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NR	Author	Section, table, figure	Page						
1	*Embraer*	Section 3.1.3.	7	Embraer understands that this CM is intended to be a complete list of failure modes to be considered in the design of monocoque sandwich structure for critical applications.	Embraer suggest including in list of page 7 the pullout allowable for assemblies involving panels inclined to each other.	Yes	No	Partially Accepted	The 'Pullout' example and has been added to the CM. Note: The CM is only intended to highlight potentially problematic issues (based upon industry/regulator experience). It does not attempt to provide an all-inclusive listing of potential issues. The introductory text has also been amended to emphasis this point further to related comments from other commentators.
2	*Airbus Helicopters*		All & title	Introduction of new expression 'critical structure'; not clear why not to stay with the already established expression 'PSE; PSE definition from AC 29.573:*'A structural element that contributes significantly to the carrying of flight or ground loads and whose failure can lead to catastrophic failure of the rotorcraft'* Furthermore there is a risk to confuse with CS-27/29 'Critical Parts'	As per provided definition 'critical structure' seems to be the same than 'PSE' it is recommended to stay with 'PSE' based on the definition provided in AC 29.573.		yes	Partially Accept	CM title and text revised to emphasise that the CM is primarily addressing single load path PSE sandwich structures, particularly monocoque structures. However, the definition of 'critical structure' has been retained because it provides reference for background discussion in the context of AC20-107B/AMC20-29. The inclusion of reference to CS29.602 and 'Critical Parts' was deliberate. For rotorcraft, some monocoque PSEsmay have critical characteristics, thus satisfying the definition of being a 'Critical Parts'. Note: the CM 'scope' has been amended to clarify that it is broadly applicable to sandwich structures, regardless of product type. Note: The broader issues associated with structure categorisation and identification of 'Critical Parts' are beyond the scope of this CM.
3	*Airbus Helicopters*	1.2	3	Mention of *'CS/29. 602 Critical Parts'*; these requirements are only applicable for helicopters and not for fixed wing airplanes. It is assumed that the subject of this CM is 'PSE' and not 'critical parts' according CS27/29.602.	Delete these requirements from the CM		yes	Not Accepted	See comment response 2
4	*Airbus Helicopters*	1.3	4	The abbreviation 'PSE' is missing as used e.g. in chapter 2.1	Add the abbreviation 'PSE'	yes		Accepted	'PSE' definition added.
5	*Airbus Helicopters*	1.4	4	Title of proposed CM is *'The safe design and use of monocoque sandwich structures…'*; the definition of 'monocoque' is missing	Add the expression 'monocoque' and the related definition (e.g. as provided in BRUHN)	yes		Accepted	A definition of 'Monocoque' has been added (Megson).

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NR	Author	Section, table, figure	Page						
6	*Airbus Helicopters*	1.4	4	For the definition of 'Co-cured Structure' it should be added that composite sandwich structures are co-cured structures (according to AC29-2C, Change 4, 29.573, Definitions).	Add a sentence mentioning that rotorcraft composite sandwich structures are co-cured structures		yes	Not Accepted	Unlike a laminate, which transfers load between similar plies, structure transferring loads between design features, e.g. skin to web, through a bond should be considered to be a bonded structure. Furthermore, the majority of sandwich structure involves precured composite or metallic skin and/or core, which better satisfies the definition of 'co-bonding' or 'structural bonding', than co-curing. Therefore, the consideration of a sandwich structure as universally being co-cured may be inappropriate. Note: AC 29 2C may require further amendment accordingly. Until then, this CM recognises, and respects, the fact that sandwich monocoque structures can be designed and produced successfully without necessarily including discrete 'arrest' features, e.g. 'chicken rivets etc. as is often assumed when satisfying the bonded structure requirements, e.g. per 23.573a(5). This CM is intended to emphasise the key aspects of monocoque design which could make such configurations acceptable, e.g. emphasising strict process control, robust DT philosophy etc., and the identification of any additional mitigating factors to those used in typical multi-load path sandwich structures. Furthermore, this CM acknowledges that there exist established examples of sandwich structures which have been used safely in critical limited load path applications, e.g. rotor blades. Therefore, it does not attempt to change such established practices. For such structure, mitigating factors may include exposure to limited dominant load cases, low strain levels, the potential for progressive evident damage modes, e.g. delamination/disbond, evident through vibration etc. CM text has been amended to reflect the points above.
7	*Airbus Helicopters*	1.4	5	In definition of 'Witness Structure' the term *'witness coupons used in the production process'* is used; it is assumed that here the so-called 'Process Control Specimen (PCS)' are meant	If 'PCS' are meant this already established term should be used		yes	Partially Accepted	PCS was not intended. 'Witness Structure' definition amended to make clear this is not referring to PCS
8	*Airbus Helicopters*	2.2	6	Reference to CS29.602; is only applicable for helicopters (Part27 & 29); see also comment 2	Delete this part		yes	Not Accepted	See response to comment response 2 Note: 'Purpose and Scope' text amended to emphasise that the priority for the CM is monocoque sandwich structure, not the specific application.
9	*Airbus Helicopters*	2.2	6	Comment to *'Note: AMC 20-29…provide further guidance specific to rotorcraft **bonded**/sandwich structure'*; composite sandwich structures used in rotorcraft are **co-cured** structures (see comment 5)	Adjust wording to make clear that sandwich structures used in rotorcraft are co-cured structures		yes	Not Accepted	See response to comment response 6
10	*Airbus Helicopters*	3.1.1	7	To *'Absence of telegraphing effects…'*; such a manufacturing effect is visible on the part and controlled through curing cycle monitoring. Moreover, such an effect shall not be systematically considered as a defect. If such an effect is found during process qualification it will be assessed and corrected if necessary	Suggestion is to replace *'Absence of telegraphing effects…' by 'Absence of undesired telegraphing effects…'*		yes	Partially Accepted	EASA agrees with the comment. Text amended in response to this and other comments. Note: the CM is attempting to emphasise issues which history has demonstrated to be problematic, regardless of the existing intent in the rules and guidance material in place at the time, or what has been considered to be appropriate practices.

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11	*Airbus Helicopters*	3.1.1	7	To *'Distortion of the core cells…'*; from AH point of view this is an effect which has to be taken into account in the qualification process (a distortion is not necessarily a defect)	To be taken into account in qualification process		yes	Partially Accepted	See response to comment response 10
12	*Airbus Helicopters*	3.1.3	7	To *'Because of the peculiarity of the sandwich panel construction…the material properties should be established on specimen **fully representative** of the panel construction…'*; the basic material properties are generally determined using generic specimen; the real parts design is verified on component and/or full scale level (according to so-called building block approach)	Prescription much too detailed. Delete the word 'fully'.		yes	Accepted	Text amended accordingly
13	*Airbus Helicopters*	3.1.3	7	To *'It is expected that at least the following static allowables be established….'*; here it is reminded that the mainly applicable failure modes for composite sandwich structures are local and global stability modes which are driven by the stiffness properties of the core and face sheets (not strength); furthermore this definition of expected allowables is considered as too much detailed.	This part to be deleted		yes	Partially Accepted	Text amended to include reference to stiffness. Some detail retained for example purposes.
14	*Airbus Helicopters*	3.1.3	8	To *'It is also expected that relevant **fatigue** testing at specimen level…'*; The CS 29.573 is named '**Damage tolerance and fatigue** evaluation of composite rotorcraft structures'; So in this CM also the expression 'Damage Tolerance & Fatigue (DT&F)' should be used.	Correct wording according § 573		yes	Partially Accepted	This CM is not attempting to standardise terminology across the CSs. The important point is to address F&DT or DT&F, regardless of word order. Noting that this order differs across CSs, F&DT has been adopted for the needs of simplicity. Abbreviation section amended to include F&DT and DT&F.
15	*Airbus Helicopters*	3.1.3	8	To *'It is also expected that relevant fatigue testing at **specimen level**…'*; The substantiation tests for damage tolerance and fatigue are carried out usually with specimen for establishing basic material properties as well as structural components and/or full scale structures to demonstrate behaviour of real structure.	No need to limit damage tolerance and fatigue testing to specimen level		yes	Accepted	Text amended to better express intent.
16	*Airbus Helicopters*	3.1.4.1	8	Concerning *'variation in range of impactor stiffness'*; prescription too much detailed and limited; an impact is probably not the only way to simulate a threat	Just mentioning that potential interaction between different threats has to be assessed		yes	Partially Accepted	The intent was to provide an example, e.g. impact threats, which raise related detailed issues requiring consideration, e.g. sharp and blunt impactors, impactor stiffness etc. Text amended to separate this example from the generic point.
17	*Airbus Helicopters*	3.1.4.1	8	To *'That all potentially undetectable damage modes…'*; inner core shear failure (shear crimping) is one of the failure modes considered in the stress substantiation; it is not allowed to occur below Design Ultimate Load (DUL)	As this failure mode in-service is only to be expected above DUL it is considered in the substantiation; this section of the proposed CM should be deleted		yes	Partially Accepted	EASA agrees with the 'comment summary'. However, being monocoque PSE structure, it is considered to be particularly important to identify all damage modes, and then to manage them accordingly, e.g. regarding appropriate type and extent of inspections following CAT5 events such that appropriate and complete repair becomes possible.

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18	*Airbus Helicopters*	3.1.4.1	8	To *'Note: Witness structures…'*; this solution is considered as impractical	This section of the proposed CM should be deleted		yes	Partially Accepted	This approach has been applied on some products. However, it requires extensive test work and applies to a limited scope of application. Text has been amended to strengthen this message.
19	*Airbus Helicopters*	3.1.4.2	9	To *'*Note: The application..'*; meaning of this note not clear at all; no added value seen	This section of the proposed CM should be deleted		yes	Partially Accepted	The note is based upon experience and can be important. However, a definition for 'grandfathered' has been added in order to further clarify why this might be important.
20	*Airbus Helicopters*	3.1.4.2	9	Mention of *'obviously detectable damage'*; is this the same as CVID (Clearly Visible Impact Damage)?	If this is related to CVID (Clearly Visible Impact Damage) according to CMH-17 rules for GVI (Global vision impacts) the expression 'CVID' should be used here accordingly		yes	Partially Accepted	Text amended accordingly to reflect fixed wing and rotorcraft discussion.
21	*Airbus Helicopters*	3.1.4.2	9	Damages Cat2 or Cat3 not commonly used in the substantiation process; coming from AMC 20-29	Adapt wording to BVID (Barely Visible Impact Damage) and CVID (Clearly Visible Impact Damage)		yes	Partially Accepted	Text amended accordingly to reflect fixed wing and rotorcraft discussion
22	*Airbus Helicopters*	3.1.6	9	In this chapter *'repaired structures'* are mentioned. From AH point of view this is limited here to repairs published in the Structural Repair Manual which is subject to the certification process.	Precise wording		yes	Accepted	CM intent was to address post event inspections and the need to pay particular attention to existing repairs previously completed in the newly damaged structure and other existing ICA, including Airworthiness Directives. Text amended accordingly
23	*Airbus Helicopters*	3.1.6	9	To *' – any existing, and potentially related, ICA, e.g. existing ADs, etc.'*; the meaning of this sentence is not clear	Precise wording		yes	Accepted	See comment response 22
24	*Boeing*	General		Boeing Commercial Airplanes appreciates the opportunity to review and provide comments on the subject proposed certification memoranda. We have reviewed this document and have developed the enclosed comprehensive set of comments that identify a number of areas of the proposed text where changes would be beneficial for better clarity and accuracy. There are two main points we want to emphasize. First, we recommend EASA to be consistent with the guidance written in the AMC 20-29. There are areas of the proposed text that do not seem aligned or consistent with the AMC. Second, we suggest that EASA minimize the use of vague words leaving up to the reader to interpret the intent of the text. We have written specific comments for these two points, in addition to other important clarifications to ensure consistent and standardized interpretation and application of the requirements and guidance provided in the document.				Noted	

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25	*Boeing*	Sec. 1.1, 3rd paragraph	3	*1.1 Purpose and scope* *…* *It is recognized that the behaviour of sandwich structures is dependent upon configuration details and that the use of sandwich structures in monocoque critical single load path structure applications tends to be associated with thicker skin and heavier core configurations than is typical of control surface and high lift device designs. Therefore, this CM does not attempt to address all issues associated with sandwich structures of control surfaces and high lift devices, such as the effect of pressure cycles. Pressure cycles may…*	We request to edit the text as follows: *It is recognized that the behaviour of sandwich structures is dependent upon configuration details and that the use of sandwich structures in monocoque critical single load path structure applications tends to be associated with thicker skin and heavier core configurations than is typical of control surface and high lift device designs. Therefore, this CM does not attempt to address all issues associated with* ***these lighter weight*** *sandwich structures* ~~***of control surfaces and high lift devices,***~~ *such as the effect of pressure cycles. Pressure cycles may…* Justification: The subsequent discussion of pressure cycle effects is pertinent to the use of lightweight sandwich structures in critical structures, and not limited to control surfaces and high lift devices alone.	Yes	No	Accepted	Text amended accordingly
26	*Boeing*	Sec. 1.1, 4th paragraph	3	*1.1 Purpose and scope* *…* *This CM does not explicitly address all Static Strength, Fatigue, and Damage Tolerance (F&DT) requirements as may be associated with all product types, but simply intends to support such requirements by ensuring robust design. For example, subject to product and configuration specific F&DT design philosophy, applicants considering monocoque sandwich structure pressure hulls may be expected to show Continued Safe Flight and Landing (CSF&L) and/or Limit Load capability with extensive areas of skin and/or core damage associated with all threats defined in AMC 20-29. Therefore, it is particularly important for such applicants to discuss intent to develop such a design with the regulator early in the product development.*	We request to edit the highlighted text as follows: *For example, subject to product and configuration specific F&DT design philosophy, applicants considering monocoque sandwich structure pressure hulls may be expected to show Continued Safe Flight and Landing (CSF&L) and/or Limit Load capability with* ~~***extensive areas of***~~ *skin,* ***bondline*** *and/or core damage associated with all threats defined in AMC 20-29.* Justification: "Extensive" is vague, and the extent of damage to be assessed is better defined by the five categories of damage described in AMC 20-29. Allowances for use of arrestment features to define limits to such areas should be noted if "extensive" is retained. Recommend that bondline damage scenarios be considered along with skin and core damage, if adhesive is utilized in the bondline.	Yes	No	Partially Accepted	Text deleted, considering amendments relating to other comments and balance of the text in this section.
27	*Boeing*	Sec. 1.4	4	*1.4 Definitions* *Adhesion Failure - Separation of the adhesive-adherend interface usually the result of inadequate bonding.*	We request to edit the text as follows: *1.4 Definitions* *Adhesion Failure –* ***A mode of failure associated with*** ~~***S***~~***s****eparation of the adhesive-adherend interface usually the result of inadequate bonding.* Justification: An adhesion failure does not imply failure of the part but is a mode of failure. Inadequate bonding does not necessarily result in separation of the adhesive and the adherend, for example in the case of a kissing bond.	Yes	No	Accepted	Text amended accordingly

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28	*Boeing*	Sec. 2.1, 1st paragraph	5	*2.1. General* *…However, there have also been several significant incidents involving sandwich structures (of various configurations in various applications) which have presented a potentially serious safety concern.*	"Several significant incidents" are referred to many times in this document without examples. Is it possible to list some examples while keeping it generic (for example, incident reports)? Justification: Providing detailed examples of prior incidents will emphasize the importance of following the guidance and will assist the reader in understanding the contextual background which led to development of the CM.	Yes	No	Partially Accepted	EASA agrees with the comment. Some reference to public documents has been added, ref. content in EASA Bonded Structure Workshop, June 2013.
29	*Boeing*	Sec. 2.1, 3rd paragraph	5	*2.1. General* … *Therefore, it is considered appropriate to more explicitly emphasise the importance of strict manufacturing processes and a robust Fatigue & Damage Tolerance (F&DT) philosophy which includes identification of all likely damage modes, particularly those resulting from impact…*	We request to edit the text as follows: *2.1. General* … *Therefore, it is considered appropriate to more explicitly emphasise the importance of strict manufacturing process ~~es~~ **control** and a robust Fatigue & Damage Tolerance (F&DT) philosophy which includes identification of all likely damage modes, particularly those resulting from impact…* Justification: We believe our suggestion provides a more typical context to the phrase.	Yes	No	Accepted	

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30	*Boeing*	Sec. 2.1, 4th paragraph	5	*2.1 General* … Furthermore, it is also considered to be necessary to simulate all such likely undetectable damage to its full extent during certification tests, in addition to the consideration of disbond or weak bonds as typically included in current design substantiation processes.	We request to edit the text as follows: *2.1 General* … *Furthermore, it is also considered to be necessary to simulate* ~~*all such*~~ *likely undetectable damage* ***(realistically or conservatively)*** ~~***to its full extent***~~ *during certification* ***or engineering*** *tests, in addition to the consideration of disbond or weak bonds as typically included in current design substantiation processes.* Justification: Simulating "all such likely undetectable damage to its fullest extent" could mandate certification testing of improbable damage scenarios, e.g. tests in which every bonded interface was assumed ineffective. It would likely be very difficult for a safe-life structure like a rotor blade (subject to a very large number of fatigue cycles) to meet this requirement. Recommend stating as "simulate likely undetectable damage (realistically or conservatively) during certification or engineering tests" to permit testing of worst case likely scenarios such that other likely scenarios may be addressed via validated analyses, and to permit such simulations to be conducted through a combination of certification and engineering tests.	No	Yes	Accepted	Text amended accordingly
31	*Boeing*	Sec. 2.1, 6th paragraph	5	*2.1 General* … *Although it is understood that co-cured structures can generally provide relatively more robust bonding between the constituent parts of the structure than other bonding processes, e.g. co-bonding, it should be noted that the potential exists for any bonded joint to present a challenge. Therefore, this CM also applies to co-cured structures.*	We request to edit the highlighted text as follows: *Therefore, this CM also applies to co-cured structures* ***in consideration of AMC 20-29 requirements for damage tolerance and residual strength, thereby excluding co-cured structures from the disbond failsafe requirement.*** Justification: AMC 20-29 excludes co-cured structure from fail-safe disbond residual strength requirements; the guidance herein should be consistent with AMC 20-29.	No	Yes	Partially Accepted	The question remains regarding the appropriateness of including 'sandwich structures' in the examples list for the definition of 'co-cured' structure in some guidance texts, e.g. AC29 2C MG8, because sandwich structure typically uses pre-cured composite/ metal skins and/or cores. Co-bonded structure would be a more appropriate definition. However, this CM also recognises that monocoque sandwich structure has been, and can be acceptable. The text has been amended to address the intent of the comment and to make clear that, although the simple fail-safe requirement may not apply, other mitigating factors need to be considered, in addition to following strict process, etc., as would be expected for multi-load path structures.

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32	*Boeing*	Sec. 3.1.1, 3rd paragraph	6-7	*3.1.1. Qualification of the manufacturing process* *…* *As part of the process qualification, destructive and non-destructive inspection (NDI) should be conducted to determine conformity to specified design requirements and check the suitability of the resulting product by assessing features such as:* *- Absence of 'telegraphing' effects and waviness on the skins of the sandwich panel.*	We request to edit the highlighted text as follows: *- Absence of 'telegraphing' effects and waviness on the skins of the sandwich panel **beyond that accounted for in the design data.*** Justification: In section 1.4, telegraphing is defined as "excessive undulation of the sandwich panel skin resulting from excessive overpressure during the autoclave process." "Excessive" is vague, and moderate facesheet waviness (dimpling) may be acceptable as long as its effects have been appropriately accounted for in the development of design values.	Yes	No	Accepted	Text amended accordingly to address intent of the comment
33	*Boeing*	Sec. 3.1.1, 3rd paragraph	6-7	*3.1.1. Qualification of the manufacturing process* *…* *As part of the process qualification, destructive and non-destructive inspection (NDI) should be conducted to determine conformity to specified design requirements and check the suitability of the resulting product by assessing features such as:* *- Disbonds between core and cells.*	We request to edit the highlighted text as follows: *- Disbonds between core and ~~cells~~ **skin (facesheet).*** Justification: Disbond between core and skin (facesheet) is considered to be a critical failure mode. A clarification would be helpful to avoid any misinterpretation.	Yes	No	Accepted	Text amended accordingly
34	*Boeing*	Sec. 3.1.1, 3rd paragraph	6-7	*3.1.1. Qualification of the manufacturing process* *…* *As part of the process qualification, destructive and non-destructive inspection (NDI) should be conducted to determine conformity to specified design requirements and check the suitability of the resulting product by assessing features such as:* *- Weak bonds.*	We request to edit the text as follows: *3.1.1. Qualification of the manufacturing process* *…* *As part of the process qualification, destructive and non-destructive inspection (NDI) **and specimen-level tests** should be conducted to determine conformity to specified design requirements and check the suitability of the resulting product by assessing features such as:* *- Weak bonds.* Justification: The other features listed are associated with geometric details which can be detected and assessed via NDI, or covered analytically based upon destructive tests of representative articles. As no NDI method is available to detect weak bonds (state of current technology), the effects of weak bonds are typically assessed via coupon-level specimen tests to characterize process sensitivity of the bonded joints.	Yes	No	Accepted	Text amended accordingly

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35	*Boeing*	Sec. 3.1.2, 3rd paragraph	7	*3.1.2. Process specifications* *…* *The process specification should typically include information required by AC 21-26, paying particular attention to:* *- Procedures for accepting the in-coming material (skin and core) and instructions for its handling and storing conditions.*	We request to edit the highlighted text as follows: *- Procedures for accepting the in-coming material (skin, **adhesive [when used],** and core) and instructions for its handling and storing conditions.* Justification: Acceptance procedures for adhesives (when used) in the sandwich fabrication process should be included in the process specification.	Yes	No	Accepted	Text amended accordingly
36	*Boeing*	Sec. 3.1.3, 2nd paragraph	7	*3.1.3. Material strength and determination of design allowable* *… Because of the peculiarity of the sandwich panel construction, the material properties should be established on specimens fully representative of the panel construction in terms of skin, core material and curing cycle.*	We request to edit the highlighted text as follows: *Because of the peculiarity of the sandwich panel construction, the material properties should be established on specimens ~~fully~~ representative of the panel construction in terms of skin, **adhesive (when used),** core material and curing cycle.* Justification: Requiring testing of specimens fully representative of panel construction mandates testing of all skin layup/gage and core geometry/density combinations; current industry practice is to test representative, conservative combinations. If utilized, test panels should include skin-to-core interfacial adhesive.	Yes	No	Accepted	Text amended accordingly.
37	*Boeing*	Sec. 3.1.3, 4th paragraph	7	*3.1.3. Material strength and determination of design allowable* *… It is expected that at least the following static allowables be established according to the statistics required under CS 2X.613:*	We request to edit the highlighted text as follows: *~~It is expected that at least the~~ **The** following static allowables **may need to** be established according to the statistics required under CS 2X.613:* Justification: Some of the allowables listed in the proposed CM may not be necessary for all sandwich applications. The proposed statement can be misinterpreted as a minimum requirement. For example, it is typical to develop facesheet compression strength allowables using either flexural tests or edgewise compressive tests, but not both.	Yes	No	Partially Accepted	Text amended accordingly (also considering other comments)
38	*Boeing*	Sec. 3.1.3, 1st paragraph	8	*3.1.3. Material strength and determination of design allowable* *… In determining the above properties, the effect due to humidity uptake, highest and lowest temperature expected in service, manufacturing defects up to limit of acceptability, impact damages should be also considered.*	We request to edit the highlighted text as follows: *In determining the above properties, the effect due to humidity uptake, highest and lowest temperature expected in service, manufacturing defects up to limit of acceptability, **and** impact damage~~s~~ should be also considered.* Justification: Editorial correction.	Yes	No	Accepted	Text amended accordingly

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NR	Author	Section, table, figure	Page						
39	*Boeing*	Sec. 3.1.3, 2nd paragraph	8	*3.1.3. Material strength and determination of design allowable* *… The validity of engineering formula used to establish analytical design allowables should always be verified by dedicated experimental activity in order to assess the effects of the manufacturing process (e.g. curing pressure which is normally limited to the crush core strength) and environmental conditions on the allowable predicted by these formulas.*	We request to edit the highlighted text as follows: *The validity of engineering formula**s** used to establish analytical design allowables should **~~always~~** be verified by **~~dedicated~~** experimental **~~activity~~** **data** in order to assess the effects of the manufacturing process (e.g. curing pressure which is normally limited to the crush core strength) and environmental conditions on the allowable**s** predicted by these formulas.* *Justification:* Analytical methods validated by similar experimental data can be sufficient, rather than using a "dedicated experimental activity".	Yes	No	Partially Accepted	'Always' retained because some level of verification is always required (by 'test' or 'analysis supported by test'). Otherwise, text amended accordingly.
40	*Boeing*	Sec. 3.1.3, 3rd paragraph	8	*3.1.3. Material strength and determination of design allowable* *… It is also expected that relevant fatigue testing at specimen level, representative of design point (e.g. fastened joint) and typical panel configuration be performed in order to assess the effects of on the fatigue strength of:*	We request to edit the highlighted text as follows: *It is also expected that relevant **specimen-level** fatigue testing **~~at specimen level,~~** representative of **critical** design **~~point~~** **features** (e.g. fastened joint) and typical panel configuration be performed in order to assess the effects of **the following** on **~~the~~** fatigue strength **~~of~~**:* Justification: Editorial correction.	Yes	No	Accepted	Text amended accordingly
41	*Boeing*	Sec. 3.1.4.1, 5th paragraph	8	*3.1.4.1. Threat survey and damage modes* *As part of compliance with the applicable F&DT requirements, the applicant should clearly demonstrate that a robust structure has been produced by showing:* … *- That all potentially undetectable damage modes (not only disbonds, but also inner core shear failure etc) have been simulated in testing (up to appropriate dimensions such that detection becomes possible and the dimensions of such damage have been quantified such that UL can be maintained up to readily detectable levels, or to the limits defined by substantiated design back-up features). The possibility of interaction between threats, e.g. impact and heat, should be considered in the simulation and substantiation process.*	We request to edit the highlighted text as follows: *- That all potential**~~ly undetectable~~** damage modes (not only disbonds, but also inner core shear failure etc) have been simulated in testing **or validated analyses** (up to appropriate dimensions **detailed in AMC 20-29**, such that **UL can be maintained for undetectable levels and ~~detection becomes possible and the dimensions of such damage have been quantified such that UL~~** **LL** can be maintained up to readily detectable levels, or to the limits defined by substantiated **arrestment** **~~design back-up~~** features)…* Justification: Readily detectable (damage found during planned inspection) and damage defined by back-up (arrestment) features (if readily detectable) is a limit requirement. The residual strength requirements should be related to the damage state and level of visibility per the guidance in AMC 20-29.	No	Yes	Partially Accepted	Text amended accordingly, and in response to other comments. Intent to address AMC 20-29 is captured in amended 3.1.4.2.

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NR	Author	Section, table, figure	Page						
42	*Boeing*	Sec. 3.1.4.2, 1st paragraph	9	*3.1.4.2. Residual strength* *Unless the applicant can demonstrate, to the satisfaction of the regulator, robust experience* using similar materials and processes in similar configurations at similar strain levels and in similar service environments, then the monocoque sandwich structures being used in the critical single load path application should be demonstrated to sustain no less than LL capability with obviously detectable damage** for any potentially catastrophic damage modes. Any potentially catastrophic damage mode which may not initially be readily detectable should be identified and addressed for growth up to readily detectable levels for this purpose.*	We request to edit the highlighted text as follows: *...then the monocoque sandwich structures being used in the critical single load path application should be demonstrated to sustain no less than LL capability with **readily detectable damage (Category 2 per AMC 20-29), near limit load with** obviously detectable damage **(Category 3)**and "continued safe flight and landing" with discrete source damage (Category 4),** for ~~any~~ **all** potentially catastrophic damage modes. Any potentially catastrophic damage mode which may not initially be readily detectable should be identified and addressed for growth up to readily detectable levels for this purpose **or should be demonstrated to exhibit "no detrimental damage growth" under repeated loadings for the applicable duration**.* Justification: The level of damage and resulting residual strength requirement should be linked to the guidance in AMC 20-29. Update ** accordingly. If considering Category 3 damage (obvious), link the residual strength requirement to the period of unrepaired use or match the AMC and state "near" limit as the requirement. Consider adding disbond failsafe requirement for co-bonded structure and secondarily bonded facesheets to limit load residual strength, also per the AMC. Also provide for allowance of "no detrimental damage growth" demonstrations to limit the damage size for certain likely scenarios.	No	Yes	Accepted	Note text amended allowing for other comments.
43	*Boeing*	Sec. 3.1.5, 1st paragraph	9	*3.1.5. SMS* *Recognising that several structural failures have resulted from various combinations of design, production, and continued airworthiness deficiencies, the applicant must clearly demonstrate that the structure has been subjected to the appropriate co-ordinated involvement of material suppliers, the design organisation (TC Holder), production organisations, and those with appropriate continued airworthiness experience throughout the supply, design, development, and certification processes.*	We request to edit the text as follows: *3.1.5. SMS* *Recognising that several structural failures have resulted from various combinations of design, production, and continued airworthiness deficiencies, the applicant ~~must clearly demonstrate that the structure has been subjected to the appropriate~~ **is enjoined to** co-ordinated involvement of material suppliers, the design organisation (TC Holder), production organisations, and those with appropriate continued airworthiness experience throughout the supply, design, development, and certification processes.* Justification: It is not clear what regulations mandate an SMS approach be utilized. This should be cross-referenced to appropriate documentation.	No	Yes	Partially Accepted	Amended using similar text.

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44	*Airbus*	1.1	3	"use of monocoque sandwich structures in critical structure applications ('critical structure' as defined in AMC 20-29), particularly those structures with single load paths." Critical structures are not described in CS25 and different interpretations are done between FAA and EASA. There could also be confusion with the 'Critical Parts' definition in CS 27/29.	Please replace critical structure application by Principal Structural Elements (PSE).	No	Yes	Partially Accepted	Text amended accordingly in conjunction with responses to other comments. Also see comment response 2.
45	*Airbus*	1.1	3	"to show Continued Safe Flight and Landing (CSF&L) and/or Limit Load capability with extensive areas of skin and/or core damage associated with all threats defined in AMC 20-29" It is not required to show LL for cat 5 damage in AMC20-29.	Please remove this sentence	No	Yes	Partially Accepted	The original sentence does not address Cat 5 damages, or the need for Cat 5 to be associated with CSF&L. This intent was to ensure that a robust structure is designed with adequate damage capability such that less readily detectable damage modes would be detected appropriately and in accordance with the intent of AMC 20-29 needs. However, the text has been amended in response to other comments.
46	*Airbus*	1.3	4	Missing PSE	Add PSE : Principal Structural Elements	Yes	No	Accepted	Definition added
47	*Airbus*	1.4	4	Critical Structure to be replaced by PSE	PSE: Principal structural elements are those which contribute significantly to carrying flight, ground, and pressurisation loads, and whose failure could result in catastrophic failure of the aeroplane. (25.571)	No	Yes	Partially Accepted	See comment response 2.
48	*Airbus*	1.4	4	The definition of "Monocoque" should be added.	Add the definition of 'Monocoque"	Yes	No	Accepted	Definition Added
49	*Airbus*	1.4	5	Definition of weak bond should be exactly the same as in AMC20-29 to avoid ambiguity.	Change literal definition to the one from AMC20-29	Yes	No	Not Accepted	Amended definition is considered to be more appropriate because it refers to reliability of detection, rather than suggesting that it is always impossible to detect.
50	*Airbus*	2.1	5	Reference to development tests in the context of this CM could lead to the interpretation that EASA would like to take it into account for the certification process. See the wording below "for both the applicant and the certifying agency" and "they are considered to be of increasing value and relevance to the certification process.": "Although development tests have not typically been considered to form part of the formal certification process, they can contribute significantly towards gaining confidence in support of the certification of a product, for both the applicant and the certifying agency, such that they are considered to be of increasing value and relevance to the certification process." Airbus would like to avoid that such an interpretation would be possible as development tests are for development purposes by the manufacturer.	Delete the below text: ~~"Although development tests have not typically been considered to form part of the formal certification process, they can contribute significantly towards gaining confidence in support of the certification of a product, for both the applicant and the certifying agency, such that they are considered to be of increasing value and relevance to the certification process."~~	No	Yes	Partially Accepted	EASA considers that being only background discussion in a CM, it does not represent any certification requirement. It simply indicates that information may be available from development work which can support certification confidence This CM does not attempt to resolve discussion regarding the broader issues associated with the definition of what certification may, or may not, include. Text has been amended to soften the message.

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51	*Airbus*	2.2	6	CS 2X.601 Design states the structure: '(a) ...may have no design features or details that experience has shown to be hazardous or unreliable. (b) The suitability of each questionable design detail and part must be established by tests.'	Any new design and material change has to be in line with AMC 20-29 and it will be covered by tests and/ or calculations. Hence, reference to 2x.601 can be removed.	Yes	No	Not Accepted	The reference to 601 is retained as a reminder for the need to develop concepts relative to 'lessons learned'.
52	*Airbus*	3.1.1	6	"Absence of 'telegraphing' effects and waviness on the skins of the sandwich panel." Telegraphing is common for most of sandwich and could be taking into account in the design value. It should be analysed but not forbidden.	Replace this sentence by "'telegraphing' effects and waviness on the skins of the sandwich panel have to be assessed"	No	Yes	Partially Accepted	Text amended to capture similar intent in response to several comments.
53	*Airbus*	3.1.1/3.1.2/3.1.3	6 & 7	These paragraphs covering qualification of the manufacturing process, process specifications, material strength and design allowables do not bring anything new compared to the guidance material already included in AC21-26, AC20-107B and AMC20-29. It is a duplication of materials already included in the AC/AMC. If EASA want to focus on specific aspects of these AC's, a reference could be included and would it make it more logic.	Please remove paragraphs 3.1.1, 3.1.2, 3.1.3. If necessary incorporate a reference list of items in existing AC/AMC material for applicants to pay special attention to.	No	Yes	Partially Accepted	EASA agrees that these are currently generic issues which should be addressed by existing good detailed practices. However, some experience has suggested that they remain appropriate issues worthy of further emphasis by repetition.
54	*Airbus*	3.1.3	7	The expected static criteria are too precise (not relevant for CM). Some are used more for qualitative comparison (flatwise strength) rather than criteria. Several sandwich structures are also mainly sized by stiffness criteria, not part of this list	Remove list of static allowables.	No	Yes	Not Accepted	The intent of the list is to provide important examples of what is being discussed and what has been problematic. Note: Consideration of stiffness has been added to the introduction of the list.
55	*Airbus*	3.1.3	8	"It is also expected that relevant fatigue testing at specimen level, representative of design point (e.g. fastened joint) and typical panel configuration be performed in order to assess the effects of on the fatigue strength of: - Material/Manufacturing Process variability. - Environmental Condition. - Allowable manufacturing defects. - Impact damages." Manufacturing process variability is not often assessed in fatigue at specimen level, as well as environmental condition in fatigue.	Reword the paragraph.	No	Yes	Partially Accepted	Noting the potential for competing failure modes in a sandwich structure, it is appropriate to consider fatigue testing at specimen level for such structures. Text amended in response to several comments.

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56	*Airbus*	3.1.4.1	8	It is not clear why witness structure is specifically mentioned in this CM and it does not seem to have any additional contribution to the issue except for mentioning it. Moreover, this section is considered as impractical for in-service applications. Airbus would not like to create any ambiguity with existing processes that have proven their value over decades of operation.	Remove the references to witness structures	Yes	No	Partially Accepted	The use of witness structures has been accepted as part of an F&DT strategy. However, this requires significant substantiation work and has been very limited in application. Text amended to emphasise points above.
57	*Airbus*	3.1.4.1	8	"…and the dimensions of such damage have been quantified such that UL can be maintained up to readily detectable levels, or to the limits defined by substantiated design backup features." EASA requirement to demonstrate UL level for readily detectable levels goes far beyond the acceptable MoC in AC201-107B/AMC20-29 Cat 1 definition: (i) Category 1: Allowable damage that may go undetected by scheduled or directed field inspection or allowable manufacturing defects. Structural substantiation for Category 1 damage includes demonstration of a reliable service life, while retaining ultimate load capability. By definition, such damage is subjected to the requirements and guidance associated with paragraph 7 of this AC. Some examples of Category 1 damage include BVID and allowable defects caused in manufacturing or service (e.g., small delamination, porosity, small scratches, gouges, and minor environmental damage) that have substantiation data showing ultimate load is retained for the life of an aircraft structure. See also chapter 7(f) of the AC20-107B/AMC20-29	Change sentence to reflect Cat 1 damage definition of AC20-107B and AMC20-29.	No	Yes	Partially Accepted	3.1.4.1 text has been amended to reference AMC 20-29 and to be more in line with the AC/AMC text following several comments. 3.1.4.2 text also amended
58	*Airbus*	3.1.4.2	9	The note starting with "the application of 'grandfathering'…" is unclear.	Please clarify or delete the note	No	Yes	Accepted	Definition added.

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59	*Bell Helicopter Textron Inc.*	ALL	ALL	It appears that all requirements set forth in this CM are already covered by the regulations set forth in 2X.573.	This CM pales in comparison to 2X.573. We suggest the author discuss these items with the Structures expert at EASA...		X	Not Accepted	A CM is not intended to compete with the rules. The function of a CM is as indicated on the title page: '…**to provide guidance on a particular subject and, as non-binding material, may provide complementary information and guidance for compliance demonstration with current standards**…and **must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or as Guidance Material (GM).**…**not intended to introduce new certification requirements or to modify existing certification requirements**" In this case, the intent is to provide '**complementary information**' relating to a specific subset of sandwich PSE structures, i.e. critical monocoque sandwich structures and which are not explicitly identified in the existing requirements, e.g. 2X.573 or guidance. The 'complementary information' is that identifying, and emphasising, subjects which experience has directly shown to be challenging for such configurations, regardless of having previously been identified as potential issues in the existing guidance documents. Please note that the CM was written by structures and materials experts with full internal consultation before release according to the applicable procedures. The purpose of releasing the draft document for industry discussion is to obtain consensus and potentially improve the document with positive industry input relating to such configurations. Furthermore, it informs industry regarding subjects of particular interest to EASA.
60	*Bell Helicopter Textron Inc.*	3.1	6	*"To satisfy the means of compliance provided in AMC 20-29 for 'critical structures'…"* 29.573 identifies PSE parts, which includes critical and non-critical parts.	Provide clarity as to how the proposed CM is not already addressed by 2X.573.		X	Not Accepted	See also response to comment 59
61	*Bell Helicopter Textron Inc.*	3.1.1	6	*"The manufacturing process has to be fully qualified before starting production of the parts."* 2X.573 specifically mentions that the manufacturing process should be fully qualified and all production parts shown to comply prior to achieving Type Certification.	*"The manufacturing process should be fully qualified and all production parts shown to comply prior to achieving Type Certification."*		X	Partially Accepted	See also response to comment 59. The draft CM text emphasises this point because 'lessons learned' indicate that this has been a problematic issue, particularly when complicated by supplier changes etc., although 2x.573 was in place at the time. Proposed text adopted, icw responses to other comments
62	*Bell Helicopter Textron Inc.*	3.1.1	7	*"Absence of 'telegraphing' effects and waviness on the skins of the sandwich panel."* The guidance material for 2X.573 requires that all manufacturing processes and the results thereof are included as part of the Threat Assessment and overall certification effort.	*"'Telegraphing' effects and waviness on the skins of the sandwich panel."*		X	Partially Accepted	Text revised, also considering other comments.
63	*Bell Helicopter Textron Inc.*	3.1.3	7-8	This section does not agree with current amendment level practice. It puts too much emphasis on static allowables and does not consider repeated load, as required, in 2X.573.			X	Partially Accepted	Text revised, also considering other comments.

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64	*Bell Helicopter Textron Inc.*	3.1.4.1	8	*"That all potentially undetectable damage modes…"* The Threat Assessment identifies all potentially undetectable damage modes.	*"That potentially undetectable damage modes determined by the Threat Assessment…"*		X	Partially Accepted	Text revised, also considering other comments.
65	*Bell Helicopter Textron Inc.*	3.1.4.1	9	The Residual Strength requirements of 2X.573 appear to be more strenuous and precise than what's contained in this section of the CM. The OEM should demonstrate ultimate load capability throughout the life of the aircraft (i.e. after repeated loading) and shall not fall below limit capability, which would require an inspection/repair to ultimate capability for continued airworthiness.	Utilized verbiage within 2X.573 for residual strength requirements		X	Partially Accepted	See response to comment 59 Text revised, also considering other comments.
66	*Bell Helicopter Textron Inc.*	3.1.5	9	The Threat Assessment requirements of 2X.573 are more precise and robust than what is presented in this CM.	Utilized verbiage within 2X.573 for threat assessment		X	Partially Accepted	See response to comment 59 Text revised, also considering other comments.
67	*Bell Helicopter Textron Inc.*	3.1.6	9	ICA requirements in 2X.573 define what is required for ALL PSE parts. This CM appears to be redundant and less precise than what is defined by 2X.573.	Utilized verbiage within 2X.573 for ICA requirements.		X	Partially Accepted	See response to comment 59 Text revised, also considering other comments. Note: 2x.573 does not explicitly state that inspection of load paths and consideration of other existing ICA be addressed following detection of damage and/or following an incident.
68	*Bell Helicopter Textron Inc.*	3.2	10	Why isn't 2X.573 listed here?	Add 2X.573 to this section		X	Accepted	Although the intent was not to list all requirements, EASA agrees that 2X.573 is a key requirement. Reference to 2X.573 added to list.
69	*Bell Helicopter Textron Inc.*	4	10	Shouldn't a Structures expert also be listed as a POC?	Consider having a structures expert as a POC as a part of the certification memorandum team.		X	Not Accepted	See response to comment 59

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