Public Review Comment Matrix

Originating Office:	Document Description:	Project Lead/Reviewer	Reviewing Office:	Date of Review:
AIR-130	TSO-C200a	John C. Barry		

	Commenter	Section # and Page #	Comment	Suggested Change and Rationale	Disposition
1.	Dukane Seacom, Inc	Paragraph 5.d (page 4)	This paragraph indirectly introduces DO-254 requirements by requiring the submittal of a PHAC, Hardware Verification Plan, etc. Typically the FAA does not require use of DO-254 for equipment utilizing complex custom airborne hardware in TSO articles when the failure classification is minor. Below is the FAA's response to this same question during the comment period for TSO-C200. **Not Accepted** – The FAA does not require use of RTCA DO-254 for complex custom airborne electronic hardware in TSO articles when the failure condition classification is minor. Additionally, the FAA does not require a PHAC or documentation of the hardware lifecycle data for the TSO article if the failure condition classification is minor. Thus, paragraphs 3.f., 5.d., and 6.h. are removed when the failure condition classification is defined by the TSO as minor, as it is with TSO-C200.	Remove Paragraph 5.d	**Accepted –** 5.d removed and subsequent paragraphs renumbered.

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2.	Dukane Seacom, Inc	Appendix 1 Page 7	The second paragraph states "…Sections 1.5, 1.6, 1.7, and 2 of RTCA/DO-347…" should be considered when designing cells and batteries. Paragraph 2 of DO-347 specifies all of the qualification requirements for Rechargeable Lithium Batteries. Some of these only apply to rechargeable batteries and/or are different to the qualification tests required in DO-227. It is assumed that "considering" these requirements does not impose additional test requirements on the battery.	Please Clarify this paragraph. It is suggested that it read as follows: "…Sections 1.5, 1.6, and 1.7 of RTCA/DO-347…"	**Not Accepted –**RTCA/DO-347 Section 2 contains useful information for design of the battery but does not impose additional requirements beyond those stated in the appendix to TSO-C200a.
3.	Dukane Seacom, Inc	Appendix 1 Paragraph 2.a Page 8	Paragraph 2.a states to perform 2.3.15.1 step (e) in lieu of steps (c) and (d). Step (e) requires step (b), which states to prepare the EUT with an ignition source inside the battery case. However, paragraph 2.b states to "…*not compromise the integrity of the ULD to instrument or trigger the internal battery…*". From this statement, it is assumed that the ignition source is not required.	Please Clarify this paragraph. It is suggested that the following note be added as follows: Paragraph 2.a: "… case temperature during the runaway. Note: 2.3.15.1 step (b) is not required to complete step (e)."	**Accepted** – Added note.

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4.	Dukane Seacom, Inc	Appendix 1 Paragraph 2.a Page 8	Paragraph 2.a states to perform 2.3.15.1 step (e) in lieu of steps (c) and (d). Paragraph 2.3.15.1 step (f) includes a note that temperatures in excess of 300°C may be required to trigger a thermal runaway. This is a concern because a typical ULD aluminum housing loses >80% of its strength at temperatures above 200°C and >90% above 300°C. An alternate test method is requested so that the external triggering event (excessive heating) does not negatively affect the test article or results. Dukane Seacom has demonstrated that a direct short circuit of a battery cell following minimal pre-charge has been shown to induce a Thermal Runaway in some battery chemistries / configurations. We are requesting that this test method be added to Appendix 1 as an alternate test method.	Please add an alternate method for triggering thermal runaway. It is suggested that Paragraph 2.c be added as follows: 2.c Induce a thermal runaway in a cell closest to the center of the battery by i. connecting the terminals of a single electrically isolated cell to a power supply set to the following: • Constant voltage of at least 1.5 times the rated nominal cell voltage • Current limit of I_1 (or Imax if less than I_1) of a single cell (+/- 50mA) Monitor the battery voltage during charge and terminate the charge when the peak voltage is reached. ii. subject the cell to a direct short circuit of less than 5 mOhm iii. Install the battery into the ULD (and bracket, as necessary) prior to the onset of Thermal Runaway iv. Monitor and record the battery charging voltage and current, the ULD case temperature, the ULD	**Accepted** – Added alternate method to appendix

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				Bracket temperature	
5.	Dukane Seacom, Inc	Appendix 1 Paragraph 3 Page 8	Paragraph 3 states that the ULD must not emit any gases. However, Note 1 states that TAD SC3 does allow for explosive and toxic gases to be uncontained and not vented overboard if they do not accumulate in hazardous quantities. If the ULD does vent during the Thermal Runaway containment test, what criteria will be applied to determine if Note 1 is met. Please clarify the Means of Compliance to Note 1. Dukane Seacom is concerned that unless a method of showing compliance to Note 1 is provided, then a ULD that vents as part of its design would not be able receive TSO-C200a approval	Please add a means of compliance and pass / fail criteria to address Appendix 1, Paragraph 3, Note 1. Reference to applicable FAR's or other Standards should also be included where possible.	**Partially Accepted** – Revised paragraph 3 to allow controlled venting and added requirement to document the nature and volume of any gasses emitted. See also comment 7.
6.	AIRBUS P.Anders	§2 /page 1	There is an issue that should be considered by FAA concerning the Applicability of C200A versus C200. Item §2 of the draft states: "This TSO affects new applications submitted after its effective date. TSO-C200 is no longer effective after the effective date of this TSO, and we will no longer accept applications for TSO-C200."	To solve this issue, AIRBUS proposes not to "cancel" the existing TSO-C200, but change the status to "Active historical" just for the sake of issues of Reciprocal Acceptance between FAA/EASA.	**Not Accepted.** EASA did not address this in their comment, #7 in this table, nor did they object to immediate cancellation when queried in resolving this comment.

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			The European agency EASA issued the ETSO-C200 (12.07.2013), which is technically equivalent to the FAA TSO-C200. ETSO-C200 is being referred as a Means of Compliance with EU-OPS regulation CAT.IDE.A.285(f) “Flight over Water”. AIRBUS and suppliers of LF-ULDs will approach EASA to obtain an ETSO-C200 approval for their type of LF-ULD that complies with mentioned regulation. The European regulation is the only known regulation that implements corresponding ICAO Annex 6 standard (§6.5.3.1(c)), having a 30day LF-ULD. The existing FAA TSO-C200, and the ETSO-C200 cover this ICAO Annex 6 standard. The new TSO-C200A, if published in line with the Draft, will include different requirements of LF-ULDs, compared to those, which are applicable to TSO-C200 and ETSO-C200. AIRBUS recognizes the rationales of introducing these differences (90 day, battery aspects); however, these differences are not needed to obtain compliance with the mentioned EU/EASA regulation and with the ICAO standard. AIRBUS assumes that by principles of Reciprocal Acceptance, the current TSO-C200 and the ETSO-C200 are considered as equivalent standards. By		

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			cancelation of the FAA TSO-C200 an acceptance of EASA approved LF-ULDs (ETSO-C200) seems to be impossible for FAA, or at least be complicated, because FAA "will no longer accept applications for TSO-C200" (as mentioned in draft §2). There is the same issue on the reverse case: EASA would not be able to accept TSO-C200A approved equipment, because EASA didn't issue a corresponding technical standard so far. Generally, Reciprocal Acceptance of approvals for different issues of TSO/ETSO-C200x seems to be impeded.		
7.	Xavier Audouze (EASA)	Appendix 1 section 3. page 8	Appendix 1 Section 3. requires the ULD to contain the gases emitted by the battery sustaining the thermal runaway. The battery is generally occupying most of the ULD internal volume, which leaves little room for the gases to expand. The gases emission will therefore translate in excessive pressures, which: 1. may prove more dangerous than a controlled relief, 2. will result in heavy and voluminous designs, with adverse effect on the intended function as described in the note page 7. In comparison, many PED onboard	It is suggested to remove section 3, or at least to restrict it to batteries less than 100 Wh and to remove the note 1. Rationale: The requirement to contain gases is obviously difficult, if not impossible to meet for small equipment such as ULD where the battery volume is preponderant. The evaluation of the criteria exposed in TAD SC 3 should be left at installation level. As an alternative, the paragraph could also require the insertion of a standard note in the	**Partially Accepted** – Revised paragraph 3 to allow controlled venting and added requirement to document the nature and volume of any gasses emitted. Added a requirement to prevent inadvertent opening of ULDs with failed batteries that may be under internal pressure.

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			aircraft are not required to meet such a stringent requirement. In addition, the note 1 to section 3.0 may be understood as a relief to this requirement. However, the TAD SC3 is only applicable when installing the equipment in an aircraft, and therefore it is unclear how a ULD venting emission gases would be eligible to receive a TSOA.	installation manual addressing the concern of the TAD SC3, along with the inclusion of the data necessary for the installer to assess the compliance (capacity, chemical system, ...).	