

**Clearance Record
DOCUMENT COMMENT LOG**

Originating Office: AIR-130	Document Description: TSO-C119d	Project Lead: Steve Plummer, 650-756-0227 x166	Reviewing Office: AIR-130	Date of Review: 9/16/13
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Index Number	Name of Reviewer	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
1	MIT Lincoln Laboratory	<p>I'm not sure what should be done –possibilities are: 1. an errata sheet issued for DO-185B. 2. a test added to the TSO to supplement the current DO-185B. 3. test changes listed in the TSO. 4. other??</p>	<p>There is a test in the latest DO-185B that would benefit by some clarifying words, i.e., more specificity. The test is in Volume One, section 2.4.2.2.4.1, Scenario A, 2nd half (for DO-185A and later versions). It checks the contents of the RA Report that is downlinked to Mode S ground stations when the TCAS aircraft has issued an RA. (See problem description in next column.) Currently the test asks the manufacturer/applicant to check the contents for “TIDA=alt, TIDR=rng, and TIDB=brg.” I would like to replace the words alt, rng, and brg with the exact bits that should be in the message. I think this test, as is, is not catching problems in the unit under test.</p>	<p>In the TCAS monitoring, we see many aircraft that report faulty information in the RA Reports downlinked to Mode S ground stations. Specifically, if an ATCRBS intruder is causing the TCAS RA, the TCAS aircraft is supposed to identify the intruder by including intruder altitude, range, and bearing in the RA Report. The altitude and bearing fields often contain incorrect information. It is important to correct this information because this same information (same transponder register) is used for the ADS-B TCAS RA Broadcast Message (DO-260B – 1090ES MOPS), which is being considered for future use in air-to-air coordination and thus needs a high degree of reliability.</p> <p>With the TSO open for comment, it seemed important to try to fix this problem.</p>	<p>Implement one of the options given in the second column – or something else that would accomplish the purpose of better catching these errors.</p>	<p>Accepted. Accepted but action will be deferred until the DO-185B MOPS is open for revision. The commenter will be requested to submit a change request to the TCAS committee at RTCA, SC-147.</p>

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2	L3-ACSS	3.d	<p>There appear to be some typographical omissions in this paragraph in which referenced dates are omitted:</p> <p>Demonstrate the required performance under the test conditions in RTCA/DO-185B, Section 2 as modified by Change 1 dated and Change 2 thereto and RTCA/DO-300A, Section 2.</p>	<p>Be consistent with similar language used in the paragraph in Section 3:</p> <p>New models of TCAS II identified and manufactured on or after the effective date of this TSO must meet the MPS qualification and documentation requirements in these RTCA, Inc. documents: RTCA/DO-185B, <i>Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II)</i>, dated June 19, 2008, Section 2 as modified by Change 1 dated Jul 1, 2009 and Change 2 Mar 20, 2013 thereto and RTCA/DO-300A, <i>Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance</i>, dated Mar 20, 2013.</p>	<p>Recommend modifying paragraph 3.d. to state the following:</p> <p>Demonstrate the required performance under the test conditions in RTCA/DO-185B, Section 2 as modified by Change 1 dated Jul 1, 2009 and Change 2 Mar 20, 2013 thereto and RTCA/DO-300A, Section 2, dated Mar 20, 2013.</p>	<p>Partially accepted. The extraneous word “dated” has been removed.</p>

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3	L3-ACSS	3.e	<p>ACSS suggests that rather than stating: ‘Test the equipment according to RTCA/DO-160G, <i>Environmental Conditions and Test Procedures for Airborne Equipment</i>, dated Dec 12, 2010’</p> <p>that the following words be used:</p> <p>The use of RTCA/DO-160D, <i>Environmental Conditions and Test Conditions for Airborne Equipment</i>, dated July 29, 1997, (with Changes 1 and 2 only, incorporated) or earlier versions is generally not considered appropriate and will require substantiation via the deviation process as discussed in paragraph 3.g of the TSO.’</p>	<p>Many of the TCAS units that will be updated to comply with DO-160D will be based upon updates of existing TCAS units that were originally environmentally qualified to early versions of DO-160.</p> <p>In alignment with AC 21-16 , RTCA Document DO-160 versions D, E, F, and G, “Environmental Conditions and Test Procedures for Airborne Equipment, where it is provide that:</p> <p>‘The FAA has determined that versions D, E, F, and G provide an equivalent level of safety (ELOS) when the applicable version is identified in the Environmental Qualification Form (EQF). If the installed electrical/electronic equipment must meet lightning requirements use RTCA/DO-160D or later per the latest revision of AC 20-136. However, if the installed equipment is expected to be subject to HIRF requirements.</p> <p>This will reduce the number of required deviations as applicants seek to use prior versions of DO-160</p>	<p>Modify section 3.e as described in the comment field.</p>	<p>Partially accepted. The recommendation is not directly adopted but the language in section 3.e has been revised to match the TSO template which accomplishes the same intent.</p>

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4	L3-ACSS	N/A	DO-300A MOPS error in Section 2.2.7.5 Revalidation. When own aircraft is operating on the surface, the current logic does not allow for revalidation when the intruder meets both the altitude and range criteria for the active surveillance region (which no longer applies on the surface).	When own aircraft is operating on the surface, revalidation should always be permitted (including when the intruder is close in the active surveillance region).	<p>Add an Appendix for “FAA Modifications to RTCA/DO-300A” to fix Section 2.2.7.5 Revalidation.</p> <p>2nd shall: Remove, “but not the second (range) condition”.</p> <p>Table 2, last note: modify as follows, “A = When own aircraft is taking off or airborne, all of the range and range rate combinations in that cell satisfy the conditions for transitioning to active interrogations, and therefore that cell should never be accessed to determine the safe interval until the next revalidation. When own aircraft is operating on the surface, all of the range and range rate combinations in that cell can be accessed because the active surveillance region for transitioning to active surveillance does not apply; in these combinations, A = 10.”</p>	<p>Related to #21 =====</p> <p>Accepted. Several comments were submitted against the same section(s) of RTCA/DO-185B Change 2 and/or RTCA-DO-300A. Because of the similarity between certain subsets of those comments, the surveillance working group (SWG) of the RTCA special committee 147 (SC-147) was requested to review them and submit suggested dispositions. The disposition recommended by the SWG for #4 and #21 is as follows:</p> <p>“Add an Appendix for “FAA Modifications to RTCA/DO-300A” to fix Section 2.2.7.5 Revalidation.</p> <p>Insert the following text after the first semicolon in the 2nd sentence of 2.2.7.5</p> <p>if it satisfies the first and second (altitude and range) conditions of 2.2.6.1.4 but not the third (airborne) condition, it shall be subject to revalidation every 10th surveillance update interval;</p> <p>Additionally the tests identified [in Appendix 1 of this comment matrix] need to be performed in addition to the tests in DO-300A.”</p> <p>Their recommendations dispositioning #4 and #21 have been adopted.</p>

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5	L3-ACSS	N/A	DO-300A MOPS error in Section 2.2.11 Interface to CAS Logic. Remove 1 st paragraph/shall requiring to distinguish a position report that resulted from a passive reception.	There are no other requirements for what the CAS logic is to use this information for. The requirements in the next paragraph is sufficient to prevent CAS from initiating a TCAS alert on a passive track without the need of this additional passive status. Also prefer to minimize any interace or logic changes in CAS unless absolutely required.	Add an Appendix for “FAA Modifications to RTCA/DO-300A” to fix Section 2.2.11Interface to CAS Logic. Remove 1 st paragraph/shall requirement.	<p>Related to #22.</p> <hr/> <p>Accepted. Several comments were submitted against the same section(s) of RTCA/DO-185B Change 2 and/or RTCA/DO-300A. Because of the similarity between certain subsets of those comments, the surveillance working group (SWG) of the RTCA special committee 147 (SC-147) was requested to review them and submit suggested dispositions. The disposition recommended by the SWG for #5 and #22 is as follows:</p> <p>“Add an Appendix for “FAA Modifications to RTCA/DO-300A” to fix Section 2.2.11Interface to CAS Logic.</p> <p>Remove 1st paragraph/shall requirement.”</p> <p>Their recommendations for dispositioning #5 and # 22 have been adopted.</p>

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6	L3-ACSS	N/A	<p>Allowing for larger range calculation errors above +/-60 degrees latitude was removed from DO-300A Section 2.2.7.6. Previously, this allowed manufactures to use less stressful range approximation calculations near the poles. The test section needs to be updated to remove any constraints around 60 degrees. Also the approximation equations defined in Appendix A should be removed.</p>	<p>Based on this change, the test and Appendix in DO-300A was not updated accordingly.</p>	<p>Add an Appendix for “FAA Modifications to RTCA/DO-300A” to fix the following Sections.</p> <p>2.4.2.8 Verficiation of Error Budget in Computing Slant Range from Passive Data: In second paragraph, remove, “(near 60 degrees)”.</p> <p>2.4.2.10 Verification of DF17 Decoding: In the Success Criteria section, remove, “with Latitudes within +/-60 degrees”.</p> <p>Appendix A: Remove all discussion of approximate conversion equations and the equation in A.2 should be described as an acceptable example that meets the performance requirements.</p>	<p>Related to #20.</p> <hr/> <p>Accepted. Several comments were submitted against the same section(s) of RTCA/DO-185B Change 2 and/or RTCA/DO-300A. Because of the similarity between certain subsets of those comments, the surveillance working group (SWG) of the RTCA special committee 147 (SC-147) was requested to review them and submit suggested dispositions. The disposition recommended by the SWG for #6 and #20 is as follows:</p> <p>“Add an Appendix for “FAA Modifications to RTCA/DO-300A” with the following text.</p> <p>Modify the following tests as given below.</p> <p>2.4.2.8 Verficiation of Error Budget in Computing Slant Range from Passive Data: In second paragraph, remove, “(near 60 degrees)”.</p> <p>2.4.2.10 Verification of DF17 Decoding: In the Success Criteria section, remove, “with Latitudes within +/-60 degrees”.</p> <p>Appendix A should be read with the following understanding.</p> <p>The equations in A.2 provide an example of conversion equations which meet the accuracy requirements. The approximation equations provided in the appendix may not provide the required accuracy.”</p> <p>Their recommendations for dispositioning #6 and #20 have been adopted.</p>

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7	L3-ACSS	N/A	DO-185B Change 2 seems to be unclear on what to do with the +/- 3,000 feet altitude limit for ATCRBS and ADS-B passive tracks when own-ship is on-ground. Section (1.1) 1 st paragraph and the modified requirements seem to imply that only the Mode S surveillance volume is limited to +/-3000 feet when operating on the ground, but the note in Section 2.2.2 seems to imply that Mode C aircraft are also included.	I understand that the intent was to limit the Mode S interrogations when on-ground but it may also be important to also apply the 3000 feet altitude limit to ATCRBS and ADS-B passive tracks to have a consistent display of intruders.	Add an Appendix for “FAA Modifications to RTCA/DO-185B Change 2” to clarify the 3,000 feet altitude limit for ATCRBS and ADS-B passive tracks when own-ship is on-ground. ACSS recommends allowing manufacturers to also apply the +/-3000 feet altitude limit for ATCRBS and ADS-B passive tracks when own-ship is on-ground.	<p>Accepted. Several comments were submitted against the same section(s) of RTCA/DO-185B Change 2 and/or RTCA/DO-300A. Because of the similarity between certain subsets of those comments, the surveillance working group (SWG) of the RTCA special committee 147 (SC-147) was requested to review them and submit suggested dispositions. The disposition recommended by the SWG for #7 is as follows:</p> <p>“Add an Appendix for “FAA Modifications to RTCA/DO-185B Change 2” which includes the following statement with a reference to the appropriate section in the change 2 document.</p> <p>It is acceptable to limit the output of all TCAS intruders to the display to those with an altitude less than or equal to 3000 feet of own altitude when own aircraft is on the ground. This is permitted (but not required) so that the altitude surveillance volume for TCAS Mode C intruders can be consistent with the Mode S surveillance altitude limits modified in RTCA/DO-185B Change 2 (section 2.2.4.6.2.2.1). This allowance to limit the display to +/- 3000 feet does not modify surveillance altitude volumes which are defined in RTCA/DO-185B 2.2.4.6.</p> <p>The system shall use the definition of on-ground as defined in RTCA/DO-185B Volume II 2.1.14. Alternatively, the system may use the definition of “operating on Surface” in RTCA/DO-300A section 2.2.8 for on-ground.”</p> <p>Their recommendation for dispositioning #7 has been adopted.</p>

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8	AIRBUS	p2 §4.d	This section is consistent with intent of the field loadable software technology deployed on Airbus aircraft, but the last requirement <i>“If electronic marking is used, it must be readily accessible <u>without the use of special tools</u> or equipment.”</i> focuses on a design solution. But the design could be different.	The possibility to use a special tool (SIS reader) allowing to read equipment marking as well as loaded software ident on un-powered equipment (even if not installed on aircraft) and the consultation through cockpit means are expected to answer to the requirement on access to the electronic marking requirement.	Airbus proposes to remove this last sentence.	Not accepted. The language in this section is dictated by the TSO template in FAA Order 8150.1C CHG 1 dated 5/10/12.
9	AIRBUS	p1 §2.a	<i>“Generally we will not accept applications after the effective date of this TSO. However, we may do so up to six months after it, if we know that you were working against the earlier MPS before the new change became effective.”</i> Historically, TSOs are used to allow a six month period to apply for an earlier version. The six months period is no more adapted to existing equipment complexity and associated development duration.	Compared to previous standalone equipment, the complexity of new systems such as AESS increases, integrating more and more functions. Complex equipment requires a significant lead time in order to : <ul style="list-style-type: none"> - develop the specification taking into account all applicable TSOs and certification material, - develop the equipment and associated documentation, - and finally submit the dossier to the FAA for TSO approval. In a general way on avionics, the complex equipment with longer development duration will have difficulties to integrate new revision of TSO while developing. Currently, Airbus already work on the integration of new AESS platform to be certified next year that took into account TSO-C119c requirements. The six month period to submit for TSO-C119c is considered at risk.	Airbus proposes to extend in TSOs the 6 months period allowing to apply for an earlier TSO version in order to match with the lead time to develop complex equipment and associated documentation.	Accepted. The 6 month period will be changed in the TSO template to 18 months. That change has been reflected in the TSO-C119d document and it will be reposted to RGL.
10	Honeywell	General	Honeywell believes this TSO should not be released until hybrid surveillance has been validated via the SESAR project 9.47 validation activities – which include field testing.	DO-300A has gone through the RTCA and EUROCAE review process, but Honeywell believes that flight testing is warranted before establishing this standard to insure that it safely achieves its 1090 MHz reducing objectives. Several comments listed below indicate that additional validation is warranted.	Delay the release of TSO-C119d until positive results are achieved via the SESAR validation efforts or make the implementation optional until successful SESAR 9.47 validation efforts are completed. SESAR Project 9.47 validation activities related to DO-300A Hybrid Surveillance are expected to be completed in 2014	Not accepted. If the standard were immature, RTCA would not have published it.

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11	Honeywell	All pages, header	Editorial. Change "TSO C-119d" to "TSO-C119d"	it is wrong as currently written	see comment.	Accepted.
12	Honeywell	Page 1, para. 2(a)	The six month window for accepting previous revisions of the TSO is too short of a time frame for manufacturers who have products already in development and targeted for certification in late 2014/early 2015.	This new TSO revision does not address specific safety issues associated with its MPS to warrant immediate compliance to the new TSO for major TSO changes to existing products.	Increase the compliance window from six months to eighteen months to allow manufacturers enough time to incorporate these changes into their products without impacting current commitments.	Accepted. The 6 month period will be changed in the TSO template to 18 months. That change has been reflected in the TSO-C119d document and it will be reposted to RGL.
13	Honeywell	Page 1, para. 3(a)	Change the word "displaying" to "conveying"	The word "displaying" may lead to interpretations that a display must be on the TCAS unit.	See comment.	Partially accepted. The word "displaying" has been replaced with "presenting."
14	Honeywell	Page 2, para. 3(c)	The statement implies that the design assurance levels for all functions within the TCAS II correspond to Level B.	Architectural, hardware, and software partitioning allows functions that do not contribute to failure conditions with a higher criticality to be developed to a lower design assurance level.	"Failure of the function defined in paragraph 3b of this TSO which can contribute to a misleading or incorrect resolution advisory is a hazardous/sever-major failure condition. Develop the TCAS II to at least the design assurance level equal to this failure condition."	Not accepted. The commenter misinterprets the failure condition classification. It is for the collision avoidance function in totality, not individual subfunctions. Recommendation not adopted.
15	Honeywell	p.2, 3.d	Editorial. Remove the superfluous word "dated"	It is not needed	See comment	Accepted.

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16	Honeywell	Page 4, para. 5(g)	This section duplicates the data requirements in 5(b). Deviations do not need to be included in the CMM. This information is already provided in a Manual described in 5(a)(2).	The data requirement in Order 8150.1c includes the statement in 5(b). Paragraph 5(g) is not needed.	Remove paragraph 5(g).	Accepted.
17	Honeywell	Page 4, para. 5(f)	This section duplicates the data requirements in 5(a)(7)	Leaving the duplicated requirements in place creates confusion and an opportunity for misinterpreted or conflicting TSO data submittal requirements.	Remove paragraph 5(f)	Accepted.
18	Honeywell	Page 5, para. 5(p)	This section duplicates the data requirements in 5(a)(4)(a)	Leaving the duplicated requirements in place creates confusion and an opportunity for misinterpreted or conflicting TSO data submittal requirements.	Remove paragraph 5(p)	Accepted.
19	Honeywell	Page 5, para. 5(q)	This section duplicates the data requirements in 5(n)	Leaving the duplicated requirements in place creates confusion and an opportunity for misinterpreted or conflicting TSO data submittal requirements.	Remove paragraph 5(q)	Accepted.
20	Honeywell	Page 1, para. 3	RTCA/DO-300A test 2.4.2.10 should be modified to match the changed requirement. This can be done by removing the two instances of the phrase “with Latitudes within +/- 60 degrees” from the test.	The requirement in 2.2.7.6 was modified in the latest version of DO-300A to require accurate passive range computation at all latitudes and not just within +/- 60 degrees. Not changing the test could result in certification of systems which would not accurately compute range when a traffic is in Extended Hybrid Surveillance.	Document the updated test requirement in the TSO.	Refer to #6 for disposition.

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21	Honeywell	Page 1, para. 3	<p>A “gap” in RTCA/DO-300A section 2.2.7.5 should be corrected in the TSO or in a correction to the MOPS. This section of the requirements does not correctly address the condition when:</p> <ul style="list-style-type: none"> - own ship is operating on the surface per RTCA/DO-300A 2.2.8 <p>and</p> <ul style="list-style-type: none"> - The intruder does not qualify for extended hybrid surveillance based on reported quality but does qualify for hybrid surveillance 	<p>The following sentence and specifically the bolded portion from section 2.2.7.5 as written only correctly applies when own aircraft is airborne:</p> <p>“If a track under hybrid surveillance does not satisfy the first (altitude) condition of 2.2.6.1.4, it shall be subject to revalidation every 60th surveillance update interval; if it satisfies the first condition of 2.2.6.1.4 but not the second (range) condition, it shall be subject to revalidation at intervals calculated according to the following procedure.</p> <p>So in this case where own ship is on the ground and a hybrid track satisfies both the altitude condition and the range condition then the intruder is never re-validated. This was not the intent of the MOPS.</p>	<p>Document in the TSO or in update to DO-300A a specific requirement for the revalidation rate for the requirement gap identified. Specifically the new requirement should be as follows.</p> <p>1 – delete the phrase “but not the second (range) condition”.</p> <p>2 – Add a sentence to the last note following Table 2 stating. When own is operating on the surface per 2.2.8 then A in the table represents 10 seconds.</p> <p>If validating traffic (that qualify for hybrid surveillance but not extended hybrid surveillance) using the same criteria as when airborne is considered too excessive then the equation in section 2.2.7.5 of RTCA/DO-300A should be specifically modified for on ground operations.</p> <p>The FAA may consider requesting that the RTCA/SC147 SWG membership review the final decision or ask the SWG to provide input.</p>	Refer to #4 for disposition.

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22	Honeywell	Page 1, para. 3	In RTCA/DO-300A section 2.2.11. The third “shall” satisfies the “first” shall. The way the first shall is written – it implies that this is not the case.	Section 2.2.11 states ...”information shall be provided in addition to that required in Ref A, 2.2.4.8.1(a) to distinguish a position report that resulted from passive reception of an Airborne Position Message from one that resulted from an active interrogation.” This shall is satisfied by the 3 rd shall in this section that requires “Surveillance_Mode input to the Other_Aircraft state” to be set to reduced for passive tracked aircraft.	Change the first “shall be” to “is”.	Refer to #5 for disposition.
23	Honeywell	Page 1, para. 3	Please clarify RTCA/DO-185B 2.2.3.10.4.2.1. RTCA/DO-185B 2.2.3.10.4.2.1 requires that the TCAS provide the transponder hardware and software part number information. The requirement as written is ambiguous and does not necessarily insure that the intended function will be performed.	<p>The requirement mentions a “software part number enable discrete”.</p> <p>The phase “<i>software part number enable</i>” <i>discrete input</i> is not defined in the MOPS, so the source of the data is left to the avionics system developer to define; the MOPS provides no guidance on what the enable state is, nor how it is set/cleared, so these also are left to the avionics developer to define.</p> <p>ARINC 735B defines a mechanism by which the software part number information can be transmitted to the displays. This mechanism is activated by grounding pin RBP 6D (Software P/N Enable Disc Input). However there is no mention in ARINC 735B that this pin should be used to send the part number information to the transponder, only to the displays.</p> <p>Additionally, for the function to perform as intended – the software part number must be transmitted periodically or else the transponder will clear out the information.</p>	<p>Provide clarification in the TSO – that the requirements of this section are optional or if they are required then</p> <ol style="list-style-type: none"> 1. The transmission of the function can be enabled via a program pin or by design. 2. 	<p>7/10/13; E-mail exchange with Honeywell reveals that the number 2 in the “Recommendation” cell is a typo and should not be present. They only submitted one recommendation.</p> <hr/> <p>Not accepted. The recommendation proposed by the commenter is outside the scope of the TSO. The commenter should pursue resolution through ARINC which is the standards setting organization for the interface characteristic (ARINC 735). The recommendation is not adopted.</p>

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24	Garmin	Page 1, par 3.a.	<p>This comment is related to the comment provided for Paragraph 5.c.</p> <p>The requirement to display logged hybrid surveillance faults is ambiguous and should be removed or modified to allow alternative methods to meet the intent implied by the note.</p>	<p>The requirement of TSO paragraph 3.a is ambiguous and has implications for existing TCAS II installations that are probably not intended by the authors.</p> <p>The requirement states, “TCAS II units must provide a means for displaying logged hybrid surveillance faults to maintenance personnel to enable on-wing monitoring of hybrid surveillance functionality at periodic intervals.” The requirement contains multiple terms and phrases that are not defined in this TSO, nor in the RTCA/DO-300A or RTCA/DO-185B MOPS. First, logging of “hybrid surveillance faults” is not supported by any description of what should be logged nor the capacity of such a log.</p> <p>The method of displaying such faults is also ambiguous. While TCAS II contains requirements for display, that function is most often provided by an appliance separate from the TCAS II processor that performs hybrid surveillance. Is the intent of the requirement to require one of the TCAS II components to provide a visual display of such faults? Some older TCAS II Traffic and RA displays may be incapable of presenting text adequate to display logged faults. Is it the intent of the TSO that such displays be replaced with ones capable of displaying a log?</p> <p>The note in TSO paragraph 3.a seems to give a clue as to the intent of the requirement which is to provide a means for the system to indicate whether hybrid surveillance is functional in a given installation. The requirement in itself is unnecessarily prescriptive and other means should be allowed to meet the intent.</p>	<p>This commenter assumes that the intent of the requirement is to provide a means to determine whether hybrid surveillance will be functional in a given installation under normal operating conditions. If the assumption about intent is correct, the requirement should be restated as, “TCAS II units must provide a means to determine whether hybrid surveillance is functional in a given installation under normal operating conditions.”</p>	<p>Not accepted. Refer to #31 for a further explanation,</p>

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25	Garmin	Page 2, par. 3.c	<p>Includes the statement:</p> <p>Develop the TCAS II to at least the design assurance level equal to this failure condition classification.</p> <p>Wording needs to change to recognize the fact that failure condition classification is ultimately determined by aircraft level analysis.</p>	<p>It is reasonable to clarify the wording to ensure aircraft level analysis is the driver for determining failure classifications. EASA has recognized this using the following wording in ED Decision 2010/010/R 14/12/2010 Annex I Subpart A – General 2.4 Failure condition classification:</p> <p>“Develop the system to, at least, the design assurance level equal to the failure condition classifications provided in the ETSO. Development to a lower Design Assurance Level may be justified for certain cases and accepted during the ETSO process but will lead to installation restrictions.”</p>	<p>Re-work this section to match the EASA wording. Or work with industry to develop an agreed to wording.</p>	<p>Not accepted. The format of paragraph 3.c is dictated by the TSO template.</p>
26	Garmin	Page 3, par 4.b.(2)	<p>Paragraph 4.b.(2) states:</p> <p>Each subassembly of the article that you determined may be interchangeable.</p> <p>This language is confusing.</p>	<p>The language for this requirement is confusing. This could mean that a stuffed printed circuit board needs the TSO number.</p>	<p>Suggest removing the statement or if removing causes problems, work with industry to establish wording that is better understood.</p>	<p>Not accepted. The format of paragraph 4.b.(2) is dictated by the TSO template.</p>

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27	Garmin	Page 4, par 5.c	<p>This comment is related to the comment provided for Paragraph 3.a.</p> <p>The requirements of Paragraph 5.c are ambiguous and should clearly reflect the intent of what is required in Paragraph 3.a.</p>	<p>As noted in the comment for Paragraph 3.a, it is assumed that the TSO's intent is to require a means to determine whether hybrid surveillance will be functional in a given installation under normal operating conditions. Currently, paragraph 5.c states, "To address a unique aspect associated with the hybrid surveillance functionality, information must be included in the TCAS installation guidance that alerts an installer of the requirement for either a failure annunciation on the flight deck when hybrid surveillance functionality has failed or a scheduled maintenance task to verify that hybrid surveillance is (and has been) functional." What is the unique aspect? Is it that there is no MOPS requirement to annunciate a hybrid surveillance function failure when TCAS II is otherwise functional?</p> <p>Paragraph 5.c as currently written implies that some intermittent failure may occur during normal operation that can be logged in such a way as to enable diagnosis by maintenance personnel at some indeterminate interval. This commenter is familiar with TCAS systems as well as ADS-B receive systems and struggles to conceive of any such intermittent failure. If the appliance has the appropriate data inputs, then the hybrid surveillance function can be verified to be functional at installation time. If the appliance includes a means to determine whether hybrid surveillance will be functional in a given installation under normal operating conditions, then checks at installation time and return to service are sufficient and a periodic check should not be required.</p>	<p>Suggest that the paragraph be updated to the following:</p> <p>"Information must be included in the TCAS installation guidance that instructs an installer of the requirement to verify the functionality of the hybrid surveillance functionality as part of the installation and return to service procedure."</p>	<p>Partially accepted. Section 5.c has been revised to elaborate on what the unique aspect of hybrid surveillance is. The commenter further recommends that the continued airworthiness can be satisfied by a return to service task. That is deemed unacceptable because the large mean time between failures of modern avionics (on the order of many thousands of flight hours) does not permit acceptable monitoring for a potential hidden failure using the condition monitoring technique. Therefore the remainder of the recommendation is not accepted. Refer to #31 for more discussion associated with continued airworthiness.</p>

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28	Garmin	Page 5, par 5.r	TSO paragraph 5.r and its subparagraphs define required information to be supplied to the ACO for a non-TSO function. This guidance is inconsistent with Order 8110.4C CHG 4.	TSO paragraph 5.r indicates that “you must ... include the following information with your TSO application” but the TSO 5.r subparagraphs which specify the required information to be supplied to the ACO for a non-TSO function are inconsistent with the Order 8110.4C CHG 4 paragraph 6-9.b.(3) “Manufacturer Data Submittal” requirements. For example, TSO paragraphs 5.r.(5) and 5.r.(6) require submittal of “Results of test/analysis” while Order 8110.4C CHG 4 paragraph 6-9.b.(3) requires submittal of “proposed test procedures”; while both sets of guidance use the word “test”, otherwise there is no similarity.	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	Not accepted. The format of paragraph 5.r is dictated by the TSO template. However, the apparent disconnect between the two Orders (8110.4C CHG4 and 8150.1C CHG 1) is noted and it has been discussed with the AIR-120 organization. They expect to coordinate with AIR-110 (the responsible organization for Order 8110.4C) to resolve the inconsistencies between the two orders. At this time the expected resolution will be to remove the non-TSO functionality guidance from order 8110.4C and absorb it into a future revision of Order 8150.1C.
29	Garmin	Page 5, par 5.r	TSO paragraph 5.r 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 4.	TSO paragraph 5.r 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 4 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 4 paragraph 6-9 is critical to making non-TSO function work long term.	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	Refer to #28 for disposition.

Index Number	Name of Reviewer	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
30	Garmin	Page 6, par 7.b	TSO paragraph 7.b contains wording that is inconsistent with Order 8110.4C CHG 4.	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.r.(1) through 5.r.(4).” This guidance is inconsistent with Order 8110.4C CHG 4. Order 8110.4C CHG 4 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.	Adjust the wording in the TSO (template) to be consistent with the 8110.4C CHG 4 intent.	Refer to #28 for disposition.

Index Number	Name of Reviewer	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
31	Boeing	Pages: 1-2 Paragraph: 3.a. Hybrid Surveillance	<p>The proposed text states: “a. Hybrid Surveillance. TCAS II units must provide a means for displaying logged hybrid surveillance faults to maintenance personnel to enable on-wing monitoring of hybrid surveillance functionality at periodic intervals. NOTE: This requirement enables implementation of a scheduled maintenance task to ensure hybrid surveillance is functional on aircraft without a centralized warning system and/or an onboard maintenance computer.”</p> <p>We suggest this text be deleted.</p>	<p>Hybrid surveillance is used by TCAS in order to reduce utilization of the 1090MHz and 1030MHz frequency bands by TCAS systems. If hybrid surveillance is REQUIRED to be operational for installations that use a TSO-C119d-compliant TCAS computer, then failure of the hybrid surveillance function should be tied to the existing TCAS failure annunciation. This can be done as part of the new TSO-C119d-compliant TCAS computer’s design without requiring changes to other aircraft systems. A new, separate “Hybrid Surveillance” failure annunciation should not be required, as it would necessitate additional, extensive/expensive avionics system changes (e.g., to displays and/or on-board maintenance systems) at the aircraft level.</p> <p>Additionally, per the related AC 20-151A [Airworthiness Approval of Traffic Alert and Collision Avoidance Systems (TCAS II), Versions 7.0 & 7.1 and Associated Mode S Transponders], hybrid surveillance is an optional function. New maintenance messages or scheduled maintenance should not be required for an optional/non-mandated, non- essential function. Activation of hybrid surveillance requires additional inputs into the TCAS computer (e.g., GPS). Since hybrid surveillance is not required, the installer is not required to install the new wiring.</p> <p>In addition, a scheduled maintenance task should not be required, since this would add to the airlines’ already extensive list of maintenance tasks and would not provide real-time “on-wing” fault monitoring, as stated in paragraph 3.a.</p> <p>As indicated above, we maintain that tying a hybrid surveillance function failure to the existing TCAS failure annunciation should be the method for annunciating a hybrid surveillance failure.</p>	We suggest this text be deleted.	<p>Notes:</p> <ol style="list-style-type: none"> Boeing submitted three (3) comments using their own comment form. The text from their form was transcribed to a corresponding cell in this AIR-130 comment matrix. Boeing classified this as a non-concur comment. <hr/> <p>Not accepted. The failure of the hybrid surveillance functionality by design will <u>not</u> lead to a TCAS failure. This design feature precludes a GPS outage from disabling TCAS on own ship (and any proximate aircraft so equipped which would be affected by the outage). This will ensure collision avoidance remains functional on own ship and any other TCAS equipped aircraft with the hybrid functionality if and when a GPS outage occurs.</p> <p>Regarding the AC 20-151A portion of their comment, a revision is in process to delete the language explaining that hybrid surveillance is optional. To ensure the continued airworthiness of the hybrid functionality, failures of hybrid surveillance must be annunciated to the flight crew or the occurrence of faults and the continued airworthiness must be assessed during periodic scheduled maintenance tasks. Guidance is being proposed for that document which will add maintenance considerations for Hybrid Surveillance Functionality.</p>

Index Number	Name of Reviewer	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
32	Boeing	Pages: 2 Paragraph: 3.f. Software Qualification (Also see pages 5, and 6, paragraphs 5.p., 5.q., and 6.h., that call out DO-178B.)	<p>The proposed text states:</p> <p>“f. Software Qualification. If the article includes a digital computer, develop the software according to RTCA/DO-178B, Software Considerations in Airborne Systems and Equipment Certification, dated December 1, 1992. Those articles containing software upgraded from an original product, compliant with the process described in RTCA/DO-178A, need only apply the requirements in RTCA/DO-178B to change software and all software affected by the change. Perform a change analysis to clearly identify components affected by the change. See RTCA/DO-178B Section 12 for more guidance on previously developed software.”</p>	AC 20-115 is currently under revision to call out the latest version of RTCA DO-178. Proposed TSO-C119d is only applicable for newly designed TCAS computers, and would not be applicable to currently approved TSO-C119c TCAS computers. Our suggested revision would simplify this proposed paragraph while maintaining its intent.	<p>We recommend revising the text as follows:</p> <p>f. Software Qualification. If the article includes a digital computer, develop the software according to the latest version of FAA AC 20-115, “Radio Technical Commission for Aeronautic, Inc. Document RTCA/DO-178B.”</p>	<p>Note:</p> <ol style="list-style-type: none"> Boeing submitted three (3) comments using their own comment form. The text from their form was transcribed to a corresponding cell in this AIR-130 comment form. Boeing classified this as a substantive comment. <hr/> <p>Not accepted. The commenter is correct that AC 20-115 is currently under revision and that action will likely invoke the latest iteration of RTCA/DO-178. However, there is no guarantee that will happen either as expected or in a timely manner. Furthermore, we envision that hybrid surveillance can and likely will be added to units in the field currently approved at TSO-C119c or earlier.</p>

Index Number	Name of Reviewer	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
33	Boeing	Page: 4 Paragraph: 5.c. (APPLICATION DATA REQUIREMENTS)	<p>The proposed text states:</p> <p>“c. To address a unique aspect associated with the hybrid surveillance functionality, information must be included in the TCAS installation guidance that alerts an installer of the requirement for either a failure annunciation on the flight deck when hybrid surveillance functionality has failed or a scheduled maintenance task to verify that hybrid surveillance is (and has been) functional.</p> <p>(1) For installations that do not annunciate to the pilot on the flight deck when the hybrid functionality has failed, the manufacturer must provide:</p> <p>(a) The recommended interval for a scheduled maintenance check; and,</p> <p>(b) The recommended procedure for performing that task.”</p>	<p>Hybrid surveillance is used by TCAS in order to reduce utilization of the 1090MHz and 1030MHz frequency bands by TCAS systems. If hybrid surveillance is REQUIRED to be operational for installations that use a TSO-C119d-compliant TCAS computer, then failure of the hybrid surveillance function should be tied to the existing TCAS failure annunciation. This can be done as part of the new TSO-C119d-compliant TCAS computer’s design without requiring changes to other aircraft systems. A new, separate “Hybrid Surveillance” failure annunciation should not be required as it would necessitate additional, extensive and expensive avionics system changes (e.g., to displays and/or on-board maintenance systems) at the aircraft level.</p> <p>Also, per related AC 20-151A, hybrid surveillance is an optional function. New maintenance messages or scheduled maintenance should not be required for an optional/non-mandated, non-essential function. Activation of hybrid surveillance requires additional inputs into the TCAS computer (e.g., GPS). Since hybrid surveillance is not required, the installer is not required to install the new wiring.</p> <p>In addition, a scheduled maintenance task should not be required, since this would add to the airlines’ already extensive list of maintenance tasks and would not provide real-time “on-wing” fault monitoring.</p> <p>As we have stated above, tying a hybrid surveillance function failure to the existing TCAS failure annunciation should be the appropriate method for annunciating a hybrid surveillance failure.</p>	This text/requirement should be deleted.	<p>Notes:</p> <ol style="list-style-type: none"> Boeing submitted three (3) comments using their own comment form. The text from their form was transcribed to a corresponding cell in this AIR-130 comment form. Boeing classified this as a non-concur comment. <hr/> <p>Not accepted. Refer to the disposition for Index Number 31.</p>

Appendix 1. A Portion of the SWG Recommendations for Dispositioning Comments Number 4 and 21.

The DO-300A test section should be considered modified as indicated below

Test 2.4.2.5

The following modifications are required for this test.

Tests 2, 3a, and 3b should not be performed as their expected results are not correct.

Test 2.4.2.6

Perform the additional test defined as Test 11a. This does NOT replace Test 11.

Test 11a (Intruder Revalidation Rate when own aircraft is operating on the surface §2.2.7.5)

This test verifies the revalidation rate when own aircraft is operating on the surface based on the altitude and range criteria for active tracking (§2.2.7.5).

(The following tests may be performed using ADS-B reports or directly decoded ADS-B messages. TIS-B and ADS-R data is not permitted.)

Scenario Description

- Intruder 1 shows that when own aircraft is operating on the airport surface and an intruder is within the altitude and range criteria for active surveillance it will be tracked using hybrid surveillance with a 10 second revalidation rate (§2.2.7.5).
- Intruder 2 shows that when own aircraft is operating on the airport surface and an intruder is within the altitude but not the range criteria for active surveillance it will be tracked using hybrid surveillance with a variable revalidation rate according to the requirements in (§2.2.7.5).

TCAS Aircraft

Altitude = 0 ft (Ground Level)

Altitude Rate = 0 FPM

Position = Sydney

Radio altitude input = 0 ft

Ground Speed is valid and at 0 knots and TCAS Air/Ground (OOGROUN) indicates on-ground.

Intruder Aircraft #1

Altitude = 2,000 ft

Altitude Rate = 0 FPM

Range = 2 NM

Relative Speed = 0 kt

At T=100 the intruder is terminated.

Intruder Aircraft #2

Altitude = 2,000 ft

Altitude Rate = 0 FPM

Range = 8 NM

Relative Speed = 0 kt

At T=100 the intruder is terminated.

Success Criteria

For the tests in this section the revalidation rate for each applicable success criteria was identified using the table in §2.2.7.5. If the implementation uses the equation method then the revalidation interval can be longer by 10 to 20 seconds. Care should be taken to verify that the success criteria matches the value expected based on the implementation.

For each intruder:

The surveillance reports to the CAS logic are present for the duration of the track.

Verify that the track is under passive surveillance.

Intruder 1

Verify that revalidation interrogations are transmitted every 10 seconds.

Intruder 2

Verify that revalidation interrogations are transmitted every 30 seconds.

The revalidation rate for each applicable success criteria was identified using the table in §2.2.7.5. If the implementation uses the equation method then the revalidation interval can be longer by up to 10 to 20 seconds. Care should be taken to verify that the success criteria matches the value expected based on the implementation.