI."
response	Partially accepted The review of the paragraph allowed to identify some issues with the original text; the paragraph has been modified to clarify the intention of EASA. However, EASA considers that the development and certification processes are inextricably intertwined as methods used all along the design process are the guaranty of the validity of the statement regarding the design compliance. For this reason, EASA scrutinises the HFs processes and methods used by the applicants on top of the proposed design itself. Therefore, EASA considers that monitoring the design process is a key part of its role.

comment	*139* comment by: *AIRBUS* Page 22 - § 3.3.2 (d) Page 84 - § 3.3.2 (d) "*The criteria to select the crews in the HFs assessments should be presented to EASA for acceptance*." The definition and presentation of criteria to select the crews could be done on a case by case basis depending on the changes (for aircraft level assessments). Airbus suggests to replace the sentence with "The criteria to select the crews in the HFs assessments at aircraft level should be presented to EASA for acceptance."
response	Not accepted EASA confirms the aim of making this guidance applicable to any kind of assessments, knowing that this AMC is applicable to any applicant. Some arrangement regarding part-task assessments may be considered on a case-by-case basis when the procedures used by the applicant are well-known by EASA.

comment *140* comment by: *AIRBUS*

Page 23 - § 3.3.2 (j)(2)
Page 85 - § 3.3.2 (j)(2)

"*The primary means of collecting data should be direct observation (including videos).*"

The current CS-25.1302 does not require the use of videos. The primary mean for collecting data is a direct human observation, and it is not mandatory to use video. It must be clarified if EASA consider the use of videos as mandatory during HFs assessments.

Please remove "(including videos)" as means of collecting data, if not considered as mandatory.

response Accepted

EASA agrees with the spirit of this comment and the need to clarify the use of video. The paragraph has been modified to provide further clarity.

comment *147* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
7	3.1 (b)	"all"	Extraneous word. Not necessary. In the part 25 world have TC applicants tried to say 1302 applies to this installed but not that installed equipment? Additionally, "all" may confuse the issue if 1302 via 21.101 is invoked for a particular STC modification. Does that mean the entire cockpit ("all") is now subject to 1302 even though the STC only affects a portion?	Delete "all".

response Accepted

The text has been amended accordingly.

comment *148* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution

10	1.2(b)	"abnormal"	What is the difference between an abnormal condition and emergency condition? The level of the 1322 alert that is generated? (Cautions are "abnormal" and Warnings are "emergency"?) "Abnormal " is more in the Part 25 transport airplane lexicon. Additionally, the authorities do not approve "abnormal" procedures according to 27/29.1585	Delete "abnormal". Keep consistent with the rules (27/29.1585)
10	1.2(d)(1)	". . .and IFR operations, . . ."	This should include all Part 29 rotorcraft regardless of IFR/VFR	Delete " . . .approved for CAT B and IFR operations, or CAT A . . ."
10	1.2(d)(2)	However, if the specific characteristics or the types of operations for which the rotorcraft is designed justify it, the applicant may propose to EASA the use of appropriate alleviations.	This is not clear. Rotorcraft are multirole aircraft. Additionally, one could say that flying VFR is more hazardous than IFR due to its "see and avoid" requirements. As a result, HF and PMI could be more critical.	Delete (2) IF the suggested resolution above is adopted. Otherwise clarify what is meant by "specific characteristics or type of operations".
10	1.2(d)(3)	Entire paragraph	IF 21.101 is not applicable and the applicant is not required to step up to the latest amendment, then the guidance in this paragraph is not required. If the intent is to levy 1302 on all projects, this should be explained and justified in a document other than the AMC.	Delete (3).

response Partially accepted

1.2(b) and other paragraphs of the AMC: the FAA comment is that 'abnormal' is not a commonly used term in CS-27/CS-29. 'Malfunctions' has been introduced, where applicable (to be noted that there are cases in the text where the word 'abnormal' is appropriate and, therefore, has been kept).

1.2(d)(1), 1.2(d)(2) and 1.2(d)(3): since the paragraph describing the proportionality has been completely restructured and reworded, these comments are no longer applicable.

comment *149* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
11	1.3	"Conformity": ". . . Conformity of the facility is one parameter that distinguishes one means of compliance from another."	How does conformity of a facility fit into conforming a part installed on an aircraft or the aircraft itself and how does it relate to 1302?	Clarify or delete

response Accepted

The quoted sentence has been deleted since within the new AMC the notion of conformity is not part of the definition of 'means of compliance' any more.

comment *150* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
12	1.3	"Crew member" ". . .or to helping the crew to control the aircraft in a hover are considered to be crew members."	confusing. In context of a hoist operation, the hoist operator's fine maneuvering of the helicopter via the hoist pendant controls is "helping" the pilot.	Change " . . .helping the crew. . ." to ". . .helping the pilot. . ." Or Delete words after "hoist"

12	1.3	Display: "(typically visual, but it may be accompanied by auditory or tactile feedback)"	The paranthetical statement not necessary since, in context, auditory and tactile feedback is ancillary to the display	Delete paranthetical statement
12	1.3	Human Error: "attributable to the crew . . ."	"attributable" infers "caused by". In context with 1302, the HE would be caused by the human's interaction with equipment/information that lead to the human taking an erroneous or inappropriate action.	Change "attributable" to "A deviation by the pilots or crew from what is considered . . ."
12	1.3	Abnormal or emergency conditions: For the purpose of this AMC, abnormal or emergency operating conditions refer to conditions that do require the crew to apply procedures different from the normal procedures included in the rotorcraft flight manual	Consider rewording. Sounds as if from Part 25. "Abnormal" is regulatorally undefined. For example: being 10 knots slow on airspeed during an approach could be considered "abnormal" where there are no OEM dictated procedures.	Suggestion: "Emergency conditions: Aircraft or operational conditions requiring the crew to perform actions, either by memory or by reference to the Emergency Procedures section of the flight manual."

response

Partially accepted

1. Partially accepted

2. Accepted

3. Accepted

4. Not accepted, as there are a few products for which ‘abnormal procedures’ are provided in the operating manuals.

comment *151* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
14	2.1(b)	". . .guidance material for all . . ."	MG-20 does not provide guidance material for "all" the HF related regulations	Change "all" to "some of"

response Accepted

The FAA comment is shared by EASA.

comment *152* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
15	2.2	". . .the assumption that the rotorcraft will be operated by qualified crew members who are trained in the use of the installed equipment."	This is sticky for the FAA. What does "trained" mean in context? Formally, unless the aircraft is over 12,500 pounds (5,669 kg), "training" in the form of a type rating is not required.	For 29, "trained" may be OK but, for 27, "familiar", a similarly undefined and unquantified term, may be better.

response Not accepted

The issue with the different rules between the FAA and EASA for crew qualification and how this affects especially CS-27 rotorcraft is known. However, it cannot be solved at the level of this AMC. Most likely, this regulatory difference will be identified as significant standard difference (SSD).

comment *153* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
16	3.1	Overview ". . .an overview of the human factors certification process that is necessary to demonstrate."	IF an AMC is equivalent to an AC it is a guidance document not regulatory. The statement ". . . Necessary to demonstrate. . ."	IF an AMC is guidance and an applicant can suggest another means of compliance through the

			compliance sounds mandatory	CRI/IP process: Change to ". . .an overview of a human factors certification process acceptable to demonstrate compliance . . ."

response

Accepted

The text has been amended accordingly.

comment

154 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
17	3.2.2 (d)	Applicants may evaluate whether statements of the intended function(s) and the associated task(s) are sufficiently specific and detailed by using the following questions: (and (1)....(7)	Consider moving these to separate subparagraph. This sentence and the following subparagraphs are different topic than "novel" features and are more general to section 3.2.2.	Move to separate subparagraph

response

Accepted

The text has been amended accordingly.

comment

155 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
19	3.2.3 (v)	A function or system that the applicant chooses to refer to as	This is unclear and ambiguous. Does this mean that installing a	Clarify.

		a baseline from which the novelty is derived needs to have been certified by the applicant under CS 29.1302.	touchscreen display in a cockpit with no existing TS displays requires the underlying TS needs to have been certified by the applicant? Does it mean that the applicant must have installed a TS in another cockpit and certified it under 1302 in order to use as a baseline? How would that work for an STC?	
19	3.2.4	Irrespective of the above, the EASA involvement in the verification of compliance demonstration of the subsequent steps of the human factors process will depend on the LoI determined by EASA in accordance with point 21.B.100 of Part 21	"LoI" ; Presume means "Level of Involvement"? But could mean Lots of laughs? Lots of love? Laugh out loud?	Spell out "LoI"

response Accepted

1. Paragraph 3.2.3 has been fully reviewed: the reference to the regulatory material used for the certification of the reference product has been removed and transferred to AMC 27/29.1302 Section 5 that describes the means of compliance.

2. 'LoI' is defined in the abbreviations table.

comment *156* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
26	4.2(d)(1)(iii) and (iv)	Controls can be made distinguishable or predictable by differences in form, colour,	This two provides a means to make a control easily identifiable by the pilot (see (i)). (iii) is out of context with	Either delete or combine (iii) and (iv) into: Critical controls should have

		location, motion, effect and/or labelling. AND "Colour coding is usually not sufficient . . . "	the rest of the Sbullets, (iv) is good content but prescriptive.	multi-sensory identification means (Size, shape, texture, haptics, visual, etc). For example, use of color alone as an identifying feature is not sufficient.
26	4.2(d)(2)(i)	CS 29.1302(a) and (b) require the information necessary to accomplish defined tasks to be provided precisely and clearly. They also require the controls to be accessible and usable by the crew in a way that is consistent with the urgency, frequency and duration of the tasks. Therefore, labels	The explanatory text is not needed. If tie into 1302 section desired, do so in heading "Labelling"	Delete explanatory text, start para with "Labels should . . ." Add "CS29.1302 (a), (b) to (2) Labelling . . ."

response

Accepted

The text has been amended accordingly.

comment

157 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
27	4.2(d)(2)(iii)	The design should avoid hidden functions (such as clicking on empty space on a display to make something happen). However, such	In context of the preceding and following information this information is an orphan. It does not clearly fit the flow of (2) and "icons"	Move to appropriate space or delete

		hidden functions may be acceptable if adequate alternate means are available to access the function. The design should still be assessed for its ease of use and crew understanding		
27	4.2(e)(1)	The applicant must show that each crew member in the minimum crew, as defined by CS 29.1523, has access to and can operate all the necessary controls. Accessibility is one factor in determining whether controls support the intended function of the equipment used by the crew.	Explanatory text not needed.	Delete. Start para with "Any control . . ."
27	4.2(e)(1)	If the shoulder restraints are lockable, this may be shown with the shoulder restraints locked.	If this is not a "should" then delete. It sounds like its an option. Accessibility of controls with shoulder harnesses locked should be assessed, particularly primary controls or any other control used in emergency procedures	Delete the sentence or modify "Show that the pilots can reach and manipulate high priority controls needed for the safe operation of the aircraft with the shoulder harnesses locked."
27	4.2(e)(2)	CS 29.1302(b) requires	No need to repeat rule language	Delete sentence : CS

		information intended for the use by the crew to be provided in a clear and unambiguous form, to be accessible, and to enable crew awareness.		29.1302(b) requires information intended for the use by the crew to be provided in a clear and unambiguous form, to be accessible, and to enable crew awareness.
27	4.2(e)(2)	". . .and of a minimum equipment list (MEL) dispatch."	MMEL usually accomplished by AEG post-TC. Is this intended for ATC/STC?	If this statement relates to STC or ATC's clarify

response

Accepted

The MMEL is part of the initial TC process, as part of the OSD assessment.

'MEL' replaced by 'MMEL'.

comment *158* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
28	4.2(f)(1)(ii)	". . .with an. . ."	grammatical	Delete "an"
28	4.2(f)(1)(iv)		The wording describes the same thing as (i) but in greater detail	combine (i) and (iv) "The applicant should show that the controls required to regain control of the rotorcraft or system and the controls required to continue operating the rotorcraft in a safe manner are usable in conditions with extreme lighting levels or severe

				vibrations like turbulence or other vibration and should not prevent the crew from performing all their tasks at an acceptable level of performance and workload"
28	4.2(f)(2)	Controls of a variable nature that use a rotary motion must move clockwise from the OFF position, through an increasing range, to the full ON position.	This statement is out of context with paragraph and is specific to a control. If maintain, should describe how you want controls to move relative to their function	Delete, move to appropriate section, or precede with "for example"
28	4.2(f)(2)(i)	A control input is often required in response to information on a display or to change a parameter setting on a display.	extraneous language, not needed.	Delete. Revised para: To ensure that a control is unambiguous per CS 27.1302(b)(1), the relationship and interaction between a control and its associated display or indications should be readily apparent, understandable, and logical.
28	4.2(f)(2)(i)	The applicant should specifically assess any rotary knob that has no obvious 'increase' or	This is written as if it addresses a specific issue in a cert project. If yes, use as an example. Add "For example" to rotary knob example.	Delete, expand to clarify, or phrase as example. To ensure that a control is unambiguous per CS 29.1302(b)(1),

		‘decrease’ function with regard to crew expectations and its consistency with the other controls in the cockpit.	A knob's inherent rotational function does not always have to be "increase" or "decrease". For example, discrete field selection could be accompished turning knob clockwise for "right", counter clockwise of "left") The tricky bits arise when a knob controls a vertically displayed parameter like a bug. For instance, if the knob is located adjacent to and to the left of the parameter controlled. does the pilot rotate the knob clockwise to move the bug down the scale spatially or does the pilot rotate the knob clockwise to "increase" the value that the bug is indexing (meaning, the bug moves "up" the scale, presuming "up" indicates greater or larger values) What about a knob located adjacent to and to the right of the parameter controlled?	the relationship and interaction between a control and its associated display or indications should be readily apparent, understandable, and logical. For example, the applicant should specifically assess any rotary knob that has no obvious ‘increase’ or ‘decrease’ function with regard to crew expectations and its consistency with the other controls in the cockpit. The Society of Automotive Engineers’ (SAE) publication ARP4102, Chapter 5, is an acceptable means of compliance for controls used in cockpit equipment.

response

Partially accepted

The text has been amended in order to accommodate, as far as possible, these comments.

comment *159* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
29	4.2(g)(2)	Feedback, in an appropriate form, should be provided to inform the crew that	Info in 4.2(g)(6) would work well here since (g)(6) is broad in scope.	Either replace (2) with (6), rewrite (2) to include parts of (6) and delete (6), or delete (6). Recommend: 4.2(g)(2): "To meet the requirements of CS 29.1302, the applicant should show that feedback in all forms is obvious and unambiguous to the crew in their performance of the tasks associated with the intended function of the equipment. Feedback, in an appropriate form, should be provided to inform the crew that:" Retain 4.2(g)(2) (i)-(iv) Delete 4.2(g)(6).
29	4.2(g)(1)	Each control should provide feedback to the crew member for menu selections, data entries, control actions, or other inputs.	Extraneous wording. This is "motherhood" and not necessary	Delete
29	4.2(g)(1)	There should be a clear and unambiguous indication when a crew input is not	Additional text to help clarify (2)	There should be a clear and unambiguous indication as to the meaning of the feedback

		accepted or not followed by the system (29.1302(b)(1)). This feedback can be visual, auditory, or tactile.		indications. For example, if the intent of the feedback is to indicate a commanded event vs system state. Additonally, provide feedback when a crew input is not accepted or not followed by the system (29.1302(b)(1)). This feedback can be visual, auditory, or tactile.
29	4.2(g)(2)(iv)	when a control is used to move an actuator through its range of travel, the equipment should provide, within the time required for the relevant task, operationally significant feedback of the actuator's position within its range. Examples of information that could appear relative to an actuator's range of travel include the target speed, and the state of the valves of various systems	This is confusing. "Actuators " normally relates to flight control acuators. Does this mean that when the cyclic is moved there needs to be an indicator in the cockpit showing the position of the pitch/roll actuators and the swash plate? The example is not clear. How does an actuator's range of travel coincide with "target speed" (presuming target speed = airspeed/ground speed). Also, the rationale for including "the valves of various systems" in the sentence seems to indicate actuator valves?	Clarify or delete

response Accepted

The text has been amended accordingly.

It is to be noted that the main objective here is to address the control and feedback information of a fly-by-wire or fly-by-light piloting system. Most of the times, the difficulties of such a system are the lack of information of the remaining margin of the controls and the proximity of the control stops.

comment *160* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
30	4.2(g)(3)	As an example, the switch position alone is insufficient feedback if awareness of the actual system response or the state of the system as a result of an action is required as per CS 29.1302(b)(3).	This is confusing as worded. Is or is not switch position alone sufficient? Currently switch position is referenced in 29.1329 and 1335. Is the intent to broaden the concept of switch position alone is insufficient to other systems?	Clarify
30	4.2(g)(4)	Controls that may be used while the user is looking outside or at unrelated displays should provide tactile feedback. Keypads should provide tactile feedback for any key depression. In cases when	Majority of the paragraph information is in the second paragraph relating to keypads. I think the topic is tactile feedback. There seems to be two sep topics though; controls for use while not looking at the control or display and keyboards. Is the topic tactile	Suggest: Controls should include tactile feedback. Keypads should provide tactile feedback for any key depression. In cases when this is omitted, it should be replaced with appropriate visual or other feedback indicating that the system has received the inputs and is responding as expected. Tactile feedback in the form

		this is omitted, it should be replaced with appropriate visual or other feedback indicating that the system has received the inputs and is responding as expected.	feedback or type of control?	of control identification and use should be included for controls that may be used while the user is looking outside or at unrelated displays.
30	4.2(g)(6)	To meet the requirements of CS 29.1302, the applicant should show that feedback in all forms is obvious and unambiguous to the crew in their performance of the tasks associated with the intended function of the equipment	Same recommendation as 4.2(g)(2) As written (6) is a generalization compared to the (1) . . .(5). Looks like an an expansion of (2)	Either replace (2) with (6), rewrite (2) to include parts of (6) and delete (6), or delete (6). Recommend: 4.2(g)(2): "To meet the requirements of CS 29.1302, the applicant should show that feedback in all forms is obvious and unambiguous to the crew in their performance of the tasks associated with the intended function of the equipment. Feedback, in an appropriate form, should be provided to inform the crew that:" (retain 4.2(g)(2) (i)-(iv)). Delete 4.2(g)(6).
30	4.3 (a)(1)	Applicants should use this AMC to show that the information displayed in the proposed design	Unnecessary. The AMC is a means of compliance by definition.	Delete sentence

		complies with CS 29.1302(b).		
30	4.3 (a)(1), (2)	All	(2) is more general and broader than (1)	Swap (1) with (2) "(1) The presentation of information to the crew can be visual (for instance, on a display), auditory (a 'talking' checklist) or tactile (for example, control feel). The presentation of information in the integrated cockpit, regardless of the medium used, should meet all of the requirements bulleted above. The following provides compliance considerations for the requirements found in CS 29.1301(a), CS 29.1301(b), CS 29.1302, and CS 27.1543(b). (2)Show, in sufficient detail, that the function, method of control operation, and results of information presentation comply with the requirements in CS 29.1301 and 29.771(a) and that the results of the presented information are — clear, — unambiguous, — appropriate in resolution and precision, — accessible, — usable, and — able to provide adequate feedback for crew awareness.

30	4.3 (a)(1)	The proposed means should be of sufficient detail to show that the function, method of control operation, and results comply with the requirements in CS 29.1301 and that the results of the presented information are:	Add 771(a) See previous comment	Suggest: Show, in sufficient detail, that the function, method of control operation, and results of information presentation comply with the requirements in CS 29.1301 and 29.771(a) and that the results of the presented information are:

response Partially accepted

4.2(g)(3): Noted. Today, the requirement to have additional feedback (on top of the switch position) to indicate which configuration is selected is only applicable to the autopilot and the flight director (as per 29.1329/1335).

4.2(g)(4): Not accepted. Both, keypad is an example, but the paragraph deals with all the controls (e.g. switches, push buttons, and others).

4.2(g)(6): Accepted. The text has been amended accordingly.

4.3(a)(1): Accepted. The text has been amended accordingly.

4.3(a)(1) and (2): Accepted. The text has been amended accordingly.

4.3(a)(1): Accepted. The text has been amended accordingly.

comment *161* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
31	4.3 (b)(1), (2)	entire (b)	The use of "quantitative" and "qualitative" is confusing. These are design strategies. The end result is that the information is presented in such a manner that the pilots	Not sure how to revise. However should be agnostic as to how information is presented to the pilots

			can access, read, interpret, and act on the information presented with the timeliness and precision required. How the applicant does that is their responsibility. The section title is "Presentation of Information" and is agnostic to how that presentation is presented. Yet (1), (2) are display (visual mode of presentation) centric. For example, an applicant could choose to provide an aural "overtorque" or "torque" alert (qualitative) driving the pilot to look at the TQ gauge (quantitative) or lower the torque commanded.	
31	4.3 (c)	Characters, fonts, lines and scale markings (CS 29.1301(b) and CS 29.1543(b)) Crew members, seated at their stations and using normal head movement, should be able to see and read display format features such as fonts, symbols, icons and markings. In some cases, cross-cockpit readability may be required to meet the intended function that both pilots	The text targets readability of the display from both pilot positions. The title topic, "Characters, fonts . . ." is part of readability. If the title is the topic you should include effects of parallax, etc.	Change title to "Display readability". The last sentence of the existing text covers characters, fonts, etc.

		must be able to access and read the display. Examples of situations where this might be needed are cases of display failures or when cross-checking flight instruments. Readability must be maintained in sunlight viewing conditions (per CS 29.773(a)) and under other adverse conditions such as vibration. Figures and letters should subtend not less than the visual angles defined in SAE ARP4102-7 at the design eye position of the crew member who normally uses the information.		
31	4.3 (d) (2), (3)	(2) Different systems in the cockpit should use the same colour coordinates. (3) Applicants should show that the chosen colour set is not susceptible to confusion or misinterpretation due to differences in colour usage between displays.. . ."	(3) can be interpreted as contradicting (2). Additionally, for post-TC mods, the color coordinates between OEM installed v. STC house installed can be different if there are different TSOA'd equipment installed. The important takeaway is that there is no confusion regarding what color is what (think NVIS A Red v. amber).	Suggest Delete (2), change (3) to (2) with revision: (i) The meaning of the color should be consistent within the cockpit and consistent with 29.1322. (ii) Color combinations, like blue on black or red on black, should be readily seen and readable in all environmental lighting and

				foreseeable display illumination levels. Move the following to (1): Improper colour coding increases the response times for display item recognition and selection, and increases the likelihood of errors, which is particularly true in situations where the speed of performing a task is more important than the accuracy, The use of the red and amber colours for other than alerting functions or potentially unsafe conditions is discouraged. Such use diminishes the attention-getting characteristics of true warnings and cautions
31	4.3 (d) (3)	"AMC 25-11 . . ."	Has EASA accepted change 7?	Change to AMC 29-2 MG-19

response

Partially accepted

4.3(b)(1) and (2): Agreed in principle, but the challenge of the HFs assessment is to determine a good compromise between the quantitative and the qualitative display formats.

'Aural' here is not within the scope of the paragraph.

4.3(c): Accepted.

4.3(d)(2) and (3): Partially accepted. Sentences reworded to improve clarity.

4.3(d)(3): Not accepted. So far, EASA has formally recognised only Change 6.

comment *162* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
32	4.3 (e) (1), (5)	(1) Designs can base many elements of electronic display formats on established standards and conventional meanings. For example, ICAO Doc 8400 provides abbreviations, and is one standard that could be applied to cockpit text. SAE ARP4102-7, Appendices A to C, and SAE ARP5289A are acceptable standards for avionics display symbols. (5) The applicant should show that displayed text and auditory messages are distinct and meaningful for	Both these are general, introductory, and generically performance based. Although (5) references text and auditory, the performance requirements apply to symbology also. The last two sentences are agnostic as to the type of "message"	Combine (1), (5): (1) Relaying information to the crew via symbols, text, auditory cues or combinations of the three should be distinct and the information they are intended to convey should be easily recognized and understood by the crew. Equipment should present standard and/or unambiguous abbreviations, nomenclature, symbols, and auditory cues consistent within a function and across the cockpit. Industry documents such as ICAO Doc 8400, SAE ARP 4102-7, and SAE ARP 5289A are acceptable standards for symbols and text. Additionally, industry standards and accompanying TSOs provide acceptable means of using symbols,

		the information presented. CS 29.1302 requires information intended for use by the crew to be provided in a clear and unambiguous format in a resolution and precision appropriate to the task, and the information to convey the intended meaning. Equipment should display standard and/or unambiguous abbreviations and nomenclature, consistent within a function and across the cockpit		audio, and textual messages. (2) Symbols and Icons should be easily identifiable as to their meaning with little or no familiarization. Use of text or abbreviations to label icons is acceptable as long as the abbreviation is common. (i) Symbols with the highest priority should remain in view if there are multiple symbols displayed simultaneously. (ii) New symbols not traditionally used in the cockpit should be assessed for their distinguishability and for crew understanding and retention. This is particularly important if the new symbol represents information or a function that historically used another symbol. (iii) Symbols and icons not related to moving maps or geo-reference displays should be displayed in the same area of a display to enable pilots to easily locate them consistently. (3) Text messages (ii) Auditory messages or cueing should be distinct and easily

				recognizable. The number of tone only (non-vocal) cues should be limited to ensure distinction and recognition of meaning.
32	4.3 (e)(2), (3), (4)	See text	(2)-(4) basically discussing symbology. Combine into new (2) with sub paragraphs.	(2) Symbols and Icons should be easily identifiable as to their meaning with little or no familiarization. Use of text or abbreviations to label icons is acceptable as long as the abbreviation is common and easily interpreted. (i) Symbols with the highest priority should remain in view if there are multiple symbols displayed simultaneously. (ii) New symbols not traditionally used in the cockpit should be assessed for their distinguishability and for crew understanding and retention. This is particularly important if the new symbol represents information or a function that historically used another symbol. (iii) Symbols and icons not related to moving maps or geo-reference displays should be displayed in the same area of a display to enable

				pilots to easily locate them.
32	4.3 (e)(2), (3), (4)	See text	(2)-(4) basically discussing symbology. Combine into new (2) with sub paragraphs.	(2) Symbols and Icons should be easily identifiable as to their meaning with little or no familiarization. Use of text or abbreviations to label icons is acceptable as long as the abbreviation is common and easily interpreted. (i) Symbols with the highest priority should remain in view if there are multiple symbols displayed simultaneously. (ii) New symbols not traditionally used in the cockpit should be assessed for their distinguishability and for crew understanding and retention. This is particularly important if the new symbol represents information or a function that historically used another symbol. (iii) Symbols and icons not related to moving maps or geo-reference displays should be displayed in the same area of a display to enable pilots to easily locate them.
32	4.3 (e)		Add new (3)	(3) Ensure auditory message are prioritized correctly. Messages

				of lower priority should not interefere with higher priority messages. (i) Auditory messages using tones should be distinct and the number limited per technical standards. (ii) Tones should be loud enough for pilots' perception but not so loud to cause a startle response in the pilot. Additionally, depending on the priority of the tone alert, it should not be squelched by intercom communications or other less important messages. (iii) Voice messages should meet the performance targets of tone messages. (iv) A means should be provided for the pilots to mute messages or, depending on the priority, inhibit messages to keep clutter
32	4.3 (e)		Add new (4) It is unclear whether the term "text" in (e) title refers to text messages like those found on cell phones or relates to the text labels of icons, symbols, or other alerts.	Depending on the intent of "text" in the title (e), provide a set of performance measures expected in system integration, either pre or post TC.
32	4.3 (f) (i)	Information intended for the crew must	Reciting the rule requirement is redundant. The flow	Suggest revision:(i) The applicant should show that any

		be accessible and useable by the crew in a manner consistent with the urgency, frequency, and duration of their tasks, per CS 29.1302(b)(2). The crew may, at certain times, need some information immediately, while other information may not be necessary during all phases of flight. The applicant should show that the crew can access and manage (configure) all the necessary information on the dedicated and multifunction displays for the phase of flight. The applicant should show that any information required for continued safe flight and landing is accessible in the relevant degraded display modes following failures as	of the paragraph places important information in the middle and end. The performance requirement should be first in the paragraph and the other information after it.	information required for continued safe flight and landing is accessible in the relevant degraded display modes following failures as defined by CS 29.1309. The applicant should specifically assess what information is necessary in those conditions, and how such information will be simultaneously displayed. The applicant should also show that supplemental information does not displace or otherwise interfere with the required information. The crew may, at certain times, need some information immediately, while other information may not be necessary during all phases of flight. The applicant should show that the crew can access and manage (configure) all the necessary information on the dedicated and multifunction displays for the phase of flight.

		defined by CS 29.1309. The applicant should specifically assess what information is necessary in those conditions, and how such information will be simultaneously displayed. The applicant should also show that supplemental information does not displace or otherwise interfere with the required information.		

response

Noted

The proposed rewording will be considered in the context of a future update of the regulatory material.

comment

163 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
33	4.3 (f)(2) (i), (ii), and (iv)	Visual or auditory clutter is undesirable. To reduce the crew member's interpretation time, equipment should	Should be performance oriented. Explanatory text should be at the end of the paragraph.	Revise (2) as follows. Leave (iii) as writtee (2) If there are displays or presentation methods in the cockpit that have mulitple layers of information available to the

		present information simply and in a well-ordered way. Applicants should show that an information delivery method (whether visual or auditory) presents the information that the crew member actually requires to perform the task at hand. The crew can use their own discretion to limit the amount of information that needs to be presented at any point in time. For instance, a design might allow the crew to program a system so that it displays the most important information all the time, and less important information on request. When a design allows the crew to		pilot, applicants should show that information is presented in a well-ordered way. The mechanisms and logic to selecting and deselecting, "decluttering", information should be easily understood and performed. (i) Pilot selectable declutter modes should ensure that information required by regulation is either not deselectable or a means provides the pilot with an equivalent level of awareness of the information if it is deselected. Normally, information required by CS29.1303 is not allowed to be deselected. Waiting until a parameter reaches a cautionary or warning boundary to alert the pilot to a non-standard condition or status is unacceptable. The use of part-time displays depends not only on the removal of clutter from the information, but also on the availability and criticality of the display.

		select additional information, the basic display modes should remain uncluttered.		(ii) Automatic decluttering that deselects information for the purpose of reducing visual clutter should not hide needed information from the crew member. If equipment uses automatic deselection of data to enhance the crew member's performance in certain emergency conditions, the applicant must show, per CS 29.1302(a), that it provides the information the crew member needs. (iii) Information layering should be prioritised according to the criticality of the task. Lower-priority information should not mask higher-priority information, and higher-priority information should be available, readily detectable, easily distinguishable and usable. (iv) Auditory information decluttering through mute or inhibit features should ensure that high priority auditory information is presented as needed. When audio inhibit

				functions are active, their inhibit status should be presented to the pilots. If the auditory information is high priority and can be inhibited, the visual indication of inhibit status should be in the pilot's primary field of view.
33	(2) Clutter (CS29.1302) (ii)	The paragraph reads Therefore, when designing such features, the applicant should follow the guidance in AMC 25-11, Chapter 6.	The FAA AC 25-11 is equilevent to AMC 25-11 and it would not be used for the Part 27 and Part 29 guidance to show compliance	
33	4.3 (f)(3)	Title	Needs a title. Content seems better suited to 4.2 Controls (g) Adequacy of Feedback. Recommend writing so the performance target is first, explanatory at the end.	Consider moving to new subparagraph in 4.2(g) Control Initiation and Response The applicant should show that the response to a control input, such as setting values, displaying parameters, or moving a cursor symbol on a graphical display, is fast enough to allow the crew to complete the task at an acceptable level of performance. For actions that require a noticeable system processing time, equipment should

				indicate that the system response is pending. Long or variable response times between a control input and the system response can adversely affect the usability of the system.

response

Partially accepted

1. Text to be improved in the context of a future update of the regulatory material.

2. Noted. However, EASA considers that the guidance provided is still appropriate for system designs, as stated in the text.

3. Accepted. The title 'System response time' has been added.

comment

164 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
34	4.4 (a)	This paragraph provides means for demonstrating compliance with the design considerations for the requirements found in CS 29.1302(c), CS 29.1301(a), CS 29.1309(c), or any other relevant paragraphs of CS-29	Is the intent of this AMC to replace MOC's in the referenced CS's? If no, then this is an inaccurate statement. If yes, then we should go back and reference this AMC in affected sections (i.e., AMC 29.771(a): For MOC see AMC 29.1302 sections X, Y, Z.) As written this appears to override MOC's in section 29.1301, 1309, 771, etc.	Clarify intent.
34	4.4 (a)(2)	The requirement for operationally	These two sentences appear to contradict one another when the words ". . .and	Revise one or both sentences. Suggest: "The requirement for operationally

		relevant system behaviour to be predictable and unambiguous will enable the crew to know what the system is doing and why. AND This distinguishes system behaviour from the functional logic within the system design, much of which the crew does not know or does not need to know.	why." are in the first sentence. The "why" a system is behaving the way it is is a result of the systems functional logic particularly when it is interacting with other systems.	relevant system behaviour to be predictable and unambiguous will enable the crew to know what the system is doing and what they did to enable/disable the behaviour."
34	4.4 (a)(5)	Examples include fly-by-wire systems and full authority digital engine controls (FADECs). Detailed specific guidance for automatic systems can be found in the relevant parts of CS-29	Examples of FBW is misleading, pilot awareness of FBW status should still be needed particularly if the system changes control law modes based on aircraft parameters.	Remove FBW as an example

response

Accepted

1. Accepted. EASA agrees that the intent of this paragraph is not to replace the means of compliance to the affected requirements; therefore, the quoted sentence has been deleted.

2. Noted. EASA considers that the comment qualifies for deeper analysis, especially a better definition of the terms ‘operationally relevant system behaviour’ and

'system function logic'. Therefore, the text will need to be improved in the context of a future update of the regulatory material.

3. Accepted. EASA considers that some examples used across the document are obsolete and would qualify for a complete review. Therefore, for this specific case, the 'fly-by-wire' example has been removed.

comment *165* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
35	4.4 (b)(1)	the crew is able to perform all the tasks assigned to them,;	"assigned" is wrong word. Task allocation is more accurate.	Change "assigned" to "allocated"
35	4.4 (b)(3)	". . .and the rotorcraft. . ."	Not clear on tasks allocated to the rotorcraft unless it is a semi-autonomous design?	change to ". . .and the system or systems. . ."
35	4.4 (c)	title "functional"	The rule states "operationally relevant". 4.4(a)(2) cites "operationally relevant system behaviour". 4.4.(c)(3) cites "operationally relevant". There is no direct tie in the rule language to "functional" behaviour. There is also no disagreement that the functional behaviour of a system or systems relative to HMI is important for HF and error management. However, the terminology should be consistent or not as definitive	Suggest changing title to "The behaviour of a system" to make it more general and discuss "functional" in (1). Or
35	4.4 (c)(1)	". . .automated system. . ."	"automated system" narrows the applicability to automation. Other systems, "manually" controlled" by the pilots have behavior patterns also	Delete "automated"

			and can have bad design interfaces	
35	4.4 (c)(1), (2)	all	Are these two paragraphs intended to be introductory or explanatory text? They are written as explanatory text or description of functional behaviour and has no MOC descriptors. They explain how the behaviour is determined rather than provide guidance on how to show compliance.	If they are intended to be explanatory or intro text, the title (1) "Introduction" (or similar) and move paragraphs (1), (2) to sub paragraphs under new (1)
35	4.4 (c)(3)	Applicants should propose the means they will use to show that the behaviour of the system or the system mode in the proposed design is predictable and unambiguous to the crew	focus appears to be on "should propose the means". The AMC is a means. The applicant has to show that the behaviour of the system . . . etc	Suggest: "Applicants should show that the behaviour of the system. . ." or delete the sentence
35	4.4 (c)(3)(i)		Is (3)(i) needed? It is introductory and explanatory regarding system behavior. What does it add?	consider deleting.

response

Partially accepted

1. Accepted: ‘assigned’ changed to ‘allocated’.

2. Not accepted.

3. EASA acknowledges that this paragraph could be improved. It is EASA’s intention to conduct an in-depth review of the part ‘4. DESIGN CONSIDERATIONS AND GUIDANCE’ and rework it in the context of a future update of the CSs.

4. See above.

5. See above.

6. Partially accepted. The text has been reworded to clarify the intent.

7. See above.

comment *166* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
36	4.4.(c)(3)(ii) (A)	The design should be simple (for example, the number of modes, or mode transitions).	As written, appears to dictate design. Should target the HMI. In complex systems developing a "simple" user interface can drive the underlying design to be complex. Depending on intended function and the interface with other aircraft systems, a "simple" design may not be attainable. However, a "simple" HMI may be.	Suggest: "The human-machine interface should be easily understood and, if required, easily controlled by pilots."
36	4.4.(c)(3)(ii) (D)	"Uncommanded . . ."	The term "uncommanded" should be defined either here or in the section 1.3. Does "uncommanded" mean the pilot did not command the change but the automation did as part of its normal operation or does it mean there was a malfunction (failure) in the system resulting in a mode change? Past discussions with applicants revealed different definitions. Some described it as if the	Define "uncommanded" here or in 1.3.

			pilot did not initiate the action it was "uncommanded". Othe rs defined any change to a mode as "commanded" unless the result of a system malfunction regardless of pilot or automation initiation.	
36	4.4.(c)(3)(iii)	Note that formal descriptions of modes typically define them as mutually exclusive, so that a system cannot be in more than one mode at a particular time. For instance, a display can be in 'north-up' mode or 'track-up' mode, but not both at the same time	This does not seem necessary, unsure what this adds. Additionally, based on the example, this seems a narrow description of modes. In AFCS modes one can couple to a VS mode while still in maintaining a horizontal nav mode on the roll axis depending on the AFCS system?	Either delete or expand to explain why this is important and how an applicant could show compliance to it
36	4.4.(c)(4)(i),(ii)	(i) Applicants should propose the means that they will use to show that the behaviour of the systems in the proposed design allows the crew to intervene in the operation of the systems without compromising safety. This should include	There is information in (ii) applicable to (i). (ii) reads as an exception statement. I think, depending on the complexity and integration of the system, that analysis alone is insufficient. The first paragraph, with revision, could be sufficient guidance. Are there issues in the past that triggered the need to specifically call out	Suggested revision: (i) Applicants should propose the means that they will use to show that the behaviour of the systems in the proposed design allows the crew to intervene in the operation of the systems without compromising

		descriptions of how they will determine that the functions and conditions in which intervention should be possible have been addressed. (ii) If the means of demonstrating compliance is by analysis, the applicant should describe it thoroughly. In addition, the methods proposed by applicants should describe how they would determine that each means of intervention is appropriate to the task	"analysis" in (ii)? (5)(iii) "manually intervene . . ." is also appropriate to the intervention paragraph.	safety. The methods proposed by applicants should show how they will determine that each means of intervention is appropriate to the task. The methods should also take into consideration the level of integration with other systems as appropriate. (ii) Applicants should show that the crew can intervene in any system function, as required by the operational conditions. Pilo t intervention resuting in a change to manual from automatic control should be safe, be accomplished in a timely manner, and not result in a state requiring exceptional pilot skill or knowledge to manage.
36	4.4.(c)(5)(i),(ii),(iii)	Automated systems can perform various tasks selected by	I think the paragraph could be more succinct and direct. Also this section may be more	Applicants should show that controls for automated systems with

		and under the supervision of the crew. Controls should be provided for managing the functionality of such a system or set of systems. The design of such 'automation-specific' controls should enable the crew to:	appropriate moved to 4.2 controls	tasks that are commanded and supervised by the pilots: (ii) Clearly indicate the system mode the pilot is selecting. If the mode has a preparatory or "armed" phase, the "armed" mode indication should be distinct from the "active" mode. (ii) that allow for selection of multiple submodes, like a vertical path vs. a vertical speed mode, clearly indicate the selected submode such that the pilot can easily discern which mode is active. (iii) Used to deactivate automatic systems should provide protection against inadvertant actuation by the pilots. Consider moving to section 4.2 Controls

response Partially accepted

1. Partially accepted. EASA considers that CS 27/29.1302 addresses both the human–machine interface (HMI) and the system architecture. To improve clarity, the term 'design' has been replaced by 'system behaviour'.

2. Accepted. The paragraph has been clarified by adding the following: 'Uncommanded could refer both to a mode change not commanded by the pilot but by the automation as part of its normal operation, or to a mode change resulting from a malfunction.'

3. Accepted. Paragraph 4.4(c)(3)(iii) has been deleted.

4. Partially accepted. The first sentence has been deleted.

5. Noted. Please refer to comment #165, part 3.

comment *167* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
37-38	4.5(a)(1) through (3)	Entire	The proposed resolultion is a revision of the two paragraphs. The rational is provided in the three following comments	a) Demonstrating compliance with CS 29.1302(d) (1) CS29.1302(d) recognizes that regardless of how well trained, experienced, how well rested the crew, or how well designed the sytem is, crews will make errors when interacting with the equipment. Therefore, the applicant should show that their system design and installation enables the crew to detect and recover from errors that are reasonably expected in service in addition to the systems' design and engineered error prevention and mitigation features.

				(2) To comply with CS 29.1302(d), the design and installation should: (i) enable the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)); (ii) ensure that the effects of crew errors on the rotorcraft functions or capabilities are evident to the crew, and continued safe flight and landing is possible (see 4.5(d)); (iii) discourage crew errors by using switch guards, interlocks, confirmation actions, or similar means; (iv) preclude the effects of errors through system logic and/or redundant, robust, or fault-tolerant system design (see 4.5(e))). (3) These above objectives: (i) recognise and assume that crew errors cannot be entirely prevented, and that no validated methods exist to reliably predict either their probability or all the sequences of events with which they may be associated; (ii) call for means of compliance that are methodical and complementary to, and separate and distinct from,

				rotorcraft system analysis methods such as system safety assessments. (iii) CS 29.1302(d) addresses errors that are design related. It is not intended to require consideration of errors resulting from acts of violence, sabotage or threats of violence
37-38	4.5(a)(1)	"This addresses the fact that crews will make errors, even when they are well trained, experienced, rested, and are using well-designed systems."	Unclear as to what "This" references particularly as it relates to " . . .using well designed systems." Does the "This" in the sentence relate to the previous sentence starting with "This subparagraph . . ." or does it relate to the fact regardless of how well-designed a system is, the crew will make errors when using it? This seems to be the more logical interpretation. However it is not clear.	IF interpretation is that crews will make errors regardless, suggest: "(1) CS29.1302(d) recognizes that regardless of how well trained, experienced, how well rested the crew, or how well designed the sytem is, crews will make errors when interacting with the equipment. Therefore, the applicant should show that their system design and installation enables the crew to detect and recover from errors that are reasonably expected in service in addition to the systems' design and engineered error prevention and mitigation features." IF interpretation is that the last sentence containing "well designed systems" relates to errors associated with manual control of the aircraft: Change last sentence

				to read: " "This addresses the fact that crews will make errors manually controlling the aircraft, even when they are well trained, experienced, rested, and are using well-designed systems."

response Partially accepted

1. Paragraph (2) has been modified according to the proposal: '(2) To comply with CS 29.1302(d), the design and installation should: …'

Paragraph (3)(i) has been deleted.

2. The sentence has been modified as follows: 'This subparagraph addresses…' in order to clarify the subject.

comment *168* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
38	4.5(a)(2)(i)-(iv)	To comply with CS 29.1302(d), the design should meet one of the following criteria. It should: (i) enable the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)); or (ii) ensure that the effects of crew errors on the rotorcraft functions or capabilities	Looks as if this is a cut/paste from AMC 25. Listing "options" raises the question of hierarchy. Is (i) more "desirable" than (iv) as specifically stated in 4.5(a)? Will EASA accept a system that only has (i) as an error management strategy? In this section, my first impression is that a flight manual procedure or reliance on training is adequate error management. For example, If I meet (i), I'm good because these are "or" statements. I don't	Revise: To comply with CS 29.1302(d), the design and installation should: (i) enable the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)); (ii) ensure that the effects of crew errors on the rotorcraft functions or capabilities are evident to the crew, and continued safe flight and landing is possible (see 4.5(d)); (iii) discourage crew errors by using switch guards,

		are evident to the crew, and continued safe flight and landing is possible (see 4.5(d)); or (iii) discourage crew errors by using switch guards, interlocks, confirmation actions, or similar means; or (iv) preclude the effects of errors through system logic and/or redundant, robust, or fault-tolerant system design (see 4.5(e))).	have to have as robust a design because I have a good alerting sytstem and the pilots can undo whatever they did wrong. There may be a subtle point where it is inferred and expected that adequate design and engineering error management controls are present and this section is addressing the "regardless of design and engineering controls, pilots will still make errors. If this is the case, then clarifying sections 4.5(a)(1) and (2) will help. (see comment for 4.5(a)(1) above) When designing for human factors, reliance on the human is not #1. AC25.1302 does lists these as "and" statements which decreases the relevance of order. 4.5(a)(3) indicates that the preference is that crew detection and error recovery is the preferred design criteria for managing error. This does not correlate to designing for HF. By definition, crew based error detection and recovery increases	interlocks, confirmation actions, or similar means; (iv) preclude the effects of errors through system logic and/or redundant, robust, or fault-tolerant system design (see 4.5(e))). Or, To comply with CS 29.1302(d), even though adequate error management controls are present in the design and engineering of the systems, errors can still occur. The applicanr should show that the design and installation enables the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)) that escape the design and engineering controls. Or copy AC 25.1302 wording: Applicants should show the design enable the crew to “manage errors,” to the extent practicable. The installed equipment design should meet the following criteria: (i) Enable the flightcrew to detect (see 4.5(b), and/or recover from errors (see 4.5(c)); (ii) Ensure effects of

			crew workload depending on procedures and system integration complexity.	flightcrew errors on the airplane functions or capabilities are evident to the flightcrew and continued safe flight and landing is possible (see 4.5(d)); (iii) Discourage flightcrew errors by using switch guards, interlocks, confirmation actions, or similar means, and (iv) Preclude the effects of errors through system logic and/or redundant, robust, or fault tolerant system design (see 4.5(e))).
38	4.5(a)(3)(i)	These above objectives: (i) are, in a general sense, in a preferred order;	"preferred order" infers a hierarchy wherein (i) is more desirable than (ii)-(iv). However, for a well designed system, is it inferred that (ii)-(iv) of the objectives in (2) are satisfied? From an applicant's standpoint, the interpretation could be that if I have training and procedures, I do not need design and engineering level error management	Delete (i), renumber. Revised para (3) suggestion: (3) These above objectives: (i) recognise and assume that crew errors cannot be entirely prevented, and that no validated methods exist to reliably predict either their probability or all the sequences of events with which they may be associated; (ii) call for means of compliance that are methodical and complementary to, and separate and distinct from, rotorcraft system analysis methods such as system safety assessments.

				(iii) CS 29.1302(d) addresses errors that are design related. It is not intended to require consideration of errors resulting from acts of violence, sabotage or threats of violence
38	4.5(a)(3)(i)	Errors that do have a design-related component are considered to be within the scope of this AMC. Examples are a procedure that is inconsistent with the design of the equipment, or indications and controls that are complex and inconsistent with each other or other systems on the cockpit	Not sure what this paragraph means in context of crew error management. It is logical that design (and installation) related errors are within the scope of this AMC since it applies to installed equipment the crew uses. This paragraph seems as if it is an introductory statement to design related error management.	Consider if this paragraph adds useful information and then expand or clarify. Or delete.
38	4.5(a)(4)	Errors that do have a design-related component are considered to be within the scope of this AMC.	grammatical correction	Errors that have a design-related component are considered to be within the scope of this AMC.
38	4.5(a)(5)	The applicant should not expect the errors considered to	This expecation may not be realistic. The added workload of handling an	Delete the sentence unless it is clarified.

		be different from those in normal conditions	emergency may show different errors o	
38	4.5(a)(5)	abnormal	"Abnormal" is undefined. Even though it is a transport airplane term it is not normally used in transport category lexicon. Additionally, where in CS29 is are "abnormal" procedures referred to?	Define "abnormal" in context of this AMC

response

Accepted

1. Paragraph (2) has been modified according to the proposal.

2. Paragraph (3)(i) has been deleted.

3. Accepted: paragraph (iv) has been modified according to the proposal and paragraph (4) has been deleted.

4. The paragraph has been deleted.

5. Not accepted: EASA considers that the workload associated to the handling of an emergency situation could increase the likelihood of errors but does not change their nature.

6. Please see the response to comment #150, item 4.

comment *170* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
40	4.5(b)(1)	Applicants should design equipment to provide information so the crew can become aware of an error or a system/rotorcraft state resulting from	Unclear what is meant by ". . .a system/rotorcraft state resulting from a system action." As written it seems separate from error. The interpretation is the crew can become of aware of an error or the crew can become	Depends on the intent of the sentence. Regardless clarify based on intent. If not refering to an erroneous system action, then delete and move to section regarding system state

		a system action.	aware of a system/rotorcraft state. Does this mean a state resulting from an erroneous system action; resulting from an erroneous crew action/inaction? Inference is that awareness of the system/rotorcraft state resulting from an erroneous system or crew action?	awareness. If referring to erroneous system action regardless of cause, then suggest: ". . .erroneous system/rotorcraft state resulting from a crew error." OR ". . .system/rotorcraft state resulting from an erroneous system action."
40	4.5(b)(2)(i)(B)	"Other locations for the information may be appropriate depending on the crew's tasks"	It is not only crew tasks but the importance of the information and consequence of the error.	Suggest adding ". . .and the importance of the information." to the end of the sentence. " Other locations for the information may be appropriate depending on the crew's tasks and the importance of the information,"
40	4.5(b)(2)(ii)( )	Entire section	I think the section is ultimately telling the applicant that the system should provide the crew with indications that their action or inaction resulted in an abnormal system configuration or state. This could be stated compactly	(ii) Indications to the crew that provide information of an error or a rotorcraft system condition resulting from their error. (A) An alert that activates after a pilot error may be sufficient to show an error is detectable and provide sufficient information about an error. The alert should directly relate to the error or be easily assessed by the pilots as an

				error. Alerts should not be confusing leading the pilots to believe there may be non-error causes for the annunciated condition. (B) If a crew error results in the system generating a caution or higher level alert, then the flight manual procedure should have sufficient information for the crew to identify and undo their action that lead to the alert. For example, an alert about the system state resulting from accidentally shutting down a hydraulic pump, for example, may not provide sufficient information to the crew to enable them to distinguish an error from a system fault. In this case, flight manual procedures may provide the error detection means as the crew performs the 'Loss of Hydraulic System' procedures. (C) An error that is detectable by the system should provide an alert and provide sufficient information that a crew error has occurred, such as in the case of the crew

				forgetting to put one or both engines into "FLY". (D) If the system can detect pilot error, the system should be designed to prevent pilot error. For example, if the system can detect an incorrect frequency entry by the pilot, then the system should be able to disallow that entry and provide appropriate feedback to the pilot. Examples are automated error checking and filters that prevent the entry of unallowable or illogical entries with appropriate feedback as to why the entry was not accepted.
40	4.5(b)(2)(ii)( )	Crew indications that provide information of an error or a resulting rotorcraft system condition	"Crew indications" Is intent "Indications to the crew"? ". . .or a resulting rotorcraft system condition." Is the intent a rotocraft system condition resulting from a pilot error? The title of 4.5 is "Crew Error Management"	Clarify "Indications that provide information . . ." Clarify ". . .or rotorcraft system condition resulting from crew error."
40	4.5(b)(2)(ii)(A)	An alert that could activate after a crew error may be a sufficient means for the applicant to show that	The AMC should be one means of complying with a regulation. The use of "could" sounds like a design option and has caveats. The means for the applicant to show their design	"An alert that activates after a pilot error may be sufficient to show an error is detectable and provides sufficient information about

		information about an error exists and that the error is adequately detectable,	complies for this specified means (the AMC) should written as a requirement but using "should" vs "will" or "must.	an error. The alert should directly relate to the error or be easily assessed by the pilots as an error. Alerts should not be confusing leading the pilots to believe there may be non-error causes for the annunciated condition."

response Partially accepted

1. Agreed to delete the end of the sentence '(1) Applicants should design equipment to provide information so the flight crew can become aware of an error or a system/aircraft state resulting from a system action.'

2. and 3.: Noted. The proposals for editorial improvements to this paragraph might be considered in the context of a future update of the CSs.

4. Accepted. Sentence improved.

5. Accepted. Reworded as per the FAA proposal.

comment *171* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
41	4.5(b)(2)(iii)	'Global' alerts cover a multitude of possible errors by annunciating external hazards, or the envelope of the rotorcraft, or operational conditions.	Grammatical change	'Global' alerts cover a multitude of possible errors by annunciating external hazards, the envelope of the rotorcraft, or operational conditions.
41	4.5(b)(3)	The applicant should consider the following when establishing whether the	Grammatical change depending on intent	The applicant should consider the following when establishing whether the degree or type of

		degree or type of information is available to the crew, adequately detectable, and clearly related to the error		information available to the crew is adequately detectable and clearly related to the error OR The applicant should consider the following when establishing whether the Information is available to the crew, adequately detectable, and clearly related to the error
41	4.5(b)(3)(i)	An example would be the alignment of engine speed indicator needles in the same direction during normal operations. Failure of the needles to align in the same direction during normal operations would indicate a problem with one of the engines, since one engine would be rotating at a different speed from the other engine.	Tie this back to an "error" or error mitigation or delete	An example would be the alignment of engine speed indicator needles in the same direction during normal operations. In the event of an engine anomaly or malfunction that manifested itself in a change of RPM on one engine, the spatial misalignment of the needles should assist the pilots in diagnosing the issue and manipulating the correct engine according to procedure.
41	4.5(b)(3)(ii)	Training, crew resource	Moving the "monitoring systems . .	Suggest: Rotorcraft

		management (CRM), and monitoring systems such as TAWS and TCAS are examples of ways to provide a redundant level of safety if any or all the crew members fail to detect certain errors.	.errors." up to section 4.5(b)(2)(iii) may make this more pertinent. Unsure how "Training, crew resource management . . ." provide a redundant level of safety if any or all the pilots fail to detect errors. (This is an operational difference between EASA/FAA. FAA does not require formal training on all Part 29 rotorcraft)	alerting and indication systems may not detect whether an action is erroneous because the systems cannot know the intent of the crew in many operational circumstances. In these cases, reliance is often placed on the crew's ability to scan and observe indications that will change as a result of an action such as selecting a new altitude or heading, or making a change to a flight plan in a flight management system (FMS). For errors of this nature, global alerting and monitoring systems aid in error detection. For example, monitoring systems such as TAWS and TCAS are examples of ways to provide a redundant level of safety if any or all the crew members fail to detect certain errors.

response

Partially accepted

1. Accepted: first ‘or’ has been deleted.

2. Accepted: sentence has been amended.

3. Partially accepted: text has been amended.

4. Partially accepted: quoted sentence has been deleted.

comment *172* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
42	4.5(c)(1)	Assuming that the crew detects an error or its effects, the next logical step is to ensure that the error can be reversed, or that the effect of the error can be mitigated in some way so that the rotorcraft is returned to a safe state	Write as a performance related requirement for this MOC	When errors are detected the system should ensure the pilots or the system function can reverse the error. If the error initiates a state change in the aircraft, the effect of the error should be mitigated to prevent an unsafe condition until the error is corrected.
42	4.5(c)(2)((ii)	". . .the crew can be expected to use. . ."	Not sure the rationale of "expected to use". Shouldn't the design provide and ensure the controls and indications are easily detectable and usable?	The indications and controls provided to accomplish the corrective actions are usable by the crew in a timely manner.
42	4.5(d)(1)(ii)	". . .do not adversely impact on safety (do not prevent continued safe flight and landing)."	Grammatical change "(do not prevent continued safe . . .)" implies that this MOC applies only errors resulting in	". . .do not adversely impact safety (do not prevent continued safe flight and landing)."

			catastrophic or possibly hazardous conditions. This also implies that "safety" = "ability to continue safe flight and land". Is that the intent?	DEPENDING ON INTENT: ". . .do not adversely impact safety."
42	4.5(e)(1)	". . .An example of multiple confirmations would be the presentation of a temporary flight plan that the crew can review before accepting it."	Should state as design requirement if implemented. For a system input that can signigicantly alter the aircraft's state (attitude,etc; flight path, etc), the pilot should have to perform multiple steps for the system to accept.	". . .An example of multiple confirmations would be the presentation of a temporary flight plan where the crew cannot activate the change without a confirmation action."

response

Partially accepted

1. Not accepted. However, EASA has improved the sentence.

2. Not accepted. EASA considers that the sentence covers a wider scope. Indeed, controls should not only be timely usable but are also expected to be used in the context of the error (see paragraph (4)). However, EASA has improved the sentence.

3. Accepted. Text has been modified.

4. Partially accepted. However, EASA has improved the sentence.

comment

173 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
43	4.6(b)(1)	If similar information is presented in multiple locations or modes (both visual and auditory, for example), consistent presentation of the	Add other systems also. Integration of post-TC systems creates an issue with providing information generated by two systems independtly of each other.	Add "by different systems" "Show that similar information presented in multiple locations, by different systems, or in different modes (both visual and auditory, for example), is consistent. For any

		information is desirable.		differences in presentation, show that the differences do not result in crew confusion or increase in crew workload that would increase error rates or task times. Show that new and novel presentation of information that is not consistent with aviation norms and standards does not lead to pilot confusion and increase workload."

response

Not accepted

EASA considers that the same approach and information is provided in paragraph 4.6(c) 'Consistency trade-offs'.

comment *174* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
44	4.6(b)(2)(iii)	For example, the navigation symbology used on other cockpit systems or on commonly used paper charts should be considered when developing the symbology to be used on electronic map displays	a more rotorcraft related example? In rotorcraft consistency between different systems, particularly as the result of STC modifications, etc, will be an issue.	Change the example to: "It is important that functions that convey the same information are consistent. One example is symbole sets. Traffic or terrain awareness systems should display consistent symbol sets if generated by

				separate installed systems."
44	4.6(b)(2)(iv)	It is important that an FMS is consistent with the operational environment so that the order of the steps required to enter a clearance into the system is consistent with the order in which they are given by air traffic management (ATM	This paragraph is specific to FMS as written. Rotorcraft operations are fluid and dynamic. If this paragraph is retained, then suggest a more rotorcraft specific example.	Not sure how to revise. Perhaps tie it back into (ii), (iii) somehow?
44	4.6(b)(2)(v)	One way in which the applicant can achieve consistency within a given system, as well as within the overall cockpit, is to adhere to a comprehensive cockpit design philosophy	this paragraph is generic and broad, seems outside the format and level of information in (i)-(iv).	Either delete or move to (2)
44	4.6(b)(3)	Another way is to standardise certain aspects of the design by using accepted, published standards such as the labels and abbreviations recommended in ICAO Doc 8400 or in SAE ARP4105C. The applicant might	Grammatical/Clarification	Another way to show consistency is to show certain aspects of the design are consistent with accepted, published standards such as the labels and abbreviations recommended in ICAO Doc

		standardise the symbols used to depict navigation aids (very high frequency omnidirectional range, VOR, for example), by following the conventions recommended in SAE ARP5289A. However, inappropriate standardisation, rigidly applied, can be a barrier to innovation and product improvement. Thus, guidance in this paragraph promotes consistency rather than rigid standardisation.		8400 or in SAE ARP4105C. The applicant might standardise the symbols used to depict navigation aids (very high frequency omnidirectional range, VOR, for example), by following the conventions recommended in SAE ARP5289A. However, inappropriate standardisation, rigidly applied, can be a barrier to innovation and product improvement. Thus, guidance in this paragraph promotes consistency rather than rigid standardisation.

response Accepted

The text has been amended.

comment *175* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
43-45	4.6(b) & (c) All	All	The section is long and hard to follow. The introductory paragraph (1) lays out a good sequence that includes	4.6 Integration b. Consistency (1) If similar information is presented in multiple

			"Consitency tradeoff" concept. (4.6(c)). 4.6(c) contains concise and straightforward means to show compliance. The sections could be combined to make them more concise and to the point. In proposed resolution (c) is integrated with (b).	locations or modes (both visual and auditory, for example), presentation of the information should be consistent. . (i) One way to show consistency within a given system, as well as within the overall cockpit, is to show information complies to a comprehensive cockpit design philosophy. (ii) Another way to show consistency is to show certain aspects of the design are consistent with accepted, published standards such as the labels and abbreviations recommended in ICAO Doc 8400 or in SAE ARP4105C. The applicant might standardise the symbols used to depict navigation aids (very high frequency omnidirectional range, VOR, for example), by following the conventions recommended in SAE ARP5289A. However, inappropriate standardisation, rigidly applied, can be a barrier to innovation and product improvement. Thus, guidance in this paragraph promotes consistency rather than rigid standardisation. (2) Where consistent presentation of

				information is not possible, the applicant should show that the differences do not cause crew confusion, do not increase the error rates or task times, which could lead to a significant reduction in the safety margins or an increase in the crew workload. Where consistency trade-offs exist, as discussed in the next paragraph, the following are design attributes to consider for their consistency within and across systems: (i) Consistency trade-offs It is recognised that it is not always possible to provide a consistent crew interface. For example, the use of a consistent format across the cockpit may not work when individual task requirements necessitate the presentation of data in two significantly different formats. In such cases, it should be demonstrated that the design of the interface is compatible with the requirements of the piloting task, and that it can be used individually and in combination with other interfaces without interference with either the system or the function. (3) To show presentation and

				format of information is consistent in the integration of systems in the cockpit, the applicant should (i) provide an analysis identifying each piece of information or data presented in multiple locations, and show that the data is presented in a consistent manner or, where that is not true, justify why that is not appropriate. (ii) Where information is inconsistent, that inconsistency should be obvious or annunciated, and should not contribute to errors in the interpretation of information. (iii) There should be a rationale for instances where the design of a system diverges from the cockpit design philosophy. Applicants should consider any impact on the workload and on errors as a result of such divergences. (iv) The applicant should describe what conclusion the crew is expected to draw and what action should be taken when information on the display conflicts with other information in the cockpit (either with or without a failure).

response

Not accepted

EASA considers that 'consistency trade-offs' qualifies for a dedicated paragraph as it emphasises it as a means to demonstrate compliance with the rule. Therefore, both paragraphs are kept separate.

However, EASA has improved the quoted sentences.

comment *176* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
57	FAA Orders and Policy		This is for rotorcraft. The FAA would not accept applicant use of transport category airplane orders and policy if there is adequate and applicable Part 29 policy and guidance material available.	Change title: "FAA Guidance" There are no orders listed and the policy is all Part 25.. Add AC 29-2C material. MG-19 EDS, MG-20 HF, other applicable AC material unless EASA has not adopted Change 7 at the time of 1302 publication. Add: FAA AC 20-175 Controls for Flight Deck Systems Move the Part 25 memos to Other Documents section since they are good reference material.
57	Other Documents			ADD: FAA AC 00-74 Avionics Human Factors Considerations for Design and Evaluation (this is an "avisory" AC and not a means of compliance) DOT/FAA/TC-13/44

				Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls

response

Accepted

The text has been amended as proposed.

comment *211* comment by: *Airbus Helicopters*

AMC 29.1302 paragraph 4.2(e)

- end of page 28 and of page 90

>> Pilot incapacitation is not part of CS29 / CS 27 today. Addressing pilot incapacitation as proposed would require a specific rulemaking activity. AH position: Pilot incapacitation is covered in CS25 only and should not be carried over in this AMC.

Airbus Helicopters

response

Accepted

The wording '(including crew incapacitation)' has been removed from the proposed text on pp. 28 and 90 of the NPA.

3 Proposed amendments | 3.1 Draft CSs (draft EASA Decision) | GM No 1 to 29.1302 Explanatory material p. 58-64

comment *133* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on Page 60, paragraph 2 (c) (iii)
Comment/Rationale:
The reference to Part 21 is erroneous
Proposal for update of the NPA:
Revise the reference to Part 21A.21 (a)

response

Accepted

The text has been amended accordingly.

3 Proposed amendments | 3.1 Draft CSs (draft EASA Decision) | GM No 2 to 29.1302 Example of compliance matrix p. 64-68

comment *102* comment by: *European Cockpit Association*

GM No 2 to 29.1302 and GM No 2 to 27.1302

pages 65, 67, 127 and 128

(reflecting to CS 29.777 (b) and CS 27.777 (b))

Original text:
The controls must be located and arranged with respect to the pilots' seats so that there is full and unrestricted movement of each control without interference from the cockpit structure or the pilot's clothing when pilots from 1.57 m (5 ft 2 inches) to 1.8 m (6 ft) in height are seated

Comment:
The reflected heights are not reflecting the reality of pilot`s heights; numbers have to be changed.

Suggested text:
The controls must be located and arranged with respect to the pilots' seats so that there is full and unrestricted movement of each control without interference from the cockpit structure or the pilot's clothing when pilots from 1.57 m (5 ft 2 inches) to 1.95 m (6.5 ft) in height are seated

Justification:
In the NPA it is only required to have appropriate seating and up to a flight crew height of 1.80 m. This is far not reflecting reality. Since human mankind has gained massive in height over the recent time in average and variation, flight crew height up to 1.95m has to be considered in cockpit arrangement and seating provisions. E.g. has (according to Wikipedia) the average height of man in several countries already exceed the height of 1.80; like Netherlands (182.5), Belgium (181.7), Denmark (181.4).

response Partially accepted

The text has been amended to reflect the actual values provided in CS 27/29.777(b).

3 Proposed amendments | 3.1 Draft CSs (draft EASA Decision) | CS 27.1302 Installed systems and equipment for use by the crew p. 69

comment *123* comment by: *Airbus Helicopters*

Airbus Helicopters comment:
Comment on NPA CS 27 part from Page 69 to 129

Comment/Rationale:
All the previous comments made by Airbus Helicopters on the CS 29 are transposed to CS 27, by similarity

response: Noted

comment: *177* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
69	1st paragraph - second sentence	This installed equipment must be shown, individually and in combination with other such equipment, to be designed so that trained crew members can safely perform their tasks associated with the intended function of the equipment by meeting the following requirements:	This statement suggest that Part 27 rotorcratf will have more than one crew member. Part 27 only requires one pilot. Suggest to update the wording to read This installed equipment must be shown, individually and in combination with other such equipment, to be designed so that a trained crew member can safely perform the task associated with the intended function of the equipment by meeting the following requirements:	

response: Not accepted.

'Crew members' has been redefined; therefore, EASA considers the use of the plural appropriate.

comment: *207* comment by: *Garmin International*

CS 27.1302, AMC 27.1302:

The proposed regulation and guidance material do not contain information about the qualifications of the individuals or organizations who will be authorized to make findings of compliance to this regulation.

Provide information about the minimum qualifications necessary for a member of EASA staff or other to make a finding of compliance to the proposed rule.

response: Not accepted

Please see the response to comment #73.

3 Proposed amendments | 3.1 Draft CSs (draft EASA Decision) | AMC 27.1302 Installed systems and equipment for use by the crew p. 70-120

comment	*7* comment by: *THALES Avionics* THALES Avionics concurs with AMC 27.1302 §.1.2 (d) about the limitation of AMC 27.1302 applicability to part 27 high end helicopters segment only (IFR and CAT A). However and for the sake of better clarity, THALES propose to modify the sentence in AMC 27.1302 §.1.2. (d)(1) by suppressing « or CAT A » and by modifying the sentence with « Applicants for a CS-27 rotorcraft approved for CAT A and IFR operation, or for a significant change potentially affecting the HFs for CS-27 rotorcraft approved for Cat A and IFR operation ».
response	Not accepted The proportionality provisions have been significantly reworded. However, the proportionality provisions applicable to CS-27 rotorcraft approved for CAT A have been retained as a CAT A approval implies a high level of complexity, similarly to IFR.

comment	*78* comment by: *Garmin International* **AMC 27.1302 Paragraph 2.2 Page 77:** In this section and numerous others, reference is made to “qualified crew trained in the use of installed equipment”. This is appropriate for the purpose of conducting a human factors evaluation; however, we are concerned that this could become the basis for requiring training for specific equipment on Part 27 rotorcraft which is not presently required. Add clarifying language that references to “qualified crew trained in the use of installed equipment” will not be used as a basis for imposing additional training requirements.
response	Not accepted Please see the response to comment #152.

comment	*79* comment by: *Garmin International* **AMC 27.1302 Paragraph 3.2.1(c) Page 78**: The phrase “Therefore, while mapping the entire cockpit and cabin or the modified one…” is unclear. What is “the modified one”? Should this state “the modified equipment” or “the modified aspects”?
response	Accepted The sentence has been modified.

comment	*80* comment by: *Garmin International* **AMC 27.1302 Paragraph 3.2.3 (b) Page 81:** Include a description of what level of integration, complexity, novelty, or severity will meet the criteria for including in the candidate list of items to be scrutinized. The current wording doesn't make this clear.
response	Not accepted Please see the response to comment #76.

comment	*81* comment by: *Garmin International* **AMC 27.1302 Paragraph 3.3.2(e) Page 84:** Controlled scenario-based HF assessment in simulated flight with multiple crews has the potential to add significant cost to CS 27 projects. Further, the paragraph 3.3.2(e) statement that "Due to interindividual variability, HFs scenario-based assessments performed with a single crew are not acceptable" conflicts with the AMC 27.1302 paragraph 1.2(d)(3)(iii) statement that allows use of "a single crew member to demonstrate the HFs scenario-based assessments (refer to 3.3.2(e))". Note in particular that paragraph 1.2(d)(3)(iii) directly refers to the paragraph 3.3.2(e), which makes it all the more confusing. Suggest that the 3.3.2(e) statement be removed or at least modified to acknowledge the paragraph 1.2(d)(3)(iii) allowance for single crew demonstration.
response	Not accepted EASA considers 1.2(d)(3)(iii) 'allowed to use a single crew member to demonstrate the HFs scenario-based assessments (refer to 3.3.2(e)).' as part of the proportionality approach; it enables the applicant, should the project be subject to this alleviation, to use a single crew for scenario-based evaluations.

comment	*83* comment by: *Garmin International* **AMC 27.1302 Appendix 1 "FAA Orders and Policy" Page 120:** References Policy Memo ANM-0103 and Notice 8110.98. Notice 8110.98 was cancelled in 2003 and can only be found through a historical search of the FAA's http://rgl.faa.gov/ website. It would be better to reference AC 00-74, Avionics Human Factors Considerations for Design and Evaluation, which was published by the FAA in part to fill the gap left by the expiration of Notice 8110.98. The reference to "Policy Memo ANM-0103" cannot be found on the FAA's http://rgl.faa.gov/ website. However, it can be found by using the policy number "PS-ANM100-01-03A" (see

	http://rgl.faa.gov/Regulatory_and_Guidance_Library/rgPolicy.nsf/0/4B68CF2DFB0ED36586256D6400548CF5?OpenDocument). Suggest adjusting the reference to "PS-ANM100-01-03A", which is also consistent with the reference used in AC00-74 section 4.3.
response	Accepted The commented references have been amended accordingly.

comment	*85* comment by: *LBA* The NPA uses the expressions „simple rotorcraft“ and „simple change to rotorcraft“ unless these expressions are not defined neither in the basic regulations (216/2008 and 2018/1139) nor in Part 21 (see Chapter 2.3.1, Page 5 AND AMC 29.1302, Chapter 3.3.1 (c), Page 21 AND AMC 27.1302, Chapter 3.3.1 (c), Page 83) or in the applicable AMC/GM 29/27.1302. The basic regulation and Part 21 use the expression “complex motor-powered aircraft” which seems to be the correct expression until Part 21 will be revised/updated on the basis of the new basic regulation. Furthermore the expression “simple change to rotorcraft” is not defined. Part 21 uses minor and major changes. Therefore, it is not clear what is a simple rotorcraft nor a simple change to rotorcraft.
response	Accepted Please see the response to comment #84.

comment	*94* comment by: *General Aviation Manufacturers Association* AMC 27.1302 Paragraph 2.2 Page 77 GAMA requests clarification of the term “qualified crew trained in the use of installed equipment”, as this is currently not a part 27 requirement.
response	Not accepted Please see the response to comment #152.

comment	*95* comment by: *General Aviation Manufacturers Association* AMC 27.1302 Paragraph 3.2.3 (b) Page 81 This section lacks the necessary detail to understand under what level of complexity and when an assessment is required. GAMA recommends additional criteria is developed to clarify when and the level of scrutiny required.
response	Not accepted Please see the response to comment #76.

comment	*96* comment by: *General Aviation Manufacturers Association* AMC 27.1302 Paragraph 3.3.2(e) Page 84 GAMA considers paragraph 3.3.2(e) to be confusing and conflicting with AMC 27.1302 paragraph 1.2(d)(3)(iii) which directly refers to the paragraph 3.3.2(e). GAMA recommends that paragraph 3.3.2(e) recognizes paragraph 1.2(d)(3)(iii) and makes allowance for single crew demonstration under a controlled scenario-based human factors assessment.
response	Not accepted EASA considers 1.2(d)(3)(iii) 'allowed to use a single crew member to demonstrate the HFs scenario-based assessments (refer to 3.3.2(e)).' as part of the proportionality approach; it enables the applicant, should the project be subject to this alleviation, to use a single crew for scenario-based evaluations.

comment	*99* comment by: *General Aviation Manufacturers Association* Section 1.3, Page 72 Typo: Change to 'high-level' or 'high level'.
response	Accepted The typo has been corrected.

comment	*101* comment by: *General Aviation Manufacturers Association* Section 1.3, Page 72 Typo: Ambiguity in the definition for 'Catachresis'. Within the definition, change the word 'use' to 'misuse' to be consistent with its common definition.
response	Not accepted Catachresis indeed refers to the unplanned use of the equipment, contrary to the prescribed use. It is, however, not the wrong use of the equipment.

comment	*106* comment by: *General Aviation Manufacturers Association* Section 1.3, Page 72 Ambiguity in the definition for 'Clutter'. It is unclear what is meant by 'reduce crew access'. Please clarify the definition.
response	Accepted

	The paragraph has been modified to improve clarity.

comment	*109* comment by: *General Aviation Manufacturers Association* Section 3.2.8(a), Page 83 Due to the context of this section, the second usage of the word 'crew' should be singular. We suggest: Change 'expected crew behaviours' to expected crew member behaviours'. It may be beneficial to review all uses of the word crew.
response	Accepted The text has been amended accordingly.

comment	*111* comment by: *General Aviation Manufacturers Association* Section 3.3.2(a), Page 84 Typo: 'scenario designers' text should be modified for clarity. We suggest changing to 'scenario-designers'.
response	Accepted The text has been amended accordingly.

comment	*112* comment by: *European Cockpit Association* 4.3. Presentation of information (c) **Original text:** (c) Characters, fonts, lines and scale markings (CS 29.1301(b) and CS 29.1543(b)) Crew members, seated at their stations and using normal head movement, should be able to see and read display format features such as fonts, symbols, icons and markings. In some cases, crosscockpit readability may be required to meet the intended function that both pilots must be able to access and read the display. Examples of situations where this might be needed are cases of display failures or when cross-checking flight instruments. Readability must be maintained in sunlight viewing conditions (per CS 29.773(a)) and under other adverse conditions such as vibration. Figures and letters should subtend not less than the visual angles defined in SAE ARP4102-7 at the design eye position of the crew member who normally uses the information. **Comment:** Due to the typical construction of helicopter windshields and windows blinding by the sun is highly probable.

	Suggested: Add a sentence: Means to avoid sun blinding by the flight crew, like an adjustable sun-blinding-protection, must be available.
response	Not accepted Although EASA recognises the benefits that may result from the installation of a sun-blinding protection, it is considered that making it mandatory is beyond the scope of this AMC.

comment	*114* comment by: *General Aviation Manufacturers Association* Section 3.3.2(e), Page 85 Typo: Odd and confusing use of the words 'interindividual variability'. We suggest it is changed to: 'crew member dependency'.
response	Not accepted 'inter-individual variability' is considered self-explanatory. This term is widely used in Human Factors literature. The meaning is different from 'crew member dependency'.

comment	*118* comment by: *General Aviation Manufacturers Association* Section 4.1(a), Page 88 Typo: Sentence 'Not all the criteria can or should be met by all systems.' is confusing. Should the word 'criteria' be replaced by 'standard'?
response	Not accepted Please see the response to comment #117.

comment	*120* comment by: *General Aviation Manufacturers Association* Section 4.3(b), Pages 92 to 93 Typo: There appears to be missing content or enumeration after '…presentation of information…'
response	Noted Please see the response to comment #119.

comment	*121* comment by: *General Aviation Manufacturers Association* Section 4.1(a),

	Page 88 Typo: ’27.1302’ should be ‘CS 27.1302’.
response	Accepted The text has been amended accordingly.

comment *178* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
71	1.2 (a)	and several other paragraphs in CS-27	Is the intent of this AMC to replace MOC's in the referenced CS's? If no, then this is an inaccurate statement. If yes, then we should go back and reference this AMC in affected sections (i.e., AMC 27.771(a): For MOC see AMC 27.1302 sections X, Y, Z.) Non concur if the intent of this AMC is to provide acceptable MOC for other CS 27 paragraphs.	Clarify. However, would not agree that this AMC takes precedence over MOCs defined in specific rule AC's. Example: ". . .CS 27.1302 and complements MOCs in several other paragraphs in CS 27 (refer to paragraph 2, Table 1 of this AMC). . ."
71	1.2 (b)	"all"	Extraneous word. Not necessary. "all" may confuse the issue if 1302 via 21.101 is invoked for a particular STC modification. Does that mean the entire cockpit ("all") is now subject to 1302 even though the STC only affects a portion?	Delete "all" .
71	1.2(b)	"abnormal"	What is the difference between an abnormal condition and emergency condition? The level of the 1322 alert that is generated? (Cautions are "abnormal" and Warnings are "emergency"?) "Abnormal" is more in the Part 25 transport airplane lexicon. Additionally, the authorities do not approve	Delete "abnormal". Keep consistent with the rules (27/27.1585)

			"abnormal" procedures according to 27/27.1585	
71	1.2(d)()		This is interesting breakdown. When discussing HF relative to 1302 the issue is crew workload and error. What are the thoughts of focusing (d) on minimum crew and kind of operation (27.1523 and 1525) vs. solely kind of operation? From a cockpit complexity and workload reference, the number of pilots will significantly change the workload and impact error managment. An example is that the H135T3 (single pilot IFR/CAT A) is just as complex as an AW139 or H175 (Both are dual pilot IFR/CAT A (for FAA)). From the FAA reference, the H135T3 does not require formal pilot training or type rating.	Possible solutions: (1) Applicants for CS-27 rotorcraft approved for single pilot IFR, IFR with CAT A design and performance, or for a significant change potentially affecting the HFs should follow all this material. (2) Applicants for CS-27 rotorcraft approved for dual pilot IFR or single pilot VFR with CAT A design and performance are: (3) Applicants for CS-27 rotorcraft approved for single pilot VFR only are:
71	1.2(d)(1)	Applicants for a CS-27 rotorcraft approved for CAT A and IFR operation, or CAT A, or for a significant change potentially affecting the HFs, should follow all this material	If previous comment not accepted, then consider this and following comment. Unsure why a CAT B IFR rotorcraft is different from a CAT A IFR rotorcraft is. Appendix B does not delineate differences between CAT A/B.	Suggested change: "Applicants for a CS-27 rotorcraft approved for CAT A, IFR operation, or proposed significant changes that potentially affect human factors, should follow all this material"

71	1.2(d)(2)	". . . CAT B and IFR. . . "	Unsure why a CAT B IFR rotorcraft is different from a CAT A IFR rotorcraft is. Appendix B does not delineate differences between CAT A/B.	Suggested change: "Applicants for CS-27 rotorcraft approved for CAT A and VFR operations only, are:"

response Partially accepted

1) Accepted. 1.2(a): the point made by the FAA is shared. The comment is included in the text.
2) Not accepted.

   1.2(b): Perhaps there is a wrong reference here. It seems that the FAA is challenging the language of the rule (for 'all') as in the same comment applicable to CS-29 (please see comment #147).
3) Accepted.

   1.2(b): Here again there may be a wrong reference. Anyway, the wording 'abnormal' has been changed to 'abnormal/malfunction' as per AMC to CS 29.1302.
4) 1.2(b): please see the response to comment #147.

comment *179* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
72	1.2(d)(4)	Entire paragraph	IF 21.101 is not applicable and the applicant is not required to step up to the latest amendment, then the guidance in this paragraph is not required. If the intent is to levy 1302 on all projects, this should be explained and justified in a document other than the AMC.	Delete (4).
72	1.3	"Conformity": ". . . Conformity of the facility is one parameter that distinguishes one means of	How does conformity of a facility fit into conforming a part installed on an aircraft or the aircraft itself and how does it relate to 1302?	Clarify or delete

		compliance from another."		

response

Accepted

1. '1.2(d)(4)' has been deleted and an explanation has been provided in 1.2(d).

2. The quoted sentence has been deleted.

comment *180* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
73	1.3	"Crew member" ". . .or to helping the crew to control the aircraft in a hover are considered to be crew members."	confusing. In context of a hoist operation, the hoist operator's fine maneuvering of the helicopter via the hoist pendant controls is "helping" the pilot. Otherwise, is providing clearing callouts considered "helping"?	Change " . . .helping the crew. . ." to ". . .helping the pilot. . ." and clarify "helping" Or Delete words after "hoist"
73	1.3	Display: "(typically visual, but it may be accompanied by auditory or tactile feedback)"	The paranthetical statement not necessary since, in context, auditory and tactile feedback is ancillary to the display	Delete paranthetical statement
73	1.3	Human Error: "attributable to the crew . . ."	"attributable" infers "caused by". In context with 1302, the HE would be caused by the human's interaction with equipment/information that lead to the human taking an erroneous or inappropriate action.	Change "attributable" to "A deviation by the pilots or crew from what is considered . . ."

response

Partially accepted

The definition of 'crew member' has been improved to clarify that only cabin operators that have the possibility to interfere with the cockpit crew are to be

considered as ‘crew members’. A call-out triggered by a cabin operator does not qualify this operator as a ‘crew member’.

Please see also the response to comment #150.

comment *181* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
74	1.3	Abnormal or emergency conditions: For the purpose of this AMC, abnormal or emergency operating conditions refer to conditions that do require the crew to apply procedures different from the normal procedures included in the rotorcraft flight manual	Consider rewording. Sounds as if from Part 25. "Abnormal" is regulatorally undefined. For example: being 10 knots slow on airspeed during an approach could be considered "abnormal" where there are no OEM dictated procedures.	Suggestion: "Emergency conditions: Aircraft or operational conditions requiring the crew to perform actions, either by memory or by reference to the Emergency Procedures section of the flight manual."
74	1.3		The use of "uncommanded" in guidance documents, particularly in context of automation initiated mode changes, has created issues in the	Add: "Uncommanded. For the purposes of this document, uncommanded is defined as a change to system or aircraft configuration or status not initiated by the pilot. Changes to the system or aircraft configuration or status

			past. In context of HF, the term "uncommanded" should be defined. Applicants have argued that when the automation logic changes a mode that it is "commanded" by the logic. Others have used "uncommanded" to describe events where the pilot did not "command" a change and automatic mode changes are "uncommanded." Refer to 4.4.(c)(3)(ii)(D), page 36.	made by automation is considered "uncommanded."

response

Partially accepted

Please see the responses to comments #150 and #166.

comment

182 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
76	2.1(b)	". . .guidance material for all . . ."	MG-20 does not provide guidance material for "all" the HF related regulations	Change "all" to "some of"

response

Partially accepted

EASA agrees that MG-20 does not provide guidance for all HFs-related regulations. Paragraph 2.1 has been completely reworded to provide more clarity.

comment

183 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
77	2.2	". . .the assumption that the rotorcraft will be operated by qualified crew members who are trained in the use of the installed equipment."	This is sticky for the FAA. What does "trained" mean in context? Formally, unless the aircraft is over 12,500 pounds (5,669 kg), "training" in the form of a type rating is not required.	, for 27, the use of "familiar", albeit an unquantifiable concept and generic term, may be better than "trained" which implies a formal process.
77	3.1	Overview ". . .an overview of the human factors certification process that is necessary to demonstrate."	IF an AMC is equivalent to an AC it is a guidance document not regulatory. The statement ". . . Necessary to demonstrate. . ." compliance sounds mandatory	IF an AMC is guidance and an applicant can suggest another means of compliance through the CRI/IP process: Change to ". . .an overview of a human factors certification process acceptable to demonstrate compliance . . ."

response

Not accepted

2.2) Please see the response to comments #37, #145 and #152.

3.1) The comment is accepted; the text has been reworded accordingly.

comment *184* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
79	3.2.2 (d)	Applicants may evaluate whether statements of the intended function(s) and the associated task(s) are sufficiently	The topic in this paragraph pertains to HF generally and not just new and novel. Consider moving these to separate subparagraph. This sentence and the following subparagraphs are different	Move to paragraph that talks about HF, not just "novel"

		specific and detailed by using the following questions: (and (1)....(7)	topic than "novel" features and are more general to section 3.2.2.	

response Accepted

The quoted sentence has been deleted.

comment *185* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
80	3.2.3 (a)(3) (v)	A function or system that the applicant chooses to refer to as a baseline from which the novelty is derived needs to have been certified by the applicant under CS 27.1302.	This is unclear and ambiguous. Does this mean that installing a touchscreen display in a cockpit with no existing TS displays requires the underlying TS needs to have been certified by the applicant? Does it mean that the applicant must have installed a TS in another cockpit and certified it under 1302 in order to use as a baseline? How would that work for an STC?	Clarify.

response Partially accepted

Paragraph 3.2.3. has been fully reviewed: the reference to the regulatory material used for the certification of the reference product has been removed and transferred to AMC 27/29.1302 Section 5 that describes the means of compliance.

comment *186* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
81	3.2.4	Irrespective of the above, the EASA involvement in the verification of	"LoI" ; Presume means "Level of Involvement"?	Spell out "LoI"

		compliance demonstration of the subsequent steps of the human factors process will depend on the LoI determined by EASA in accordance with point 21.B.100 of Part 21		

response Accepted

'LoI' is already included in the abbreviations list of AMC 27/29.1302.

comment *187* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
85	3.3.2(h)	The crews need to be properly trained prior to every assessment so that during the analysis, the 'lack of training' factor can be excluded to the maximum extent possible from the set of potential causes of any observed human performance issue. Furthermore, for operational representativeness purposes, realistic crew task sharing, from normal to emergency workflows and checklists, should be respected during HFs assessments. The applicant should make available any draft or final rotorcraft flight manual (RFM),	This is good but should expande to discuss level of training. Does EASA require a full type rating course for Part 27 rotorcraft or is it more of a check flight and pilot license endorsement? Depending on the answer and the depth of required training, this paragraph should be amended. It is good to have pilots who have experience with a system but that also means they may have workarounds that are their own and not in procedure. Likewise, having novice pilots with no or just the required familiarization provides good information regarding usability, concentration and workload under 771, 1301, and 1325 as well as 1302	Consider expanding and clarifying.

		procedures and checklists sufficiently in advance for the crew to prepare		

response

Noted

EASA requires a full type-rating course for Part-27 rotorcraft.

comment

188 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
88	4.2(d)(1)(iii) and (iv)	Controls can be made distinguishable or predictable by differences in form, colour, location, motion, effect and/or labelling. AND "Colour coding is usually not sufficient . . . "	This two provides a means to make a control easily identifiable by the pilot (see (i)). (iii) is out of context with the rest of the Sbullets, (iv) is good content but prescriptive.	Either delete or combine (iii) and (iv) into: Critical controls should have multi-sensory identification means (Size, shape, texture, haptics, visual, etc). For example, use of color alone as an identifying feature is not sufficient.
88	4.2(d)(2)(i)	CS 27.1302(a) and (b) require the information necessary to accomplish defined tasks to be provided precisely and clearly. They also require the controls to be accessible and usable by the crew in a way that is consistent with the urgency, frequency and duration of	The explanatory text is not needed. If tie into 1302 section desired, do so in heading "Labelling"	Delete explanatory text, start para with "Labels should . . ." Add "CS27.1302 (a), (b) to the title (2) Labelling . . ."

		the tasks. Therefore, labels		

response

Accepted

The text has been amended accordingly.

comment *189* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
89	4.2(d)(2)(iii)	The design should avoid hidden functions (such as clicking on empty space on a display to make something happen). However, such hidden functions may be acceptable if adequate alternate means are available to access the function. The design should still be assessed for its ease of use and crew understanding	In context of the preceding and following information this information is an orphan. It does not clearly fit the flow of (2) and "icons"	Move to appropriate space or delete
89	4.2(e)(1)	"The applicant must show that each crew member in the minimum crew, as defined by CS 27.1523, has access to and can operate all the necessary controls. Accessibility is one factor in determining whether controls	Explanatory text not needed.	Delete from "The applicant" to ". . .by the crew.". Start para with "Any control . . ."

		support the intended function of the equipment used by the crew. Any control . . ."		
89	4.2(e)(1)	If the shoulder restraints are lockable, this may be shown with the shoulder restraints locked.	If this is not a "should" then delete. It sounds like its an option. Accessibility of controls with shoulder harnesses locked should be assessed, particularly primary controls or any other control used in emergency procedures	Delete the sentence or modify "Show that the pilots can reach and manipulate high priority controls needed for the safe operation of the aircraft with the shoulder harnesses locked."
89	4.2(e)(2)	CS 27.1302(b) requires information intended for the use by the crew to be provided in a clear and unambiguous form, to be accessible, and to enable crew awareness.	No need to repeat rule language	Delete sentence : CS 27.1302(b) requires information intended for the use by the crew to be provided in a clear and unambiguous form, to be accessible, and to enable crew awareness.

response

Accepted

Please see the response to comment #157.

comment

190 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution

90	4.2(e)(2)	". . .and of a minimum equipment list (MEL) dispatch."	MMEL usually accomplished by AEG post-TC. Is this intended for ATC/STC?	If this statement relates to STC or ATC's clarify
90	4.2(f)(1)(ii)	". . .with an. . ."	grammatical	Delete "an"
90	4.2(f)(1)(iv)		The wording describes the same thing as (i) but in greater detail	combine (i) and (iv) "The applicant should show that the controls required to regain control of the rotorcraft or system and the controls required to continue operating the rotorcraft in a safe manner are usable in conditions with extreme lighting levels or severe vibrations like turbulence or other vibration and should not prevent the crew from performing all their tasks at an acceptable level of performance and workload"
90	4.2(f)(2)	Controls of a variable nature that use a rotary motion must move clockwise from the OFF position, through an increasing range, to the full ON position.	This statement is out of context with paragraph and is specific to a control. If maintain, should describe how you want controls to move relative to their function	Delete, move to appropriate section, or precede with "for example"
90	4.2(f)(2)(i)	A control input is often	extraneous language, not needed.	Delete. Revised para:

		required in response to information on a display or to change a parameter setting on a display.		To ensure that a control is unambiguous per CS 27.1302(b)(1), the relationship and interaction between a control and its associated display or indications should be readily apparent, understandable, and logical.
90	4.2(f)(2)(i)	The applicant should specifically assess any rotary knob that has no obvious 'increase' or 'decrease' function with regard to crew expectations and its consistency with the other controls in the cockpit.	This is written as if it addresses a specific issue in a cert project. If yes, use as an example. Add "For example" to rotary knob example. A knob's inherent rotational function does not always have to be "increase" or "decrease". For example, discrete field selection could be accomplished turning knob clockwise for "right", counter clockwise of "left") The tricky bits arise when a knob controls a vertically displayed parameter like a bug. For instance, if the knob is located adjacent to and to the left of the parameter controlled. does the pilot rotate the knob clockwise to move the bug down the scale spatially or does the pilot rotate the knob clockwise to "increase"	Delete, expand to clarify, or phrase as example. To ensure that a control is unambiguous per CS 27.1302(b)(1), the relationship and interaction between a control and its associated display or indications should be readily apparent, understandable, and logical. For example, the applicant should specifically assess any rotary knob that has no obvious 'increase' or 'decrease' function with regard to crew expectations and its consistency with the other controls in the cockpit. The Society of Automotive Engineers' (SAE) publication ARP4102, Chapter 5, is an acceptable

			the value that the bug is indexing (meaning, the bug moves "up" the scale, presuming "up" indicates greater or larger values) What about a knob located adjacent to and to the right of the parameter controlled?	means of compliance for controls used in cockpit equipment.

response

Accepted

The text has been amended accordingly.

comment *191* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
91	4.2(g)(1)	There should be a clear and unambiguous indication when a crew input is not accepted or not followed by the system (27.1302(b)(1)). This feedback can be visual, auditory, or tactile.	Additional text to help clarify (2)	There should be a clear and unambiguous indication as to the meaning of the feedback indications. For example, if the intent of the feedback is to indicate a commanded event vs system state. Additonally, provide feedback when a crew input is not accepted or not followed by the system (27.1302(b)(1)). This feedback can be visual, auditory, or tactile.
91	4.2(g)(2)	Feedback, in an appropriate form, should be provided to	Info in 4.2(g)(6) would work well here since (g)(6) is broad in scope.	Either replace (2) with (6), rewrite (2) to include parts of (6) and delete (6), or delete (6).

		inform the crew that		Recommend: 4.2(g)(2): "To meet the requirements of CS 27.1302, the applicant should show that feedback in all forms is obvious and unambiguous to the crew in their performance of the tasks associated with the intended function of the equipment. Feedback, in an appropriate form, should be provided to inform the crew that:" Retain 4.2(g)(2) (i)-(iv) Delete 4.2(g)(6).
91	4.2(g)(2)(iv)	when a control is used to move an actuator through its range of travel, the equipment should provide, within the time required for the relevant task, operationally significant feedback of the actuator's position within its range. Examples of information that could appear relative to an actuator's range of travel include the target speed,	This is confusing. "Actuators" normally relates to flight control acuators. Does this mean that when the cyclic is moved there needs to be an indicator in the cockpit showing the position of the pitch/roll actuators and the swash plate? The example is not clear. How does an actuator's range of travel coincide with "target speed" (presuming target speed = airspeed/ground speed). Also, the rationale for including "the valves of various systems" in the sentence seems to indicate actuator valves?	Clarify or delete

		and the state of the valves of various systems		

response Accepted

The text has been amended accordingly.

comment *192* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
92	4.2(g)(3)	As an example, the switch position alone is insufficient feedback if awareness of the actual system response or the state of the system as a result of an action is required as per CS 27.1302(b)(3).	This is confusing as worded. Is or is not switch position alone sufficient? Currently switch position is referenced in 27.1327 and 1335. Is the intent to broaden the concept of switch position alone is insufficient to other systems?	Clarify
92	4.2(g)(4)	Controls that may be used while the user is looking outside or at unrelated displays should provide tactile feedback. Keypads should provide tactile feedback for any key	Majority of the paragraph information is in the second paragraph relating to keypads. I think the topic is tactile feedback. There seems to be two sep topics though; controls for use while not looking at the control or display and keyboards. Is the topic tactile feedback or type of control?	Suggest: Controls should include tactile feedback. Keypads should provide tactile feedback for any key depression. In cases when this is omitted, it should be replaced with appropriate visual or other feedback indicating that the system has received the inputs and is responding as expected. Tactile feedback in the form

		depression. In cases when this is omitted, it should be replaced with appropriate visual or other feedback indicating that the system has received the inputs and is responding as expected.		of control identification and use should be included for controls that may be used while the user is looking outside or at unrelated displays.
92	4.2(g)(6)	To meet the requirements of CS 27.1302, the applicant should show that feedback in all forms is obvious and unambiguous to the crew in their performance of the tasks associated with the intended function of the equipment	Same recommendation as 4.2(g)(2) As written (6) is a generalization compared to the (1) . . .(5). Looks like an an expansion of (2)	Either replace (2) with (6), rewrite (2) to include parts of (6) and delete (6), or delete (6). Recommend: 4.2(g)(2): "To meet the requirements of CS 27.1302, the applicant should show that feedback in all forms is obvious and unambiguous to the crew in their performance of the tasks associated with the intended function of the equipment. Feedback, in an appropriate form, should be provided to inform the crew that:" Retain 4.2(g)(2) (i)-(iv) Delete 4.2(g)(6).
92	4.3 (a)(1)	Applicants should use this AMC to show that the information displayed in	Unnecessary. The AMC is a means of compliance by definition.	Delete sentence

		the proposed design complies with CS 27.1302(b).		
92	4.3 (a)(1), (2)	All	(2) is more general and broader than (1)	Swap (1) with (2) "(1) The presentation of information to the crew can be visual (for instance, on a display), auditory (a 'talking' checklist) or tactile (for example, control feel). The presentation of information in the integrated cockpit, regardless of the medium used, should meet all of the requirements bulleted above. The following provides compliance considerations for the requirements found in CS 27.1301(a), CS 27.1301(b), CS 27.1302, and CS 27.1543(b). (2) Show, in sufficient detail, that the function, method of control operation, and results of information presentation comply with the requirements in CS 27.1301 and 27.771(a) and that the results of the presented information are: — clear, — unambiguous, — appropriate in resolution and precision, — accessible, — usable, and — able to provide

				adequate feedback for crew awareness.
92	4.3 (a)(1)	The proposed means should be of sufficient detail to show that the function, method of control operation, and results comply with the requirements in CS 27.1301 and that the results of the presented information are:	Add 771(a) See previous comment	Suggest: Show, in sufficient detail, that the function, method of control operation, and results of information presentation comply with the requirements in CS 27.1301 and 27.771(a) and that the results of the presented information are:
92	4.3 (b)(1), (2)	entire (b)	The use of "quantitative" and "qualitative" is confusing. These are design strategies. The end result is that the information is presented in such a manner that the pilots can access, read, interpret, and act on the information presented with the timeliness and precision required. How the applicant does that is their responsibility. The section title is "Presentation of Information" and is agnostic to how that presentation is presented. Yet (1), (2) are display (visual mode of	Not sure how to revise. However should be agnostic as to how information is presented to the pilots

			presentation) centric. For example, an applicant could choose to provide an aural "overtorque" or "torque" alert (qualitative) driving the pilot to look at the TQ gauge (quantitative) or lower the torque commanded.	

response

Partially accepted

Please see the response to comment #160.

comment

193 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
93	4.3 (c)	Characters, fonts, lines and scale markings (CS 27.1301(b) and CS 27.1543(b)) Crew members, seated at their stations and using normal head movement, should be able to see and read display format features such as fonts, symbols, icons and markings. In some cases, cross-cockpit readability may be required to meet the intended function that both pilots must be able to access and read the display. Examples of	The text targets readability of the display from both pilot positions. The title topic, "Characters, fonts . . ." is part of readability. If the title is the topic you should include effects of parallax, etc.	Change title to "Display readability". The last sentence of the existing text covers characters, fonts, etc.

		situations where this might be needed are cases of display failures or when cross-checking flight instruments. Readability must be maintained in sunlight viewing conditions (per CS 27.773(a)) and under other adverse conditions such as vibration. Figures and letters should subtend not less than the visual angles defined in SAE ARP 4102-7 at the design eye position of the crew member who normally uses the information.		
93	4.3 (d) (2), (3)	(2) Different systems in the cockpit should use the same colour coordinates. (3) Applicants should show that the chosen colour set is not susceptible to confusion or misinterpretation due to differences in colour usage between displays.. . ."	(3) can be interpreted as contradicting (2). Additionally, for post-TC mods, the color coordinates between OEM installed v. STC house installed can be different if there are different TSOA'd equipment installed. The important takeaway is that there is no confusion regarding what color is what (think NVIS A Red v. amber).	Suggest Delete (2), change (3) to (2) with revision: (i) The meaning of the color should be consistent within the cockpit and consistent with 27.1322. (ii) Color combinations, like blue on black or red on black, should be readily seen and readable in all environmental lighting and foreseeable display illumination levels.

				Move the following to (1): Improper colour coding increases the response times for display item recognition and selection, and increases the likelihood of errors, which is particularly true in situations where the speed of performing a task is more important than the accuracy, The use of the red and amber colours for other than alerting functions or potentially unsafe conditions is discouraged. Such use diminishes the attention-getting characteristics of true warnings and cautions
93	4.3 (d) (3)	"AMC 25-11 . . ."	Has EASA accepted change 7?	Change to AMC 27-2 MG-19

response

Partially accepted

Please see the response to comment #161.

comment

194 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
94	4.3 (e) (1), (5)	(1) Designs can base many elements of electronic display formats	Both these are general, introductory, and generically performance based. Although (5)	Combine (1), (5): (1) Relaying information to the crew via symbols, text, auditory cues

		on established standards and conventional meanings. For example, ICAO Doc 8400 provides abbreviations, and is one standard that could be applied to cockpit text. SAE ARP4102-7, Appendices A to C, and SAE ARP5289A are acceptable standards for avionics display symbols. (5) The applicant should show that displayed text and auditory messages are distinct and meaningful for the information presented. CS 27.1302 requires information intended for use by the crew to be provided in a clear and unambiguous format in a resolution and precision appropriate to the task, and the information to convey the intended meaning.	references text and auditory, the performance requirements apply to symbology also. The last two sentences are agnostic as to the type of "message"	or combinations of the three should be distinct and the information they are intended to convey should be easily recognized and understood by the crew. Equipment should present standard and/or unambiguous abbreviations, nomenclature, symbols, and auditory cues consistent within a function and across the cockpit. Industry documents such as ICAO Doc 8400, SAE ARP 4102-7, and SAE ARP 5289A are acceptable standards for symbols and text. Additionally, industry standards and accompanying TSOs provide acceptable means of using symbols, audio, and textual messages. (2) Symbols and Icons should be easily identifiable as to their meaning with little or no familiarization. Use of text or abbreviations to label icons is acceptable as long as the abbreviation is common. (i) Symbols with the highest priority should remain in view if there are multiple symbols displayed

		Equipment should display standard and/or unambiguous abbreviations and nomenclature, consistent within a function and across the cockpit		simultaneously. (ii) New symbols not traditionally used in the cockpit should be assessed for their distinguishability and for crew understanding and retention. This is particularly important if the new symbol represents information or a function that historically used another symbol. (iii) Symbols and icons not related to moving maps or geo-reference displays should be displayed in the same area of a display to enable pilots to easily locate them consistently. (3) Text messages (ii) Auditory messages or cueing should be distinct and easily recognizable. The number of tone only (non-vocal) cues should be limited to ensure distinction and recognition of meaning.
94	4.3 (e)(2), (3), (4)	See text	(2)-(4) basically discussing symbology. Combine into new (2) with sub paragraphs.	(2) Symbols and Icons should be easily identifiable as to their meaning with little or no familiarization. Use of text or abbreviations to label icons is acceptable as long as the abbreviation is

				common and easily interpreted. (i) Symbols with the highest priority should remain in view if there are multiple symbols displayed simultaneously. (ii) New symbols not traditionally used in the cockpit should be assessed for their distinguishability and for crew understanding and retention. This is particularly important if the new symbol represents information or a function that historically used another symbol. (iii) Symbols and icons not related to moving maps or geo-reference displays should be displayed in the same area of a display to enable pilots to easily locate them.
94	4.3 (e)		Add new (3)	(3) Ensure auditory message are prioritized correctly. Messages of lower priority should not interefere with higher priority messages. (i) Auditory messages using tones should be distinct and the number limited per technical standards. (ii) Tones should be loud enough for pilots' perception

				but not so loud to cause a startle response in the pilot. Additionally, depending on the priority of the tone alert, it should not be squelched by intercom communications or other less important messages. (iii) Voice messages should meet the performance targets of tone messages. (iv) A means should be provided for the pilots to mute messages or, depending on the priority, inhibit messages to keep clutter
94	4.3 (e)		Add new (4) It is unclear whether the term "text" in (e) title refers to text messages like those found on cell phones or relates to the text labels of icons, symbols, or other alerts.	Depending on the intent of "text" in the title (e), provide a set of performance measures expected in system integration, either pre or post TC.
94	4.3 (f) (i)	Information intended for the crew must be accessible and useable by the crew in a manner consistent with the urgency, frequency, and duration of their tasks, per CS 27.1302(b)(2). The crew may, at certain	Reciting the rule requirement is redundant. The flow of the paragraph places important information in the middle and end. The performance requirement should be first in the paragraph and the other information after it.	Suggest revision:(i) The applicant should show that any information required for continued safe flight and landing is accessible in the relevant degraded display modes following failures as defined by CS 27.1309. The applicant should specifically assess what information is necessary in those

		times, need some information immediately, while other information may not be necessary during all phases of flight. The applicant should show that the crew can access and manage (configure) all the necessary information on the dedicated and multifunction displays for the phase of flight. The applicant should show that any information required for continued safe flight and landing is accessible in the relevant degraded display modes following failures as defined by CS 27.1309. The applicant should specifically assess what information is necessary in those conditions, and how such information will be		conditions, and how such information will be simultaneously displayed. The applicant should also show that supplemental information does not displace or otherwise interfere with the required information. The crew may, at certain times, need some information immediately, while other information may not be necessary during all phases of flight. The applicant should show that the crew can access and manage (configure) all the necessary information on the dedicated and multifunction displays for the phase of flight.

		simultaneously displayed. The applicant should also show that supplemental information does not displace or otherwise interfere with the required information.		

response

Partially accepted

Please see the response to comment #162.

comment

195 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
95	4.3 (f)(2) (i), (ii), and (iv)	Visual or auditory clutter is undesirable. To reduce the crew member's interpretation time, equipment should present information simply and in a well-ordered way. Applicants should show that an information delivery method (whether visual or auditory)	Should be performance oriented. Explanatory text should be at the end of the paragraph.	Revise (2) as follows. Leave (iii) as writtnen (2) If there are displays or presentation methods in the cockpit that have mulitple layers of information available to the pilot, applicants should show that information is presented in a well-ordered way. The mechanisms and logic to selecting and deselecting, "decluttering", information should be easily understood and performed.

		presents the information that the crew member actually requires to perform the task at hand. The crew can use their own discretion to limit the amount of information that needs to be presented at any point in time. For instance, a design might allow the crew to program a system so that it displays the most important information all the time, and less important information on request. When a design allows the crew to select additional information, the basic display modes should remain uncluttered.		(i) Pilot selectable declutter modes should ensure that information required by regulation is either not deselectable or a means provides the pilot with an equivalent level of awareness of the information if it is deselected. Normally, information required by CS27.1303 is not allowed to be deselected. Waiting until a parameter reaches a cautionary or warning boundary to alert the pilot to a non-standard condition or status is unacceptable. The use of part-time displays depends not only on the removal of clutter from the information, but also on the availability and criticality of the display. (ii) Automatic decluttering that deselects information for the purpose of reducing visual clutter should not hide needed information from the crew member. If equipment uses automatic deselection of data to enhance the crew

				member's performance in certain emergency conditions, the applicant must show, per CS 27.1302(a), that it provides the information the crew member needs. (iii) Information layering should be prioritised according to the criticality of the task. Lower-priority information should not mask higher-priority information, and higher-priority information should be available, readily detectable, easily distinguishable and usable. (iv) Auditory information decluttering through mute or inhibit features should ensure that high priority auditory information is presented as needed. When audio inhibit functions are active, their inhibit status should be presented to the pilots. If the auditory information is high priority and can be inhibited, the visual indication of inhibit status should be in the pilot's primary field of view.

95	(2) Clutter (CS29.1302) (ii)	The paragraph reads Therefore, when designing such features, the applicant should follow the guidance in AMC 25-11, Chapter 6.	The FAA AC 25-11 is equilevent to AMC 25-11 and it would not be used for the Part 27 and Part 29 guidance to show compliance	
95	4.3 (f)(3)	Title	Needs a title. Content seems better suited to 4.2 Controls (g) Adequacy of Feedback. Recommend writing so the performance target is first, explanatory at the end.	Consider moving to new subparagraph in 4.2(g) Control Initiation and Response The applicant should show that the response to a control input, such as setting values, displaying parameters, or moving a cursor symbol on a graphical display, is fast enough to allow the crew to complete the task at an acceptable level of performance. For actions that require a noticeable system processing time, equipment should indicate that the system response is pending. Long or variable response times between a control input and the system response can adversely affect the usability of the system.

response

Partially accepted

Please see the response to comment #163.

comment *196* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
96	4.4 (a)	This paragraph provides means for demonstrating compliance with the design considerations for the requirements found in CS 27.1302(c), CS 27.1301(a), CS 27.1309(c), or any other relevant paragraphs of CS-27	Is the intent of this AMC to replace MOC's in the referenced CS's? If no, then this is an inaccurate statement. If yes, then we should go back and reference this AMC in affected sections (i.e., AMC 27.771(a): For MOC see AMC 27.1302 sections X, Y, Z.) As written this appears to override MOC's in section 27.1301, 1309, 771, etc.	Clarify intent.
96	4.4 (a)(2)	The requirement for operationally relevant system behaviour to be predictable and unambiguous will enable the crew to know what the system is doing and why. AND This distinguishes system	These two sentences appear to contradict one another when the words ". . .and why." are in the first sentence. The "why" a system is behaving the way it is is a result of the systems functional logic particularly when it is interacting with other systems.	Revise one or both sentences. Suggest: "The requirement for operationally relevant system behaviour to be predictable and unambiguous will enable the crew to know what the system is doing and what they did to enable/disable the behaviour."

		behaviour from the functional logic within the system design, much of which the crew does not know or does not need to know.		
96	4.4 (a)(5)	Examples include fly-by-wire systems and full authority digital engine controls (FADECs). Detailed specific guidance for automatic systems can be found in the relevant parts of CS-27	Examples of FBW is misleading, pilot awareness of FBW status should still be needed particularly if the system changes control law modes based on aircraft parameters.	Remove FBW as an example

response

Accepted

1. Accepted. This AMC does not replace the referenced ones. The quoted sentence has been deleted.
2. Accepted. The text has been amended accordingly.
3. Accepted. The example has been deleted.

comment *197* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
97	4.4 (b)(1)	the crew is able to perform all the tasks assigned to them,;	"assigned" is wrong word. Task allocation is more accurate.	Change "assigned" to "allocated"
97	4.4 (b)(3)	". . .and the rotorcraft. . ."	Not clear on tasks allocated to the rotorcraft unless it is a semi-autonomous design?	change to ". . .and the system or systems. . ."
97	4.4 (c)	title "functional"	The rule states "operationally	Suggest changing title

			relevant". 4.4(a)(2) cites "operationally relevant system behaviour". 4.4.(c)(3) cites "operationally relevant". There is no direct tie in the rule language to "functional" behaviour. There is also no disagreement that the functional behaviour of a system or systems relative to HMI is important for HF and error management. However, the terminology should be consistent or not as definitive	to "The behaviour of a system" to make it more general and discuss "functional" in (1). Or
97	4.4 (c)(1)	". . .automated system. . ."	"automated system" narrows the applicability to automation. Other systems, "manually" controlled" by the pilots have behavior patterns also and can have bad design interfaces	Delete "automated"
97	4.4 (c)(1), (2)	all	Are these two paragraphs intended to be introductory or explanatory text? They are written as explanatory text or description of functional behaviour and has no MOC descriptors. They explain how the behaviour is determined rather than provide guidance on how to show compliance.	If they are intended to be explanatory or intro text, the title (1) "Introduction" (or similar) and move paragraphs (1), (2) to sub paragraphs under new (1)
97	4.4 (c)(3)	Applicants should propose the means they will use to show that the behaviour of the system or the system mode in the	focus appears to be on "should propose the means". The AMC is a means. The applicant has to show that the behaviour of the system . . . etc	Suggest: "Applicants should show that the behaviour of the system. . ." or delete the sentence

		proposed design is predictable and unambiguous to the crew		
97	4.4 (c)(3)(i)		Is (3)(i) needed? It is introductory and explanatory regarding system behavior. What does it add?	consider deleting.

response

Partially accepted

Please see the response to comment #165.

comment *198* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
98	4.4.(c)(3)(ii) (A)	The design should be simple (for example, the number of modes, or mode transitions).	As written, appears to dictate design. Should target the HMI. In complex systems developing a "simple" user interface can drive the underlying design to be complex. Depending on intended function and the interface with other aircraft systems, a "simple" design may not be attainable. However, a "simple" HMI may be.	Suggest: "The human-machine interface should be easily understood and, if required, easily controlled by pilots."
98	4.4.(c)(3)(ii) (D)	"Uncommanded . . ."	The term "uncommanded" should be defined either here or in the section 1.3. Does "uncommanded" mean the pilot did not command the change but the automation did	Define "uncommanded" here or in 1.3.

			as part of its normal operation or does it mean there was a malfunction (failure) in the system resulting in a mode change? Past discussions with applicants revealed different definitions. Some described it as if the pilot did not initiate the action it was "uncommanded". Othe rs defined any change to a mode as "commanded" unless the result of a system malfunction regardless of pilot or automation initiation.	
98	4.4.(c)(3)(iii)	Note that formal descriptions of modes typically define them as mutually exclusive, so that a system cannot be in more than one mode at a particular time. For instance, a display can be in 'north-up' mode or 'track-up' mode, but not both at the same time	This does not seem necessary, unsure what this adds. Additionally, based on the example, this seems a narrow description of modes. In AFCS modes one can couple to a VS mode while still in maintaining a horizontal nav mode on the roll axis depending on the AFCS system?	Either delete or expand to explain why this is important and how an applicant could show compliance to it
98	4.4.(c)(4)(i),(ii)	(i) Applicants should propose the means that they will use to show that the behaviour of	There is information in (ii) applicable to (i). (ii) reads as an exception statement. I think, depending on the complexity and	Suggested revision: (i) Applicants should propose the means that they will use to

		the systems in the proposed design allows the crew to intervene in the operation of the systems without compromising safety. This should include descriptions of how they will determine that the functions and conditions in which intervention should be possible have been addressed. (ii) If the means of demonstrating compliance is by analysis, the applicant should describe it thoroughly. In addition, the methods proposed by applicants should describe how they would determine that each means of intervention is appropriate to the task	integration of the system, that analysis alone is insufficient. The first paragraph, with revision, could be sufficient guidance. Are there issues in the past that triggered the need to specifically call out "analysis" in (ii)? (5)(iii) "manually intervene . . ." is also appropriate to the intervention paragraph.	show that the behaviour of the systems in the proposed design allows the crew to intervene in the operation of the systems without compromising safety. The methods proposed by applicants should show how they will determine that each means of intervention is appropriate to the task. The methods should also take into consideration the level of integration with other systems as appropriate. (ii) Applicants should show that the crew can intervene in any system function, as required by the operational conditions. Pilo t intervention resuting in a change to manual from automatic control should be safe, be accomplished in a timely manner, and

				not result in a state requiring exceptional pilot skill or knowledge to manage.
98	4.4.(c)(5)(i),(ii),(iii)	Automated systems can perform various tasks selected by and under the supervision of the crew. Controls should be provided for managing the functionality of such a system or set of systems. The design of such 'automation-specific' controls should enable the crew to:	I think the paragraph could be more succinct and direct. Also this section may be more appropriate moved to 4.2 controls	Applicants should show that controls for automated systems with tasks that are commanded and supervised by the pilots: (ii) Clearly indicate the system mode the pilot is selecting. If the mode has a preparatory or "armed" phase, the "armed" mode indication should be distinct from the "active" mode. (ii) that allow for selection of multiple submodes, like a vertical path vs. a vertical speed mode, clearly indicate the selected submode such that the pilot can easily discern which mode is active. (iii) Used to deactivate automatic systems should provide protection

				against inadvertant actuation by the pilots. Consider moving to section 4.2 Controls

response Partially accepted

Please see the response to comment #166.

comment *199* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
98	4.4.(c)(3)(ii)(A)	The design should be simple (for example, the number of modes, or mode transitions).	As written, appears to dictate design. Should target the HMI. In complex systems developing a "simple" user interface can drive the underlying design to be complex. Depending on intended function and the interface with other aircraft systems, a "simple" design may not be attainable. However, a "simple" HMI may be.	Suggest: "The human-machine interface should be easily understood and, if required, easily controlled by pilots."
98	4.4.(c)(3)(ii)(D)	"Uncommanded . . ."	qq	Define "uncommanded" here or in 1.3.

response Partially accepted

1. Accepted: please see the response to comment #166.

2. Partially accepted: the paragraph has been clarified; a definition for ‘uncommanded’ is not added.

comment *200* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
99-100	4.5(a)(1) through (3)	Entire	The proposed resolultion is a revision of the two paragraphs. The rational is provided in the three following comments	a) Demonstrating compliance with CS 27.1302(d) (1) CS27.1302(d) recognizes that regardless of how well trained, experienced, how well rested the crew, or how well designed the sytem is, crews will make errors when interacting with the equipment. Therefore, the applicant should show that their system design and installation enables the crew to detect and recover from errors that are reasonably expected in service in addition to the systems' design and engineered error prevention and mitigation features. (2) To comply with CS 27.1302(d), the design and installation should: (i) enable the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)); (ii) ensure that the effects of crew errors on the rotorcraft functions or capabilities are evident to the crew, and continued safe flight and landing is possible (see 4.5(d)); (iii) discourage crew

				errors by using switch guards, interlocks, confirmation actions, or similar means; (iv) preclude the effects of errors through system logic and/or redundant, robust, or fault-tolerant system design (see 4.5(e))). (3) These above objectives: (i) recognise and assume that crew errors cannot be entirely prevented, and that no validated methods exist to reliably predict either their probability or all the sequences of events with which they may be associated; (ii) call for means of compliance that are methodical and complementary to, and separate and distinct from, rotorcraft system analysis methods such as system safety assessments. (iii) CS 27.1302(d) addresses errors that are design related. It is not intended to require consideration of errors resulting from acts of violence, sabotage or threats of violence
99	4.5(a)(1)	"This addresses the fact that crews will make errors, even when	Unclear as to what "This" references particularly as it relates to " . . .using well designed systems." Does the "This" in the	IF interpretation is that crews will make errors regardless, suggest: "(1) CS27.1302(d) recognizes that

		they are well trained, experienced, rested, and are using well-designed systems."	sentence relate to the previous sentence starting with "This subparagraph . . ." or does it relate to the fact regardless of how well-designed a system is, the crew will make errors when using it? This seems to be the more logical interpretation. However it is not clear.	regardless of how well trained, experienced, how well rested the crew, or how well designed the sytem is, crews will make errors when interacting with the equipment. Therefore, the applicant should show that their system design and installation enables the crew to detect and recover from errors that are reasonably expected in service in addition to the systems' design and engineered error prevention and mitigation features." IF interpretation is that the last sentence containing "well designed systems" relates to errors associated with manual control of the aircraft: Change last sentence to read: " "This addresses the fact that crews will make errors manually controlling the aircraft, even when they are well trained, experienced, rested, and are using well-designed systems."

response Partially accepted

Please see the response to comment #167.

comment *201* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
100	4.5(a)(2)(i)-(iv)	To comply with CS 27.1302(d), the design should meet one of the following criteria. It should: (i) enable the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)); or (ii) ensure that the effects of crew errors on the rotorcraft functions or capabilities are evident to the crew, and continued safe flight and landing is possible (see 4.5(d)); or (iii) discourage crew errors by using switch guards, interlocks, confirmation actions, or similar means; or (iv) preclude the effects of errors through system logic and/or redundant, robust, or fault-tolerant	Looks as if this is a cut/paste from AMC 25. Listing "options" raises the question of hierarchy. Is (i) more "desirable" than (iv) as specifically stated in 4.5(a)? Will EASA accept a system that only has (i) as an error management strategy? Reliance on the human for the first gate of error management is contrary to HF design. In this section, my first impression is that a flight manual procedure or reliance on training is adequate error management. For example, If I meet (i), I'm good because these are "or" statements. I don't have to have as robust a design because I have a good alerting sytstem and the pilots can undo whatever they did wrong. There may be a subtle point where it is inferred and expected that adequate design and engineering error management controls are present and this section is addressing the "regardless of design and engineering controls, pilots will still make errors. If this is the case, then clarifying	Revise: To comply with CS 27.1302(d), the design and installation should: (i) enable the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)); (ii) ensure that the effects of crew errors on the rotorcraft functions or capabilities are evident to the crew, and continued safe flight and landing is possible (see 4.5(d)); (iii) discourage crew errors by using switch guards, interlocks, confirmation actions, or similar means; (iv) preclude the effects of errors through system logic and/or redundant, robust, or fault-tolerant system design (see 4.5(e))). Or, To comply with CS 27.1302(d), even though adequate error management controls are present in the design and engineering of the systems, errors can still occur. The applicanr should show that the design

		system design (see 4.5(e))).	sections 4.5(a)(1) and (2) will help. (see comment for 4.5(a)(1) above) When designing for human factors, reliance on the human is not #1. AC25.1302 lists these as "and" statements which decreases the relevance of order. 4.5(a)(3) indicates that the preference is that crew detection and error recovery is the preferred design criteria for managing error. This does not correlate to designing for HF. By definition, crew based error detection and recovery increases crew workload depending on procedures and system integration complexity.	and installation enables the crew to detect (see 4.5(b)) and recover from errors (see 4.5(c)) that escape the design and engineering controls. Or copy AC 25.1302 wording: Applicants should show the design enable the crew to "manage errors," to the extent practicable. The installed equipment design should meet the following criteria: (i) Enable the flightcrew to detect (see 4.5(b), and/or recover from errors (see 4.5(c)); (ii) Ensure effects of flightcrew errors on the airplane functions or capabilities are evident to the flightcrew and continued safe flight and landing is possible (see 4.5(d)); (iii) Discourage flightcrew errors by using switch guards, interlocks, confirmation actions, or similar means, and (iv) Preclude the effects of errors through system logic

				and/or redundant, robust, or fault tolerant system design (see 4.5(e))).
100	4.5(a)(3)(i)	These above objectives: (i) are, in a general sense, in a preferred order;	"preferred order" infers a hierarchy wherein (i) is more desirable than (ii)-(iv). However, for a well designed system, is it inferred that (ii)-(iv) of the objectives in (2) are satisfied? From an applicant's standpoint, the interpretation could be that if I have training and procedures, I do not need design and engineering level error management	Delete (i), renumber. Revised para (3) suggestion: (3) These above objectives: (i) recognise and assume that crew errors cannot be entirely prevented, and that no validated methods exist to reliably predict either their probability or all the sequences of events with which they may be associated; (ii) call for means of compliance that are methodical and complementary to, and separate and distinct from, rotorcraft system analysis methods such as system safety assessments. (iii) CS 27.1302(d) addresses errors that are design related. It is not intended to require consideration of errors resulting from acts of violence, sabotage or threats of violence
100	4.5(a)(3)(i)	Errors that do have a design-related component are considered to be within the scope of this AMC.	Not sure what this paragraph means in context of crew error management. It is logical that design (and installation) related errors are within the scope of this AMC since it	Consider if this paragraph adds useful information and then expand or clarify. Or delete.

		Examples are a procedure that is inconsistent with the design of the equipment, or indications and controls that are complex and inconsistent with each other or other systems on the cockpit	applies to installed equipment the crew uses. This paragraph seems as if it is an introductory statement to design related error management.	
100	4.5(a)(4)	Errors that do have a design-related component are considered to be within the scope of this AMC.	grammatical correction	Errors that have a design-related component are considered to be within the scope of this AMC.
100	4.5(a)(5)	The applicant should not expect the errors considered to be different from those in normal conditions	This expecation may not be realistic. The added workload of handling an emergency may show different errors o	Delete the sentence unless it is clarified.
100	4.5(a)(5)	abnormal	"Abnormal" is undefined. Even though it is a transport airplane term it is not normally used in transport category lexicon. Additionally, where in CS27 is are "abnormal" procedures referred to?	Define "abnormal" in context of this AMC

response | Accepted

Please see the response to comment #168.

comment | *202* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
102	4.5(b)(1)	Applicants should design equipment to provide information so the crew can become aware of an error or a system/rotorcraft state resulting from a system action.	Unclear what is meant by ". . .a system/rotorcraft state resulting from a system action." As written it seems separate from error. The interpretation is the crew can become of aware of an error or the crew can become aware of a system/rotorcraft state. Does this mean a state resulting from an erroneous system action; resulting from an erroneous crew action/inaction? Inference is that awareness of the system/rotorcraft state resulting from an erroneous system or crew action?	Depends on the intent of the sentence. Regardless clarify based on intent. If not refering to an erroneous system action, then delete and move to section regarding system state awareness. If referring to erroneous system action regardless of cause, then suggest: ". . .erroneous system/rotorcraft state resulting from a crew error." OR ". . .system/rotorcraft state resulting from an erroneous system action."
102	4.5(b)(2)(i)(B)	"Other locations for the information may be appropriate depending on the crew's tasks"	It is not only crew tasks but the importance of the information and consequence of the error.	Suggest adding ". . .and the importance of the information." to the end of the sentence. " Other locations for the information may be appropriate depending on the

				crew's tasks and the importance of the information,"
102	4.5(b)(2)(ii)( )	Entire section	I think the section is ultimately telling the applicant that the system should provide the crew with indications that their action or inaction resulted in an abnormal system configuration or state. This could be stated compactly	(ii) Indications to the crew that provide information of an error or a rotorcraft system condition resulting from their error. (A) An alert that activates after a pilot error may be sufficient to show an error is detectable and provide sufficient information about an error. The alert should directly relate to the error or be easily assessed by the pilots as an error. Alerts should not be confusing leading the pilots to believe there may be non-error causes for the annunciated condition. (B) If a crew error results in the system generating a caution or higher level alert, then the flight manual procedure should have sufficient information for the crew to identify and undo their action that lead to the alert. For example, an alert about the system state resulting from accidentally shutting down a hydraulic pump, for

				example, may not provide sufficient information to the crew to enable them to distinguish an error from a system fault. In this case, flight manual procedures may provide the error detection means as the crew performs the 'Loss of Hydraulic System' procedures. (C) An error that is detectable by the system should provide an alert and provide sufficient information that a crew error has occurred, such as in the case of the crew forgetting to put one or both engines into "FLY". (D) If the system can detect pilot error, the system should be designed to prevent pilot error. For example, if the system can detect an incorrect frequency entry by the pilot, then the system should be able to disallow that entry and provide appropriate feedback to the pilot. Examples are automated error checking and filters that prevent the entry of unallowable or illogical entries with appropriate

				feedback as to why the entry was not accepted.
102	4.5(b)(2)(ii)( )	Crew indications that provide information of an error or a resulting rotorcraft system condition	"Crew indications" Is intent "Indications to the crew"? ". . .or a resulting rotorcraft system condition." Is the intent a rotocraft system condition resulting from a pilot error? The title of 4.5 is "Crew Error Management"	Clarify "Indications that provide information . . ." Clarify ". . .or rotorcraft system condition resulting from crew error."
102	4.5(b)(2)(ii)(A)	An alert that could activate after a crew error may be a sufficient means for the applicant to show that information about an error exists and that the error is adequately detectable,	The AMC should be one means of complying with a regulation. The use of "could" sounds like a design option and has caveats. The means for the applicant to show their design complies for this specified means (the AMC) should written as a requirement but using "should" vs "will" or "must.	"An alert that activates after a pilot error may be sufficient to show an error is detectable and provides sufficient information about an error. The alert should directly relate to the error or be easily assessed by the pilots as an error. Alerts should not be confusing leading the pilots to believe there may be non-error causes for the annunciated condition."

response Partially accepted

Please see the response to comment #170.

comment *203* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution

103	4.5(b)(2)(iii)	'Global' alerts cover a multitude of possible errors by annunciating external hazards, or the envelope of the rotorcraft, or operational conditions.	Grammatical change	'Global' alerts cover a multitude of possible errors by annunciating external hazards, the envelope of the rotorcraft, or operational conditions.
103	4.5(b)(3)	The applicant should consider the following when establishing whether the degree or type of information is available to the crew, adequately detectable, and clearly related to the error	Grammatical change depending on intent	The applicant should consider the following when establishing whether the degree or type of information available to the crew is adequately detectable and clearly related to the error OR The applicant should consider the following when establishing whether the Information is available to the crew, adequately detectable, and clearly related to the error
103	4.5(b)(3)(i)	An example would be the alignment of engine speed indicator needles in the same direction during normal operations. Failure of the needles to align in the same	Tie this back to an "error" or error mitigation or delete	An example would be the alignment of engine speed indicator needles in the same direction during normal operations. In the event of an engine anomaly or malfunction

		direction during normal operations would indicate a problem with one of the engines, since one engine would be rotating at a different speed from the other engine.		that manifested itself in a change of RPM on one engine, the spatial misalignment of the needles should assist the pilots in diagnosing the issue and manipulating the correct engine according to procedure.
103	4.5(b)(3)(ii)	Training, crew resource management (CRM), and monitoring systems such as TAWS and TCAS are examples of ways to provide a redundant level of safety if any or all the crew members fail to detect certain errors.	Moving the "monitoring systems . . .errors." up to section 4.5(b)(2)(iii) may make this more pertinent. Unsure how "Training, crew resource management . . ." provide a redundant level of safety if any or all the pilots fail to detect errors. (This is an operational difference between EASA/FAA. FAA does not require formal training on all Part 27 rotorcraft)	Suggest: Rotorcraft alerting and indication systems may not detect whether an action is erroneous because the systems cannot know the intent of the crew in many operational circumstances. In these cases, reliance is often placed on the crew's ability to scan and observe indications that will change as a result of an action such as selecting a new altitude or heading, or making a change to a flight plan in a flight management system (FMS). For errors of this nature, global alerting and monitoring

				systems aid in error detection. For example, monitoring systems such as TAWS and TCAS are examples of ways to provide a redundant level of safety if any or all the crew members fail to detect certain errors.

response

Partially accepted

Please see the response to comment #171.

comment

204 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
104	4.5(c)(1)	Assuming that the crew detects an error or its effects, the next logical step is to ensure that the error can be reversed, or that the effect of the error can be mitigated in some way so that the rotorcraft is returned to a safe state	Write as a performance related requirement for this MOC	When errors are detected the system should ensure the pilots or the system function can reverse the error. If the error initiates a state change in the aircraft, the effect of the error should be mitigated to prevent an unsafe condition until the error is corrected.
104	4.5(c)(2)((ii)	". . .the crew can be expected to use. . ."	Not sure the rationale of "expected to use". Shouldn't the design provide and	The indications and controls provided to accomplish the

			ensure the controls and indications are easily detectable and usable?	corrective actions are usable by the crew in a timely manner.
104	4.5(d)(1)(ii)	". . .do not adversely impact on safety (do not prevent continued safe flight and landing)."	Grammatical change "(do not prevent continued safe . . .)" implies that this MOC applies only errors resulting in catastrophic or possibly hazardous conditions. This also implies that "safety" = "ability to continue safe flight and land". Is that the intent?	". . .do not adversely impact safety (do not prevent continued safe flight and landing)." DEPENDING ON INTENT: ". . .do not adversely impact safety."
104	4.5(e)(1)	". . .An example of multiple confirmations would be the presentation of a temporary flight plan that the crew can review before accepting it."	Should state as design requirement if implemented. For a system input that can signigicantly alter the aircraft's state (attitude,etc; flight path, etc), the pilot should have to perform multiple steps for the system to accept.	". . .An example of multiple confirmations would be the presentation of a temporary flight plan where the crew cannot activate the change without a confirmation action."

response

Partially accepted

Please see the response to comment #172.

comment

205 comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
105	4.6(b)(1)	If similar information is presented in multiple locations or modes (both	Add other systems also. Integration of post-TC systems creates an issue with providing information generated by two	Add "by different systems" "Show that similar information presented in multiple locations, by

		visual and auditory, for example), consistent presentation of the information is desirable.	systems independtly of each other.	different systems, or in different modes (both visual and auditory, for example), is consistent. For any differences in presentation, show that the differences do not result in crew confusion or increase in crew workload that would increase error rates or task times. Show that new and novel presentation of information that is not consistent with aviation norms and standards does not lead to pilot confusion and increase workload."

response

Not accepted

Please see the response to comment #173.

comment *206* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
106	4.6(b)(2)(iii)	For example, the navigation symbology used on other cockpit systems or on commonly used paper charts should be considered when developing the symbology to	a more rotorcraft related example? In rotorcraft consistency between different systems, particularly as the result of STC modifications, etc, will be an issue.	Change the example to: "It is important that functions that convey the same information are consistent. One example is symbole sets. Traffic or terrain awareness systems should display consistent

		be used on electronic map displays		symbol sets if generated by separate installed systems."
106	4.6(b)(2)(iv)	It is important that an FMS is consistent with the operational environment so that the order of the steps required to enter a clearance into the system is consistent with the order in which they are given by air traffic management (ATM	This paragraph is specific to FMS as written. Rotorcraft operations are fluid and dynamic. If this paragraph is retained, then suggest a more rotorcraft specific example.	Not sure how to revise. Perhaps tie it back into (ii), (iii) somehow?
106	4.6(b)(2)(v)	One way in which the applicant can achieve consistency within a given system, as well as within the overall cockpit, is to adhere to a comprehensive cockpit design philosophy	this paragraph is generic and broad, seems outside the format and level of information in (i)-(iv).	Either delete or move to (2)
106	4.6(b)(3)	Another way is to standardise certain aspects of the design by using accepted, published standards such as the labels and abbreviations recommended in ICAO Doc	Grammatical/Clarification	Another way to show consistency is to show certain aspects of the design are consistent with accepted, published standards such as the labels and abbreviations recommended in ICAO Doc 8400 or

		8400 or in SAE ARP4105C. The applicant might standardise the symbols used to depict navigation aids (very high frequency omnidirectional range, VOR, for example), by following the conventions recommended in SAE ARP5289A. However, inappropriate standardisation, rigidly applied, can be a barrier to innovation and product improvement. Thus, guidance in this paragraph promotes consistency rather than rigid standardisation.		in SAE ARP4105C. The applicant might standardise the symbols used to depict navigation aids (very high frequency omnidirectional range, VOR, for example), by following the conventions recommended in SAE ARP5289A. However, inappropriate standardisation, rigidly applied, can be a barrier to innovation and product improvement. Thus, guidance in this paragraph promotes consistency rather than rigid standardisation.
106	4.6(b) & (c) All	All	The section is long and hard to follow. The introductory paragraph (1) lays out a good sequence that includes "Consitency tradeoff" concept. (4.6(c)). 4.6(c) contains concise and straightforward means to show compliance. The sections could be combined to make them more concise and to the	4.6 Integration b. Consistency (1) If similar information is presented in multiple locations or modes (both visual and auditory, for example), presentation of the information should be consistent. . (i) One way to

			point. In proposed resolution (c) is integrated with (b).	show consistency within a given system, as well as within the overall cockpit, is to show information complies to a comprehensive cockpit design philosophy. (ii) Another way to show consistency is to show certain aspects of the design are consistent with accepted, published standards such as the labels and abbreviations recommended in ICAO Doc 8400 or in SAE ARP4105C. The applicant might standardise the symbols used to depict navigation aids (very high frequency omnidirectional range, VOR, for example), by following the conventions recommended in SAE ARP5289A. However, inappropriate standardisation, rigidly applied, can be a barrier to innovation and product improvement. Thus, guidance in this paragraph promotes consistency rather

				than rigid standardisation. (2) Where consistent presentation of information is not possible, the applicant should show that the differences do not cause crew confusion, do not increase the error rates or task times, which could lead to a significant reduction in the safety margins or an increase in the crew workload. Where consistency trade-offs exist, as discussed in the next paragraph, the following are design attributes to consider for their consistency within and across systems: (i) Consistency trade-offs It is recognised that it is not always possible to provide a consistent crew interface. For example, the use of a consistent format across the cockpit may not work when individual task requirements necessitate the presentation of data in two significantly different formats.

				In such cases, it should be demonstrated that the design of the interface is compatible with the requirements of the piloting task, and that it can be used individually and in combination with other interfaces without interference with either the system or the function. (3) To show presentation and format of information is consistent in the integration of systems in the cockpit, the applicant should (i) provide an analysis identifying each piece of information or data presented in multiple locations, and show that the data is presented in a consistent manner or, where that is not true, justify why that is not appropriate. (ii) Where information is inconsistent, that inconsistency should be obvious or annunciated, and should not contribute to errors in the interpretation of information. (iii) There should

				be a rationale for instances where the design of a system diverges from the cockpit design philosophy. Applicants should consider any impact on the workload and on errors as a result of such divergences. (iv) The applicant should describe what conclusion the crew is expected to draw and what action should be taken when information on the display conflicts with other information in the cockpit (either with or without a failure).

response Accepted

Please see the response to comment #174.

comment *208* comment by: *FAA*

Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution
119	FAA Orders and Policy		This is for rotorcraft. The FAA would not accept applicant use of transport category airplane orders and policy if there is adequate and applicable Part 27 policy and guidance material available.	Change title: "FAA Guidance" There are no orders listed and the policy is all Part 25.. Add AC 27-1B material. MG-19 EDS, MG-20 HF, other applicable AC material unless EASA has not adopted

				Change 7 at the time of 1302 publication. Add: FAA AC 20-175 Controls for Flight Deck Systems Move the Part 25 memos to Other Documents section since they are good reference material.
119	Other Documents			ADD: FAA AC 00-74 Avionics Human Factors Considerations for Design and Evaluation (this is an "avisory" AC and not a means of compliance) DOT/FAA/TC-13/44 Human Factors Considerations in the Design and Evaluation of Flight Deck Displays and Controls

response

Accepted

Please see the response to comment #74.

comment

209 comment by: *Garmin International*

CS 27.1302, AMC 27.1302:

The proposed rules, AMCs, and GMs pass/fail criteria are highly subjective. The similarly subjective CS 25.1302 and AMC have caused significant problems for validation projects since EASA promulgated the rule prior to other authorities. Further, the problems of determining what is an acceptable design to meet 25.1302 continues to occur even after the FAA published a harmonized rule and AC because the different EASA / FAA flight test/human factors teams arrive at different conclusions when reviewing the same installation due to the lack of clear pass/fail criteria.

	The lack of clear pass/fail criteria will especially cause issues for applicants without access to qualified individuals authorized to make findings of compliance (see related comment about what constitutes a qualified individual). Add clear pass/fail criteria.
response	Not accepted Please see the response to comment #74.

3 Proposed amendments | 3.1 Draft CSs (draft EASA Decision) | GM No 2 to 27.1302 Example of compliance matrix p. 127-130

comment	*103* comment by: *European Cockpit Association* GM No 2 to 29.1302 and GM No 2 to 27.1302 pages 65, 67, 127 and 128 (reflecting to CS 29.777 (b) and CS 27.777 (b)) **Original text:** The controls must be located and arranged with respect to the pilots' seats so that there is full and unrestricted movement of each control without interference from the cockpit structure or the pilot's clothing when pilots from 1.57 m (5 ft 2 inches) to 1.8 m (6 ft) in height are seated **Comment:** The reflected heights are not reflecting the reality of pilot`s heights; numbers have to be changed. **Suggested text:** The controls must be located and arranged with respect to the pilots' seats so that there is full and unrestricted movement of each control without interference from the cockpit structure or the pilot's clothing when pilots from 1.57 m (5 ft 2 inches) to 1.95 m (6.5 ft) in height are seated **Justification:** In the NPA it is only required to have appropriate seating and up to a flight crew height of 1.80 m. This is far not reflecting reality. Since human mankind has gained massive in height over the recent time in average and variation, flight crew height up to 1.95m has to be considered in cockpit arrangement and seating provisions. E.g. has (according to Wikipedia) the average height of man in several countries already exceed the height of 1.80; like Netherlands (182.5), Belgium (181.7), Denmark (181.4).
response	Accepted

The anthropometric measures have been corrected to make them consistent with CS-27 and CS-29.

6 References p. 133

comment	*122* comment by: *General Aviation Manufacturers Association* Section 4, Page 133 Typo: Text reads 'Refer to Section 2.4' but section 2.4 does not exist.
response	Not accepted 'Section 2.4' exists and refers to the NPA; it is headed: 'What are the expected benefits and drawbacks of the proposals' (pp. 5 and 6 of the NPA).