Comment #	Commenter	Identification of the document and commented section
1	GAMA	Cover Page Executive Summary
2	GAMA	2.1.3 page 4
3	GAMA	AMC 20-136 Section 2.1.4
4	GAMA	AMC 20-136A, 2.a Page 8
5	GAMA	AMC 20-136 Section 3 Page 8
6	GAMA	AMC 20-136A Section 3.1 4. Related Material e. SAE International
7	GAMA	AMC 20-136A, 4.c Page 9
8	GAMA	AMC 20-136 Section 5 Page 11
9	GAMA	AMC 20-136 Section 6.c.2 Page 13
10	GAMA	AMC 20-136A, 6.c.2 Page 14

11	GAMA	AMC 20-136A, 6.c.3 Page 15 & AMC 20-136A, 7.a.2 Page 21
12	GAMA	AMC 20-136 Table 1
13	GAMA	AMC 20-136A, Section 7.a.3 Page 21 & AMC 20-136A, Appendix 2, c, Minimum conditions for complying with CS 25.1316, item (3) Page 42
14	GAMA	AMC 20-136 Section 7.a.3

15	GAMA	AMC 20-136A, Item 7.a.3 Page 22 & AMC 20-136A, Appendix 2, c, Minimum conditions for complying with CS 25.1316, item (3) Page 42
16	GAMA	AMC 20-136A, 7.a.5 page 22
17	GAMA	AMC 20-136A, 7.a.5 page 22
18	GAMA	AMC 20-136 Section 7.a.6

19	GAMA	AMC 20-136A, 7.a.6 Page 22
20	GAMA	AMC 20-136A, 7.a.6 Page 22 & AMC 20-136A, Appendix 2, Examples Pages 43-49
21	GAMA	AMC 20-136A, Section 7.a.6 Page 22 & AMC 20-136A, Appendix 2, Example #6 Page 47
22	GAMA	AMC 20-136 Section 7.d
23	GAMA	AMC 20-136A, Section 7.g.1 Page 25
24	GAMA	AMC 20-136 Section 7.g.2
25	GAMA	AMC 20-136 Section 9.a
26	GAMA	AMC 20-136 Section 9.a
27	GAMA	AMC 20-136 Section 9.a
28	GAMA	AMC 20-136 Section 9.c.

29	GAMA	AMC 20-136 Section 9.c.1.a
30	GAMA	AMC 20-136 Section 9.d
31	GAMA	AMC 20-136A, Appendix 1, a, Definitions page 37
32	GAMA	AMC 20-136A, Appendix 1, a, Definitions page 39
33	GAMA	AMC 20-136A, Appendix 1, a, Definitions page 39
34	GAMA	AMC 20-136 Appendix 2
35	GAMA	AMC 20-136A, Appendix 2, c, Assumptions, item (2) Page 42

36	GAMA	AMC 20-136A, Appendix 2, c, Minimum conditions for complying with CS 25.1316, item (1) Page 42
37	GAMA	AMC 20-136A, Appendix 2, c, Minimum conditions for complying with CS 25.1316, item (2) Page 42
38	GAMA	AMC 20-136A, Appendix 2, Example 1 page 43
39	GAMA	AMC 20-136A, Appendix 2, Example 3 page 44

40	GAMA	AMC 20-136A, Appendix 2, Example 7 Page 48
41	GAMA	AMC 20-136A, Appendix 2, Examples Pages 43-49
42	GAMA	AMC 20-136A, Appendix 2, Examples Pages 43-49
43	GAMA	All of AMC 20-158
44	GAMA	AMC 20-158A, 2 page 51
45	GAMA	AMC 20-158A Section 3.2 6. Approaches to Compliance g. Take corrective measures (if needed) 1st paragraph
46	GAMA	AMC 20-158A Section 3.2 Figure 1
47	GAMA	AMC 20-158A Section 3.2 Figure 1

48	GAMA	AMC 20-158A Section 3.2 Figure 1
49	GAMA	AMC 20-158A Section 3.2 Figure 1
50	GAMA	AMC 20-158A Section 3.2 Figure 1
51	GAMA	AMC 20-158A Section 3.2 Figure 1
52	GAMA	AMC 20-158A Section 3.2 Figure 1
53	GAMA	AMC 20-158A Section 3.2 Figure 1
54	GAMA	AMC 20-158A Section 3.2 Figure 1
55	GAMA	AMC 20-158A Section 3.2 Figure 1
56	GAMA	AMC 20-158A, 5.a.5 Page 53
57	GAMA	AMC 20-158A, 5.a.6 Page 53
58	GAMA	AMC 20-158A, 6 Page 54

59	GAMA	AMC 20-158A, 6.b.2 Page 55
60	GAMA	AMC 20-158A, 6.b.3 page 56 & AMC 20-158A, 7.a.2 page 65
61	GAMA	AMC 20-158A, 6.e.2 page 60
62	GAMA	AMC 20-158 Section 6.g
63	GAMA	AMC 20-158 Section 7.a.3
64	GAMA	AMC 20-158 Section 7.a.3
65	GAMA	AMC 20-158A, 7.a.3 Page 65 & AMC 20-158A, Appendix 3, c, Minimum conditions for complying with CS 25.1317, item 3 Page 97

66	GAMA	AMC 20-158A, 7.a.3 page 65
67	GAMA	AMC 20-158 Section 7.a.4
68	GAMA	AMC 20-158A, 7.a.5 page 66
69	GAMA	AMC 20-158A, 7.a.6 Page 66 & AMC 20-158A, Appendix 3, Example #6 Page 103
70	GAMA	AMC 20-158 Section 7.a.6
71	GAMA	AMC 20-158 Section 7.a.7
72	GAMA	AMC 20-158 Section 7.g
73	GAMA	AMC 20-158 Section 7.j.2.a

74	GAMA	AMC 20-158 Section 9
75	GAMA	AMC 20-158A Appendix 1 - Normal Operation
76	GAMA	AMC 20-158 Appendix 3
77	GAMA	AMC 20-158A, Appendix 3, b.1 page 96
78	GAMA	AMC 20-158A, Appendix 3, c, Minimum conditions for complying with CS 25.1317, item 1 page 97
79	GAMA	AMC 20-1586A, Appendix 3, Examples

80	GAMA	AMC 20-193, 2.2.1, First Paragraph page 107
81	GAMA	AMC 20-193, 5.1, Objective MCP_Planning_1, item 5 page 111

Comment
Text In Question From NPA - ".. Overall, the proposed documents would provide economic benefit by streamlining the certification process, would have no safety, …" The change to the AMC does allow the use of simpler lightning and HIRF certification methods for CS-23, which does provide an economic benefit with better balance of safety and cost. However, it is hoped that in the future that something similar can be done for CS-27 since the proposed lightning and HIRF changes are considered to increase requirements that would increase cost of certification. How the increased cost is offset by a safety benefit is not discussed within the NPA not only for CS-27 but also for CS-25 and CS-29.
Text In Question From NPA - "..a proposal for the Lightning and HIRF Certification Level for the protection of systems according to the probability of occurrence of the threat event.." The new CS-23 guidance took the above into consideration, but it was not clear in the NPA whether the increased requirements had any bearing on the above.
The changes to the safety assessment process could have drawbacks. See: Industry Response to CATA HIRF paper Dated July 27, 2020
Text In Question From NPA - "..The present AMC 20.136A can still be used as guidance for CS 23.2515, if agreed with the Agency…" Proposing to remove "if agreed with the Agency…".
Under document history, it specifies HIRF and lightning for AMC 20-136. HIRF should be removed
Item #5, ARP 5415A is referenced here, however ARP 5415B is the current version.
ED-158 should be added to the list of related EUROCAE materials.
There is no guidance on where exposure to lightning is likely
Should the lightning safety assessment include a reference to 23.2510?
Text In Question From NPA - "..NOTE: Considering that lightning and HIRF environments may have similar effects on electro-electronic systems (disturbing electrical signals, causing upsets or damage to circuits) and that the applicable regulations are similarly structured, normally the system LCL and HCL will be the same."

Text In Question From NPA - "This electrical and electronic system must also automatically recover normal operation of the Level A functions in a timely manner to comply with paragraph (a) (2) of these specifications." The impact of integrity of a function is not considered in the above and in general throughout the NPA. Malfunctions may be CAT and would need to address a(1), but it should not need to recover per a(2) if the availability is less than CAT.
This references HIRF, should be lightning
The word "monitor" in the text "used to assist, augment, or monitor" indicates that annunciation aspects of Level A functions are always required to meet Level A Display, even if it can be shown that there is no electrical contribution to the failure itself.
See: Industry Response to CATA HIRF paper Dated July 27, 2020

Text In Question From NPA -
"For example, if the mechanical, hydraulic, and/or pneumatic channel(s) has/have foreseeable latent failures, then the electrical/electronic channel would be the active channel during normal operations."

Text In Question From NPA -
"…Automatic recovery applies to all redundant channels of the Level A system required for normal operation unless…"

"All redundant channel" as written above conflicts with text in other areas of the NPA.

Text In Question From NPA -
"..The exception for recovery conflicts must be based on aircraft operational or functional requirements independent of lightning exposure. The exception should not be a mitigation for Level A system effects observed after exposure to lightning.."

It the intent of the above is unclear, especially related to exposure period of lightning.

See: Industry Response to CATA HIRF paper Dated July 27, 2020

The 2X.1316(a)(1) rule or current guidance does not stipulate which system (eg Active or Active back up) can be used to require the function to be not adversely affected. The 2X.1316(a)(1) can be met with any Active or Active-back up when availability is CAT.
The last sentence says "These excluded elements or channels should comply with CSs 23.1306/2515(b), 25.1316(b), 27.1316(b), and 29.1316(b)." IEL regulations only have subparts (a) and (b). As described in Table 1, with the exception of 23.2515, subpart (b) addresses both Hazardous and Major. Based on the corresponding section in AMC 20-158A and on the CATA paper, it appears that the intent here was to have these elements or channels meet Hazardous requirements. This lack of clarity is also present in the examples in Appendix 2.
Example 6 says "For the electronic engine thrust reverse control and the electronic spoiler control systems, the applicable parts of CS 25.1316 would depend on the specific failure condition." This matches the logic in Item #1 of "Industry Response to CATA HIRF paper" Dated July 27, 2020. This appears to contradict the logic in Section 7.a.6, which indicates that these items should meet 25.1316(b) (Hazardous), at a minimum.
Should read ETDL, instead reads EDTL
The last sentence talks about Level A Display systems. It seems that it should reference Step 11 (7.k), rather than Table 3.
Change the phrase "Significant testing, including aircraft level testing, is required to support the analysis."
Recommend saying the documentation described here is guidance and applicants should adapt their documentation based on their specific project.
A detailed lightning safety assessment is not mature before a lightning compliance plan is generally submitted.
This should say the "planned or expected internal lightning environment".
There needs to be an explanation for the expected application of these plans

While it may be a good idea to include the schedule, the items required for an adequate test plan can change from authority to authority and this content may be used by multiple authorities.

Comment #27 of this sheet is also applicable to this section as well.

Text In Question From NPA -
"Adverse effect: A lightning effect that results in a system failure, malfunction, or misleading information to a degree that is unacceptable for the specific aircraft function or system addressed in the system lightning protection regulations."

For the Normal Operation that is required to meet sub-part (a)(2), which type of modes as defined in "redundant channels" (Active channel, Active-backup or passive-backup) is this referring to?
It would be good to update the Normal and Non-Normal operation definition as to what type of channels/mode is being referred to. The definition of "redundant channels" could include all 3 types of modes (ref page 41 of NPA), yet there are places where all redundant channels are required to recover and in other places only certain modes of channels are required to recover. Example Normal operation (ref page 22 of NPA) vs non-normal operation (ref page 22 of NPA).

Text In Question From NPA -
"Timely manner: The meaning of 'in a timely manner' depends upon the function performed by the system being evaluated, the specific system design, interaction between that system and other systems, and interaction between the system and the flight crew. The definition of 'in a timely manner' must be determined for each specific system and for specific functions performed by the system. The applicable definition should be included in the certification plan for review and approval by the certification authorities."

Need more guidance on the above.

See: Industry Response to CATA HIRF paper Dated July 27, 2020

Text In Question From NPA -
"The lightning safety assessment must include all electrical and electronic equipment and components, assuming that they are potentially affected by lightning. It is not appropriate to use the lightning immunity data for electrical and electronic equipment or components as information input to the lightning safety assessment."

Text In Question From NPA -
"Minimum conditions for complying with CS 25.1316
(1) All electrical and electronic system channels that perform functions whose failure would prevent continued safe flight and landing, and can operate in ‘Active’ mode during normal operation, should fully comply with CS 25.1316(a)."

Text In Question From NPA -
"Channels that operate only in non-normal situations and are dissimilar should comply with CS 25.1316(b), and ..."

Its unclear what the requirement is if the system isi in non-normal situation and is not dissimilar. Item 1 only talks to channel in “Active” mode which would not include “Active-backup” per the definition. There may also be multiple backup channels and not all should be required to meet a default requirement of Level B.

Text In Question From NPA -
"Compliance with CSs 25.1316(a)(1), and (a)(2) should demonstrate that neither pilot display of aircraft attitude, altitude, and airspeed is adversely affected and that each of them recovers normal operation when the aircraft is exposed to lightning."

Update the above to reiterate that only the CAT functions need to recover

Text In Question From NPA -
"If the mechanical channel is independent of the electronic engine control speed control and overspeed protection, and has no electrical or electronic components, then the engine overspeed protection function is not adversely affected when the aircraft is exposed to lightning."

The pneumatic channel in this example does not need to meet any IEL requirement due to it being mechanical in nature. Mechanical system such as these would have a very hard time meeting HAZ requirements under 2X.1309 especially for availability, yet under example 1 that has an electronic backup it is required to meet a classification of HAZ by default and not what is associated with the failure condition of the backup while the Active channel is working correctly. Apply CL appropriate to the hazard classification for the back up only.
All the examples provided are for functions that have a Level A availability requirement. These examples do not convey, and even confuse, requirements for functions that have a requirement that is less than CAT for availability but have integrity (or malfunction) that are CAT. A proposed Example 9 is provided.
Each example should be fully contained on a single page. Examples 3 and 6 have page breaks in them.
Numerous mentions of CS 23.1308 are made throughout the document, but only 1 mention of 23.2520
Text In Question From NPA - "This AMC could nevertheless be used as guidance for CS 23.2520, if agreed with the Agency."
"lightning" at the end of the sentence should be "HIRF".
In the "System safety assessment" box, there is an underline caused by misplacement of the arrow to the next box.
In the "Define aircraft and system HIRF protection" box, "(2)" is cut off and not visible.

In the "Select system assessment" box, "(3)" is cut off and not visible.
In the "Select aircraft assessment" box, "(7)" is cut off and not visible.
There is a typo in the "System-level verification" box, the text label for the arrow reads "Similarit" and should be "Similarity".
In the "Aircraft test decision" box, "(8)" is cut off and not visible.
In the "Generic transfer functions / attenuation" box, there is a vertical line caused by misplacement of the arrow to the next box.
In the "Aircraft similarity assessment" box, "(12)" is cut off and not visible.
In the "Assess immunity" box, "(13)" is cut off and not visible, also the word "immunity" is truncated to the next line
The arrow line labeled "Acceptable" which connects "Assess immunity (13)" to "HIRF protection compliance (15)" is not connecting the boxes
Text In Question From NPA - “The increased severity of the HIRF environment because of an increase in the number and radiated power of radio frequency (RF) transmitters; and..” The above implies that it is being used to justify the changes. The above should be better defined to understand the relative nature of the increase in field strength, including the frequency spectrum impacted.
Text In Question From NPA - “… The adverse effects experienced by some aircraft when exposed to HIRF.”
A general comment that the HIRF section is written differently to the lightning section. It would be good to have commonality in the text. Example text in b.1 “... The process used for identifying these systems should be similar to the process for demonstrating compliance with CSs 23.1309, 25.1309, 27.1309, and 29.1309, as applicable …” is good text but not in the lightning section.

Text In Question From NPA - "The HIRF safety assessment must include all electrical and electronic equipment, components and electrical interconnections, assuming that they are potentially affected by HIRF. It is not appropriate to use the HIRF immunity data for electrical and electronic equipment, components and electrical interconnections as information input for the HIRF safety assessment."
Text In Question From NPA - "This electrical and electronic system must also automatically recover normal operation in a timely manner to comply with CSs 23.1308(a)(2), 25.1317(a)(2), 27.1317(a)(2), and 29.1317(a)(2)." The impact of integrity of a function is not considered in the above and in general throughout the NPA. Malfunctions may be CAT and would need to address a(1), but it should not need to recover per a(2) if the availability is less than CAT.
Text In Question From NPA - "This should include failures which could negate any system redundancy or influence more than one system performing the same function."
This should reference HIRF and not lightning in the first paragraph.
All mechanical, hydraulic and/or pneumatic channels have forseeable latent failures. Therefore, the way this is worded, they cannot be utilized
See: Industry Response to CATA HIRF paper Dated July 27, 2020
The word "monitor" in the text "used to assist, augment, or monitor" indicates that annunciation aspects of Level A functions are always required to meet Level A Display, even if it can be shown that there is no electrical contribution to the failure itself.

Text In Question From NPA - "The HIRF aircraft safety assessment should verify the reliability and availability assumptions for mechanical, hydraulic and/or pneumatic channel(s), if these assumptions would affect whether the electrical/electronic or mechanical, hydraulic, and/or pneumatic channel(s) is the active channel during normal operation. For example, if the mechanical, hydraulic, and/or pneumatic channel(s) has/have foreseeable latent failures, then the electrical/electronic channel would be the active channel during normal operations."
The statement "CSs 23.1308(a), 25.1317(a), 27.1317(a), and 29.1317(a) do not require the applicant to assume pre-existing failure conditions when classifying the functional failure conditions and the scope of the Level A systems." directly contradicts the sentence that precedes it, which states that I must consider latent failure conditions of the other possible channels
Text In Question From NPA - "… Automatic recovery applies to all redundant channels of the Level A system required for normal operation unless …"
Example 6 says "For the electronic engine thrust reverse control and the electronic spoiler control systems, the applicable parts of CS 25.1316 would depend on the specific failure condition." This matches the logic in Item #1 of "Industry Response to CATA HIRF paper" dated July 27, 2020. However, this appears to contradict the logic in Section 7.a.6, which indicates that these items should meet 25.1317(b) (Hazardous), at a minimum.
See: Industry Response to CATA HIRF paper Dated July 27, 2020
See: Industry Response to CATA HIRF paper Dated July 27, 2020
Is there any intention to address the FAA policy PS-ACE-23-10? Which allows for defined levels for Class I, II, and III aircraft
Low Level swept current testing should be 7.j.3

See comments #24 - #29 of this comment sheet, as they are applicable to the HIRF section as well.
This should reference HIRF and not lightning
See: Industry Response to CATA HIRF paper Dated July 27, 2020
Text In Question From NPA - "Redundant Channels: The multiple channels consist of equipment, components, electrical interconnections and configurations that are similar, typically with pieces of equipment that have identical part numbers. The channels should be independent. They may be configured in active, active-backup and passive-backup modes."
Text In Question From NPA - "All the electrical and electronic system channels that perform functions whose failure would prevent continued safe flight and landing, and can operate in 'Active' mode during normal operation, should fully comply with CS 25.1317(a)." Remove the need for Active channels only needing to be used to meet (a)
All the examples provided are for functions that have Level A availability requirement. These examples do not convey, and even confuse, requirements for functions that have a requirement that is less than CAT for availability but have integrity (or malfunction) that are CAT. A proposed Example 9 is provided.

The paragraph states, “An assumption in this [AMC]/[AC] is that software applications are statically allocated to cores during the start-up of the MCP software, but not during the subsequent operation of the software.” The wording is confusing.
Item 5 of MCP_Planning_1 states, “Identify whether or not the MCP will be used to host software applications from more than one system, and whether it will be used in an integrated modular avionics (IMA) platform.” This item creates two things to identify where CAST 32A had only one- “Identify whether or not the MCP device will be used in an IMA platform to host software applications from more than one system.” We cannot identify any objective that is directly affected by this new information.

Rationale for the comment
The increase in cost is primarily from: 1) Disallowing Active-back up channels (eg STBY) to be used in meeting sub part a of the lightning and HIRF rules. This puts all of the burden for meeting these rules on the Active channels (eg Primary system). 2) Any mechanical/hydraulic system used to mitigate a Level A function now requires a minimum level of reliability. 3) No methods have been defined for what might be required for existing aircraft certified to previous methods.
See: Industry Response to CATA HIRF paper Dated July 27, 2020
Seems like there should not be a need to coordinate with agency to use the AMC. The AMC is acceptable for P25/27/29 and therefore should automatically be acceptable for P23 if Applicant to chooses to use it.
AMC 20-136 is a lightning document
Latest guidance material should be referenced
ED-158 is referenced multiple times in the text of the AMC.
If applicants are to use this, they must know where exposure is likely.
Are the new amendment levels included in the lightning assessment
HIRF and Lightning CL do not need to be the same.

The automatic or manual recovery should only be required when the availability of the function is considered to be CAT.
This is the lightning requirements table
The proposed changes to the CATA paper included with "Industry Response to CATA HIRF paper" Dated July 27, 2020 changed "assist, augment, or monitor" to "necessary for".
See: Industry Response to CATA HIRF paper Dated July 27, 2020

This is a new requirement. Current guidance has no requirement for having a certain amount of reliability, where reliability is also not defined by the NPA, before it can be counted on. The section 5.2 ED017A/ARP5583A specifically states “The EEHWG, which was tasked by FAA to draft the proposed HIRF regulation, focused on system performance effects when exposed to the HIRF environment and did not intend for unrelated system failure conditions to be addressed in combination with that HIRF exposure.”

The text in NPA page 22 Item 4 says something similar also…”CSs 23.1306/2515(a), 25.1316(a), 27.1316(a), and 29.1316(a) do not require the applicant to assume pre-existing failure conditions when classifying the functional failure conditions and the scope of the Level A systems."

By having a need for reliability, the implication is that it might have failed (random failure and not related to HIRF/Lightning) and because of this, we can no longer rely on it for lightning which contradicts the above.

To comply with the text in question would now result in additional burden on the electrical systems. This additional cost burden is in the form of additional equipment design, integrated system test, and potentially aircraft level HIRF/lightning testing. All of these have high cost impact.

There is also impact to fielded aircraft with the prior certification method if an update is needed to the system that may add cost to recertifying the electrical portion if the mechanical or hydraulic system is no longer compliant wrt reliability.

There is no evidence of in field service where HIRF or lightning was an issue because of relying on mech or hyd systems in lieu of electrical equipment.

The definition of all redundant channels in normal operation is unclear. Example 1 on page 43 of the NPA has 3 redundant channels that are all “Active” with one as a backup and termed “Active-backup”. The Applicable parts of the rule for the backup is only CS25.1316(b) per the example and not (a)(2) from where the above text comes from.

See: Industry Response to CATA HIRF paper Dated July 27, 2020

If the intent of this is to show primary systems to meet 25.1316(a)(1) only, then this is something new. In the past STBY display has been used to hold up a function, so long as the primaries returned normal operation. This is a new change that increases the cost of certification. There does not seem to be any service history that previous practice is failing in the field. It also has an impact on aircraft that were certified to previous practice. Any changes to Active channels now have to assessed against the NPA, which could cause additional re-design/certification efforts.
Subpart (b) addresses Hazardous and Major, but the text in this section and the examples in Appendix 2 don't make it clear which is applicable. While the error in EASA's intent is identified, the Active back up should meet the hazardous classification associated with the loss or malfunction of the backup channel only since the Active channels are working.
The determination of HCL/LCL for items that are involved in, but not the primary means of mitigation for a Catastrophic failure condition should be determined by the system safety assessment process for the applicable aircraft.
Typo
Step 11 provides the complete picture for Level A Display, instead of just the table of levels.
This is a new requirement, previous analysis could be substantiated through rigorous testing, but aircraft testing was not necessarily required.
This is prescriptive, and it may not be applicable in all cases
A detailed lightning assessment is only fully matured towards the end of the program, after flight testing and system safety aspects have been completed
The actual internal lightning environment may not be known at the time of writing the lightning compliance plan.
A typical system or equipment qualification does not fit neatly into "test", "analysis" or "similarity". Many projects will use aspects of all three. Creating three individual plans for 1 piece of equipment that utilizes the three different methods is unecessary

Items such as test schedule are not required to show compliance.
The intent of the proposed change is to delineate that equipment may have multiple functions and that an adverse affect of a system may be MAJ/HAZ/CAT and not any adverse affect should automatically be CAT. They should be considered in relation to the sub parts of the rule. There are also varying degrees of malfunction that play into whether something is MAJ/HAZ/CAT.
Proposed text helps to add more decisive criteria to determine timely manner
See: Industry Response to CATA HIRF paper Dated July 27, 2020
The 2nd sentence contradicts the red text. The red text implies that if it is not affected then it should not be considered in the safety assessment. The safety assessment should also include any mechanical and pneumatic systems.

The current rule or guidance does not stipulate which channel has to be used to prevent the CAT case. This is a big departure from current practices where channels in Active-backup mode have been certified to prevent the loss of a function as an example. This would now put all the burden on Active channels (eg Primary Systems) to work throughout and cannot rely on any backup channel.

The objective of the executive summary states that the proposed changes “reflect the current state of the art” and that it would provide “economic benefit by streamlining the certification process”. For P25/27/29 this is not in line with either of the above:

1) You lose the flexibility of using the back up channel that was allowed previously.
2) Often the Active- back up channel is much more simple than the Active channel and easier/cheaper to protect.

The desire to have the Active channel work throughout is the ideal situation; however, in practice the aircraft does not get struck very often and given how infrequent one might have to rely on a Active-backup channel this should still be an acceptable path. We already do this today and have good field history. Note that in other areas of safety we do not make the Active channel meet the CAT requirement by themselves (eg DO178, DO254).

The proposed change is intended to ensure that functions that are not CAT are not required to recover.

It is possible to have some electronics and if it has no contribution to the failure mode that would be CAT then this should be acceptable.

Seems like we accept lower reliability system when it is pneumatic and should consider the same for the electronic Active-backup channel also that is driven by the safety requirements of the back up channel. When considering example 1 the AC25-11A Table 3 shows that the highest criticality of any upset on the STBY display only is MAJ. Therefore the Active-backup in the example should only need to meet MAJ requirement.
This applies to Example 8 also.
Is CS 23.2520 covered by this document?
Proposing to remove the latter part of the sentence since AMC should be acceptable for use by default since the AC is acceptable for P25/27/29 if Applicant to chooses to use it.
Accuracy
Readability
Understandability

Understandability
Understandability
Typographical
Understandability
Readability
Understandability
Understandability
Readability
Since the general nature of the proposed guidance is considered to be an increase in requirements, additional clarification should be provided to help in the assessment of the proposed changes.

The 2nd sentence contradicts the red text. The red text implies that if it is not affected then it should not be considered in the safety assessment. The safety assessment should also include any mechanical and pneumatic systems.

The automatic or manual recovery should only be required when the availability of the function is considered to be CAT.

Align with the notion of a system with multiple channels producing the same function.

It is in the HIRF AMC

These other non electrical/electronic systems can often be utilized as the primary path for meeting catastrophic requirements. This statement does not allow this

See: Industry Response to CATA HIRF paper Dated July 27, 2020

The proposed changes to the CATA paper included with "Industry Response to CATA HIRF paper" dated July 27, 2020 changed "assist, augment, or monitor" to "necessary for".

This is new requirement. Current guidance has no requirement for having a certain amount of reliability before it can be counted on. The section 5.2 ED017A/ARP5583A specifically states “The EEHWG, which was tasked by FAA to draft the proposed HIRF regulation, focused on system performance effects when exposed to the HIRF environment and did not intend for unrelated system failure conditions to be addressed in combination with that HIRF exposure.”

The text in NPA page 65 Item 4 says something similar also ”... CSs 23.1308(a), 25.1317(a), 27.1317(a), and 29.1317(a) do not require the applicant to assume pre-existing failure conditions when classifying the functional failure conditions and the scope of the Level A systems. ...”

By having a need for reliability, the implication is that it might have failed (random failure and not related to HIRF/Lightning) and because of this we can no longer rely on it, which contradicts to the above.

To comply with the text in question would now result in additional burden on the electrical systems. This additional cost burden is in the form of additional equipment design, integrated system test, and potentially aircraft level HIRF/lightning testing. All of these have high cost impact.

There is also impact to fielded aircraft that used the prior certification method if an update is needed to the system that may add cost to recertifying the electrical portion if the mechanical or hydraulic

The definition of all redundant channels in normal operation is unclear. Example 1 on page 98 of the NPA has 3 redundant channels that are all “Active” with one as a backup and termed “Active-backup”. The Applicable part of the rule for the backup is only CS25.1317(b) per the example and not (a)(2) where the above text comes from.

The determination of HCL/LCL for items that are involved in but not the primary means of mitigation for a Catastrophic failure condition should be determined by the system safety assessment process for the applicable aircraft.

See: Industry Response to CATA HIRF paper Dated July 27, 2020

See: Industry Response to CATA HIRF paper Dated July 27, 2020

Currently there seems to be some disconnect between EASA and the FAA regarding the usage of the FAA policy. Clarification of EASA position would be useful
It is a test technique just like the LLDD and LLSF

It is in the HIRF AMC
See: Industry Response to CATA HIRF paper Dated July 27, 2020
You could have completely different wiring and equipment and be considered a redundant channel. All the examples show that typically the backup channel would be very different; even dissimilar.
The current rule or guidance does not stipulate which channel has to be used to prevent the CAT case. This is a big departure from current practices where channels in Active-backup mode have been certified to prevent the loss of a function as an example. This would now put all the burden on Active channels (eg Primary Systems) to work throughout and cannot rely on any backup channel. The objective of the executive summary states that the proposed changes “reflect the current state of the art” and that it would provide “economic benefit by streamlining the certification process”. For P25/27/29 this is not in line with either of the above: 1) You lose the flexibility of using the back up channel that was allowed previously. 2) Often the Active- back up channel is much more simple than the Active channel and easier/cheaper to protect. The desire to have the Active channel to work through HIRF is the ideal situation however in practice the aircraft does encounter the highest HIRF levels each flight otherwise we would see upsets on equipment qualified for MAJ/MIN regularly. Given we do not see this that reliance on Active-backup would be infrequent and therefore should be acceptable; we already do this today and have good field history. Note that in other areas of safety we do not make Active channel meet the CAT requirement by themselves (eg DO178, DO254).

The wording of the sentence is not clear. It is assumed the intent is that applications are allocated to cores during start-up, and not allocated during the subsequent operation.
CAST 32A specifies identification when MCP is used in an IMA platform, while AMC 20-193 adds identification of MCP used to host software applications from more than one system, whether in an IMA platform or not. In CAST 32A it is clear that the combined information of items 5 and 6 provide the information necessary to determine which type of MCP platform to consider for MCP_Software_1. In AC 20-193, we now have a consideration of hosting software applications from more than one system on any MCP platform.

Proposed solution
Go back and properly address the increased cost that will be incurred for certifying Parts 25, 27, and 29 to the new methods proposed within AMC 20-136A and AMC 20-158A. If the cost/benefit is not positive, revise AMC 20-136A and AMC 20-158A and allow a 2nd public comment period.
Clarify whether the text in question is only for CS-23 or also applies to the other CS parts.
See: Industry Response to CATA HIRF paper Dated July 27, 2020
Remove "if agreed by the agency" from the last sentence of Section 2.a. Also, correct "AMC 20.136A" to "AMC 20-136A" in this sentence.
Remove the reference to HIRF
Change to ARP 5415B.
Add ED-158 to the list of related EUROCAE materials.
Either define the conditions where exposure is likely, or point to the document that has those definitions
Include the reference to the new regulation
Change "will be" to "can be" in the NOTE. i.e., "..NOTE: Considering that lightning and HIRF environments may have similar effects on electro-electronic systems (disturbing electrical signals, causing upsets or damage to circuits) and that the applicable regulations are similarly structured, normally the system LCL and HCL can be the same."

Suggest changing to "This electrical and electronic system must also automatically recover normal operation of the Level A functions in a timely manner when the availability of the function is considered to be CAT, to comply with paragraph (a) (2) of these specifications."
Remove HIRF reference, rename it to lightning
Change "used to assist, augment, or monitor" to "necessary for" in 7.a.3 and Appendix 2.c, Minimum conditions for complying with CS 25.1316, #3.
See: Industry Response to CATA HIRF paper Dated July 27, 2020

Propose removing the requirement to have a certain level of reliability for any mechanical or pneumatic systems used to prevent the CAT cases.
Provide additional clarification on which redundant channels are required to meet a(2).
Clarify the intent.

See: Industry Response to CATA HIRF paper Dated July 27, 2020

Propose to change text to continue previous practice that allows at least the Active -backup system in meeting a(1). This applies to page 97 5th paragraph also.

Change the last sentence of Section 7.a.6 to: "These excluded elements or channels should comply with classification associated with the loss or malfunction of the backup channel only since the Active channels are working." Update example accordingly.
The last sentence of Section 7.a.6 should be changed to: "For these excluded elements or channels, the applicable parts of CSs 23.1306/2515, 25.1316, 27.1316, and 29.1316 should be determined by the hazard classification of the specific failure conditions for each channel by itself in the system safety assessment."
Remove EDTL, and replace with ETDL
Change "Table 3" at the end of 7.g.1 to "Step 11" or "Section 7.k".
Change to "Significant testing, including aircraft level testing, may be required to support the analysis."
Add a statement that this is guidance, and may be able to adapt based upon their project
It is more appropriate to say the overall method used for the lightning safety assessment will be defined in the lightning compliance plan.
Change statement 3 to say the "planned or expected internal lightning environment"
Ensure section 9 is provided as guidance material only, and not necessarily a requirement

Change "should" to "may"

Suggest changing to "Adverse effect: A lightning effect that results in a system failure, malfunction, or misleading information to a degree that is unacceptable in meeting the appropriate sub-part of the rule for the specific aircraft function or system addressed in the system ..."

This applies to HIRF also on page 85..

Update the Normal and Non-Normal operation definition as to what type of channel/mode is being referred to.

Suggest changing to:

"Timely manner: At a functional level 'in a timely manner' should be the time it takes for the loss or malfunction to result in a hazard classification that is CAT/HAZ/MAJ when the term is used by appropriate sub-parts of the rule. The specific system design, interaction between that system and other systems, and interaction between the system and the flight crew should be considered in determining the appropriate hazard classification. For the system recovery where redundant channels are required to recover in a timely manner it could use the same time criteria also although it could be longer because the function is not lost. The latter should be coordinated with the appropriate certification authority."

This applies to HIRF page 87

See: Industry Response to CATA HIRF paper Dated July 27, 2020

Suggest changing to:

"The lightning safety assessment must include all electrical and electronic equipment, components and electrical interconnections. It can also include mechanical and pneumatic systems in the assessment. It is not appropriate to use the lightning immunity data for electrical and electronic equipment, components and electrical interconnections as information input for the lightning safety assessment."

Suggest removing this requirement, and restoring the previous method of compliance. It seems that passive backup caused a lot of concerns in the creation of the new method of compliance. As a minimum, the Active-backup should still be allowed.

Similar comment applies to HIRF also.

This also applies to Example 1 for Lightning & HIRF.

See also Industry response sent to EASA July 2nd 2020.

Clarify requirements for channels that are not dissimilar and requirement on multiple back up channels.

Suggest changing to "Compliance with CSs 25.1316(a)(1), and (a)(2) should demonstrate that neither pilot display of aircraft attitude, altitude, and airspeed is adversely affected and that each of them recovers normal operation of the function (ATT/ALT/AS) after the aircraft is exposed to lightning. The Active channels should return to its original non-disturbed state."

Suggest changing to "If the mechanical channel is independent of the electronic engine control speed control and overspeed protection, and has no electrical or electronic components that have failure modes that could prevent overspeed protection, then the engine overspeed protection function is not adversely affected when the aircraft is exposed to lightning."

Update example 1 to meet 2X.1316(c) in lieu of 25.1316(b)

Example 9	
Function	System
Provide roll axis autopilot control	The function is produced by a system with no redundant channels.
Applicable parts of CS 25.1316	a(1)
The availability requirement for the autopilot (AP) is Minor, however a hardover is considered CAT. The catastrophic condition occurs when there is a malfunction in the autopilot that is not caught and results in an uncommanded servo operation with enough authority to cause a CAT condition for the aircraft. The applicable sub-part CS25.1316 a(1) should be demonstrated by showing that there is no adverse affect by preventing the above malfunction. The malfunction can be prevented by an electronic monitor within the autopilot computer or by the pilot recognizing the failure and disconnecting the AP via the AP DISC switch. In both cases the autopilot is disconnected to prevent the malfunction. Since the loss of the AP is Minor this is acceptable. For CS25.1316 a(2), the system does not need to demonstrate automatic or manual recovery since the availability of the AP is Minor.	

Make sure that each example does not span multiple pages when it can fit on one page.

Include the reference to the new regulation

Suggest changing to "This AMC could nevertheless be used as guidance for CS 23.2520~~, if agreed with the Agency~~."

change "lightning" to "HIRF"

Correct figure to align arrows with the boxes

Resize the box to allow "(2)" to be visible

Resize the box to allow "(3)" to be visible
Resize the box to allow "(7)" to be visible
Correct the typo
Resize the box to allow "(8)" to be visible
Correct figure to align arrows with the boxes
Resize the box to allow "(12)" to be visible
Resize the box to allow "(13)" to be visible and the word "immunity" to be on one line
Correct figure to align arrows with the boxes
Provide additional text to help understand the relative nature of the increase in field strength, including the frequency spectrum impacted.
To provide some context to the nature of the HIRF upset, the NPA should provide information as to whether the HIRF upset was on equipment qualified or not qualified to the HIRF regulations and the criticality of resulting upset.
Provide a more harmonized harmonized approach in layout of sections and text that are common between HIRF & Lightning

Suggest changing to "The HIRF safety assessment must include all electrical and electronic equipment, components and electrical interconnections. It can also include mechanical and pneumatic systems in the assessment~~, assuming that they are potentially affected by HIRF~~. It is not appropriate to use the HIRF immunity data for electrical and electronic equipment, components and electrical interconnections as information input for the HIRF safety assessment."
Suggest changing to "This electrical and electronic system must also automatically recover normal operation in a timely manner when the availability of the function is considered to be CAT, to comply with CSs 23.1308(a)(2), 25.1317(a)(2), 27.1317(a)(2), and 29.1317(a)(2)."
Suggest changing to "This should include failures which could negate any system redundancy or influence more than one ~~system~~ channel performing the same function."
Change the reference from lightning to HIRF
Remove the statement about foreseeable latent failures or define acceptable rate of failure for those paths to be utilized for level A systems
See: Industry Response to CATA HIRF paper Dated July 27, 2020
Change "used to assist, augment, or monitor" to "necessary for" in 7.a.3 and Appendix 3.c, Minimum conditions for complying with CS 25.1317, #3.

Propose removing the requirement to have a certain level of reliability for any mechanical or pneumatic systems used to prevent the CAT cases.
Resolve the conflict between the two statements.
Provide additional clarification on which redundant channels are required to meet a(2).
The last sentence of Section 7.a.6 should be changed to: "For these excluded elements or channels, the applicable parts of CSs 23.1308, 25.1317, 27.1317, and 29.1317 should be determined by the hazard classification of the specific failure conditions for each channel by itself in the system safety assessment."
See: Industry Response to CATA HIRF paper Dated July 27, 2020
See: Industry Response to CATA HIRF paper Dated July 27, 2020
Make this paragraph 7.j.3

Change the reference from lightning to HIRF

See: Industry Response to CATA HIRF paper Dated July 27, 2020

Suggest changing to "Redundant Channels: Equipment, components, electrical interconnections that produce the same or similar function. The equipment and components are typically the same."

This applies to lightning also.

Suggest removing this requirement, and restoring the previous method of compliance. It seems that passive backup caused a lot of concerns in the creation of the new method of compliance. As a minimum the Active-backup should still be allowed.

This also applies to Example 1 for Lightning & HIRF.

See also Industry response sent to EASA July 2nd 2020.

Example 9	
Function	System
Provide roll axis autopilot control	The function is produced by a system with no redundant channels.
Applicable parts of CS 25.1317	a(1), a(3)
The availability requirement for the autopilot (AP) is Minor, however a hardover is considered CAT. The catastrophic condition occurs when there is a malfunction in the autopilot that is not caught and results in an uncommanded servo operation with enough authority to cause a CAT condition for the aircraft. The applicable sub-part CS25.1317 a(1) should be demonstrated by showing that there is no adverse affect by preventing the above malfunction. The malfunction can be prevented by an electronic monitor within the autopilot computer or by the pilot recognizing the failure and disconnecting the AP via the AP DISC switch. In both cases the autopilot is disconnected to prevent the malfunction. Since the loss of the AP is Minor this is acceptable. For CS25.1316 a(2), the system does not need to demonstrate automatic or manual recovery since the availability of the AP is Minor. CS25.1317a(3) is met since Env II is lower than Env I used in CS25.1317a(1).	

Change "but" to "and" in the sentence.
We suggest a change to use the CAST 32A meaning- “Identify whether or not the MCP will be used in an integrated modular avionics (IMA) platform to host software applications from more than one system.”

Additional details

See Comment, item 22 (Line #40) for related details.

A standby display would be a good example of a project that utilizes all three methods. The equipment manufacturer or OEM would perform a test. An analysis would be performed on any susceptibilities and similarity would be used to examine the installation. I would not create 3 different plans for this one piece of equipment. I would have 1 plan that would describe my methods.