Originating Office: AIR-130	Document Description: AC 20-151B, Airworthiness Approval of TCAS II, Versions 7.0 & 7.1 and Associated Mode S Transponders	Project Lead: Steve Plummer, 650-756-0227 x166	Reviewing Office:	Date of Review:

Index No.	Name of Reviewer	Page & Paragraph	Comment	Rationale for Comment	Recommendation	Disposition
1	DASSAULT-AVIATION	Page #6 Chap 2-9	DASSAULT-AVIATION suggest to add the mention of TSO-C119d of which a draft was published in last june 2013			**Accepted.**
2	Honeywell	6 / 2-9	TSOs C119b and C119c are mentioned, but not C119d	Missing TSO	Add TSO-C119D	**Accepted.** See #1.
3	Honeywell	11 / 2-15.b, 2-15.c	The reference here is to DO-181D, but the latest transponder MOPS is DO-181E	Wrong DO-xxx document reference	Change to use DO-181E	**Accepted**.
4	Honeywell	19 / 2-18.h	TSOs C119b and C119c are mentioned, but not C119d	Missing TSO	Add TSO-C119D	**Accepted**.
5	Honeywell	25 / 3-3.m, Note 3	The reference here is to DO-181D, but the latest transponder MOPS is DO-181E	Wrong DO-xxx document reference	Change to use DO-181E	**Accepted**.
6	Honeywell	33 / 4-2.j, Note 3.	The reference here is to DO-181D, but the latest transponder MOPS is DO-181E	Wrong DO-xxx document reference	Change to use DO-181E	**Accepted**.
7	Honeywell	A-16 / (b), parts (1) & (2)	When equipped with a TSO-C119d or later TCAS unit, passive surveillance was designed to allow TCAS to operate while on the ground and provide situational awareness	Take advantage of TSO-C119d	Reword to allow TCAS operations while on the ground for TSO-C119d or later TCAS units.	**Not accepted**. Monitoring data shows that TCAS systems are operating on the ground for extended periods of time which contributes significantly to 1090 MHz congestion. Passive surveillance was designed to mitigate 1090 MHz congestion not to allow TCAS operation on the ground. FAA guidance for TCAS II operations while on the ground instructs flight crews not to activate TCAS (TA or TA/RA modes) until taking the active runway just prior to takeoff and

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						deselecting as soon as practical upon landing after exiting the runway. Incorporation of hybrid surveillance has not altered that guidance.
8	Honeywell	B-3 / q.	You might want to add a note here that acquisition sqiutters are not transmitted by ADS-B Out transponders while on the ground (as long as surface position squitters are being transmitted)	Required transponder operation when certified with ADS-B Out capability	Add requested note.	**Not accepted.** Appendix B provides a listing of transponder functionality that should be verified to be working correctly. Functionality resident in a transponder other than ATCRBS/Mode S is not covered by this guidance. Separate FAA guidance for ADS-B functionality is available in AC 20-165( ), Airworthiness Approval of ADS-B Out Systems.
9	ACSS	1 / 1-4	7th sentence should be clarified to indicate passive tracking while on ground applies only to those aircraft that are transmitting extended squitters.	TCAS will still perform active surveillance on ground for aircraft that are not transmitting extended squitters.	Should say "While on the ground, a TSO-C119d TCAS unit will only perform passive (i.e. automatic dependent surveillance-broadcast (ADS-B)) surveillance of aircraft transmitting extended squitters."	**Accepted.** See also #39.
10	ACSS	4 / 2-8	Consider allowing single directional installation on bottom	To accommodate certain aircraft configurations	Recommend adding comment to allow alternate antenna solution if it can be demonstrated that performance is equivalent or better (i.e. helicopter installation).	**Not accepted**. TCAS II was never intended for installation on rotorcraft. Consequently neither this AC nor its predecessor versions provide guidance specific to those aircraft. Separate guidance for installation of TCAS II in those aircraft may be created in the future.
11	ACSS	6 / 2-9	Line 5 should include TSO-C119d	Currently only includes TSO-C119b or TSO-C119c as applicable.	Should say "…TSO-C119b or TSO-C119c/TSO-C119d as applicable."	**Accepted.** See #1.

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12	ACSS	6 / 2-9	Last sentence should only be applicable to TSO C119c/d	TSO C119d is only TSO requiring hybrid surveillance.	Should say "The TCAS II processor also includes hybrid surveillance functionality which only applies to TSO C119c/d (optional for TSO C119c)".	**Accepted**.
13	ACSS	11 / 2-15b.,c.	1st sentence in each referenced paragraph calls out DO-181C or DO-181D but no reference to DO-181E		Should say"…execute the following RTCA/DO-181c or RTCA/DO-181d or RTCA/DO-181e…."	**Accepted.** See #5.
14	ACSS	19 / 2-18. h. NOTE	Note should include TSO-C119d	Currently only includes TSO-C119b or TSO-C119c TCAS II units	Should say, "…TSO-C119b or TSO-C119c/TSO-C119d TCAS II units…"	**Accepted.** See #4.
15	ACSS	22 / 2-21 c.	This paragraph is not applicable to certification of the TCAS.	Maintenance requirements will address aircraft equipment issues. Additionally, the status of hybrid surveillance capability is already available via transponder downlink.	Recommend this paragraph be removed.	**Not accepted**. Section 2-21 establishes policy to ensure the continued airworthiness of hybrid surveillance when so equipped. Reporting maintenance history to the TCAS manufacturer is required as part of compliance with 14 CFR XX.1529, Instructions for Continued Airworthiness. See also #25, 34, 45 & 46.
16	ACSS	26 / 3-5	Grammatical error in 4th sentence of the 1st paragraph.		Recommend rephrasing this sentence to say "The intruder aircraft must be equipped with a previously approved transponder installation capable of Mode A, Mode C, and for those tests necessary, Mode S, TCAS II and ADS-B Mode S Extended Squitter if appropriate."	**Accepted**.
17	ACSS	D-3 / 5.	Consider adding reference for RTCA/DO-185B Change 2 since it is invoked by TSO-C119d.	Missing the latest version.	Consider adding reference for RTCA/DO-185B Change 2.	**Accepted**. Both the RTCA/DO-185B Change 1 and the Change 2 documents were added to the RTCA related documents section in appendix D.

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18	(Eurocopter)	p. 3 §2-3 b.	"*An RA display that provides the pilot with information on the vertical speed or pitch angle to fly or avoid a threat.* "	Formulation "*to fly or avoid a threat* " not clear	Please clarify	**Accepted**. Clarification has been added. See also #41.
19	(Eurocopter)	p. 6 §2-8 a. (6)	"*For propeller-driven aircraft, investigate …*" The statement is applicable for rotorcraft, too.	The rotors of rotorcrafts represent an obstruction for the antennas similar to propellers.	"*For propeller-driven airplane or for rotorcraft, investigate …*"	**Not accepted.** TCAS II was never intended for installation on rotorcraft. Consequently neither this AC nor its predecessor versions provide guidance specific to those aircraft. Separate guidance for installation of TCAS II in those aircraft may be created in the future.
20	(Eurocopter)	p. 6 §2-8 a. (6)	Precise acceptance criteria or applicable tests for the antenna performance for these installations.	Standardization of acceptance criteria for antenna performance	Add acceptable criteria or representative tests in addition to the bearing accuracy test to demonstrate appropriate installation on propeller driven airplanes or rotorcraft	**Not accepted**. Section 2-8 provides guidance for location of the antennas. Specific criteria would be provided in the installation manual the TCAS manufacturer is required to supply.
21	(Eurocopter)	p. 6 §2-9	For the environmental requirements the compliance with TSO-C119d (as applicable) is missing		Add TSO-C119d	**Accepted.** See #1.
22	(Eurocopter)	p. 12ff §2-16, §2-17	The AC should consider the performance aspects specific to rotorcrafts regarding TCAS II.	Despite the obvious safety benefit of TCAS II installations on rotorcraft the AC does not provide guidelines considering rotorcraft specifics. Such a guideline would allow an accelerated introduction of the safety enhancement provided by TCAS II on rotorcraft to the FAA air space.	See proposal in Annex.	Note: In an annex to their submittal, the commenter submitted for consideration proposed changes to sections 2-16, Performance Considerations and 2-17, Evaluating Airplane Performance. They also submitted text for a new section, 2-18, Evaluating Rotorcraft Performance. That material has been replicated in Appendix 1 of this comment matrix. ========== **Not accepted**. TCAS II was never intended for installation on rotorcraft.

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						Consequently neither this AC nor its predecessor versions provide guidance specific to those aircraft. Separate guidance for installation of TCAS II in those aircraft may be created in the future. However, the FAA will consider the material submitted in the annex if and when separate guidance is created for rotorcraft. Refer also to disposition of #10.
23	(Eurocopter)	p. 19 §2-18	For the altitude alert functionality the reference to TSO-C119d is missing		Add TSO-C119d	**Accepted.** See #14.
24	Garmin	Page 1, para 1-4.	Description of TSO-C119d on-ground passive surveillance functionality is unclear.	If only passive surveillance is performed when on-ground, how will "traffic in the vicinity of own-ship with operable transponders will still be tracked and displayed by TCAS?"	Clarify the on-ground passive surveillance functionality description.	**Accepted.** See #4.
25	Garmin	Page 2, para 1-4	One of the Significant Changes listed in paragraph 1-4 is "To ensure that the spectrum reduction benefits continue to accrue as the TSO-C119d equipment deploys into the field and to ensure that hidden failures of hybrid surveillance are not resident in airborne TCAS II units for long periods of time". This concept is also included in paragraph 2-21.b (see related Garmin comment). It is unclear how any of the guidance of paragraph 2-12.b can "ensure that the spectrum reduction benefits continue to accrue as the equipment deploys into the field." This commenter feels the realistically achievable	At the level of individual installations, it is impossible to "ensure the spectrum reduction benefits". It *is* possible to implement procedures to identify and address failures in hybrid surveillance functionality. Additionally, as currently written, the AC requires the establishment of a maintenance program and reporting requirements that are outside the scope of this AC since this AC applies to the airworthiness applicant and not TCAS operators.	Revise the second to last sentence: "To ~~ensure that the spectrum reduction benefits continue to accrue as the TSO-C119d equipment deploys into the field and to~~ ensure that hidden failures of hybrid surveillance are not resident in airborne TCAS II units for long periods of time, failures of TSO-C119d hybrid surveillance must be annunciated to the flight crew or the ~~occurrence of faults and the~~ continued airworthiness of that functionality must be assessed during periodic continued airworthiness ~~scheduled maintenance~~ tasks."	**Partially accepted.** The intent of the recommendation has been adopted. The sentence now reads "To ensure that hidden failures of hybrid surveillance are not resident in airborne TCAS II units for long periods of time, failures of TSO-C119d hybrid surveillance must be annunciated to the flight crew or the continued airworthiness of that functionality must be assessed during periodic scheduled maintenance tasks."

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			goal is to "ensure that hidden failures are not resident in airborne TCAS II units for long periods of time." Such prevention will contribute to the goal of spectrum reduction and is achievable for existing as well as future installations.			
26	Garmin	Page 3, para 2-4.c.	This subparagraph is not related to the paragraph subject of "Mode S Transponder."	This paragraph describes the intended functionality of TCAS II, not the Mode S transponder.	Delete subparagraph c or relocate to paragraph 2-1.	**Accepted**.
27	Garmin	Page 4, para 2-5	Paragraph inaccurately states: "Passive surveillance data is provided by an on-board navigation source, such as a global positioning system (GPS)."	A position source, such as GPS, enables the ability to use passive surveillance data. However, the navigation source does not provide the passive surveillance data directly.	Change sentence to read: "An own-ship position source, such as GPS, is necessary to utilize the passive surveillance data broadcast by other aircraft."	**Partially Accepted**. Intent of comment accommodated by deletion of the cited sentence and modification of the previous one. Sentence now reads, "Passive surveillance uses ADS-B data broadcast from other aircraft."
28	Garmin	Page 5, para 2-7.c.	Weather radar controls are not relevant to TCAS system controls.	Although some multifunction displays may show both TCAS and weather radar data, specifying weather radar controls in this AC is not relevant. Most multifunction displays can combine TCAS data with many other display items, so including weather radar alone is not complete or necessary.	Delete items (1) and (3) from the optional control list.	**Not accepted**. Specifying weather radar controls in this AC is indeed relevant as TCAS II by design can and has been integrated with weather radar systems. Although those types of installations are less prevalent now than in the past, it is still appropriate to mention weather radar related controls.
29	Garmin	Page 5, para 2-8.(a)(1)	The description of "top, forward fuselage" is ambiguous.	Due to the wide variation in aircraft structures, the guidance should be more instructive.	Change location criteria to read: "Install the top directional antenna as close to the topmost point on the fuselage as possible. The antenna should also be located as close to the centerline and as far forward as possible (while maintaining sufficient ground plane around the antenna)."	**Not accepted.** The guidance provides adequate specificity for the location of the antenna. It is incumbent on the applicant, in conjunction with the TCAS II manufacturer, to choose a suitable location for the aircraft being altered.

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30	Garmin	Page 6, para 2-9	Includes the statement: "The FAA ACO approving the initial installation of the TCAS II equipment must verify that the TCAS II processor design does not differ from the criteria specified in RTCA/DO-185A or RTCA/DO-185B as applicable."	This statement seems to imply that a TSOA TCAS II that has any FAA-approved deviation from DO-185 is not eligible for airworthiness approval.	Clarify the intent of this statement or delete.	**Not accepted**. TCAS II equipment with TSOA can be installed in an aircraft and receive airworthiness approval.
31	Garmin	Page 7, para 2-10.(b)	Includes the statement: "If the traffic display uses a multifunction display shared with other services such as aircraft communications addressing and reporting system (ACARS), the traffic display function must be immediately available for display by a single selection accessible to both pilots."	The reference to ACARS does not seem to be relevant. The intent seems to be that any shared display must meet this requirement. Additionally, the reference to "both pilots" inappropriately assumes that TCAS II systems are installed only in aircraft with two pilots.	Delete phrase "such as aircraft communications addressing and reporting system (ACARS)". Change the phrase "to both pilots" to "the flight crew".	**Not accepted**. For the first recommendation, the commenter is correct – any installation that uses a shared display must meet the requirement and an example implementation using a shared ACARS display is cited. For the second, this AC, and its companion operational approval AC (120-55) are for installations in transport category aircraft used in air carrier service. Aircraft used in air carrier service are required to have two pilots. Hence the requirement: "If the traffic display uses a multifunction display shared with other services … the traffic display function must be immediately available for display by a single selection accessible to both pilots." This AC can be used as guidance for installations in non-transport category aircraft.
32	Garmin	Page 8, para 2-12.a	The requirements for the optional caution/warning lights are excessive.	If these lights are optional, they should not be required in each pilot's primary field of view (particularly for single-pilot certified aircraft). Subparagraph (1) indicates that	Revise 12.a and its subparagraphs (1) and (2) as follows: … Two different discrete TCAS II annunciators may be optionally installed ~~have been used~~: (1) A discrete amber (or yellow)	**Not accepted**. Section 2-12.a is mistakenly titled Optional Caution/Warning Lights when it should be titled "Caution/Warning Lights." "Optional" has been deleted from the title. Only the TCAS II

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				the TCAS II TA light is optional, but (2) does not include the same indication for the TCAS II RA light. Subparagrah (2) states that a lighted-arc IVSI is an acceptable substitute. A means of RA depiction (IVSI or PFD) is required for all TCAS II, so this statement is unnecessary. The RA warning light should simply be optional. The lamp inhibiting logic should match the TA inhibiting logic; see 2-18.b. RAs are completely inhibited below certain radio height, so inhibiting the lamp is implied.	caution annunciator, which indicates the presence of a TCAS II TA. Installation of this discrete caution annunciator is optional. When installed, it must be ~~located in each pilot's primary field of view and~~ inhibited when TA voice messages are inhibited ~~below 400 feet above ground level (AGL)~~. This annunciator may be implemented as a discrete lamp annunciator or as part of an electronic display. (2) A discrete red warning annunciator that indicates the presence of a TCAS II RA. Installation of this discrete warning annunciator is optional. This red warning must be ~~located in each pilot's primary field of view and~~ inhibited when RAs are inhibited ~~below 900 feet AGL~~. ~~An IVSI with a lighted red arc or an alphanumeric message on the~~ This annunciator may be implemented as a discrete lamp annunciator or as part of an electronic ~~attitude~~ display ~~indicator (EADI) is acceptable instead of this discrete warning annunciator~~.	caution light is optional. The RA warning annunciation is required but it need not be a discrete red warning annunciator if the IVSI uses a red arc or an alphanumeric message on the EADI is used.
33	Garmin	Page 10, para 2-14.(a)	Includes the statement: "Any change in any of the system part numbers requires either a new Initial Approval or a Follow-On Approval."	For PFD/MFD displays (and control panels), requiring additional approval for unrelated changes is impractical. For example, changes to PFD/MFD software that do not affect the display of TCAS data should not require follow-on approval. Similarly, control panel functionality may be provided by	Change the quoted statement to: "The initial airworthiness approval must define the approved configuration."	**Not accepted**. The system displays information and provides advisories in a number of formats. The degree of system integration to perform these functions is extensive and as a result, the certification program must be directed toward airworthiness approval through the type certification or

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				an MFD and unrelated changes to the MFD should not require follow-on approval. As part of the initial airworthiness approval, the type design will specify what system components are approved and with what level of flexibility. For example, specific antennas may be determined to be necessary, but there may be only a minimum display software version necessary.		supplemental type certification process
34	Garmin	Page 22, para 2-21.b and 2-21.c.	This comment is related to the Garmin comment for paragraph 1-4 regarding "spectrum reduction benefits". It is unclear how any of the guidance of paragraph 2-21.b can "ensure that the spectrum reduction benefits continue to accrue as the equipment deploys into the field." This commenter feels the realistically achievable goal is to "ensure that hidden failures are not resident in airborne TCAS II units for long periods of time." Such prevention will contribute to the goal of spectrum reduction and is achievable for existing as well as future installations. The methods of compliance in the subparagraphs can then be evaluated against the goal of preventing long-term failures, and will result in guidance that can actually be achieved in the field.	At the level of individual installations, it is impossible to "ensure the spectrum reduction benefits". It *is* possible to implement procedures to identify and address failures in hybrid surveillance functionality. As currently written, these paragraphs imply 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, return to service, or at a specified interval. However, as currently written, the guidance	Paragraph 2-12.b should be rewritten as follows: b. To ~~ensure that the spectrum reduction benefits continue to accrue as the equipment deploys into the field and to~~ ensure that hidden failures are not resident in airborne TCAS II units for long periods of time, 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. ~~Periodic reliability reporting for the hybrid surveillance functionality is also required.~~ Depending on the level of avionics integration in the aircraft, different methods can be used to ensure the continued airworthiness of the hybrid surveillance such as: (1) For those aircraft equipped with an engine indicating and	**Partially accepted**. Section 2-21 establishes policy to ensure the continued airworthiness of hybrid surveillance when so equipped. Reporting maintenance history to the TCAS manufacturer is required as part of compliance with 14 CFR XX.1529, Instructions for Continued Airworthiness. The first sentence of 2-21.b has been revised to address just the hidden failure by deleting the phrase "ensure that the spectrum reduction benefits continue to accrue as the equipment deploys into the field and to." Section 2-21.b provides three alternative schemes for monitoring the continued airworthiness of the hybrid surveillance. At the discretion of the applicant, any of those (or potentially others not mentioned

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			The first method of indication on an EICAS system presupposes that such indications are already supported by all EICAS and alerting systems. This is most certainly not the case and such alerting should be required only if supported by the EICAS/alerting system. Further, the guidance of paragraph 2-21.c to "report hybrid surveillance maintenance history" to TCAS manufacturers is an operational requirement that cannot be enforced by the airworthiness applicant. Additionally, such reporting adds an undue burden on operators to provide data in what could be multiple formats, to multiple entities, with no clear indication those entities will do anything with the information. This guidance does little, if anything, to prevent long-term hybrid surveillance failures.	requires the establishment of a maintenance program and reporting requirements that are outside the scope of this AC since this AC applies to the airworthiness applicant and not TCAS operators.	crew alerting (EICAS) system (or other similar annunciation system) that can support the annunciation of a hybrid surveillance failure, integrate the failure information into the warning system such that a failure ~~of hybrid surveillance~~ is annunciated to the flight crew. (2) For those aircraft unable to annunciate a hybrid surveillance function failure to the flight crew ~~equipped with an onboard maintenance computer interfaced with TCAS~~, add a periodic continued airworthiness ~~scheduled maintenance~~ task ~~to the aircraft's maintenance program~~ to ensure ~~check for presence of any existing or past failures of~~ hybrid surveillance is functional. If the hybrid surveillance is not functional, t~~T~~ake corrective action as specified by the TCAS manufacturer. (3) ~~For aircraft without a centralized warning system and/or an onboard maintenance computer, add a scheduled maintenance task to the aircraft's maintenance program to check for presence of any existing or past failures of hybrid surveillance and to ensure hybrid surveillance is functional. Take corrective action as specified by the TCAS manufacturer.~~ ~~(4)~~ If a periodic continued airworthiness ~~scheduled maintenance~~ task is employed, the installer must establish the initial	there) could be implemented. The requirement for periodic reliability reporting is retained. The FAA does not agree with rewriting the other text in 2-21.b, nor deletion of 2-21.c.

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					frequency of the task in conjunction with the manufacturer of the TCAS equipment but on a frequency not to exceed two calendar years between tasks. Normal continued airworthiness ~~maintenance~~ escalation procedures could later be used to extend the continued airworthiness task's period ~~maintenance frequency~~ provided adequate justification to do so is provided to the cognizant ACO. Paragraph 2-21.c should be deleted entirely.	
35	Universal Avionics		Universal Avionics does not have any comments.			**Noted.**
Notes: 1. Comments in index numbers 36 through 49 were submitted by Boeing using their own comment form. The text from their form was transcribed to a corresponding cell in this comment matrix.						
36	Boeing	Page 1, Para. 1-1, Purpose of this Advisory Circular , Page 25, Para. 3-3, Basic Ground Tests Page 32, Para. 4-2, Ground Tests and Evaluations	No FAA requirement is stated in any of these sections.	TSO-C112e needs to be included to the proposed AC 20-151B for clarity and completeness.	We suggest that the new TSO-C112e requirement that transponders do not reply to ATCRBS/Mode S All-Call interrogations after January 1, 2020, be included.	Notes: 1. Boeing classified this as a substantive comment. **Partially accepted.** During the drafting process of TSO-C112e, a requirement was proposed for inclusion (in a new appendix 2) which prevented transponders from replying to ATCRBS/Mode S All-Call interrogations. During final comment resolution of draft TSO-C112e that proposed requirement was deleted. Where appropriate, occurrences of TSO-C112d (or prior) have been changed to TSO-

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						C112e.
37	Boeing	Page 1 Para. 1-1, Purpose of this Advisory Circular	The proposed text states: *"… The guidance presented in this AC can also be used for those seeking airworthiness approval for TCAS II version 7.0 (V7.0) that are certified to TSO-C119b, Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II."*	TCAS certifications always include associated Mode S transponders.	We recommend revising the text as follows: *"… The guidance presented in this AC can also be used for those seeking airworthiness approval for TCAS II version 7.0 (V7.0) that are certified to TSO-C119b, Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment (TCAS II) **and associated Mode S transponders**."*	Notes: 1. Boeing classified this as a substantive comment. **Accepted**.
38	Boeing	Page 1 Para. 1-2. Who this AC applies to	The proposed text states: *"Applicants seeking a type certificate (TC), amended type certificate, or supplemental type certificate (STC) under Title 14 of the Code of Federal Regulation (14 CFR) part 25 for initial approval and follow-on approvals of TCAS II equipment or stand alone Mode S transponder equipment. …"*	*Parallel construction: Add acronym for amended type certificate (as has been done for the other certificates).*	We recommend revising the text as follows: *"Applicants seeking a type certificate (TC), amended type certificate **(ATC),** or supplemental type certificate (STC) under Title 14 of the Code of Federal Regulation (14 CFR) part 25 for initial approval and follow-on approvals of TCAS II equipment or stand alone Mode S transponder equipment."*	Notes: 1. Boeing classified this as an editorial comment. **Not Accepted**. ATC is an often used acronym with its use depending on the context. In this document it is more appropriate to use that acronym for air traffic control.
39	Boeing	Page 1 Para. 1-4, Significant Changes	The proposed text states: *"… While on the ground, a TSO-C119d TCAS unit will only perform passive (i.e. automatic dependent surveillance-broadcast (ADS-B)) surveillance…..Traffic in the vicinity of own-ship with operable transponders will still be tracked and displayed by TCAS. …"*	As stated earlier in Para. 1-4, while on the ground, only passive surveillance is performed. Therefore, the other aircraft must be transmitting qualified ADS-B messages.	We recommend revising the text as follows: *"… While on the ground, a TSO-C119d TCAS unit will only perform passive (i.e. automatic dependent surveillance-broadcast (ADS-B)) surveillance…..Traffic in the vicinity of own-ship with operable transponders **(with qualified ADS-B transmissions)***	Notes: 1. Boeing classified this as a substantive comment. **Accepted**. See also #9.

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					will still be tracked and displayed by TCAS. …"	
40	Boeing	Page 2 Paragraph 1-5.d., Scope.	The proposed text states" *"d. We do not cover Mode S Extended Squitter or Mode S Elementary/Enhanced surveillance.* *(1) For guidance on Mode S Elementary surveillance, refer to Joint Aviation Authorities (JAA) Temporary Guidance Leaflet (TGL) 13 Revision 1, Certification of Mode S Transponder Systems for Elementary Surveillance.* *(2) For guidance on Mode S Enhanced surveillance, refer to Acceptable Means of Compliance (AMC) 20-13, Certification of Mode S Transponder Systems for Enhanced Surveillance."*	EASA's certification specifications for ELS and EHS are pending. Once they are published, they will supersede TGL 13 and AMC 20-13.	We recommend either eliminating paragraphs d.(1) and d.(2), or making the reference more general. The general verbiage could be revised to something similar to paragraph 1-5.d.(3) of AC 20-151A, which reads: *"(3) AC guidance for Mode S extended Squitter, also known as automatic dependant surveillance – broadcast (ADS-B), is being developed. Until such time as this guidance material is available, contact the cognizant Aircraft Certification Office (ACO) for more information."* We suggest using the following text: ***"EASA guidance for ELS (JAA TGL 13) and EHS (AC 20-13) is being revised. Until such time as this guidance material is available, contact the cognizant Aircraft Certification Office (ACO) for more information."***	Notes: 1. Boeing classified this as an editorial comment. **Not accepted**. We understand the intent, but we publish guidance based on currently available policy. Appendix D, Related Documents, provides contact information for procurement of various documents cited in the AC. The reader can use that information to ascertain the current revision level of a particular document.
41	Boeing	Page 3 Para. 2-3.b., System Flight Deck Displays.	The proposed text states: *"b. An RA display that provides the pilot with information on the vertical speed or pitch angle to fly or avoid a threat. The RA*	Editorial change, and to clarify that the RA display can be on any or all types of displays.	We recommend revising the text as follows: *"b. An RA display that provides the pilot with information on the vertical speed or pitch angle to*	Notes: 1. Boeing classified this as an editorial comment. **Partially accepted**. Accepted the editorial

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			display is typically implemented on an instantaneous vertical speed indicator (IVSI), a vertical speed tape that is part of a Primary Flight Display (PFD), or using pitch cues displayed on the PFD."		*fly ~~or~~ **in order to** avoid a threat. The RA display is typically implemented on an instantaneous vertical speed indicator (IVSI), a vertical speed tape that is part of a Primary Flight Display (PFD), **and/**or using pitch cues displayed on the PFD."*	recommendation. Only one RA display is provided for each pilot. Consequently the clarification is not accepted as the recommended language can be interpreted to mean that an RA display can be implemented simultaneously on multiply displays in the flight deck at each pilot station. See also #18.
42	Boeing	Page 6 Para. 2-9, The TCAS Processor	The proposed text states: *"The TCAS II processor unit must comply with the environmental requirements and minimum performance standards specified in TSO-C119b or TSO-C119c as applicable. A manufacturer of TSO equipment can obtain authorization to produce equipment that deviates from the detailed criteria of the TSO as provided for in 14 CFR § 21.609. The FAA ACO approving the initial installation of the TCAS II equipment must verify that the TCAS II processor design does not differ from the criteria specified in RTCA/DO-185A or RTCA/DO-185B as applicable. The TCAS II processor also includes hybrid surveillance functionality."*	Per Para. 1-1 of this proposed AC, this AC is also applicable to TCAS processors meeting TSO-C119d.	We recommend revising the text as follows: *"The TCAS II processor unit must comply with the environmental requirements and minimum performance standards specified in TSO-C119b, ~~or~~ TSO-C119c, **or TSO-C119d**, as applicable. A manufacturer of TSO equipment can obtain authorization to produce equipment that deviates from the detailed criteria of the TSO as provided for in 14 CFR § 21.609. The FAA ACO approving the initial installation of the TCAS II equipment must verify that the TCAS II processor design does not differ from the criteria specified in RTCA/DO-185A or RTCA/DO-185B as applicable. The **TSO-C119d** TCAS II processor also includes hybrid surveillance functionality."*	Notes: 1. Boeing classified this as a substantive comment. **Accepted.** See #1.
43	Boeing	Page 19 Para. 2-18.h., Altitude alerter data	The proposed NOTE in this paragraph reads as follows: *"NOTE: Altitude alert functionality is optional per*	Per Para. 1-1 of this proposed AC, this AC is also applicable to TCAS processors meeting TSO-C119d.	We recommend revising the NOTE as follows: *NOTE: Altitude alert functionality is optional per RTCA/DO-185A*	Notes: 1. Boeing classified this as a substantive comment. **Accepted.**

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			RTCA/DO-185A and RTCA/DO-185B. Not all TSO-C119b or TSO-C119c TCAS II units will have this option available."		*and RTCA/DO-185B. Not all TSO-C119b,* ~~*or*~~ *TSO-C119c****, or TSO-C119d*** *TCAS II units will have this option available."*	See #4.
44	Boeing	Page 20 Para. 2-18.j., Hybrid surveillance failure annunciations	The proposed text states: ***"j. Hybrid surveillance failure annunciations (TSO-C119d units only).*** *For aircraft equipped with centralized alert and warning system and or an onboard maintenance system, consideration should be given to integrating the hybrid surveillance alerting functionality into the system so as to alert the crew with an appropriate failure annunciation. Refer to Para. 2-21 for more information."*	Hybrid surveillance failures that do not affect the CAS logic do not need to be annunciated to the flight crew. However, they should be noted by the maintenance personnel.	We recommend revising the text as follows: ***"j. Hybrid surveillance failure annunciations (TSO-C119d units only).*** *For aircraft equipped with centralized alert and warning system and or an onboard maintenance system, consideration should be given to integrating the hybrid surveillance alerting functionality into the system so as to alert* ~~*the crew*~~ ***maintenance personnel*** *with an appropriate failure* ~~*annunciation*~~ ***message****. Refer to Para. 2-21 for more information."*	Notes: 1. Boeing classified this as a substantive comment. **Not accepted**. Section 2-21 provides three alternative schemes for monitoring the continued airworthiness of the hybrid surveillance. A viable option is to integrate the alerting functionality into the centralized alert and warning system. At the discretion of the applicant, any of those (or potentially others not mentioned there) could be implemented.
45	Boeing	Page 22 Para. 2-21.b., Maintenance Considerations for Hybrid Surveillance Functionality (TSO-C119d only)	The proposed text states: *"****2-21. Maintenance Considerations for Hybrid Surveillance Functionality (TSO-C119d only).*** … *b. To ensure that the spectrum reduction benefits continue to accrue as the equipment deploys into the field and to ensure that hidden failures are not resident in airborne TCAS II units for long periods of time, failures of hybrid surveillance must be annunciated to the flight crew or the occurrence of faults and the continued airworthiness must be assessed*	Our suggested changes will harmonize maintenance task sections with TSO-C119d (Section 3.a.).	We recommend revising the text as follows: ***"2-21. Maintenance Considerations for Hybrid Surveillance Functionality (TSO-C119d only).*** … *b. To ensure that the spectrum reduction benefits continue to accrue as the equipment deploys into the field and to ensure that hidden failures are not resident in airborne TCAS II units for long periods of time,* ~~*failures of hybrid surveillance must be annunciated to the flight crew or*~~ *the occurrence of faults and the*	Notes: 1. Boeing classified this as a substantive comment. **Not accepted**. Section 2-21.b provides three alternative schemes for monitoring the continued airworthiness of the hybrid surveillance. At the discretion of the applicant, any of those (or potentially others not mentioned there) could be implemented. The requirement for periodic reliability reporting is retained.

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			during periodic scheduled maintenance tasks. Periodic reliability reporting for the hybrid surveillance functionality is also required. Depending on the level of avionics integration in the aircraft, different methods can be used to ensure the continued airworthiness of the hybrid surveillance such as: *(1) For those aircraft equipped with an engine indicating and crew alerting (EICAS) system (or other similar annunciation system) integrate the failure information into the warning system such that a failure of hybrid surveillance is annunciated to the flight crew.* *(2) For aircraft equipped with an onboard maintenance computer interfaced with TCAS, add a scheduled maintenance task to the aircraft's maintenance program to check for presence of any existing or past failures of hybrid surveillance. Take corrective action as specified by the TCAS manufacturer.* *(3) For aircraft without a centralized warning system and/or an onboard maintenance computer, add a scheduled maintenance task to the aircraft's maintenance program to check for presence of any existing or past failures of hybrid surveillance and to ensure hybrid surveillance is*		*continued airworthiness must be assessed during periodic scheduled maintenance tasks. ~~Periodic reliability reporting for the hybrid surveillance functionality is also required~~. Depending on the level of avionics integration in the aircraft, different methods can be used to ensure the continued airworthiness of the hybrid surveillance such as:* *(1) For those aircraft equipped with an engine indicating and crew alerting (EICAS) system (or other similar annunciation system) ~~integrate the failure information into the warning system such that a failure of hybrid surveillance is annunciated to the flight crew~~, **one option is to annunciate a hybrid surveillance function failure to the flight crew via a crew alert message.*** *(2) For aircraft equipped with an onboard maintenance computer interfaced with TCAS, ~~add a scheduled maintenance task to the aircraft's maintenance program to check for presence of any existing or past failures of hybrid surveillance. Take corrective action as specified by the TCAS manufacturer.~~ **one option is to annunciate a hybrid surveillance function failure to maintenance personnel via a maintenance message.***	

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			functional. Take corrective action as specified by the TCAS manufacturer. …"		*(3) ~~For aircraft without a centralized warning system and/or an onboard maintenance computer,~~ **If either option (1) or (2) are not implemented, then** add a scheduled maintenance task to the aircraft's maintenance program to check for presence of any existing or past failures of hybrid surveillance and to ensure hybrid surveillance is functional. ~~Take corrective action as specified by the TCAS manufacturer~~.…"*	
46	Boeing	Page 22 Para. 2-21.c., Maintenance Considerations for Hybrid Surveillance Functionality (TSO-C119d only)	The proposed text states: *"c. Report hybrid surveillance maintenance history to the TCAS manufacturer periodically but not to exceed 18 calendar months between reports."*	This paragraph would impose a significant task without a clear safety (or other) benefit, and without a regulatory requirement. There is not an FAA regulation that this proposed means of compliance supports. Has a cost v. benefit analysis been accomplished for such a task? Even if it were eventually identified as having a benefit (i.e., worth the cost of implementing), it needs to be clarified as to: 1. **WHO** would be responsible for reporting "hybrid surveillance maintenance history to the TCAS manufacturer?" Only the operators have the maintenance history of their aircraft. Aircraft OEMs (e.g., Boeing or Airbus) do not have this information. Would all the airlines have to setup a process to submit such reports to their TCAS manufacturers?	We recommend deleting paragraph c.	Notes: 1. Boeing classified this as a non-concur comment. **Not accepted**. Section 2-21 establishes policy to ensure the continued airworthiness of hybrid surveillance when so equipped. Reporting maintenance history to the TCAS manufacturer is required as part of compliance with 14 CFR XX.1529, Instructions for Continued Airworthiness.

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				2. **WHY** is this considered necessary? Maintenance history is not required to be reported to avionics manufacturers for other equipment or functions. There is no FAA regulation that requires a process for a customer to periodically provide avionics maintenance data to equipment manufacturers. If there are issues with the manufacturer's equipment, the customers already provide this feedback to the manufacturers in order to help resolve issues. 3. **HOW** this would be done? What would be the process?		
47	Boeing	Page 31, Chapter 4.	The proposed title of Chapter 4 is: *"Follow-on Approvals (STCs or Amended STC)"*	Our suggested revision better describes the follow-on certification performed at most OEMs.	We recommend revising the title to: *"Follow-on Approvals (STCs or Amended STC **or Amended TC**)"*	Notes: 1. Boeing classified this as an editorial comment. **Accepted.**
48	Boeing	Page 35 Para. 4-4, Upgrading an Existing TCAS II Installation	The proposed text states: *"If you are upgrading an existing approved TCAS II installation to a higher TCAS II version (i.e. V7.0 or V7.1), and the higher version installation is only a software change, then no additional certification flight tests are required to obtain a follow-on STC or amended STC. …"*	Our suggested revision better describes the follow-on certification performed at most OEMs.	We recommend revising the text to read as follows: *"If you are upgrading an existing approved TCAS II installation to a higher TCAS II version (i.e. V7.0 or V7.1), and the higher version installation is only a software change, then no additional certification flight tests are required to obtain a follow-on STC or amended STC **or amended TC**. …"*	Notes: 1. Boeing classified this as an editorial comment. **Accepted.**
49	Boeing	Page C-2, Appendix C, Para. 2.(c)	The proposed text states: *"c. While developing corrective action for the operational*	Latest version of DO-300 is version **A.**	We recommend revising the text as follows: *"c. While developing corrective*	Notes: 1. Boeing classified this as an editorial comment.

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			problems, the Federal Aviation Administration (FAA), along with industry representatives, decided to develop performance standards for TCAS II Hybrid Surveillance. That work resulted in creation of RTCA/DO-300, Minimum Operational Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance."		*action for the operational problems, the Federal Aviation Administration (FAA), along with industry representatives, decided to develop performance standards for TCAS II Hybrid Surveillance. That work resulted in creation of RTCA/DO-300A, Minimum Operational Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance."*	**Not accepted**. The commenter is correct in noting that the latest version is "A." However the material in this section discusses the genesis of the hybrid surveillance standard not the subsequent revision to same.

Appendix 1
(Submitted by Eurocopter)

2-16. Performance Considerations. To help you evaluate the need to inhibit TCAS II CLIMB and/or INCREASE CLIMB RAs resulting from inadequate climb performance:

For airplane:
Use paragraphs 2-16, 2-17 and Table 1.

For rotorcraft:
Use paragraphs 2-16, 2.18 and Table 2.

The collision avoidance maneuvers posted as RAs by TCAS II assume an airplane/rotorcraft's ability to safely achieve them. If it's likely the required response to CLIMB and INCREASE CLIMB RAs are beyond the performance capability of the aircraft, then TCAS II must know beforehand so it can change strategy and issue an alternative RA. These performance limits must be provided to TCAS II from the aircraft interface and discrete settings relative to altitude and/or aircraft configuration. However, carefully consider the need to inhibit TCAS II CLIMB or INCREASE CLIMB RAs since the alternative RAs may not provide the optimum solution to the encounter. Inhibiting these RAs will increase the likelihood of TCAS II:

a. Issuing crossing maneuvers (crossing through an intruder's altitude), thus increasing the probability that an RA may be thwarted by the intruder maneuvering,

b. Causing an increase in DESCEND RAs at low altitude, and

c. Providing no RAs if below the descend inhibit altitude of 1200 feet AGL during takeoff and 1000 feet AGL on approach.

2-17. Evaluating Airplane Performance

<Unchanged from present section 2.17, except that "aircraft" should preferably be changed to "airplane">

2-18. Evaluating Rotorcraft Performance.

A rotorcraft's ability to safely achieve a CLIMB RA or INCREASE CLIMB RA is based on its dynamic climb capability. In contrary to category transport airplanes the stabilized climb rate of a rotorcraft may be insufficient throughout larger parts of the flight envelope to support CLIMB RAs or increase INCREASE CLIMB RAs. However due to the short climb maneuver during the RA (duration < 25s, increase of altitude of 300-500ft) and the fact that a rotorcraft does not have a limiting stall speed and has a much smaller inertia than a transport airplane, the rotorcraft may trade more of its horizontal speed into instantaneous climb rate than an airplane to achieve the RA maneuver and the required vertical separation. In consequence the dynamic climb performance, that is the combination of applying maximum continuous power and trading of horizontal speed for altitude gain, supports the execution of CLIMB RAs and potentially of INCREASE CLIMB RAs through acceptable ranges of the flight envelope of the rotorcraft.

a. Because TCAS II can only accept a limited number of inputs related to rotorcraft performance, it's not possible to automatically inhibit CLIMB and INCREASE CLIMB RAs in all cases where it may be

appropriate to inhibit such RAs. In these cases, TCAS II may command maneuvers that are beyond dynamic climb performances of the rotorcraft. Conditions where this may occur include bank angles greater than 30 degrees, weight/altitude/true airspeed combinations outside the envelope shown in Table 2, external load operations, one engine inoperative and abnormal configurations. Provide information concerning this aspect of TCAS in the rotorcraft flight manual (RFM) or rotorcraft flight manual supplement (RFMS) so that flight crews may take appropriate action.

b. A rotorcraft dynamic climb capability is significantly affected by the rotorcraft's weight, pressure altitude and its true airspeed available during initial climb to safely trade for instantaneous climb rate. The pressure altitude is used to automatically inhibit INCREASE CLIMB RAs and CLIMB RAs. For most rotorcraft, INCREASE CLIMB RA may have to be systematically inhibited. The pressure altitude threshold above which the CLIMB RA (respectively the INCREASE CLIMB RA) is to be automatically inhibited, is evaluated using table 2.
To prevent very unlikely combinations of events, such as weight/ altitude/ true airspeed conditions in conjunction with unusual encounter geometries causing climb inhibits when the rotorcraft's performance is more than adequate, entry conditions and RAs are provided in table 2.

c. Since rotorcraft may routinely operate at low airspeeds throughout all phases of flight, consider providing a discrete to the TCAS II based on true airspeed. Such an input, derived from a TCAS II interface system, would provide for CLIMB or INCREASE CLIMB RA inhibits when the rotorcraft is operating below a certain true airspeed. We consider such a scheme appropriate instead of an across-the-board inhibit regardless of flight regime (which is not considered to provide the best overall level of safety as previously discussed for other configurations). However, if this kind of input may not be accepted by the TCAS II installation, then refer to 2.18 a.

d. If Table 2, condition 1, Maneuver A causes IAS to drop below Vy before recovery, then the pressure altitude threshold for CLIMB RA inhibit has to be reduced. Otherwise, with Table 2, condition 2, determine minimum TAS to conduct Maneuver A without causing IAS dropping below Vy before recovery.
If Table 2, condition 3, Maneuver B causes IAS to drop below Vy before recovery, then the pressure altitude threshold for INCREASE CLIMB RA inhibit has to be reduced. Otherwise, with Table 2, condition 4, determine minimum TAS to conduct Maneuver A without causing IAS dropping below Vy before recovery.
However, early recovery of 1 to 2 seconds is of little or no consequence on both collision avoidance maneuvers and a higher overall level of safety will be achieved if inhibits are not provided under these circumstances, as previously discussed in paragraph 2-16.

Table 2. Maneuvers

Condition	Flight Regime	Weight, Altitude, Temperature[1]	Power during RA	Initial TAS	Minimum IAS at recovery	Maneuver[2]
1	Level cruise	W ≥95% MTOW Pressure Altitude: Climb RA inhibit threshold	Unchanged (MCP)	Max Cruise TAS	Vy	A
2	Level cruise	W: ≥95% MTOW Pressure Altitude: Climb RA	Apply MCP	Minimum TAS for A	Vy	A

		inhibit threshold		maneuver		
3	Level cruise	W: ≥95% MTOW Pressure Altitude: Increase Climb RA inhibit threshold	Unchanged (MCP)	Max Cruise TAS	Vy	B
4	Level cruise	W: ≥95% MTOW Pressure Altitude: Increase Climb RA inhibit threshold	Apply MCP	Minimum TAS for B maneuver	Vy	B

NOTES:

1. There is no specific temperature constraint since temperature will directly condition maximum cruise TAS and thus margin with minimum TAS to achieve A/B maneuver dynamic instantaneous climb rate.

2. Maneuvers:

Maneuver A evaluates the TCAS II CLIMB RA. From the initial steady-state condition, after a 3-second pilot-reaction time delay, simultaneously apply MCP (if not already applied) and rotate the rotorcraft at 1.25 g to attain +1500 feet per minute climb. Hold until altitude gain has reached 300-500ft. Recover to attain the initial trim airspeed.

Maneuver B evaluates the TCAS II INCREASE CLIMB RA following a CLIMB RA. From the initial steady-state condition, after a 3-second pilot-reaction time delay, simultaneously apply MCP (if not already applied) and rotate the rotorcraft at 1.25 g to attain +1500 feet per minute climb. Hold until 15 seconds has elapsed from when the CLIMB RA was issued. Then, after a 1-second pilot reaction time-delay to the INCREASE CLIMB RA, rotate the rotorcraft again at 1.25 g to attain +2500 feet per minute climb and hold until the total duration of the RA of 25 seconds has elapsed. Recover to attain the initial trim airspeed.