European Union Aviation Safety Agency

Comment-Response Document (CRD) Fourth Publication of Proposed Means of Compliance with the Special Condition VTOL issue 1

Comment Response Document (CRD) to

Fourth Publication of

Proposed Means of Compliance with the Special Condition VTOL issue 1

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1. Summary of the outcome of the consultation

The comments received addressed the various proposed means of compliance to the Special Condition VTOL-capable aircraft. These constructive comments were individually assessed and led to corrections or revised text, as deemed relevant to address the concerns raised.

The commenters included 5 CAAs, 6 aircraft manufacturers, a research institute, an industry association, and an equipment manufacturer.

2. Individual comments and responses

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

(a) **Accepted** — EASA agrees with the comment and any proposed change is incorporated into the text.

(b) **Partially accepted** — EASA either partially agrees with the comment or agrees with it but the proposed change is partially incorporated into the text.

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

(d) **Not accepted** — EASA does not agree with the comment or proposed change.

3. CRD table of comments, responses and resulting text

(General Comments)	-

comment	*4* comment by: *Czech Aerospace Research Centre* Are propulsion energy storage systems for VTOL aircraft going to be covered in future MOC with the SC VTOL, or is any information available at the moment elsewhere? The SC E-19 EHPS does not consider installation in new architectures such as VTOL as well.
response	Noted. EASA has already established various MOC related to the energy storage systems that provide details on the related compliance demonstration and other aspects. Furthermore, recognized standards are listed in the documents published by EASA. Installation aspects are addressed at aircraft level when of particular importance in the product domain. SC E-19 applies to EHPS (Electric/Hybrid Propulsion System). EHPS can include propulsion batteries. However, the requirement EHPS.380 from SC E-19 makes the link with the requirements defined in the certification basis applicable to the intended aircraft application.

comment	*27* comment by: *ASD* High level comment: There are parts in the MOC no4 SC VTOL which are more detailed than other EASA MOC.This is welcomed in the context of the Urban Air Mobility since the EASA rulemaking framework is new for the stakeholders from this sector. They wll so be able to have a detailed guideline material to use as a reference to ensure a standardised approach for the certification process.
response	Noted.

comment	*35* comment by: *DE-LBA* LBA has no comments.
response	Noted.

comment	*49* comment by: *Airbus Helicopters* Airbus Helicopters would like to thank EASA for providing the opportunity to comment on these means of compliance. High level comments have been consolidated within the ASD Innovative Aerial Service Vehicle WG and submitted by ASD directly. Other comments of medium or low level or editorial are submitted by Airbus Helicopters separately.
response	Noted.

comment	*80* comment by: *DGAC FR (Mireille Chabroux)* DGAC FR thanks EASA for the consultation. DGAC France has no specific comments on this proposal of MoC to SC VTOL.
response	Noted.

comment	*104* comment by: *FOCA (Switzerland)* Thank you for the opportunity to comment. We have no remarks on this document.
response	Noted.

comment	*106* comment by: *Embraer S.A.* Embraer S.A. is pleased to offer the following comments on Fourth Publication of Proposed Means of Compliance with the Special Condition VTOL. Embraer suggests including the MOC VTOL. 2540 in the document. MOC VTOL. 2540 Flight in icing conditions is missing.
response	Not accepted. The suggested domain is currently covered in VTOL.2165. A related industry standard has been prepared by EUROCAE in ED-314 and agreed with EASA, which we will include as a reference thereto in a future revision.

MOC VTOL.2000 Applicability and definitions p. 4

comment	*24* comment by: *Vertical Aerospace* CTOL definition is including two options to ascertain the applicability of more restringing crashworthiness and landing requirements independently of which one is applicable to the VTOL design and operations. VA does not agree with EASA proposal as a VTOL can include in its emergency procedures conventional landing and restrict this allowance only to controlled emergency landing conditions as defined in MOC SC-VTOL Issue 2. In such a case, VA would expect relevant crashworthiness conditions to be applied but not all normal CTOL landing requirements.

response	Accepted. Clarification has been added in MOC VTOL.2220 (b) that the landing load criteria applies in the landing speed cases specified in point (a)(1) only.

comment	*25* comment by: *Vertical Aerospace* MOC VTOL.2000 12. Conventional Take-off and Landing (CTOL) Capability In the MOC-2 SC-VTOL, MOC VTOL.2115 Take-off performance, 1. Introduction to take-off paths, Conventional Take-Off (ConvTO) has a different definition. Nomenclature should be standardized.
response	Not accepted. While we acknowledge that the terminology is used in different contexts and with different definitions, the related abbreviations and also their applicability differs. The individual applicability is described and appears to be sufficiently understood by all stakeholders. EASA will investigate the possibility for unique terminologies. However, at this stage no industry-specific terms to specify the intentions have been identified. Until such harmonized terminologie has been identified the currently proposed definitions would be used.

comment	*26* comment by: *Vertical Aerospace* MOC VTOL.2000 12. Conventional Take-off and Landing (CTOL) Capability (a)(s2). For category Enhanced, does emergency touchdown that exceeds 60 knots need to be performed in a runway? If yes, does this runway need to be defined in the flight planning?
response	Noted. Please see in this context MOC VTOL.2000 point 4, which specifies that “As opposed to “Continued Safe Flight and Landing” and “Controlled Emergency Landing”, “Emergency Landing” and “Survivable Emergency Landing” do not correspond to design objectives but rather to design cases.” Thus, emergency landings go beyond the safety objectives and would not require actual demonstration, nor is a runway availability to be planned for during operations or be specified in the flight manual.

comment	*89* comment by: *Federal Aviation Administration* FAA comment: The definitions for takeoff currently define Vertical and Conventional. While the definition is clear, it is dissimilar to maintain a similar framework against wing borne takeoff or Short Takeoff and Landing (STOL) type of takeoff that may be at speeds different than vertical. The use of 45 knots while possibly acceptable for structural compliance to shift from a fixed wing design case to a vertical case is not fully useful in the detemination of aircraft performance and phases of flight. The terminology is also not necessarily consistent with MOC-2 SC-VTOL. There appears to be an oversimplification to assist in helping define gear loading conditions. From a historical perspective a conventional takeoff or landing should be

	one fitting into the existing regulatory framework predominately driven by stall speed or similar minimum speed considerations. In that regard, conventional takeoff and landings would be rolling on prepared surfaces similar to runways and extended weight supporting vertiports. The next type of takeoff or landing would be that which would represent a short takeoff or landing where the lift thrust unit (LTU) and wing lift work in tandem while still providing a rolling profile using prepared surfaces. Finally the vertical takeoff uses the LTU and wing lift perform for takeoff from a hover position while not requiring prepared surfaces to support the vehicles weight. Note this may also need to consider run on cases after failuires for the landing gear or skids. FAA recommends that EASA revise both MOC-2 and MOC-4 to define more appropriately the possible combination of takeoffs and landing. As of right now, the STOL type of takeoff and landing, which is a viable option for applicants in reducing energy consumption for a given mission, is not adequately detailed.
response	Noted. EASA confirms that the definition provided in point 12 aims at the identification of the appropriate load cases. This is also emphasized by the list of MOC in that point, referencing relevant additional design landing and emergency load cases to be addressed when having the described CTOL speed characteristics. Whether an aircraft would provide STOL capability would not be relevant for the identification of the described load case scenarios when identifying the relevant landing/touch down speeds. MOC for aircraft take-off and landing performances are covered by MOC 2 and additional criteria for general performance determinations are presented in MOC 4. The current material would allow applicants to propose a low-energy consumption take-off/landing profile as e.g. the proposed 'STOL-type' as in our current MOC definitions it would be a CTOL profile. EASA for the time being has not made a difference between a short, and a conventional take-off and landing profile based on the distances required or form of lift provided.

comment	*90* comment by: *Federal Aviation Administration* FAA comment: Regarding the proposed established definition, the use of 45/60 knots does not seem to be a rational approach for aircraft that may operate using non-LTU sources for lift that may have impact to the take-off decision point/landing decision point (TDP/LDP) or V1 in excess of 45 knots. In addition, is (a)(1) appropriate for only the Enhanced Category? It would make sense to apply the same type of structural requirements to Basic Category as well. What is the applicability to Basic Category? As explained, the potential for takeoff and landing profiles using weight supported surfaces and depend predominately or solely on wing lift will likely have speeds in excess of these presented here (for example, comparing a wing-driven takeoff profile versus a Short Takeoff and Landing Profile (STOL) that uses LTU and wing lift). FAA suggests that EASA revise the definition to cover the range of possible takeoff and landings profiles, and clarify applicability to Basic Category.

response	Partially accepted. See response to comment 89. This includes also category Basic.

comment	*110* comment by: *Leonardo Helicopters* **Paragraph: 12. (a)(2) "** *Maximum forward speeds for emergency touchdown exceeds 60 kts"* **Comment:** The definition of emergency touchdown is not included in the SC-VTOL and relative Means of Compliance. Is it referred to controlled emergency landing procedure ? or is it considering a generic emergency situation ? **Resolution:** Please clarify what is the meant with emergency touchdown.
response	Accepted. It is considered as a controlled emergency landing procedure and EASA will unify the terminology used in point 12.

MOC VTOL.2100 Mass and Centre of Gravity p. 6

comment	*8* comment by: *Lilium eAircraft GmbH* (4)(c) Specifies establishment of operational w/cg limitations to be published in the AFM. in CS 27 this specification comes from 27.1583.(c) and .1519. (subpart G). Propose to remove (4)(c) from MOC VTOL.2100 since it should be covered in VTOL.2170 and Subpart G (VTOL 2620).
response	Not accepted. For the time being the Mass and CG determination guidance are identified in this MOC and EASA will consider providing amended MOC with guidance on the presentation of the information to the crew.

comment	*9* comment by: *Lilium eAircraft GmbH* MOC VTOL 2100 makes no mention of removable ballast for showing compliance. For reference CS 23.31 and CS 27.31 specifically allow removable ballast for showing compliance. Could this be added?
response	Accepted. Point 6 has been added to provide MOC for the installation of removable ballast.

comment	*41* comment by: *Lilium eAircraft GmbH* With respect to Section 5. AFM... In CS 23, each Subpart establishes what the information is, while the Aircraft Flight Manual requirement (23.2620) specifies how this information needs to be provided in the AFM. Thus, the establishment and furnishing of AFM information as covered in the MOC for VTOL.2100 should really be part of the MOC for VTOL.2170 and VTOL.2620(a) for consistency.
response	See comment 8.

comment	*53* comment by: *Lilium eAircraft GmbH* 5.(b). Please clarifiy if this definition includes the wind effects required in VTOL.2105 and VTOL.2135.
response	Noted. EASA confirms that this information should include also the wind effects.

comment	*54* comment by: *Lilium eAircraft GmbH* 4.(d) defines flight testing tolerances for weight to be +3/-1%, much tighter than CS 23 amt 4 FTG (+5/-10%) - what is the rationale behind the tighter tolerances compared to part 23 aircraft?
response	Noted. The tighter tolerances are commensurate with the increased susceptibility to CG influences in the controllability and in the performance during vertical flight and transition phases. Therefore, provisions for larger tolerances on a case-by-case basis are foreseen, when the test is less critical in those aspects.

comment	*68* comment by: *Volocopter GmbH* As the term "mass" is being used in the SC-VTOL-01, we recommend keeping the term in the MOC-4 SC-VTOL as well, replacing the currently used "weight" term. Please update the term "weight" to "mass" to match wording with SC-VTOL-01.
response	Accepted. The text has been revised accordingly.

comment	*75* comment by: *Vertical Aerospace* MOC VTOL 2100 2(c) says that the applicant my select a lower occupant mass for the maxmum weight calculation. VA seeks clarification on the intention defining the occupant mass. VA understands the Applicant could choose a higher mass since the Applicant uses the MTOW to show compliance with the certification requirements.
response	Not accepted. This MOC is derived from CS 27.25 Amdt. 7 and CS 23.25 (Amdt. 4), therefore consequently proposed here. For clarity, the wording in the MoC has been complemented to request establishment of relevant limitations.

comment	*76* comment by: *Vertical Aerospace* MOC VTOL 2100 3(b) VA would like to propose to reword the proposal to the following: It should be: (b) The minimum certificated weight should not be **higher** than the empty weight plus the weight of the minimum crew necessary to operate the aircraft.
response	Accepted.

	For consistency with CS 27.25 (b)(1) the text will be changed accordingly and further clarification regarding the potential consideration of removable Energy Storage Systems has been added.
comment	*77* comment by: *Vertical Aerospace* MOC VTOL 2100 4. Certified longitudinal and lateral centre of gravity limits. VA would like to understand why the tolerance prescribed is narrower than the one specified in AC.25-7C (+-5 and +-10%) for Part 25 products.
response	Noted. The narrower tolerances are based on the experience gained on rotorcraft, showing a higher influence of CG changes on performance and controllability, in particular in the low speed/hover regime. See also comment #54
comment	*91* comment by: *Federal Aviation Administration* FAA comment: Regarding (1)(c), what is intended by the term removable Electrical Storage System (ESS) components? The scope of this and how it applies to the empty weight needs clearer definition. FAA recommends defining how removable ESS is part (or not part) of the empty weight of the aircraft. If not part of the empty weight, clarify on how removable ESS is considered in the weight used for takeoff and landing.
response	Noted. The term will be changed to Energy Storage for harmonization within the SC VTOL and related MOC. This could refer to electrical ESS (batteries) or other types (e.g fuel). The configuration and applicable masses are specified in 1.(a). Some applicants choose a design to swap or configure ESS between flights as to provide fully charged ESS for the aircraft. Therefore, they are not permanently installed. Similar to the empty mass definition of conventional aircraft, usable fuel/removable ESS is thus excluded from the empty mass. Similar to fuel, the number of ESS with their masses needs to be accounted for in the calculation of the actual take-off/landing mass, which in case of batteries would usually not differ for VCA.
comment	*92* comment by: *Federal Aviation Administration* FAA comment: Regarding (2)(b), this language needs to be stronger than “should,” as it is difficult to see how maximum weight would ever be less than the minimum weight. FAA suggests removing the word “should” and using stronger, more direct language.
response	Noted. Since this document is defining a Means of Compliance it can for formal reasons not apply stronger verbiage. Practically, 2.(b) would not occur.
comment	*93* comment by: *Federal Aviation Administration* FAA comment: Regarding (4)(d) and (4)(d), the wording here is a concern. Historically, the weight and center of gravity ("CG") limits are no greater

	than that demonstrated in flight test. The use of “other means of compliance” needs clarification as that is a departure from the historical norms established under 14 CFR 23, 27 or 29. The scope of “other means of compliance” will be a safety emphasis item (SEI) for the FAA on eVtol.
response	Noted. This is already established practice in existing type certification projects of aircraft, since corners of the envelope may not be achievable in flight test configuration (e.g. flight test equipment mass). Considering the novelty of the technology and the required harmonization of airworthiness requirements as well as related means of compliance a close cooperation between the authorities is expected by industry to enable wide harmonization and accelerated validations. The endurance of these aircraft at this stage may foster the development of other than the historical norms to take advantage from these technologies, for which this option has been continued.

comment	*94* comment by: *Federal Aviation Administration* FAA comment: Basic performance as identified in (5)(c) defines performance in regards to Controlled Emergency Landing (CEL) capability but does not define all engine performance that would be necessary for a possible obstacle clearance determination. Also the critical failure for performance (CFP) at international standard atmosphere sea level (ISA SL) for CEL only may not be the same CFP at other altitudes. This would like lead to an FAA SEI item for SC-VTOL.2120 as the FAA defines all engine performance requirements. The requirement here only defines the weights where a CEL can be achieved for CFP at ISA SL. It is unclear if the CFP is driven by the same criterion as the FAA used for autorotation/glide or equivalent. FAA recommends revising for clarity.
response	Noted. Point (5)(c) does not aim to define the performance but the data that should be published by the applicant in the AFM. The means of compliance for VCA in category Basic translates existing requirements established for small rotorcraft and small aeroplanes, while enabling the new technologies. The means of compliance related to CEL are provided in pertinent parts of the performance requirements.

comment	*107* comment by: *Leonardo Helicopters* **Paragraph: 1.(c)** *"The empty weight does not include the removable Electrical Storage System (ESS) components, when applicable."* **Comment**: The definition of Electrical Storage Sistem is not included in the SC-VTOL and relative Means of Compliance. **Resolution:** Please clarify what is meant with *Electrical Storage System*
response	Accepted. The wording will be revised to read “Energy Storage System”. Its related definition in the context of electrical energy for lift/thrust systems is provided in MoC VTOL.2330 1.(a) as “The Electrical Energy Storage System (EESS) consists of the battery necessary for the propulsion of VTOL capable aircraft and its associated management system.”

comment	*108* comment by: *Leonardo Helicopters* **Paragraph: 2.(c)** *"For the maximum weight calculations, a mass of 77 kg for each occupant including the crew, up to the maximum occupancy, should be considered. The applicant may select a lower occupant mass, if accepted by EASA"* **Comment**: The occupant weight considered for an Helicopter should be 88 kg. It is not clear why for VTOL aircraft is considered a lower occupants weight. **Resolution:** Please clarify the origin of this requirement. Please allign with Helicopters requirement.
response	Noted. The mass is selected from CS 27.25 and CS 23.25 for normal and commuter categories. See also comment 75.

comment	*109* comment by: *Leonardo Helicopters* **Paragraph: 3.(c)** *"For the minimum weight calculations, a mass of not more than 77 kg for each crew member should be considered. The applicant may select a lower occupant weight, if accepted by EASA"* **Comment**: The occupant weight considered for an occupant should be 77 kg or less. It is not clear why is not possible considered an higher occupant weight. **Resolution:** Please clarify why is not possible considered an higher of 77 kg occupant weight.
response	See comment 75 and 108.

comment	*118* comment by: *ANAC Brazil* **MOC VTOL.2100 Mass and Centre of Gravity – Section 5(a) – Lateral CG envelope publication in the AFM (page 7)** + Comment: Fixed wing aircraft regulations do not require lateral CG envelope to be published. Rotorcraft regulations only require this information to be published if this is determined to be critical. ANAC believes imposing the publication of lateral CG limit should not be required if this is determined to not be critical, in a similar way to what is required for rotorcraft. ANAC believes that this will be the general case for EVTOLs as lateral CG travel on these vehicles are only impacted by passenger and cargo, which are located in specific positions. + Recommendation: Consider changing the MOC text to require the publication of lateral CG envelope only if this is found to be critical.
Response	Not accepted. The applicant needs to determine these limits in any case since they also play a vital role in the compliance to controllability requirements, e.g. in wind from different azimuth. Based on the experience gained with the rotorcraft industry, including third party designs on type certified aircraft, these data then can be important for the integration of internal and external installations. Often the initial configuration as specified by the aircraft manufacturer, including only internal installations and variations thereof, are less critical. However, the addition of higher-than-standard masses inside the cabin or external installations can shift the lateral CG at large while

also affecting the controllability by drag effects. In the absence of real data EASA considers this information as crucial to enable flight crews to determine that the aircraft is operated within its limitations.

MOC - SUBPART B - FLIGHT p. 6

MOC VTOL.2105 Performance Data p. 7

comment	*1* comment by: *Bold Valuable Technology* Suggestion to change the wording of section 4(d) point (2) on page 10: ...and the variation of accessible ~~power~~ **energy** in relation to the power demand profile during flight. Rationale: Avaliable energy determines the available power and the duration this power is available.
response	Accepted. The wording is revised accordingly.

comment	*42* comment by: *Lilium eAircraft GmbH* For 4.(a) 1 (i), further definitions are required for Normal and Operational flight envelopes, to clarify the applicability of these to the generation of performance data.
response	See comment no 117

comment	*43* comment by: *Lilium eAircraft GmbH* 4.(c) (1) (i). The intent of this definition is unclear, for what is actually required from the OEMs wrt the complete takeoff and landing executions. If this definition specifies that the *identified* critical wind condition must also be *demonstrated* in flight, two important issues arise: (1) in practice this is almost impossible to find, i.e., (1.a) steady uniform wind and (1.b) a place where different azimuths are available for executing 360 deg. of *complete* takeoff and landings procedures; (2) there is a high chance of noise is the measurements, incurring in low fidelity data (for isntance, TDP, LDP, distances required, etc). This is why conventional aviation develop performance data in no wind conditions (AC 29-2, 25-7).
response	Accepted. The MoC has been revised to provide flexibility in the approach to establish the minimum performance and regulatory performance, based on the option to introduce limitations to the wind conditions after respective identification.

comment	*44* comment by: *Lilium eAircraft GmbH* 4.(c) (1) (ii). The statement lead to the interpretation that Performance Data shall *only* be published for the *critical* wind. This would penalise operations which are not

	subject to the critical conditions. Regulatory data may also be published for winds less than the critical, in accordance with current operational conditions. As a suggestion, update the text to: "The regulatory performance data should be developed for calm air and performance corrections for the effects of winds developed for the wind envelope declared by the applicant and limited by the most critical wind condition identified in (i)". The intent is to allow for (1) a dispatch proportional to the wind conditions, (2) account for the benefits of headwinds (similarly to Cat A helicopters), and (3) also guarantee that the most critical wind limits the performance in such cases.
response	See comment 43

comment	*45* comment by: *Lilium eAircraft GmbH* 4.(d) (4). It is suggested to change the wording to "ESS cooling/heating *effects*", so the applicant is allowed to consider the effects of thermal management systems to control and recover some losses by manipulation of the optimum operating temperature.
response	Accepted. The wording is revised accordingly.

comment	*46* comment by: *Lilium eAircraft GmbH* 4.(f) (2) (i). Typo: "extended **of** retracted". Correct to:"extended **or** retracted"
response	Accepted. The wording is revised accordingly.

comment	*47* comment by: *Lilium eAircraft GmbH* 4.(g)(1) and 4.(g)(2) say almost the same thing in different ways. (g)(1) states that the minimum performance (data?) must consider the CFP. And (g)(2) states that the regulatory performance (data?) must consider the ´the effect of single failures and combination of failures that are not extremely improbable´, which ***IS*** the definition of the CFP. So in other words, both minimum and regulatory performance must consider the CFP, leading to confusion as to the distinction between the two.
response	Accepted. Point 4 (g) (2) has been removed and set to “reserved” for the time being.

comment	*48* comment by: *Lilium eAircraft GmbH* Sections 1, 2, and 3: The difference between MINIMUM and REGULATORY data is not clearly defined. It appears that what was understood to be ´Approved Data´ (in an AFM) for conventional aircraft has been separated in to 2 distinct categories for SC-VTOL - can EASA confirm and provide a rationale? Many of the examples of Regulatory Data in 1(b) could be deemed as ´Minimum´. It could be interpreted that *Minimum* Performance Data means charts with CMP (Certified *Minimum* Performance), in which case it is those that …´results in the maximum degradation for a given flight phase and performance parameter.´ (quote from MOC.2000). And

	the conclusion is that ´Minimum´ Data is a part of Regulatory (approved) Data anyway. Is the intent to have the data types made distinct in the AFM? Ultimately, both are certified data to be published, and distinction in the AFM does not seem to add any value to the process, and can render the data interpretation less intuitive. Can EASA provide further clarity to these points?
response	Partially accepted. The explanation of the difference between “minimum performance” and “regulatory performance” data is explained in the section 1, Introduction, of the MoC. The minimum performance data does not mean that they are charts with the CMP. The definition of minimum performance is now improved by clarifying that this is part of the regulatory performance.

comment	*51* comment by: *Lilium eAircraft GmbH* 1(c). Conventional aircraft ´non-approved´ data is now requested as *Regulatory* Data (assumed *approved*) for VTOL, e.g. Range and endurance. Should such a significant a requirement be captured at the SC-VTOL level first? Can EASA provide any specific examples of what exactly would be ´left over´ and might consititue non-regulartoy data? If EASA is concerned with the energy scheme (as implied by the reference to ED 309), the required parameter should be State of Function (SOF) parameters for consistency, rather than Range and Endurance. Range and endurance are the end of the line of a flight dispatch and a result of the application of SOF data.
response	Not accepted. EASA will consider in future amendments of SC VTOL a more specific reference stating that “range and endurance” is part of approved data. Nevertheless, it needs to be remined that the SC VTOL is a “performance based regulation”, and that all the performance information need to be provided according to VTOL.2620. The minimum performance information that is required to safely operate the aircraft should be provided of course, even if not specifically mentioned in the SC VTOL. This is why EASA is developing guidance on what is this minimum performance information, and how it should be determined.

comment	*52* comment by: *Lilium eAircraft GmbH* 4.(e)(1)(iii) and (iv). Please add "if required for the safe operation of the aircraft."
response	Not accepted. “If required for the safe operation of the aircraft” is inferred. It would be inconsistent to be added only to 4.(e)(1)(iii) and (iv).

comment	*78* comment by: *Vertical Aerospace* MOC VTOL.2105 1(a)(b) There are definitions for Certified Minimum Performance (MOC SC-VTOL), Minimum Performance Data, and Regulatory Performance Data. The recommendation is to remove the term Minimum Performance Data. The minimum performance data and regulatory data should be the same: Performance data to comply with the certification requirements.

	Minimum required gradient is mean less without the other conditions defined in the SC and in the MoC, such as speed, configuration, etc. Therefore, there is no need to refer to it separately.
response	See comment 48

comment	*79* comment by: *Vertical Aerospace* MOC VTOL.2105 2(b) Minimum Performance Data MOC VTOL.2115 Take-off performance requires 4.5% for the first segment, at VTOSS, and 2.5% for the second segment, at VFTO. MOC-4 VTOL.2105 Performance Data, 2. Minimum Performance Data (b) extends the compliance of the minimum climb gradient at any speed of the operational flight envelope. VA seeks clarification in the difference between operational and normal envelope in terms of ambient conditions for the purpose of the MOC VTOL.2105 2(b)
response	Noted. MOC-4 VTOL.2105 2 (b) refers to “operational flight envelope” for the “ambient conditions” (and not speed, as mentioned in the comment. Nevertheless, the definition of flight envelopes is under revision. EASA is considering further clarification in future amendments.

comment	*81* comment by: *Vertical Aerospace* MOC VTOL.2105 3(a) There is no requirement related to range and endurance defined in the SC-VTOL document. For CS 25/23/27/29, range/endurance is not part of the Regulatory Performance Data. VA seeks clarification in EASA intention to include it for the VTOLs.
response	See comment #51.

comment	*82* comment by: *Vertical Aerospace* MOC VTOL.2105 4(a)(2) Atmospheric condition is not controllable, such as the outside air temperature, and the runway pressure altitude. For example, this is not requested by Part 25 and there is extrapolation guidance method for engine thrust data. VA finds that deriving all data from flight test at the extremes of altitude and OAT envelopes is unpractical.
response	Partially accepted. The content has been rephrased to clarify the basis on which inter-/extrapolated data can be accepted, and which other methodologies or combinations may be acceptable. The text is also emphasising that a validation of models as well as of inter-/ extrapolation criteria needs to be established. Adoption of the

	interpolation/extrapolation criteria of existing Certification Specifications is currently not deemed suitable, awaiting practical experience.
comment	*83* comment by: *Vertical Aerospace* MOC VTOL.2105 4(c) Fix Wing certification specifications CS 23/25 aircrafts, the Regulatory Performance Data: - Are not published for the most critical wind condition. Instead, there are corrections for head/tail wind. - Are determined for no crosswind. VA prosposes EASA to follow a similar approach.
response	See comment #43.
comment	*86* comment by: *Vertical Aerospace* VA understands the SC-E-19 is providing the certification requirements for the Electric/Hybrid Propulsion System. EHPS.10 Scope includes the applicability: used to **provide or produce** lift/thrust/**power.** In the description of the EHPS propulsion batteries associated to electrical engines are included. VA understands the intention from EASA to enhance the importance of accounting all key variables and parameters when establishing the ESS performance. However, VA considers that including this guidelines with the aircraft requirements MOC can create confusion. VA would like to propose to include this information in the future EHPS MOC.
response	Noted. EASA considers useful to provide this guidance at this time. When the EHPS MoC will be available, if redundant data would be found, considerations will be made for referencing the material available.
comment	*95* comment by: *Federal Aviation Administration* FAA comment: The use of h1 and h2 heights is not defined within this Means of Compliance (MOC) but the FAA is assuming “in ground effect” or “out of ground effect” may include a high hover height from other MOC documents. In addition, the incorporation of energy consumption as part of the subpart B performance data, while not identified in SC-VTOL, is a significant departure from past practices associated with vehicles certified under 14 CFR part 23 or 27. The comment against h1 and h2 relates to a lack of consistent definitions included for each part of the MOC currently being reviewed. It is the FAA’s understanding that EASA intends to release a complete version that would encompass all released MOCs, which may resolve this comment. Regarding the incorporation of energy consumption, while the FAA can appreciate

	the concern, the substantiation / justification for this requirement should be more defined and elevated as it a complex problem involving power available, the battery state of function, and range limitation of these class of vehicles. The incorporation of the energy consumption into the approved section of the flight manuals is a departure of common practices and may result in a potential SEI as both the FAA and EASA develop their requirements. The FAA suggests that until a complete document including all of the approved MOCs is released, common terms should be defined in each section such that the reviewers do not have to reference other released MOCs to obtain the definitions. The FAA recommends that we harmonize, using a multidisciplinary approach, on the incorporation of energy consumption to avoid a potential SEI.
response	Noted. EASA agrees on the need for harmonization between authorities to avoid potential SEI. The reference to h1 and h2 heights in MOC-4 VTOL.2125 is referring to hovering data, and by the time of publication of this CRD a complete set of the previous MOC has been published while this latest MOC will be introduced in that Easy Access Rule version in the near future. As regards the comment on the energy consumption, or range and endurance, additional information are provided in the answer to comment 51.

comment	*96* comment by: *Federal Aviation Administration* FAA comment: Regarding (4)(a)(2), the use of “performance predictions” solely without flight test substantiation is not typically an accepted means of compliance. Use of a performance prediction model is rooted in analytical methods that are substantiated/verified through flight test. The concern with the choice of wording is that applicants will pursue solely analytical approach without appropriate validation through the use of flight test data. See MOC.2125 1(b) which provides more appropriate type of language. The FAA recommends revising the language “methodologies for performance prediction” to something such as “a substantiated performance prediction model” or other appropriate language for clarity.
response	Accepted. The wording has been revised to address the comment.

comment	*97* comment by: *Federal Aviation Administration* FAA comment: Regarding (4)(a)(2)(iv) and (4)(a)(3), FAA recommends that EASA define general acceptability guidelines for extrapolation of collected data. Historically, for performance, an allowance of extrapolation of +/4000 feet has been allowed. For rotorcraft handling qualities, that extrapolation is limited to +/- 2000 ft. It is unclear why EASA did not choose to define the norms in the MOC. The FAA recommends that

	EASA include generally acceptable extrapolation limits; if less than historical, explain why.
response	Noted. The extrapolation limits are intentionally not defined, as the limits defined so far for rotorcraft may not be applicable to eVTOLs. The extrapolation limits are being developed by industry in ECAE, and will be presented to EASA and FAA for concurrence.

comment	*98* comment by: *Federal Aviation Administration* FAA comment: Regarding (4)(c)(1)(ii)(A), the crosswinds for conventional takeoff and landing using the defined definitions could be as low at 9 knots (0.2Vtoss if 45 knots is used). This may define a lower crosswind limit than most vehicles certificated under 14 CFR part 23 that adhere to 61 knot stall speeds. In general, the FAA considers the crosswinds to be defined under the wing borne source of lift. The STOL or semi-thrust borne would rely on the wing borne side as a limitation, as is more compatible with the hover in all azimuth requirements. The other option would be to address the issue here the crosswind for landing and all azimuth wind hover speeds are the same. The FAA suggests considering whether these limits should be defined relative to operations or whether a Basic or Enhanced Category classification may be useful. The FAA also notes that this could be a potential FAA SEI and, as such, recommends further harmonization.
response	Noted. EASA agrees on the need for harmonization to avoid potential SEI. The limit "a maximum crosswind component not less than the highest of 0,2 V_{TOSS} and 0,2 V_{REF}" was chosen to be consistent with previous practice in Part/CS-23 certification. It is clear that since Vtoss is chosen instead of Vstall, the crosswind limit could be potentially lower than conventional fixed wing aircraft as Vtoss values are lower than conventional Vstall. However, there could be challenges in setting a higher crosswind component, possibly close to the Vtoss, as the aircraft is already airborne and is no more in a "ground referenced" flight where it can fly with a crab into the wind (so the crosswind component is no more of a factor). The comment is acknowledged, but no changes to the current MoC are introduced. With more data available, EASA will revisit this material and in case amend it, also considering FAA comments.

comment	*99* comment by: *Federal Aviation Administration* FAA comment: Regarding (4)(c)(1)(ii)(B), FAA notes that EASA intent is somewhat unclear. It appears to define another set of constraints that may be less severe than the previous requirements. Is EASA considering allowing factored winds into their takeoff and landing distance?

In general, the FAA requirements are codified in the airworthiness criteria (AWC) for these special classes of vehicles. There is potential for an FAA significant standards difference/safety emphasis item (SSD/SEI) item as it's defined in the MOC and is generally left to the discretion of the National Airworthiness Authority which may differ from the current prescriptive requirements in the FAA AWC.

The FAA suggests clarifying the intent of this section relative to VTOL.2135(a)(6) in context to what is being done in this MOC for VTOL 2105.

response

Noted.
EASA agrees on the need for harmonization to avoid potential SEI/SSD. The content has been revised to address related comments.
See also response to comment #43.

comment

100 comment by: *Federal Aviation Administration*

FAA comment:

Regarding (4)(d), specifically regarding energy storage systems and installation losses, there is a lack of clarity regarding power ratings being pursued relative to the appropriate phase of flight and their duration which may impact the achievable performance (either all engine or CFP).

The details regarding what power is being used for what portion of the flight and what the acceptable ratings would be are incomplete. There should be more discussion between the FAA and EASA regarding this topic before applicants define power ratings that provide minimal operational margin to achieve flight manual performance or range.

The FAA recommends further multidisciplinary discussions between the FAA and EASA on this subject.

response

Noted.
EASA agrees on the need for harmonization to avoid potential SEI/SSD, and will pursue and welcome future discussions with the FAA on this subject.
The paragraph describes elements which are applicable in general, independently from a rating or rating structure.

comment

116 comment by: *ANAC Brazil*

SC VTOL.2105(a)

+ Comment: Current SC VTOL.2105(a) limits meeting minimum performance for Category Basic aircraft to ISA sea level condition only. This way, minimum performance for Category Basic may not ensure margins to accommodate temperature and altitude variations. ANAC considers that: 1 - For this type of aircraft, in the event of a CFP, the aircraft may rely on the power provided by the remaining LTUs and this capability is heavily impacted by temperature increases. 2 - Rotorcraft which are approved according to Part 27 regulations are allowed to determine its performance at SL ISA, however, by regulation 27.51, it must also be demonstrated

that a landing can be performed at any point along the flight path at the maximum altitude for which takeoff and landing certification is requested or 7,000 feet density altitude, whichever is less. Because of this requirement, the performance of the aircraft has margins to accommodate variations in temperature at lower altitudes.

+ Recommendation: ANAC suggests EASA to consider future revision of SC 2105(a) to require that minimum performance for Category Basic account for temperature and altitude variations. Then MOC VTOL.2100, Section 5(c) (maximum certificated weight for Category Basic), MOC-4 VTOL.2105, Section 2(a) (minimum performance data for Category Basic) should be revised accordingly.

response

Noted.
EASA was on purpose making a proportional approach between Basic and Enhanced. The proportionality is set by making a difference between Basic and Enhanced for "minimum performance" compliance, not for "regulatory performance" (see MOC-4 VTOL.2105 (3). An amendment of SC VTOL to address better the operational flight envelope of VCA in the category Basic is being considered.

comment *119* comment by: *ANAC Brazil*

MOC VTOL.2105 Performance Data – Section 4(a) – Parameters affecting Minimum and Regulatory Performance - Altitude and temperature effects (page 9)

+ Comment: In this section, there is no distinction between Category Enhanced and Category Basic. While it is expected that this guidance is applicable to Category Enhanced, it is in conflict to the current guidance of Category Basic in SC VTOL.2105(a)(1). The MOC should be consistent with the intent of the regulation which is aimed to simplify the performance demonstration for category Basic. Note that ANAC considers that a demonstration only at SL / ISA is not sufficient for Category Basic EVTOL, however, ANAC does agree that the demonstration should be less demanding than the one applicable to Category Enhanced.

+ Recommendation: Clarify if section 4(a) applicable or not to Category Basic, especially the guidance defined for the topic (2) within Section 4(a).

response

Accepted.
The text was modified to accommodate the comment.

comment *120* comment by: *ANAC Brazil*

MOC VTOL.2105 Performance Data – Section 4(c) – Parameters affecting Minimum and Regulatory Performance – Wind conditions (pages 9 and 10)

+ Comment: While the guidance for category basic is clear in defining that the applicant should demonstrate wind at SL ISA, there is no guidance for Category Enhanced. For rotorcraft, it is recognized that the altitude is a factor that impacts the demonstration of controllability under windy conditions, while for aircraft with ConvTO, altitude is not normally a concern for controllability demonstration.

+ Rationale: Define what aerodrome conditions should be used for the determination of performance under wind conditions for Category Enhanced. Rotorcraft certified

according to 14CFR Part 29 must demonstrate this performance in all altitudes approved for takeoff and landing.

response

Noted.
The paragraph has been revised to accommodate the various comments received thereto. MOC-4 VTOL2105 (4)(c)(1) provides the reference to category Enhanced, where the wind conditions for which certification is sought need to be identified and demonstrated. The "aerodrome" conditions mentioned in the comment, assuming it is referred to the "aerodrome wind conditions", are the relative wind most critical conditions. The altitude effects are addressed in section 4(a).

comment

121 comment by: *ANAC Brazil*

MOC VTOL.2105 Performance Data – Section 4(c) – Parameters affecting Minimum and Regulatory Performance – Wind conditions (page 10)

+ Comment: The reason to determine the performance for the wind limit identified under VTOL.2135 is unclear. It is agreed that for regulatory performance, the manufacturer should account for the wind conditions, however, requiring that it demonstrates performance under extreme wind conditions seems to be an unnecessary burden to the manufacturer and it is not required for rotorcraft certified by Part 29.

+ Recommended: Consider removing item (B) of Category Enhanced.

response

Noted.
The section has been revised to take into account various comments. It specifies the wind conditions to be identified and demonstrated. This also accounts for aspects like controllability of the VCA for the take-off masses under evaluation in different environmental conditions (temperatures, altitudes), in line with current practices for CS-27 Cat A and CS-29 rotorcraft.

MOC VTOL.2110 Flight Envelopes p. 7

comment

117 comment by: *ANAC Brazil*

SC VTOL.2110

+ Comment: SC VTOL.2110 requires the determination of Normal, Operation, and Limit flight envelopes. ANAC understands that OFE and LFE are typically associated with transient flight conditions, as these envelopes are bounded by caution and warning alerts/onset. MOC SC-VTOL Issue 2 further details the role of these flight envelopes in the MHQRM for compliance with controllability (VTOL.2135). Flight crew should perform its duties maintaining the aircraft inside the normal flight envelope and there are abnormal and/or emergency procedures defined to bring the aircraft back to the normal envelope in case the aircraft is momentarily out of it due to a failure or an atmospheric disturbance. Considering the transient nature of these flight conditions, it is not fully clear to ANAC the need and practicality of determining performance data for such conditions as required by VTOL.2105(a)(2), VTOL.2115(a)(1), VTOL.2125(b) and their associated MOC. In addition, it seems

	unclear which flight parameters of the operational flight envelope should be considered when meeting such performance requirements. Additional information should be provided to clarify what conditions outside normal flight envelope should be considered for performance publication. + Recommendation: ANAC suggests EASA to consider future revision of SC performance related requirements with respect to the need to establish performance data for the operational flight envelope and/or further expand the MOC guidance on more details (including conditions and flight parameters to be considered) when determining minimum performance and performance data for the OFE.
response	Accepted. The definitions of NFE, OFE and LFE are under development, and the latest development may affect the generation of performance data and handling qualities evaluation. EASA is coordinating also with its bilateral partners these aspects to ensure appropriate harmonisation of further definitions.

MOC VTOL.2125 Climb Information p. 11

comment	*84* comment by: *Vertical Aerospace* MOC VTOL.2125 3(c) VA seeks clarification on the EASA request of h1 and h2 at cruise altitude and not only within the takeoff/landing envelope.
response	Noted. EASA agrees that including hover performance data here may be not obvious, because the title of the requirement is “climb information”, and someone may think it is referring to cruise data. This MOC should be read together with the requirement, which at VTOL.2125 talks about the “VTOL ceiling”, which is in essence the hover ceiling. That is why the refence to h1 (such as helicopter IGE) and h2 (such as helicopter OGE) is made here. EASA will consider moving the requirement on VTOL ceiling in another part of Subpart B of the SC VTOL in future revisions.

comment	*101* comment by: *Federal Aviation Administration* FAA comment: At this time the FAA climb performance requirements for “essential” and “increased” differ from EASA Basic and Enhanced Categories. As such, while the outline of MOC.2125 is sound, the details differ from the FAA AWCs. In addition, the non-inclusion of MOC.2120 into this part 4 of the MOC provides only part of the certification path for climb performance. Currently the FAA AWCs are prescriptive on acceptable climb performance and the information to be provided. This differs from EASA approach where the climb targets are included in the MOCs. It is also important to note that the FAA and EASA differ on the minimum requirements. This means that there is a potential SSD/SEI item related to this issue. While the discussion on the CMP/CFP has been valuable and it

	is likely the FAA and EASA will harmonize in that regard, the safety targets do differ and are documented either in the AWC for the FAA or the MOC for EASA. FAA recommends further harmonization.
response	Noted. EASA agrees on the need for harmonization to avoid potential SEI/SSD. While there could be a difference whether the climb targets or requirements are included in the MOC or in the AWC, there is still the possibility to harmonize on them. The reason why EASA has placed the targets in the MOC is because the SC VTOL is a performance-based regulation. Considering that at this point in time there is very little experience on actual climb performance capability of the different VCAs, keeping the targets at the MOC level allows more "agility" to adapt as the data will be available.

comment	*111* comment by: *Leonardo Helicopters* **Paragraph: 2.- (d)(2)&(3) "** When applicable, the hovering performance at h1 and h2 should be determined and the corresponding performance data published: (2) the configuration required for climb, and (3) not more than the take-off power in nominal conditions. **Comment:** The requirement in paragraph (3) seems a discount from the requirement in paragraph (2). The point (2) is requiring to consider the wind at 17kts from all azimuths. The point (3) requires to calculate the hover performance without wind plus an evidences from selected hover charts. It is not clear if these two paragraphs are considered equivalent. **Resolution:** Please clarify what if the conditions listed in the paragraph (2) are equivalent to the conditions in the paragraph (3).
response	Noted. Please note that this is applicable to category Basic. EASA has intentionally given the opportunity to applicants to provide hover performance data for 17 kts all-around (point 2), or provide hover charts with 0 wind or with wind coming from a given azimuth or quadrant (point 3). This is also an additional possibility for helicopters today for CS27 CAT B. This is why EASA has given this opportunity also to VCA in category Basic.

comment	*122* comment by: *ANAC Brazil* **MOC VTOL.2125 Climb Information – Section 2(d) – Category Basic (page 12)** + Comment: Item "d" (hovering performance for Category Basic) seems inconsistent with the guidance provided for VTOL.2105 item 4(c)(2). The latter requires performance demonstrations for the most critical wind condition for which certification is sought at Sea Level ISA. This item "d" requires hover performance demonstration for Category Basic in the extremes of take-off and landing density altitudes, considering minimum 17kt steady wind from all azimuths, with allowance for lower winds in some quadrants. It seems that the level of safety required for hovering is higher than that required for takeoff.

	+ Recommendation: EASA to further clarify and/or address perceived inconsistency between level of demonstration required for hovering performance versus general guidance in MOC VTOL.2105, section 4(c)(2).
response	Noted. The wording of MOC VTOL.2105 2(a) and VTOL.2105 section 4(c)(2)(i) have been amended to clarify that additional wind and altitudes should be considered also for the category Basic, as to provide operationally relevant data.

comment	*123* comment by: *ANAC Brazil* **MOC VTOL.2125 Climb Information – Section 3(c) – Category Enhanced (page 12)** + Comment: Guidance from the section 2105 (4)(c)(1)(ii)(B) of this proposed MOC allows publication of wind limitations (intensity and azimuth) if these are found and if they are operationally feasible. The guidance on this topic requests hover demonstration for 17kt of wind coming from all azimuths. + Recommendation: Modify the text to specify 17kts steady wind speed from all azimuths or lower as defined by limitations found necessary.
response	Noted. The entire text of MOC VTOL.2105 (4)(c) has been revised to clarify the intent of the paragraph that is dealing with the wind effects on the airfield and minimum performance and not with the wind effects on hovering performance. This will remove any inconsistency between MOC VTOL.2105 4(c) and MOC VTOL.2125 3(c).

MOC VTOL.2160 Vibration p. 12

comment	*3* comment by: *Czech Aerospace Research Centre* In part 3., paragraph (b) The rotor roughness flight test should be demonstrated on individual rotor; or on all of the rotors with different rpm ranges, configurations, etc.? (E.g. the roughness of one rotor could be affected by the vibration caused by other rotors depending on the current rpm and configuration of all the rotors.)
response	Noted. Following review of comments, EASA had decided to move the structure aspect of vibration to subpart C. Flight aspect will be addressed in the future revision of the MoC.

comment	*5* comment by: *Lilium eAircraft GmbH* **Recommended change**: Section 2.b.3 - update this section with the following words (the underlined section is the addition): (3) for system and equipment, it can be demonstrated that the actual aircraft vibration spectra are covered by an aeronautical qualification (e.g. DO160, EUROCAE ED-14) or custom vibration specification.

Rationale: it is presumed that the existing aeronautical qualifications were developed without data from VTOL aircraft, and specifically in our case electric VTOL aircraft. It is possible that the actual aircraft vibration spectra for new eVTOL aircraft is higher than existing qualification spectra in certain frequency bands. It is critical that the system and equipment are qualified to the appropriate vibration spectra, which may or may not be enveloped by existing aeronautical qualification spectra.

response

Noted.
The section 2(b)(3) has been removed. System and equipment is addressed under SC VTOL 2500. The updated Moc under 2215(b) referring to system and equipment.

comment

10 comment by: *Lilium eAircraft GmbH*

The scope of 2160 has been broadened compared to CS 23 and 27 practice, which is limited to checking buffet and vibration at high speeds. In the General section, it states that compliance should include structural and lift/thrust system aspects which overlap with other requirements of SC-VTOL as follows:

(a) Compliance with VTOL.2160 'Vibration' should include the effect on:

(1) crew and occupants, and associated effects in handling qualities and controllability --> this is the traditional scope of 2160 as per CS 23 Amt 5, also including some human factor aspects of VTOL.2600(a)

(2) the airframe structure, drive system and rotor - overlaps with VTOL.2215(b) (and arguably VTOL.2205 and 2235), and VTOL.2400(c)(4)

(3) the equipment and its installation - overlaps with VTOL.2500(b) as per MOC 1 VTOL.2500(b)

(4) the aeroelastic stability - overlaps with VTOL.2245

Lilium acknowledges that these items must certainly be covered, but would like to request an explanation of the rationale for including them as part of VTOL.2160 compliance demonstration? Based on CS 23 practice, the only scope of VTOL.2160 would be (a)(1), which is the only "Flight" part (hence in subpart B) (CS 23.2160 Vibration, buffeting, and high speed characteristics, with AMC1 as ASTM F3173 Standard Specification for Aircraft Handling Characteristics). The rest is structure (subpart C), propulsion (E) and equipment (F). This could complicate the tracing of requirements and compliance demonstration between EASA Panels and Certification Plans, compared to CS 23 practice. Could EASA consider the proposal to retain (a)(1) in VTOL.2150 and remove (a) (2) (3) (4) from VTOL.2160, since they are covered in subparts C, E and F.

response

Accepted.
The structural aspects has been moved to MoC 2215(b). The equipment is covered under 2500(b) and aeroelasticity under 2245. Flight aspect will be addressed in the future revision.

comment	*14* comment by: *Volocopter GmbH* In (2)(a), (b) and (c) there are references to vibration effects on the crew and occupants as part of the compliance demonstration for vibration. However, in (2)(d) there is no Proposed Means of Compliance associated with human factors. Please add a subsection with the typical Means of Compliance for vibration associated with Human Factors.
response	Noted. Following review of comments, EASA had decided to move the structure aspect of vibration to subpart C. Flight aspect will be addressed in the future revision of the MoC.

comment	*15* comment by: *Volocopter GmbH* Comment to 2(b) Please clarify whether there is any reference, standard or guidance material available for human factor evaluation related to excessive vibration. Please add reference material to the MOC, if available.
response	Noted. See comment 3

comment	*16* comment by: *Volocopter GmbH* Comment to 2(d)(4): Please use only "Equipment vibration qualification, code MC9" and exclude the sentence "Laboratory test for". According to Appendix A to AMC 21.A.15(b), Equipment qualification (MC 9) may include all MC's at equipment level and it is not limited to Laboratory tests. The current sentence in 2(d)(4) might be identified as MC4 or MC9.
response	Accepted. The structural aspects has been moved to MoC 2215(b). The equipment is covered under 2500(b)

comment	*19* comment by: *Vertical Aerospace* VTOL.2160 (2)(a)(2) and (4) Vibration Remove reference to aeroelastic stability and any other structural concerns of this requirement. Subpart B should be looking just at the effects of the vibration on controlability/piloting capability. 'Aeroelastic stability has a separate requirement (VTOL-2245). It should no be mixed. Structural aspects of vibrations/buffeting should be treated under VTOL-2215(b). Only interference with the control of the aircraft and fatigue crew shall be addressed here.
response	See comment 10

comment	*20* comment by: *Vertical Aerospace* VTOL.2160(d)(2) Recommendation: Remove Flight Loads survey as AMC for this Subpart-B requirement. This demonstration should be performed under VTOL-2215(b), Loads requirement. There, it should be stated the flight loads survey as AMC for vibratory and buffeting loads.
response	See comment 3 and 10

comment	*34* comment by: *ASD* Comment: Generally, in case of reduced aeroelastic stability, vibrations will increase - a clear relationship between cause and effect. On the other hand, a degradation of aeroelastic stability due to high/excessive vibrations is difficult to understand from physical point of view. How can excessive vibrations as cause degrade aeroelastic stability as effect ? Proposal: 2.(a).(4): Compliance with VTOL:2160 'Vibration" should include the effect of the aeroelastic stability on vibration (instead of … should include the effect on the aeroelastic stability). Furthermore, aeroelastic stability is proposed to be also addressed in 2.(b) with respect to evaluation of excessive vibration and with respect to 2.(c) with respect to appreciable effects.
response	Partially accepted. Aeroelasticity is addressed by SC-VTOL. 2245. See also comment 10.

comment	*39* comment by: *Airbus Helicopters* 2160 | 2.(d).(2) | M | Shake tests of components or airframe can be used in addition or alternative to bang tests. | 2.(d).(2): Bang test and/or shake test for natural frequencies determination, … 2160 | 2.(d).(2) | M | Dynamic tests (bang tests and/or shake tests) on components (e.g. isolated wing...) are understood as "laboratory tests" while dynamic tests on the full vehicle are understood as "ground tests on related product(s)". | 2.(d).(2): …, codes MC 4, MC 5
response	Accepted. The content has been moved to MOC 2215 and amended with the corresponding information.

comment	*55* comment by: *Volocopter GmbH* Comment to point 2(a)(2), 2(b)(1), 2(c)(1), 2(d)(1): It is not clear what defines the term "drive systems", in the document the term "Lift/Thrust Unit" is also utilized which is more harmonized with SC-VTOL terms, so differentiation of terms is not clear. Please clarify the term "drive systems" or harmonize with SC-VTOL terms.
response	Accepted. The terminology has been revised accordingly. Lift/Thrust unit is addressed under SC-VTOL.2400 (c)(4).

comment	*56* comment by: *Volocopter GmbH* Comment to: 2(a)(b)(c) When mentioning "drive systems", it implies overlays between compliance with VTOL.2160 and EHPS.230(a)&(b). Please clarify in this document the interaction between compliance with VTOL.2160 and EHPS.230, including the cases where the electric engine goes through a standalone EHPS certification.
response	Partially accepted. See comment 55. Interaction and interfaces between aircraft and EHPS need to be addressed during the integration.

comment	*102* comment by: *Federal Aviation Administration* FAA comment: The FAA concurs with the language regarding the vibration assessment of SC-VTOL 2160(a), with the exception that for wing borne, flight stall buffet is allowed by the FAA but is not delineated in EASA's MOC. In addition, the FAA has defined 2160(b) regarding safety high speed excursion characteristics which is not addressed by EASA in this MOC or its regulatory language in SC-VTOL. EASA's MOC for SC-VTOL 2160(a) does not allow for the presence of wing borne flight stall buffet whereas the FAA's 2160(a) does. Currently EASA does not address high speed characteristics as part of SC-VTOL 2160(b). The FAA has included such requirements for its eVTOL certification basis provided to EASA. FAA/EASA harmonization activities may converge on this requirement though they may be documented in different regulatory sources. This may be a potential FAA SSD/SEI item. FAA recommends further harmonization.
response	Noted. The flight aspect has been removed and will be published in the future following further coordination and harmonisation.

comment	*124* comment by: *ANAC Brazil* **MOC VTOL.2160 Vibration (pages 12 and 13)** + Comment: As a requirement applicable to Subpart B (Flight), the scope of the means of compliance should be preferably focused on the flight aspects and the equipment level requirements should be covered under equipment design and installation requirements. In addition, rotor roughness test seems to be missing as one of the typical means of compliance in the list provided in section 2(d). + Recommendation: EASA to consider moving equipment qualification aspects to specific requirements/MOC in subpart D, E and F. Add the Rotor Roughness Test, code MC6, as a typical means of compliance in section 2(d)(3).
response	Partially accepted. See comment 10

MOC VTOL.2265 Flight in icing conditions p. 14

comment	*7* comment by: *Lilium eAircraft GmbH* The reference to VTOL.2265 is incorrect (both the heading & in text). This should be written against VTOL.2**1**65 “Flight in icing conditions” in Subpart **B.**
response	Accepted. Flight in Icing Conditions is VTOL.2165 in Subpart B and not VTOL.2265. The MOC content has been moved accordingly.

comment	*69* comment by: *Volocopter GmbH* Comment 1: There seems to be an error in the numbering of this MOC. This MOC should be linked to SC VTOL.2165 Flight in icing conditions and not to VTOL.2265 which addresses Special factors of safety. Comment 2: The overall compliance to VTOL.2265 (b), (c) will be demonstrated through the applicant providing operating precedures and/or detection means through which icing conditions will be avoided. Meeting ED-314 is one way in which this could be achieved. This should be reflected in the MOC text. Please complement the text of the MOC with the following: For showing of compliance with VTOL.2165 (b), (c) for eVTOL aircraft not certified for icing, **the applicant must provide operating precedures and/or detection means to reliably avoid icing conditions**. EUROCAE standard ED-314 ‘Compliance Methodologies for VTOL Certification in Inadvertent Icing and Snow Operation’ is **also** acceptable.
response	Partially accepted Comment 1: see comment 7

	Comment 2: Not accepted. ED-314 specifies the so far accepted means of compliance. The proposed wording does not provide a clear alternative means of compliance which would define the necessary performance of such systems to guide applicants. However, an applicant can propose on project level an alternative that conforms to the expected safety level. EASA would currently not consider developing different MoC for this purpose.

comment	*85* comment by: *Vertical Aerospace* MOC VTOL.2265 It should be "MOC VTOL.**2165** Flight in icing conditions" instead of 2265.
response	See comment 7

comment	*105* comment by: *Embraer S.A.* MOC VTOL.2265 Flight in icing conditions has a typo, the correct number is MOC VTOL. 2165. Replace the requirement title from “Flight in icing conditions” to “Performance and flight characteristics requirements for flight in icing conditions.” Proposed: Embraer suggests this correction and identified that this correction is necessary for the whole document.
response	Partially accepted See comment 7. As regards the amendment of the title it will be kept as provided in SC-VTOL to ensure consistency between the two documents.

comment	*126* comment by: *ANAC Brazil* **MOC VTOL.2265 Flight in Icing Conditions (page 14)** + Comment: [EDITORIAL] This MOC is not numbered correctly. It is linked to VTOL.2165 regulation, not 2265. + Recommendation: Correct both the title and the MOC text to refer to VTOL.2165 regulation instead of VTOL.2265.
response	See comment 7

MOC VTOL.2220 Ground and water load conditions p. 14

comment *36* comment by: *Airbus Helicopters*

Level (NC, H, M, L, E)	RATIONALE / REASON / JUSTIFICATION for the Comment	COMMENT or PROPOSED TEXT
E	§ VTOL.2220 Ground and Water Load Conditions belong to SUBPART C Structures, not SUBPART B	Correction is required

response Accepted.
MOC VTOL.2220 belongs to Subpart C and not Subpart B. The MOC content has been moved accordingly

comment *37* comment by: *Airbus Helicopters*

Level (NC, H, M, L, E)	RATIONALE / REASON / JUSTIFICATION for the Comment	COMMENT or PROPOSED TEXT
E	§ Flight in Icing Conditions is § 2165, not § 2265	Correction is required

response See comment 7.

comment *125* comment by: *ANAC Brazil*

MOC VTOL.2220 Ground and water load conditions (page 14)

+ Comment: [EDITORIAL] This MOC is applicable to Subpart C – Structures and it was incorrectly allocated to Subpart B – Flight in this MOC-4.

+ Recommendation: Move MOC VTOL.2220 to Subpart C.

response Please see comment 36.

MOC 1 VTOL.2235 Structural Strength: Strength and Deformation p. 15

comment *23* comment by: *Vertical Aerospace*

VA proposes adding the equivalent CS23 requirements as AMC.

Many eVTOL will have flight portions of the flight envelope that are much more like a CS23 than CS27 aircraft. In these cases AMCs shall be the equivalent CS-23 requirements rather than CS-27.

response

Partially accepted.
The MOC 1 VTOL.2235 refers to CS27.305 and CS27.307. These requirements are very similar to the equivalent CS23 requirements. Therefore, reference to CS27 is considered relevant.
For other MOCs, the addition of equivalent CS23 requirements may be considered in future updates to the SC VTOL MOC when portions of the flight envelope are much more like a CS23 than CS27 aircraft. Furthermore, for certification projects, Applicants may propose the use of MOC based on CS23 prescriptive requirements if appropriate to the design and operation of the aircraft.

comment *40* comment by: *Airbus Helicopters*

2235	2.(c).(2)	L	Associations are made with respect to the crew but not to the occupants. Thus, it is not clear what is the relationship between occupants and excessive vibrations with respect to 2.(c).	The role of occupants is not very clear with respect to excessive vibrations. If it is the health aspect for human bodies to be covered, it should be explicitly addressed. Alternativeley the understanding what is the human factor in 2.(b).2 should be elaborated.
2235	MOC1	M	In the section structural strenght are included not only §305&307 but also 301/303/549/561/613...all ATA52 chapter?	is it voluntary to put only CS27.305&307 only on the section structural strenght?

response

Comment #1: This is referring to 2160. Please refer to the respective section of this CRD.

Comment#2: Noted. - MOC-4 for public consultation covers only part of the MOC for SC VTOL Subpart C requirements. Some MOC has already been published, e.g. MOC VTOL.2210 refers to CS27.301(b) and (c), MOC VTOL.2230 refers to CS 27.301(a) and CS27.303, MOC VTOL.2270 refers to CS27.561 and MOC VTOL.2260 refers to CS27.613.

comment *127* comment by: *ANAC Brazil*

MOC VTOL.2235 Structural Strength: Strength and Deformation (page 15)

+ Proposal:

1) Remove any reference to VTOL.2240 from MOC 2 VTOL.2235; and
2) Include in MOC 2 VTOL.2235 the last paragraph of AMC1 27.307*

+ Rationale:

The proposed EASA MOC-4 SC-VTOL sets forth three means of compliance with VTOL.2235: MOC 1, MOC 2, and MOC 3. MOC 2 seems strongly based on AMC1 27.307. AMC1 27.307 relates to CS 27.303, CS.27.305, and CS25.307 and is limited to static justification*. Nonetheless, MOC 2 relates not only to VTOL.2230 and VTOL.2235 but also to VTOL.2240, i.e., including structural durability. As an example only, even AMC 25.307 relates to CS 25.303, CS 25.305, and CS 25.651 (and not to CS 25.571).

In the SC-VTOL-01 preamble, EASA acknowledged the complexity of VTOL over conventional aeroplanes and rotorcraft. Considering this inherent complexity, it seems reasonable and appropriate to limit MOC 2 to static justification and to allow similar approach expansions to durability, dynamic, and crashworthiness requirements on a case-by-case basis, in line with AMC1 27.307. This (initial) limitation would allow EASA to gain experience with the certification of VTOLs over the years so that EASA could safely remove this limitation based on enough evidence in the future, if deemed suitable. Regarding structural durability, MOC-2-SC-VTOL already presents extensive means of compliance for VTOL.2240(a) and (b).

* AMC1 27.307, last paragraph: *"The approach described above is valid for static justification. However, a similar approach can be extended for compliance with fatigue, dynamic and crashworthiness requirements. For these applications, the criteria and the classification have to be accepted by and agreed with the authority."*

response

Accepted.
Reference to VTOL.2240 will be removed. The additional sentence will be added at the end of MOC 2 VTOL.2235, to be consistent with AMC1 27.307 Proof of structure:
"The approach described above is valid for static justification. However, a similar approach can be extended for compliance with fatigue, dynamic and crashworthiness requirements. For these applications, the criteria and the classification have to be accepted by and agreed with the authority."

MOC 2 VTOL.2235 Structural Strength: Methods of Compliance for Proof of Structure p. 15

comment *50* comment by: *Airbus Helicopters*

2235		MOC2	M	CS27.305 = Strength and deformation (no deformation at limit load and no failure at ultimate load) CS27.307 = Proof of the structure (which include environmental aspect to be taken into account)	why only the proof of the structure is addressed by MOC2? VTOL 2235 address also Strength and deformation

response

Noted.
MOC 2 VTOL.2235 contains only part of the MOC for compliance to SC VTOL.2235.

This section addresses 'Proof of Structure' and is based on AMC2 27.307. Both limit load and ultimate load requirements are addressed in MOC 2 VTOL.2235.

comment *114* comment by: *Leonardo Helicopters*

Paragraph: 5. (a)(3) " *(a) The following factors should be considered in deciding the need for and the extent of testing including the load levels to be achieved: (3)the consequence of the failure of interior items of mass and the supporting structure to the safety of the occupants."*
Comment: Historically, only main components in cabins are tested, such as seats, wherease, secondary items inside the cabin (i.e radio, fire extinguisher ect) are certified only using analytical approach, in order to reduce costs.
Resolution: Analysis should be proposed as a means of compliance for installations of appliances, ancillaries and instrument panels or similar.

response Not accepted.
This paragraph states that the need for and extent of testing is based on the consequence of the failure of interior items. For installations of appliances, ancillaries and instrument panels or similar, if loss of its attachment has no or low safety consequences, testing may not be required. The text is consistent with AMC1 27.307.

comment *115* comment by: *Leonardo Helicopters*

Paragraph: 6. (d)(3) " *(d)Test only(3) If tests only are used to show compliance with strength and deformation requirements for single load path structure which carries flight loads (including pressurisation loads), the test loads must be increased to account for variability in material properties, as required by VTOL.2260 (c). In lieu of a rational analysis, a factor of 1.15 applied to the limit and ultimate flight loads may be used for metallic materials."*
Comment: This paragraph applies to CS-25 large aircrafts (MTOW higher than 12600 lb)**.** .
Resolution: Introduce different approach based on the MTOW of the machine as is in the CS-23 vs CS-25

response Not accepted.
This text is consistent with AMC1 27.307, which is consistent with the MTOW of SC VTOL.

MOC 3 VTOL.2235 Structural strength: Landing Gear Drop Test p. 19

comment *2* comment by: *Czech Aerospace Research Centre*

In paragraph (d), subparagraph (1), (ii)
"Lift from the lift/thrust units may not exceed 1.5 times the lift allowed under the limit drop test."
Since the maximum "lift allowed under the limit drop test" is two-thirds of the design maximum weight, multiplying 2/3 by 1.5 gives us 3/3. Do we understand correctly,

	that the lift equal to the design maximum weight can be applied when performing the limit drop test?
response	Noted. The limit drop test should be performed in accordance with CS27.725, with the drop height modified as per the MOC 3 VTOL.2235(b). The rotor lift may not exceed two-thirds of the design maximum weight. Paragraph (d), subparagraph (1),(ii) refers to the reserve energy drop test, which is based on CS27.727. The lift may not exceed 1.5 times the lift allowed under the limit drop test. Therefore, for the reserve energy drop test the aircraft may be considered as fully airborne, i.e lift equals weight. MOC is updated to refer to CS27.725 and CS27.727 as modified by the criteria with the system in the failed condition.

comment	*11* comment by: *Lilium eAircraft GmbH* The MOC refers to CS 27.725 Amdt. 6 for Limit Drop Test and also mentions the drop height requirement not less than 8 inch (27.725(a)(2)). However, the 13 inch drop height requirement (27.725 (a)(1)) is not mentioned in the MOC. Is this excluded on purpose? If yes, what was the rationale? If not, can we still consider the 13 inch drop height?
response	Noted. CS 27.725(a) requires a drop height of 0.33m (13 inches) or any lesser height resulting in a drop contact velocity equal to the greatest probable sinking speed likely to occur is normal power off landings. The reference to power off landings was not considered directly applicable to eVTOL aircraft. The drop height selected by the Applicant should be equal to the greatest probable sinking speed likely to occur in normal landings, but not less than 0.20m (8 inches). A higher value may also be conservatively selected by the Applicant.

comment	*21* comment by: *Vertical Aerospace* MOC 3 VTOL.2235 (a)(b)(c) Landing Gear drop test Add the equivalent CS23 requirements as AMC. The equivalent CS23 requirements shall be referenced for rolling (wingborne) landing
response	Accepted. Added text: "(e) In addition, for aircraft with CTOL capability, when substantiating the criteria of MOC VTOL.2220 4.(b), i.e. CTOL additional ground conditions, the following are accepted as a means of compliance,: (1) Shock absorption tests: CS 23.723 Amdt. 4 (2) Limit drop tests: CS 23.725 Amdt. 4 (3) Ground load dynamic tests: CS 23.726 Amdt. 4 (4) Reserve energy absorption drop tests: CS 23.727 Amdt. 4"

comment	*22* comment by: *Vertical Aerospace* MOC 3 VTOL.2235 (d)Landing Gear drop test

	ISS for landing conditions should not consider instant of the failure but rather continuation of flight assumptions. The safety factors established here for the ground conditions are equivalent to those of loads at the time of occurrence on Appendix K of CS25. Due to the low exposition time this should be disregarded (as usual for any transition event) and the probabilities vs SF of being in failure condition relations shall be used instead.
response	Not accepted. MOC VTOL.2205 was adapted from CS 25 Appendix K for SC VTOL applications and is focussed on flight load alleviation systems. Further adaptation of MOC VTOL.2205 has been made specifically for systems affecting landing vertical speed. The safety factors applied in MOC VTOL.2205(c)(1) (at the time of occurrence) are considered most relevant as the increased loading will occur only during the landing phase. Consideration of exposure time during flight phase is not relevant.

MOC VTOL.2315 (a) Means of Egress and Emergency Exits p. 22

comment	*12* comment by: *Lilium eAircraft GmbH* It is not entirely clear which section is supposed to be modified. Is the idea that the provided text should be added as if it were a subparagraph 2.2.2 - 3.c ? If so, isn't it rather an addition, not a modification. Also, it makes more sense to add it after sub-paragraph 3, not as part of subparagraph 3 since 3 refers to equipment level tests. Propose to change wording to: "..., with the following addition after sub-paragraph 3: ..."
response	Accepted. The MOC is updated accordingly.

comment	*103* comment by: *Federal Aviation Administration* FAA comment: FAA recommends adding ASTM F3083-20a as a MOC to this regulation in addition to EUROCAE ED-307. FAA recommends adding to (2)(a) the language: "'ASTM F3083-20a Standard Specification for Emergency Conditions, Occupant Safety and Accommodations' is accepted as a means to demonstrate that the aircraft is designed to facilitate rapid and safe evacuation of the aircraft in conditions likely to occur following an emergency landing."
response	Not accepted. EUROCAE ED-307 was developed specifically for SC-VTOL and takes into consideration the configuration, operation and passenger profile of these aircraft types. These aspects were not considered during the drafting of ASTM F3083-20a, which is for General Aviation and is an acceptable means of compliance for CS-23 Amendment 6.

comment	*128* comment by: *ANAC Brazil* **MOC VTOL.2315 (a) Means of Egress and Emergency Exits (page 22)** What are the criteria to evaluate the effort to open the exit door? In ANAC opinion, objective criteria should be defined. For example, a definition of a weight or maximum force.
response	Noted. The acceptable effort is defined in EUROCAE ED-307 'Guidance on the demonstration of acceptable occupant safety – emergency egress', paragraph 2.2.2. Intuitive use and opening effort, sub-paragraph 3. This maximum effort is consistent with FAA AC 29-2C 29.809(b)(1).

MOC 5 VTOL.2500 (b) Flight guidance systems p. 24

comment	*17* comment by: *Vertical Aerospace* Comment: The definition of inner loops requires clarity as it is not clear whether it is referring to the Flight Control inner loops (for control and stability) or an FGS inner loop. A diagram would be useful. Potentail confusion between FGS inner loops and FCS inner loops
response	Partially accepted. Prior to being listed in section 4., the definition of inner loops is introduced in section 2, and several phrases already aim at clarifying the point raised by the comment (e.g. 'based on commands from the outer loops […] provide commands to flight […] control laws', 'Stability augmentation systems, envelope protection, or control laws parts of the Flight Control System (FCS), which are present full-time, are not deactivated/disengaged together with the FGS outer or inner loops, and do not enable hands-off flight, are out of scope of this MOC'). A diagram would prove difficult to capture all potential architectures. As a clarification attempt, 'FGS' is added multiple times in the definitions and in the entire MOC, and an additional example of interface with FCS inner loops is added to section 2.

comment	*18* comment by: *Vertical Aerospace* 'Quick disengagement controls of the inner loops' As the inner loops provide control and stability. VA would like further clarificaiton on what's EASA meaning with disengagement of outer loops.
response	Partially accepted. By analogy with aeroplanes and rotorcraft, for understanding quick disengagement controls of the VTOL FGS inner loops (not FGS outer loops, not FCS inner loops), one could refer (for information only, requirements may differ) to quick disengagement controls for autopilot and autothrust (CS 25.1329 (a)), to quick and positive disengagement capacity of the automatic pilot system (CS 29.1329 (a)(2)), and to ready and positive disengagement capacity of the automatic pilot system (CS 27.1329

	(a)(2), CS 23.1329 (a)(1)). This is about positive disengagement means of automatic controls in order to recover manual control. Following comment 17, the wording has been updated to 'quick disengagement controls of the FGS inner loops'.

comment	*29* comment by: *ASD* Comment: For all applicants, normally/rarely encountered atmospheric conditions should better have a common definition. Is it dealing with statistic, gust, turbulence and how to quantified it? Proposal: An explanation note should be added to clarify the definition of normally/rarely atmospheric conditions and the terminology infrequently
response	Partially accepted. See comment 130.

comment	*30* comment by: *ASD* Comment: Why using "Partial Loss" instead of "Malfunction". What is the definition of partial loss? Proposal: Replace "Partial Loss" by "Malfunction"
response	Not accepted. Please refer to the established standard EUROCAE ED-135: - '*Partial losses of function are conditions where function can still be performed but only at reduced capability (e.g., reduced effectiveness or with increased difficulty).*' - '*Malfunction is a condition where the operation of a function is different than intended excluding function loss.*' Partial loss may also cover loss of redundancy cases. Appendix A to AMC No. 1 to CS 25.1329 already used 'partial loss'. Applicants may use their own wording and definitions in their FHAs.

comment	*31* comment by: *ASD* This MOC refer to all §17 including §17.(d) "human performance issues" The meaning of the sentence should be clarified. What kind of issues have to be considered here: incapacitation, overload,...?
response	Not accepted. Comment is not applicable to the MOC 5 VTOL.2500(b) as published for Public Consultation. Paragraph 17.(d) does not exist. 'Human performance issue' is defined in section 4. It does not include pilot incapacitation due to physiological factors.

comment	*32* comment by: *ASD* CM-SA-002 “flight crew human factors assumptions in aircraft and system safety assessments” is applicable to large aeroplanes. Would adaptation of its content be possible in the frame of SC VTOL application?
response	Noted. Paragraph 18.(e) encourages the applicant to use a structured HF process and refer to CM-SA-002 as an example. The actual methodology/procedure should be agreed with the Agency at project level.

comment	*33* comment by: *ASD* In the definition of "Significant transient: a transient that would lead to a significant reduction in safety margins, a significant increase in flight crew workload, discomfort to the flight crew, or physical distress to passengers or cabin crew, possibly including non-fatal injuries." Is the part of the definition "possibly including non-fatal injuries" applicable to flight crew or only to "cabin crew" . If confirmed, our understanding is that the definition corresponds to major failure condition and not above (which would be hazardous)
response	Not accepted. Comment is not applicable to the MOC 5 VTOL.2500(b) as published for Public Consultation. The mentioned definition differs from the definition of the MOC section 4. Section 4 includes three levels of transient, the levels being commensurate with minor, major, and hazardous failure conditions as defined in MOC VTOL.2510.

comment	*57* comment by: *Volocopter GmbH* Comment to 4 (h) "Field of view (…) refer to CS ACNS.A.GEN.005": MOC VTOL.2600 refers to AC27-1B when defining the field of view. Why not using common references across the different MOC to SC-VTOL? Please clarify references and MOC to SC-VTOL interrelationships.
response	Noted. In MOC VTOL.2600, the reference to FAA AC 27-1B (and more precisely, FAA AC 27.773) is for the external field of view, not for the instrument field of view. The relevant section of AC 27-1B would be AC 27.1321. Reference is made to CS-ACNS.A.GEN.005 for two reasons: this is an EASA text, and it covers both rotorcraft and aeroplanes.

comment	*58* comment by: *Volocopter GmbH* Comment to 8 (b) - Control Means We would like to challenge the direct association of inner or outer loops with the location of the disengagement controls: "Quick disengagement controls of the inner loops should be provided to the flight crew on the relevant flight control inceptors." Also the two sentences seem to almost contradict each other: "They should be readily accessible to the flight crew while operating the flight control inceptors". The nature of disengagement should be based on the role relation of the FGS both in time criticality and safety which may not be directly related to inner or outer loops. We suggest rewording to reflect the safety requirement rather than linked to a technical aspect of the system. With regard to the contradiction - we recommend removing "on the relevant flight control inceptors" and retaining the "readily accessible". Forcing controls onto the inceptors may have unintended safety consequences such as inadvertent operation.
response	Not accepted. MOC 5 VTOL.2500(b) paragraph 8.(b) does not address FGS outer loop deactivation but only FGS inner loop disengagement. This is not new; refer to CS 23.1329 (b), AC 27-1B AC 27.1329 c.(5), AC 29-2C AC 29.1329 c.(5), CS 25.1329 (a), RTCA DO-325 2.2.1.1.2.a. and 2.2.5.2.1.b., RTCA DO-336 Chapter 6 67.a. The two quoted sentences are not contradictory but complementary, the former for locating the control on an inceptor (on the relevant one between left-hand and right-hand inceptors for example, if manual flight is performed with such configuration), the latter for positioning the control at an adequate place on the chosen inceptor. As mentioned in AMC 25.1309: 'The purpose of the "Quick Disengagement Control" is to ensure the capability for each pilot to manually disengage the autopilot quickly with a minimum of pilot hand/limb movement. […] The "Quick Disengagement Control" should meet the following criteria: (a) Be accessible and operable from a normal hands-on position without requiring a shift in hand position or grip on the control wheel or equivalent; (b) Be operable with one hand on the control wheel or equivalent and the other hand on the thrust levers;', and: 'The *requirement for quick disengagement for the autopilot and autothrust functions is intended to provide a routine and intuitive means for the flight crew to quickly disengage those functions.*'. The risk of inadvertent operation by the pilot has indeed to be taken into account in the design and development process. MOC 5 VTOL.2500(b) 17.(b)(1)(iii) refers to a human factors assessment of the FGS inner loops quick disengagement controls. Small and large aeroplanes and rotorcraft successfully integrated quick disengagement controls on the relevant inceptors. The adequacy of the design has to be determined and substantiated by the Applicant through assessments such as human factors and safety, but the disengagement of the inner loops is considered to warrant proven design solutions on a general basis. Applicants have the right –for example in case where the particularity of the implementation prove to benefit from different mitigation means– to propose alternative means of compliance, subject to acceptance by the Agency.

comment	*59* comment by: *Volocopter GmbH* Comment to 8 (d) Please reword to "without excessive pilot compensation or workload".
response	Not accepted. There is no MOC 5 VTOL.2500(b) paragraph 8.(d); the comment is assumed to be made on paragraph 9.(c). The wording 'without pilot compensation or excessive workload' is the same as in AMC 25.1329 section 10.1: "The flight director, in each available display presentation (e.g., single cue, cross-pointer, flight path director) should provide smooth and accurate guidance and be appropriately damped, so as to achieve satisfactory control task performance without pilot compensation or excessive workload.". This is as well aligned with FAA AC 25.1329-1C section 53.c.(7): "FD. The FD, in each available display presentation (for example, single cue, cross-pointer, flightpath director) should provide smooth and accurate guidance and be appropriately damped, to achieve satisfactory control task performance without pilot compensation or excessive workload.". The pilot should not have to compensate for flight guidance cues inadequate targets under normal system conditions.

comment	*60* comment by: *Volocopter GmbH* Comment to 10. Flight Envelope (b) The meaning of 'The Minimum Use Height (MUH) should be compatible with the FGS architecture' is not clear. Please further clarify or remove as the rest of the sentence is logical and appears to cover the topic.
response	Accepted. The following has been added to the 'Explanatory Note' of section 10: '*Point (b) mentions the 'FGS architecture' as having a potential impact on the MUH: for example, an FGS architecture enabling fail-operational outer and inner loops may have a different demonstrated MUH than a fail-passive or than a not-failure-protected one.*'.

comment	*61* comment by: *Volocopter GmbH* Comment to 10. Flight Envelope It is not sure what the following means: 'The inner loops control authority should be commensurate with the intended operations'. Please reword to: 'The inner loops control authority should be capable of controlling the system throughout the intended operation.' provided that this is the correct understanding.
response	Not accepted.

	The inner loops control authority should be capable of controlling the system throughout the intended operation indeed, but the inverse is desirable as well: not providing more control authority to the inner loops than what is necessary for the intended operation. Current MOC 5 VTOL.2500(b) paragraph 10.(e) wording addresses both considerations, as opposed to the proposed one.
comment	*62* comment by: *Volocopter GmbH* Comment to 11. Indicating and Alerting Means (b)(2) Comment 1: It is not clear on how to indicate transition - transition is a part of activation so it is redundant and may drive the applicant to create overly complex HMI just to try and meet the MOC. Please remove 'transition'. Comment 2: The statement "Means should be provided to indicate to the flight crew: The arming, … Selector switch position or status is not acceptable as the sole means of indication." is considered too strong. Also, with simple functions within a limited envelope with no significant safety implications a switch position may be acceptable - in complex FGS it may not be acceptable. We suggest amending this point. Please re-word to: 'Selector switch position or status may not be acceptable as the sole means of indication.' Additionally, please consider adding a statement such as "...if there are no other obvious and easy to read cues (such as RPM onset for the initial arming on ground)".
response	Not accepted. Regarding the first part of the comment about 'transition': 'transition' is already part of CS/AMC 25.1329 (i). MOC 5 VTOL.2500(b) paragraph 11.(b)(2) does not mention that the indication of a 'transition' has to be different than the indication of an 'activation'; it is not expected to drive 'overly complex HMI' as stated. However, applicants have to consider all cases, not just activation of each mode out of context, but each potential transition from mode to mode. As stated about the topic in the ARAC Flight Guidance System Harmonization Working Group report two decades ago: '*studies have shown that the lack of sufficient flight crew awareness of modes, transitions and reversions is a key safety vulnerability*'. Regarding the second part of the comment about 'selector switch position or status' and the suggested additional statement: 'Selector switch position is not acceptable as a means of indication' is already part of CS 23, 25, 27, and 29. As stated about the topic in the ARAC Harmonization of Miscellaneous Rotorcraft Regulations Working Group report almost three decades ago: '*Airplane accidents occurred prior to adoption of the requirement of the display of the autopilot mode in parts 23 and 25 due to the pilot not being aware of the current autopilot mode. This type of accident could occur in rotorcraft. Safety will be enhanced by requiring that the autopilot mode be displayed to the pilots of rotorcraft.*'.

comment	*63* comment by: *Volocopter GmbH* Comment to 11. Indicating and Alerting Means (c-f) This whole section seems a little over prescriptive and complex. Are inner loops disengagements not linked inextricably to outer loop reversion? We suggest reducing this section to some simpler principles as the detail may drive overly complex or confusing HMI. Please condense c-f with: 'When operationally relevant, indications for FGS disengagement, reversion and envelope protection should be supported by an alert, in accordance with the required flight crew reaction and urgency of response. Consideration should be given to the implementation of a time-critical warning alert for FGS disengagement that continues until acknowledged by the crew. Envelope protection alerts should activate with suitable margins to the limit condition to allow for flight crew reaction time and intervention while not resulting in nuisance activations.'
response	Not accepted. Although there can be links between outer loops reversion and inner loops disengagement, outer loops can also be used with the flight guidance cues in manual flight with inner loops not engaged, and inner loops may be disengaged while outer loops remain active, so there is no bijection/equivalence. Each MOC 5 VTOL.2500(b) paragraph 11.(c), (d), (e), and (f) addresses a distinct safety concern and is supported by in-service experience (on other products than VTOL-capable aircraft, obviously). The MOC has been written so that each bullet point focuses on one topic, for easy and clear traceability when referring to the MOC in certification projects.

comment	*64* comment by: *Volocopter GmbH* Comment to 11. Indicating and Alerting Means (Explanatory Note) As mentioned in section 2, specific technologies, such as the use of HUD, may require additional considerations, which may be project-specific or perhaps lead to the definition of dedicated additional MOCs. The MOC should be agnostic of technologies such as HUD. Please remove the reference to specific technologies such as HUD.
response	Not accepted. On principle, the SC and the MOC aim at being performance-based and technology-agnostic. However, there are cases where the technology changes the concept of operation, the human-machine interaction, the induced hazards, etc. MOC 5 VTOL.2500(b) has been created to cover a certain extent of foreseen flight guidance system implementations, but, as mentioned in the last paragraph of section 2, some technologies/operations/integrations have not been covered, and would require further considerations prior to extending the scope of MOC 5 VTOL.2500(b), which may or may not lead to modifications/additions to present version.

comment	*65* comment by: *Volocopter GmbH*

	Comment to 16. Performance (d)(4) It is not clear what specific safety issues apply to FGS in icing conditions. Why would this be an additional consideration over and above all the other elements already tested? For example, if the FGS is purely software based with no additional hardware, what is the justification for the need for additonal testing? Please reword to: 'if the FGS is impacted by flight in icing conditions, the applicant should assess the performance of the FGS in icing conditions if it is requested for certification.'
response	Partially accepted. In icing conditions, ice accretion could occur for example, leading to modified aerodynamic characteristics, which could indirectly affect the FGS, even 'purely software-based' FGS: e.g., performance issue, reaching authority limit, masking the condition to the flight crew. MOC 5 VTOL.2500(b) paragraph 16.(d)(4) does not explicitly require testing but assessment. Therefore, proper considerations, justifications, demonstrations are needed and cannot be dismissed a priori. However, their extent depends on the aimed certification in terms of icing conditions, on the related targeted FGS capability, on the FGS design, on other onboard systems and their interrelationship with the FGS, and on the FGS operations and limitations. The version published for Public Consultation of MOC 5 VTOL.2500(b) in general and paragraph 16.(d)(4) in particular did not capture sufficiently well the several considerations and possibilities for FGS in icing conditions. This has been corrected into the final MOC by deleting former paragraph 16.(d)(4) and by adding new paragraphs: 7.(a)(1), 19.(a), (b), (c).

comment	*66* comment by: *Volocopter GmbH* Comment to 16. Performance (d) (5) The meaning of the following is not clear: 'The applicant should test each flight phase, mode, and operation a sufficient number of times in varying conditions, commensurately with the specificities and criticality of the situation.' Please simplify to: 'The applicant should test each flight phase, mode, and operation a sufficient number of times to take into account the varying conditions and the number of different FGS functions and modes of operation.'
response	Partially accepted. The point on clarity is taken; however, the proposed wording does not fully cover the intent: this is not only about the number of functions and modes of operations, but also about the number and conditions of tests in order to be able to conclude on the performance with an adequate confidence level. The following has been added to the sentence 'in order to reach an adequate confidence level in the performance assessment'.

comment	*67* comment by: *Volocopter GmbH* Comment to 2(b) Terminology and Applicability

	The definition of inner loops "based on commands from the outer loops and based on aircraft state and configuration, they provide commands to the actuators or flight and/or lift/thrust control laws to control the aircraft and achieve the outer loops commands." does not consider direct commands from pilots through primary controls. Often, the inner loops can accept both, commands from outer loops and pilot inputs. Is this a gap or is it intentionally only for autopiloting? If it is the intention to also cover control augmentation of pilot inputs provided through inceptors / primary controls, the definition should be adjusted accordingly.
response	Noted. This is intentional. MOC 5 VTOL.2500(b) is limited to flight guidance systems, as defined in section 2. Following comment 17, the wording has been systematically updated to 'FGS inner loops', for clarification.

comment	*70* comment by: *Lilium eAircraft GmbH* 6.(j). It would be beneficial if EASA can kindly clarify if this ''Monitoring within the FGS'' is about FGS equipment and integrated systems or if it is about FGS performance and followship of targeted flight parameters.
response	Noted. It could be either or both. MOC 5 VTOL.2500(b) section 6 does not prescribe the system, but its description by the applicant. Relevant monitors, part of the applicant's product, whether they check equipment or signals for failures, or parameters for performance, should be part of the description. No modification of MOC 5 VTOL.2500(b) section 6 is deemed necessary at this stage.

comment	*71* comment by: *Lilium eAircraft GmbH* 9.(a). Accuracy of the sensors are controlled by the minumum performance standards / TSO. Since accuracy of the Altitude (for example) is dependent on the ADC, probes, installation, calibration, etc. is this accuracy demonstration in the scope of the FGS certification? When we get to PBN for TSE (FTE, NSE, PDE), the FGS contributes to the FTE and performance is based on repeatedly closing the loop on the altitude target (Navigation System Error) that corresponds to the altitude displayed to the pilot.
response	Noted. MOC 5 VTOL.2500(b) paragraph 9.(a) is about the resulting track keeping of the FGS, not about internal parts or inputs. MOC 5 VTOL.2500(b) does not prescribe the air data system. In the example of the comment, the accuracy (and precision) of the FGS to control such as the estimated altitude equates the altitude target is in scope, but not the accuracy of the altitude estimation itself; and a parallel could indeed be drawn to the PBN terminology: paragraph 9.(a) would address the FTE, and not the NSE. That being said, the performance of the sensors and flight parameters estimators obviously need to be compatible with their use and the targeted operations, and it would be appropriate to state so in the FGS compliance report.

comment	*72* comment by: *Lilium eAircraft GmbH* 11.(d). In single pilot cockpits is this absolutely necessary? In case of a single pilot operation, as discussed with Human Factors and Pilots, cockpit awareness and pilot responsibility is clear following the sound of the alert (i.e., not confused with Copilot acknowledging the alert). The time allotted allows for the pilot to attempt to clear and become aware of the failure but not be overly distracted (MAJ Hazard) by the continuous sounding of the alert in case of failure. This is typically on the pilot yoke (2 for a dual cockpit), failure of the primary would require digging for a backup "acknowledge" button that will likely never be used by the pilot.
response	Not accepted. It is unclear about which part of MOC 5 VTOL.2500(b) paragraph 11.(d) the comment is made; it is assumed that it is about '*The alert should continue until acknowledged by the crew*'. EASA position is that a positive acknowledgement action is necessary. The comment seems to show a concern about the reliability of the acknowledgement means in a certain failure condition; surely the system can be designed to provide sufficient availability of this means.

comment	*73* comment by: *Lilium eAircraft GmbH* 15.(a)(b). It should be highlighted that, due to the limited flight time, the number of tests to be performed in flight will be reduced to the minimum. This minimum set / expectation should be expanded.
response	Not accepted. Flight testing is an important part of the demonstration. If an FGS is part of the product, the applicant should be able to perform part of the FGS tests in flight. The distribution between the several means of compliance MC4/5/6/8 at different levels is expected to be presented and justified.

comment	*74* comment by: *Vertical Aerospace* VA would like to know if MOC 1 VTOL.2300 be updated to encompass MOC 5 VTOL.2500 (b). Also if there are further details to be provided in the future for flight guidance systems.
response	Noted. It is not planned to update MOC 1 VTOL.2300 to encompass MOC 5 VTOL.2500(b). VTOL.2300 addresses flight control systems, while MOC 5 VTOL.2500(b) addresses flight guidance systems. There is interaction/entanglement between the two, but the separation is explained in MOC 5 VTOL.2500(b) section 2, and section 13.(b) addresses the integration aspects. Without knowing what 'further details' means exactly: there is no plan yet to update MOC 5 VTOL.2500(b), but this could happen in the future based on experience feedback or if operations/functions not currently covered by the MOC are envisaged, for example.

comment	*87* comment by: *Vertical Aerospace* MOC VTOL.2500(b)(12)(3)(f) Remove reference to 'requirements engineering process'. MOC VTOL.2510(10)(f) only references 'considerations of derived requirements'. Derived requirements is a subset of a Requirements Engineering process, which is contained within ARP 4754B.
response	Not accepted. The term 'requirement engineering process' refers to processes used to develop system such as described in MOC VTOL.2510 (10) (b), (c), and (d) and is not deemed inadequate or problematic in the context of the MOC VTOL.2500(b)(12)(3)(f).

comment	*88* comment by: *Vertical Aerospace* MOC VTOL.2500(b)(18)(a) Provide definition of 'associated risks of incorrect analysis'. Recommend to include example of how this could contribute to Failure Condition Validation
response	Noted. For example, if assumptions are made and/or if the failure condition is complex, the validation should be commensurate with the likeliness of a mistake in the analysis and the consequences of such mistake.

comment	*113* comment by: *Leonardo Helicopters* **Comment:** Please clarify if the following two situations have correctly interpreted MOC requests. 1. Supposing to have a piloted Aircraft (lowly automated aircraft), the control laws belonging to FCS is only SAS(stability augmentation system) while Attitude hold (inner loop), upper modes, navigation & approaches modes (outer loops) belong to FGS since they can be engaged/disengaged and allows Hands-off flight? 2. Consider the following definition of highly automated aircraft: an aircraft which is commanded through horizontal/lateral/vertical/yaw accelerations with no exceptional pilot skills. Control laws providing horizontal/lateral/vertical/yaw accelerations (SAS is an inner loop) belong to FCS, while altitude/airspeed/heading hold and navigation & approaches modes belong to FGS since they can be engaged/disengaged and allows Hands-off flight?
response	Noted. The adequate assignment depends on the specific case, but at this level, both items 1. and 2. seem to translate correct understanding.

comment	*130* comment by: *ANAC Brazil* **MOC 5 VTOL.2500 (b) Flight guidance systems, section 9 (page 29 and 30)** 1 – In section 9, it appears the concept of "rarely-encountered external environmental conditions". In fact, the concept is presented in the item 4.f (definition). It seems the concept regarding environmental conditions, given its importance, should be better detailed. It also seems to be the same defined as "rare normal conditions" in the FAA AC 25.1329-1C / EASA AMC1 25.1329. If correct, it is suggested to use the nomenclature "rare normal conditions" instead of "rarely-encountered external environmental conditions" for harmonization purposes. 2 – Additionally, considering the wide variety of possible scenario for VTOL operation (when compared with a more standard scenario for Transport Aircraft), the applicant should be required to provide an environmental assessment related to the VTOL CONOPS. This document should identify what are the normal and rarely external environmental conditions (or rare normal conditions, as proposed above) expected to be encountered during operations. It will be useful to have clearly defined the scenario to evaluate the VTOL for the section 9 - FGS Behavior.
response	Partially accepted. Regarding item 1–, preference had been given to harmonisation with MOC 1 VTOL.2500(b) rather than with AMC and AC 25.1329. MOC 5 VTOL.2500(b) paragraph 4.(f) already provides a certain definition, including a list of examples. It is not possible at this stage to refine the definition, with an applicability to all existing and foreseeable eVTOL projects. Even the 'rare normal conditions' of AMC and AC 25.1329 only provide a list of potential conditions, and do not quantify them, neither in terms of amplitude nor of probability of occurrence. Regarding item 2–, the following new paragraph 16.(d)(1) has been added: *'the applicant should assess and determine the external environmental conditions (as defined in paragraph 4.(f)) applicable to the aircraft, in relation to the concept of operations*'.

MOC VTOL.2525 System power generation, energy storage, and distribution p. 40

comment	*28* comment by: *ASD* In (d)(2) it is mentioned "(2) Hazardous effects on structures, occupants, essential equipment, or systems caused by the maximum amount of heat that can be generated during normal operation or probable malfunctions should be prevented". Please confirm the hazardous definition to be used is the one of MoC 2510 and confirm the probable meaning is the same as "foreseeable " in paragraph (d)(1)
response	Accepted The text of this point has been revised to read as follows: "Hazardous/Catastrophic effects on structures, occupants, essential equipment, or systems caused by the maximum amount of heat that can be generated during normal operation or probable malfunctions should be prevented." As regards the meaning of 'foreseeable' and 'probable', EASA confirms that these

mean the same in the proposed context, referring to known, expected, inherent to the technology.

comment *38* comment by: *Airbus Helicopters*

MOC VTOL.2525	M	ESD is used as abbreviation for non-propulsion Electrical Storage Devices . This can lead to confusion with respect to Electrostatic Discharge	Use e.g. npESD as abbreviation or replace Storage with Charged to get ECD as abbreviation or use equipment instead of devices to get ESE as abbreviation
MOC VTOL.2525	*M*	*Except for 1351(a) (2), where a load analysis is requested as MoC, the paragraph (a), (b), (c) of MOC 4 refer to requirements from CS23 and CS27, these are not MoC, why not copy paste directly into CS-VTOL ?* *Some of these requirements (ex: 1351 (c) (3) for generator reverse current), are prescriptive and will probably need to be adapted.*	

response Not accepted.
Comment #1: ESD is the commonly used acronym for Electrical Storage Device. Electrostatic discharge concept is sufficiently differentiated so that this MOC should not create confusion in this context. Conversely, A/C is a standard term for air conditioning and also for aircraft while in practice this is not an issue.

Comment #2: The SC VTOL in coordination with its related MOC is established in the same spirit as the CS-23 Amdt 5 with its related MoC based on CS-23 Amdt. 4. Despite written as requirements, they are considered as MoC and can be managed in this way along the projects.

comment *129* comment by: *ANAC Brazil*

MOC VTOL.2525 System power generation, energy storage, and distribution (page 40)

For better understanding of the text, include the term “non-propulsion” at 2525(e) (page 40):

“(e) When the **non-propulsion** ESD are Lithium batteries, the use of equipment qualified according to the following standards is accepted as means of compliance in addition to (d):”

response

Not accepted.
The MOC are referring to their dedicated requirement, thus the title needs to remain consistent and should not be changed.
MOC VTOL.2525 (d) explicitly addresses the concern expressed by stating 'non-propulsion' ESD.
Propulsive ESD are intended to be addressed by VTOL.2430 'Lift/thrust system installation, energy storage and distribution systems' and its related MOC.

MOC VTOL.2545 Pressurised System Elements p. 41

comment *6* comment by: *FAA, AIR 623*

Reference	Section or paragraph	Page	Line # (if relevant)	RATIONALE / REASON / JUSTIFICATION for the Comment (What is the reason and justification behind the change you are requesting?)	PROPOSED TEXT (Be specific about the change you are requesting: specific wording change, deletion, addition…)
MOC-4 SC-VTOL	MOC VTOL.2545 Pressurised System Elements	41		Pneumatic systems on turbine aircraft use high-pressure, high-temperature air for critical functions like cabin pressurization, engine starting, and ice protection as mentioned in MOC VTOL.2545. The application of this MOC appears to be fairly straightforward for a VTOL aircraft if it used a turbine engine or compressed air in a similar manner. It is not clear how this MOC would be applied to an unpressurized aircraft using electric propulsion. Please provide some introduction text to MOC VTOL.2545 to explain the intent for how it should be applied for a small electric aircraft. Are	For VTOL aircraft that use turbine engines and bleed air MOC VTOL.2545 is intended to be applied in a similar manner to 25.1436. For fully electric aircraft, MOC VTOL.2545 is intended to be applied to XXXXXXXX.

				there any systems or cases that EASA expects this MOC to be applied to on electric aircraft? Any clarification would be helpful.	
MOC-4 SC-VTOL	MOC VTOL.2545 Pressurised System Elements	41		Consider removing the reference to pressurization, since VTOL.2000 limits the applicability to unpressurized airplanes. Also, consider removing the reference to engine starting, as this would only be relevant for large turbine engines used on transport aircraft.	(a) Pressurised systems elements (ducting and components, i.e. regulating valves, …) served by compressed air, either bled from an engine, or generated by an air compressor (e.g. for the air conditioning, and hot air ice-protection functions, if any) which are essential for the safe operation of the aircraft or whose failure may adversely affect any essential or critical part of the aircraft or the safety of the occupants, must be so designed and installed as to comply with VTOL.2505 and VTOL 2510 (a). In particular, account must be taken of elements bursting or excessive leakage.

response | Accepted.
The MOC is under revision and will be consulted again during MoC phase 5.

comment | *13* comment by: *Lilium eAircraft GmbH*

Lilium considers that since this MOC is based on CS-25.1438, it is more challenging for eVTOLs, which are closer in design to CS-23/27 aircraft. Furthermore, it only relates to compressed air-based air conditioning systems and may not be a suitable design for eVTOLs and therefore may not be applicable.

Before the draft release of MOC-4, Lilium submitted an alternative means of compliance based on the CS-23 requirements and not limited to compressed air designs. During the EUROCAE meeting held on 18 September 2023, which was related to the discussions of the draft version of MOC-4, Lilium remember it was agreed with all applicants, including EASA experts, that Lilium's proposal seemed more suitable for eVTOLs and this proposal would be reflected in the first issue of MOC-4.
For all the above reasons, Lilium consider that if this MOC could be modified as in the suggested resolution, it would be more appropriate and applicable to the eVTOLs ECS design.

Proposed modifcations consided of:

MOC VTOL.2545 Pressurised System Elements

(a) Pressurisation system elements must be burst pressure tested to 2.0 times, and proof pressure tested to 1·5 times, the maximum normal operating pressure.

(b) Pneumatic system elements must be burst pressure tested to 3.0 times, and proof pressure tested to 1.5 times, the maximum normal operating pressure.

(c) An analysis, or a combination of analysis and test, may be substituted for any test required by subparagraph (a) or (b) if the Agency finds it equivalent to the required test

response | Accepted.
The MOC is under revision and will be consulted again during MoC phase 5.

comment | *112* comment by: *Leonardo Helicopters*

Paragraph: (c) (table)
Comment: To apply Table 1, it is request to have a direct correspondence between probability of occurrence of an over-pressure and the pressure reached inside the duct under examination. Based on our experience it is possible to calculate the probability of occurrence of an over- pressure but it is more complicated to calculate the pressure reached inside the duct following the overpressure failure. Extensive destructive test of pumps/compressor/etc. should be required by the supplier which may not be economically sustainable.

	Resolution: We suggest to add also a more conservative table where the P1 remains constant and the coefficient changes based on the probability to have an over-pressure condition
response	Accepted. The MOC is under revision and will be consulted again during MoC phase 5.