

## Comments for TSO C-155b

<b>Comments Submitted By:</b>	Boeing Commercial Airplanes
<b>Organization:</b>	System Safety & Regulatory Affairs
<b>Phone:</b>	425-237-3253

#	Document Name	Page Number	Paragraph Number	Referenced Text	Comment/Rationale or Question	Proposed Resolution	Comment Type (Conceptual, Editorial, or Format)	Disposition/Response to Comment
1	TSO-C155B, Recorder Independent Power Supply (RIPS)	Page 1	Paragraph 3.	<p>The proposed text states:</p> <p>“3. REQUIREMENTS. New models of RIPS identified and manufactured on or after the effective date of this TSO must meet MPS qualification and documentation requirements in European Organization for Civil Aviation Electronics (EUROCAE) document ED-112A, “Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems,” dated September 2013, Chapters 5-2 and 5-3.”</p>	<p>We recommend that the following exception to EUROCAE ED-112A, section 5-3.1, should be added:</p> <p><b>“EUROCAE ED-112A, section 5-3.1, references RTCA DO-160G, paragraph 3.4, ‘Measurement of Air Temperature in the Test Chamber’ for standard test conditions; however, the correct reference is paragraph 3.5, ‘Ambient Conditions.’”</b></p>	<p>EUROCAE ED-112A, section 5-3.1, states:</p> <p>“For the purposes of this chapter, standard test conditions are defined in documents EUROCAE ED-14G / RTCA DO-160G, “Environmental Conditions and Test procedures for Airborne Equipment,” or the revision level as agreed with the certification authority, <a href="#">paragraph 3.4</a>, as:</p> <p>a. Temperature: +15C to +35C                      b. Relative Humidity: Not greater than 85%                      c. Ambient Pressure: 84 to 107kPa”</p> <p>Note that EUROCAE ED-112A, section 5-3.1, references RTCA DO-160G, paragraph 3.4, for standard test condition. However, that paragraph does not relate to standard test conditions, but rather to “measurement of air temperature in the test chamber;” <a href="#">paragraph 3.4</a> does not specify temperature, relative humidity, or ambient pressure. The correct <a href="#">paragraph 3.5 “Ambient Conditions.”</a> should be referenced within RTCA DO-160G to ensure that standard test conditions for temperature, relative humidity, and ambient pressure are used for testing. For the sake of</p>	Editorial	Accepted. Note added to change reference to correct DO160G paragraph.

2	TSO-C155B, Recorder Independent Power Supply (RIPS)	Page 1	Paragraph 3.	The proposed text states:  “3. REQUIREMENTS. New models of RIPS identified and manufactured on or after the effective date of this TSO must meet MPS qualification and documentation requirements in European Organization for Civil Aviation Electronics (EUROCAE) document ED-112A, “Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems,” dated September 2013, Chapters 5-2 and 5-3.”	We recommend that an exception to EUROCAE ED-112A, section 5-3.2 should be added to read as follows:  “ <b>EUROCAE ED-112A, section 5-3.2, note does not apply.</b> ”	EUROCAE ED-112A, section 5-3.2, “RIPS Minimum Performance Levels,” contains a Note that states:  "NOTE: Where these paragraphs state requirements regarding the signal in the recording medium, it should be interpreted as that observed at the output of the data retrieval equipment specified by the equipment manufacturer."  This Note, which is identical to that in sections II-3.2, III-3.2, IV-3.2 relating to flight data, image, or cockpit voice recorder minimum performance levels, does not apply to a RIPS, which does not record data and so has no recording medium.	Editorial	Acknowledged. No change necessary as the note as written is self explanatory and does not apply if signals are not recorded. Suggest commentor forward to EUROCAE for consideration of deleting the note in the next revision of the standard.
3	TSO-C155B, Recorder Independent Power Supply (RIPS)	Page 1	Paragraph 3.	The proposed text states:  “3. REQUIREMENTS. New models of RIPS identified and manufactured on or after the effective date of this TSO must meet MPS qualification and documentation requirements in European Organization for Civil Aviation Electronics (EUROCAE) document ED-112A, “Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems,” dated September 2013, Chapters 5-2 and 5-3.”	We recommend that this sentence be revised as follows:  “3. REQUIREMENTS. New models of RIPS identified and manufactured on or after the effective date of this TSO must meet MPS qualification and documentation requirements in European Organization for Civil Aviation Electronics (EUROCAE) document ED-112A, “Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems,” dated September 2013, Chapters 5-2, <b>and</b> 5-3, <b>5-4, and 5-5.</b> ”	The first sentence of the proposed text suggests that only Chapters 5-2 and 5-3 of EUROCAE ED-112A are applicable, but Chapters 5-4 and 5-5 are referenced later in the same paragraph (3.d and 3.c, respectively). For clarity, we suggest that all relevant ED-112A chapters to be listed in the first sentence.	Editorial	Accepted. Additional paragraph references added.

Comments Submitted By: Jeff Densmore

Organization:

Radiant Power Corporation

Phone:

941-893-6810

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1	TSO-C155b	13	<p>New models of RIPS identified and manufactured on or after the effective date of this TSO must meet MPS qualification and documentation requirements in European Organization for Civil Aviation Electronics (EUROCAE) document ED-112A, "Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems," dated September 2013, Chapters 5-2 and 5-3.</p>	<p>5-2.2 of ED-112A states the following:</p> <p>The RIPS shall be equipped with built-in test equipment (BITE) to determine the state of readiness of the RIPS to perform its function. The RIPS shall detect and report <b>any</b> internal failures, if maintenance is required, and of <b>any</b> conditions affecting the ability of the RIPS to perform its intended function.</p> <p>The use of the word "any" twice in the paragraph above imposes a 100% effective BITE circuitry. This is not a realistic requirement as all BITE functionality has some uncertainty.</p>	<p>There are two possible options for address this:</p> <p><b>Option 1</b> - Remove the Reference to Chapter 5-2 in the TSO as there are no unique requirements in this chapter other than the BITE requirement....</p> <p>New models of RIPS identified and manufactured on or after the effective date of this TSO must meet MPS qualification and documentation requirements in European Organization for Civil Aviation Electronics (EUROCAE) document ED-112A, "Minimum Operational Performance Specification for Crash Protected Airborne Recorder Systems," dated September 2013, Chapters <del>5-2 and</del> 5-3.</p> <p><b>Option 2 (preferred)</b> - Add a clarifying Note in the TSO indicating that BITE effectiveness should comply with 5-2.2 "to the maximum extent possible"</p> <p>... dated September 2013, Chapters 5-2 and 5-3.</p> <p><b>Note: The RIPS Built In Test Equipment (BITE) shall be designed to comply with ED-112A, Paragraph 5-2.2 to the maximum extent possible</b></p>	Conceptual	Accepted with changes. Added an exception to ED112A that replaces the word "any" with "critical" before failures and defines "critical failures". This change eliminates an unacheivable 100% failure detection requirement for any failure, while requiring the detection of failures that cause loss of function.
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Comments Submitted By Clayton Vondrasek

Organization: Garmin International

Phone: 913-440-5019

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1	TSO-C155b	Page 1	Paragraph 2.a	<p>Paragraph 2.a states:</p> <p>TSO-C155a will remain effective until {18 months after the effective date of this TSO}. After this date, we will no longer accept applications for TSO-C155a.</p>	<p>Section 2.a allows only 18 months after the publication date of this new TSO revision for all products in development against the previous revision to be completed and receive approval against the previous revision.</p> <p>18 months is a relatively short grace period for products where development cycles can easily</p>	<p>Products being developed against the previous TSO revision should be allowed 24 months from the new TSO revision release to finish all qualification and approvals against the previous TSO revision the product was designed and developed against. Garmin appreciates the recent TSO template change to allow 18 months over the previous 6 months, but we believe 24 months is more in line with industry standard development cycles of 2 to 3 years.</p>	Conceptual	<p>Not Accepted. FAA and EASA added the 18 month period based on a statistical analysis of the time period that allow applicants to finish designing an article for the previous version when a TSO is revised.</p>
2	TSO-C155b	Page 1	Paragraph 3.b.(1) and (2)	<p>Paragraph 3.b.(1) states:</p> <p>Failure of the function defined in paragraph 3.a is a minor failure condition.</p> <p>Paragraph 3.b.(2) states:</p> <p>Loss of the function defined in paragraph 3.a is a minor failure condition.</p>	<p>These two statements are confusing when combined. In some cases, "failure" as stated in 3.b.(1) is equivalent to "loss" of the function. In many cases, it is a superset of "loss" and "malfunction." In either case, including these two statements is redundant at some level.</p>	<p>Suggest clarifying 3.b.(1) to be a "malfunction" instead of "failure" or removing 3.b.(2) as 3.b.(1) covers all failure modes of the function defined in section 3.a.</p> <p>Note: This comment is superseded by comment #3 below but is applicable if comment #3 is not accepted.</p>	Editorial	<p>Not Accepted. The term "malfunction of the function" was considered and it was decided that "failure of the function" was more appropriate. In this situation, a failure of the function is where the function is still working, but it fails to function as intended and could be providing misleading information. Loss of the function means that the function isn't working at all.</p>
				<p>Paragraph. 3.b.(3) includes the statement:</p>	<p>Wording needs to change to allow failure condition to be determined at the aircraft level.</p>			

3	TSO-C155b	Page 1	Paragraph 3.b.(3)	Design the system to at least these failure condition classifications.	<p>This statement implies the failure condition classification of an appliance is determined by the TSO regardless of mitigations employed to meet aircraft level safety requirements such as redundant appliances/systems. Unless the DAL cannot be affected by the installation, the aircraft System Safety Assessment should determine the failure classification and by extension, the design assurance level (DAL) requirement. The aircraft FHA/SSA ultimately determines the DAL requirement for a particular installation. Specifying the DAL at the appliance level without the benefit of the specific aircraft level FHA/SSA means that in some cases the DAL will undoubtedly be higher and more costly than necessary. This will have a chilling effect on the installation of new, safety enhancing technologies since the cost will be greater than necessary. It is possible to build and certify a TSOA appliance that cannot be approved for installation in one or more aircraft types because it does not have the required DAL. Similarly, just because the appliance meets a TSO DAL does not mean it can be approved for installation. We recommend that no failure classification/DAL requirement be included in a TSO when the installation can affect or mitigate the hazard level and therefore consideration should be given to revising paragraph 3.c in this TSO to the general guidance in the Recommendation column.</p>	Suggest changing to the alternate wording identified in paragraph 3.b. of the TSO Template in Order 8150.1C Appendix G.	Conceptual	Not Accepted. This TSO device is designed to provide backup power to either a Cockpit Voice Recorder or Flight Data Recorder or both. Loss of function on both kinds of recorders is a minor failure condition. Therefore, loss of function of the power supply is also a minor failure condition.
4	TSO-C155b	Page 2	Paragraph 3.e.	Paragraph 3.e. discusses Software Qualification data	Similar requirements for RTCA/DO-254 life cycle data are expected as identified in the TSO Template in Order 8150.1C Appendix G.	Add new paragraph from paragraph 3.f. of the TSO Template in Order 8150.1C Appendix G.	Editorial	Not Accepted. Previous versions of this TSO do not impose the burden of DO254 compliance. Nothing prevents an applicant from using DO254 over and above the requirements of this TSO should they choose to implement that process for a level D design assurance.

5	TSO-C155b	Page 2	Paragraph 4.b.(2)	Paragraph 4.b.(2) states:	This language is confusing.	The language for this requirement is confusing. This could mean that a stuffed printed circuit board needs the TSO number.	Editorial	Not Accepted. The wording means that you can remove the card without tools. This requirement will also be reviewed during the next revision to Order 8150.1 to determine if this requirement is still needed.
6	TSO-C155b	Page 4	Paragraph 5.c	Paragraph 5.c. discusses Software deliverable data	Similar requirements for RTCA/DO-254 life cycle data are expected as identified in the TSO Template in Order 8150.1C Appendix G.	Add new paragraph from paragraph 5.d. of the TSO Template in Order 8150.1C Appendix G.	Editorial	Not Accepted. Previous versions of this TSO do not impose the burden of DO254 compliance. Nothing prevents an applicant from using DO254 over and above the requirements of this TSO should they choose to implement that process for a level D design assurance.
7	TSO-C155b	Page 4	Paragraph 5.e	TSO paragraph 5.e and its subparagraphs include definition of non-TSO functions and the data to be submitted to the ACO for non-TSO functions.	This guidance is inconsistent with Order 8110.4C CHG 5.	TSO paragraph 5.e states "Identify functionality or performance contained in the article not evaluated under paragraph 3 of this TSO (that is, non-TSO functions)" Use of the term "performance" in the definition of a non-TSO function is inconsistent with the Order 8110.4C CHG 5 paragraph 6-9.b.(1) and 6-9.b.(3)(a) guidance regarding how to define a non-TSO function. The issue is non-TSO should not be defined as "performance". It will create difficulty if these criteria are used. For example, if a TSO requires a minimum 10 watt transmitter and a company makes equipment that is robust at 11 watts, the performance exceeding the TSO is not called out under the TSO; consequently, by the paragraph 5.f "performance" definition, the 11 watt transmitter has a non-TSO 1 watt capability. The distinction of a "function that can be accomplished outside the TSO box" as is specified in Order 8110.4C CHG 5 paragraph 6-9 is critical to making non-TSO function work long term.  Adjust the wording in the TSO (and template) to be consistent with the 8110.4C CHG 5 intent.	Conceptual	Not Accepted. Exceeding the minimum performance standard for a defined TSO function is not a "Non-TSO Function." As long a performance meets or exceeds the MPS, the device is performing its intended function, robustness is a competitive selling point as long as it does not exceed any specified maximum values.

8	TSO-C155b	Page 5	Paragraph 6.g.	<p>Paragraph 6.g. states:</p> <p>If the article includes software, the appropriate documentation defined in the version of RTCA/DO 178 specified by paragraph 3.e of this TSO, including all data supporting the applicable objectives in Annex A, Process Objectives and Outputs by Software Level.</p>	<p>Similar requirements for RTCA/DO-254 life cycle data are expected as identified in the TSO Template in Order 8150.1C Appendix G.</p>	<p>Add new paragraph from paragraph 6.h. of the TSO Template in Order 8150.1C Appendix G.</p>	<p>Editorial</p>	<p>Not Accepted. Previous versions of this TSO do not impose the burden of DO254 compliance. Nothing prevents an applicant from using DO254 over and above the requirements of this TSO should they choose to implement that process for a level D design assurance.</p>
9	TSO-C155b	Page 5	Paragraph 7.b	<p>Paragraph 7.b states:</p> <p>If the article contains declared non-TSO function(s), include one copy of the data in paragraphs 5.e.(1) through 5.e.(4).</p>	<p>TSO paragraph 7.b contains wording that is inconsistent with Order 8110.4C CHG 5.</p>	<p>TSO paragraph 7.b includes additional guidance about what furnished data should be provided to an operator or repair station when the equipment includes a non-TSO function. The problematic guidance states “include one copy of the data in paragraphs 5.f.(1) through 5.f.(4).” This guidance is inconsistent with Order 8110.4C CHG 5. Order 8110.4C CHG 5 paragraph 6-9.b.(6) defines the FAA-industry agreed data that must be provided to an installer when equipment includes a non-TSO function.</p> <p>Adjust the wording in the TSO (and template) to be consistent with the 8110.4C CHG 5 intent.</p>	<p>Conceptual</p>	<p>Not Accepted. The TSO template requires that this data be provided so that installers know what the non-TSO functions do and how to properly address installation requirements/limitations. This comment doesn't identify what part of the paragraph 5.f. requirements the commenter takes exception to. The wording between 8150.1 and 8110.4 will be reviewed during the next revision to 8150.1.</p>