

**PUBLIC REVIEW COMMENTS**

#	Name	Paragraph Section	Comment (state issue)	Suggested resolution (state possible solution)	AIR-130 Disposition
1	Joslin Flt CSTA	Page 11, 3-2(c)(2)	The blades on a rotorcraft are called rotor blades and not propeller blades	Change “propeller” to “rotorcraft”	Concur. Text changed.
2	Joslin Flt CSTA	Page 25 3-10(b)	Guidance for determining the air/ground status for skid configured rotorcraft that hover taxi needs to be provided	Provide an AGL altitude threshold for determining air/ground status of rotorcraft	Not accepted. Test leaves it up to the mfg to determine an acceptable means of compliance

3

Joslin  
Flt CSTA

Page 27  
4-1(d)

EMC testing should include a show of compliance for 2X.1309 and 2X.865.

Add 2X.1309 and 2X.865

Concur. Paragraph modified to point to appropriate EMC advisory circular material for various aircraft/rotorcraft.

**§23.1309(a)(1) Each item of equipment, each system, and each installation: (1) When performing its intended function, may not adversely affect the response, operation, or accuracy of any- (i) Equipment essential to safe operation; or (ii) Other equipment unless there is a means to inform the pilot of the effect.**

**§27.1309(a) The equipment, systems, and installations whose functioning is required by this subchapter must be designed and installed to ensure that they perform their intended functions under any foreseeable operating condition.**

**§27.865(b)(3)(ii) Both the primary and backup [external load] quick release subsystems must-- (ii) Be protected against electromagnetic interference (EMI) from external and internal sources and against lightning to prevent**

4	Joslin Flt CSTA	Page 27 4-1(e)(3)	Compliance with 2X.1322 should be considered when evaluating ADS-B annunciations and alerts	Add 2X.1322 and considering mentioning AC 25-1322-1 Flight crew Alerting	Concur. Text added.
5	Joslin Flt CSTA	Page 31 4-3(b)(5)	The maximum descent rate normally associated with a rotorcraft is during an autorotative descent	Add the requirement for rotorcraft to evaluate the system in an autorotative descent	Action taken to clarify flight test profiles. Autorotation not required.
6	George Lyddane	Page 33 4-3(b)(4)	This para needs to be written as such:  <b>Turns.</b> Accomplish dedicated 360 degree turns at 3 different altitudes in 3 different configurations during the flight test. Time each turn from roll in to rollout and compute and record the turn rate for the flight test report. See Table 5A.	Change text	Concur. Suggestion incorporated.

Table 5A Turning Flight

<b>Configurations</b>	<b>Altitude Range</b>	<b>Speed Range</b>	<b>Bank Angle</b>	<b>Turn Amount</b>
Takeoff	3000-5000 AFE	1.4 Vs/V2 +20	30 L & 30R	360 degrees
Approach or Landing	2000-7000 AFE	1.4 Vs/Vapp +20	30 L & 30R	360 degrees
Cruise	7000-10000 AFE	1.5Vs to 250	30L & 30R	360 degrees

7	George Lyddane	Page 33 4-3(b)(5)	<p>This para should be rewritten as such:</p> <p><b>Climbs/Descents.</b> Accomplish climbs at both the best rate and best angle of climb and typical operational speeds, see Table 5B. Climbs and descents should be accomplished in take off, cruise, approach and landing configurations.. If your test flight does not include a takeoff and/or landing from within an ADS-B coverage area, you may simulate the takeoff and/or landing during your test flight.</p> <p><b>See table 5b below</b></p>	Change text	Suggestion incorporated.
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**Table 1B. Climb/Descent Speeds**

<b>Configurations</b>	<b>Climb</b>	<b>Descend</b>
Takeoff	Best Rate (Vy or Vfe-10)	N/A
Takeoff	Best Angle (Vx or V2 +20)	N/A
Cruise	250 (<10K)	240 (<10K)
Cruise	280 (>10K)	Vmo - 10(>10K)
Approach	N/A	Vfe-10 (<5K)
Landing	N/A	Vapp

8	Fisher	TOC	Format 1-1 in TOC	Correct formatting	Concur. Text changed.
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9	Fisher	TOC	Fig 1 and fig 2 formatting	Correct formatting	Concur. Text changed.
10	Fisher		Table, various formatting issues	Correct formatting	Concur. Text changed.
11	Fisher	Page 4 Para 2-2	Need spacing between title and text	Correct formatting	Concur. Text changed.
12	Fisher	Page 6 2-3 d	Remove spaces between d. and maintenance	Correct formatting	Concur. Text changed.
13	Fisher		Reset spacing between Table 2. and title of table	Correct formatting	Concur. Text changed.
14	Fisher		Reset spacing between Table 3. and title of table	Correct formatting	Concur. Text changed.
15	Fisher		Reset spacing between Table 4. and title of table	Correct formatting	Concur. Text changed.
16	Fisher		Reset spacing between Table 6. and title of table	Correct formatting	Concur. Text changed.
17	Fisher		Reset spacing between Table 7. and title of table	Correct formatting	Concur. Text changed.
18	Fisher	Page 23 Para 3-8 c (2)	Reword this para to say "For aircraft using a single antenna, this parameter can be set at installation"		Concur. Text changed. See also comment 27.

19	Tim Taylor FreeFlight Systems	Page 10 note 1	On page 10 Note 1 recommends that we do not install both 10909 ES and UAT ADS-B out capability on the same aircraft. We are finding cases where aircraft already have DO-260 or DO-260A transponders which are ADS-B compliant outside of the US. For US compliance, addition of the UAT can be a less expensive modification than a transponder upgrade to DO-260B - and the aircraft can be redeployed overseas and be compliant using the legacy 1090 equipment.	Can the AC clarify that UAT installation is acceptable alongside 1090 ES legacy systems that are not rule compliant?	Not accepted. If one of the links is non-compliant, it should be disabled in order to become rule compliant.
20	Honeywell	1-1.b	It is stated here that “[t]his AC is not mandatory and does not constitute a regulation”. However, there are several requirements (not found anywhere else) imposed by this AC on the transponder (e.g., NIC limiting, invalidating ground track when less than 7 knots, etc.).	Advisory Circulars are not the proper avenue for imposing requirements. That is the domain of TSOs and MOPS. Pull the requirements out of the AC and add them to the MOPS or the TSO in future revisions of these documents.	Generally FAA agrees with this point. However, the rule language and referenced TSOs were unable to be changed while this guidance was developed and published. Future revisions of the ADS-B link TSOs can incorporate these requirements if industry agrees with that disposition.
21	Honeywell	1-4	“Installation guidance for ADS-B IN can be found in AC-20-172A.” Should probably point to the latest version of AC 20-172.	“Installation guidance for ADS-B IN can be found in the latest version of AC-20-172.”	Concur. Text changed.

22	Honeywell	1-4	In the penultimate sentence there should not be an apostrophe in “its”.	“The latest version of a document should be used where () follows its name.”	Concur. Text changed.
23	Honeywell	2-2	Add a space between section title and first sentence.	“Aircraft Flight Manual. Include ADS-B OUT...”	Concur. Text changed.
24	Honeywell	2-3.d	Change blue font to black	See comment	Concur. Text changed.
25	Honeywell	Figure 2	Figure 2 references Table 3-3, but there is not a Table 3-3 in the AC.	Add Table 3-3 or fix reference.	Concur. Text changed. Ref to table 3-3 removed
26	Honeywell	3-3.c.(7).(c)	You provided guidance in appendix 2 for the setting of NACv to 1 or 2, but where is the guidance for setting NACv to 3 or 4?	Provide a mechanism for demonstrating “to the FAA that the velocity accuracy actually meets the requirement” for the setting of NACv to 3 or 4.	Not accepted.
27	Honeywell	3-8.c.(2)	DO-260B, 2.2.3.2.7.2.4.5 indicates that this should be dynamically set to ONE for a diversity installation if “the diversity configuration cannot guarantee that both channels are functional”. Should the AC provide guidance to permanently set the parameter at installation?	See comment.	Concur. Text changed. Old text: Set this parameter at installation to the appropriate value.  New text: For aircraft using a single antenna, this parameter can be set at installation  See also comment 18.
28	Honeywell	4-1.n	Change blue font to black	See comment	Concur. Text changed.
29	Honeywell	4-1.n	In the note, change the period (.) between 7500 and 7600 to a comma and space (, )	Change “7500.7600” to “7500, 7600”.	Concur. Text changed.

30	Honeywell	Appendix 1, 2.y	This is a duplicate of 2.v, as is Table 9 a duplicate of Table 8.	Delete 2.y and Table 9.	Concur. Text changed.
31	Honeywell	Appendix 6, 2.d	AC 20-172A is referenced earlier in the document, so this citation should probably be “AC 20-172()”	See comment.	Concur. Text changed.
32	Honeywell	Appendix 6, 2.g	Mention that this reference must include Corrigendum 1.	See comment.	Concur. Text changed. Ref to App 6 4.g.
33	EsterlineC MC	3-1 d. (1)	In the note, the title of ARINC 743 is incorrect.	The title of ARINC 743 is “ARINC Characteristic 743A-5”	Concur. Text changed. Changed all refs to <i>GNSS Sensor ARINC Characteristic 743A-4</i> .
34	EsterlineC MC	3-2 c. (2) Figure 2	Figure 2 refers to non existing Table 3-3.	Change text to “(next higher length code value)” and “(next higher width code value)”	Concur. Text changed.
35	EsterlineC MC	4-5 a.	It needs to be clarified that the position source must be identical from an ADS-B perspective. For example, equipment that has modified the LPV guidance interface (e.g. selected a difference DO-229D scaling option) can still provide identical ADS-B performance and interface.	Change text to “The position source must have identical ADS-B interface and performance to that of the other STC documentation.”	Not accpeted. The suggested text opens the possibility for manufacturers to argue identical performance for completely different designs. If a family of part numbers has similar performance, that case should be made during STC approval. Alternate text provided that addresses the concern.
36	EsterlineC MC	Appendix 2 3. h.	The test references to the MOPS do not address the latest RFI environment of DO-253B.	Refer to AC 20-138C for test procedures. “A test for GNSS position sources is defined in the latest revision AC 20-138 Appendix 4.”	Concur. Text changed.

37	EsterlineC MC	Appendix 2 3. n.	The required relationship of the time mark to UTC is unclear. ARINC 743() equipment is not required to align the time mark to UTC.	Change first sentence to “GNSS position sources should output a time mark identifying the Coordinated Universal Time (UTC) time of applicability of the position.”	Concur. Text changed.
38	EsterlineC MC	Appendix 2 4. d.	Note is unclear. All GNSS sources with a TSO are on a per hour basis therefore there are no limitations.	“No GNSS SW & HW changes are necessary as GNSS position sources compliant with any revision of TSO-C129, TSO-C145, TSO-C146, or TSO-C196 which output Horizontal Protection Level (HPL) or Horizontal Integrity Level (HIL) are based on a probability of $1 \times 10^{-7}$ per hour.”	Concur. Text deleted.
39	EsterlineC MC	Appendix 2 4. e.	ARINC 743 reference incorrectly identified.	“ARINC Characteristic 743A-5, <i>GNSS Sensor</i> , dated May 29, 2009”	Concur. Text changed.
40	EsterlineC MC	Appendix 2 4. f.	The sentence that states that the issue is not unique to un-augmented GPS position sources should also indicate the limitations of Class 1 operation.	Just before the last sentence, add “Note that SBAS-based HPL must use LNAV/VNAV or LPV/LP approach requirements to achieve NIC = 9.”	Concur. Text changed. Changed next to last sentence to clearly indicate the intent, when SBAS integrity is not used.
41	Esterline CMC	Appendix 2 4. f.	The list of error sources was inappropriately expanded beyond the consideration listed in DO-229D appendix U. This contradicts what is allowed during LNAV/VNAV or LPV/LP approaches.	Delete the sentence listing the error sources. The reference to DO-229D appendix U is sufficient.	Concur. Text changed to address intent of comment.

42	EsterlineC MC	Appendix 2 4. g.	Title is too general with respect to section k.	Change to “Horizontal position accuracy”	Concur. Text changed.
43	EsterlineC MC	Appendix 2 4. g., l., & o.	Incorrect title for AC 20-138 reference in the note.	“AC 20-138, Appendix 4 (GNSS Tests to Support ADS-B)”	Concur. Text changed. Ref deleted. Specific 20-138 para’s have been inserted throughout the document
44	EsterlineC MC	Appendix 2 4. g. (1) to (4)	Incorrect reference l(7) describes a VFOM test.	“See the test defined in the latest revision AC 20-138 Appendix 4.”	Concur. Text changed.
45	EsterlineC MC	Appendix 2 4. k.	The test references to the MOPS do not address the latest RFI environment of DO-235B.	Refer to AC 20-138C for test procedures. “... the position source manufacturer must run the test defined in the latest revision AC 20-138 Appendix 4.”	Concur. Text changed.
46	EsterlineC MC	Appendix 2 4. k. (1) to (6)	Incorrect reference: l(7) describes a VFOM test.	“ ... on the test defined in the latest revision AC 20-138 Appendix 4.”	Concur. Text changed.

47	EsterlineC MC	Appendix 2 4. k. (7) & (a) to (d)	Unnecessary duplication of AC 20-138C.	<p>Replace k. (7) and k. (7) (a) to (d) with “Means of compliance for this TSO requires GNSS manufacturers to provide substantiation data based on the test defined in the latest revision AC 20-138 Appendix 4.”</p> <p>Add at the end of 4.k. “The GNSS manufacturer must indicate that the equipment satisfies the requirements for the supported NACv codings in the installation instructions for the ADS-B integration. For support of NACv &gt; 1, the GNSS manufacturer must present substantiation data that the equipment dynamically outputs the velocity accuracy metric.”</p>	Concur. Text changed. References to AC 2-138 App 4 have been included through the document.
48	EsterlineC MC	Appendix 2 4. l. (1) to (7)	Unnecessary duplication of AC 20-138C.	Each paragraph should contain only: “Means of compliance for this TSO requires GNSS manufacturers to provide substantiation data along with the VFOM output based on the test defined in the latest revision AC 20-138 Appendix 4.”	Concur. Text changed. References to AC 2-138 App 4 have been included through the document.

49	EsterlineC MC	Appendix 2 4. m. and (1) to (7)	The reference “(See Integrity Limit)” does not exist. Intent of the paragraph is unclear. Mode dependencies are covered in para 4.e. for integrity fault, 4.f. for position integrity limits < 1nm, and 4.n. for approach mode integrity; the only other mode possibility is para 3.e. but that is covered in para 5.e.(1).	TBD: unable to determine exact intent of paragraph.	Concur. Text changed. Para ref provided.
50	EsterlineC MC	Appendix 2 4. n.	This also applies to SBAS LNAV/VNAV and LP not just LPV.	Update second sentence “... intended for SBAS LNAV/VNAV, LP, or LPV guidance ...”	Not accepted. This is just an example, not an all inclusive statement.
51	EsterlineC MC	Appendix 2 4. o. Note 2	Use of the term “test environment” is ambiguous. AC20-138C describes assumptions valid for both analysis or test.	Change to “Use AC 20-138C, Appendix 4 (GNSS Tests to Support ADS-B) assumptions for developing data for the minimum valid velocity.”	Concur. Text changed, para refernced.
52	EsterlineC MC	Appendix 2 4. p.	ARINC 743() compliant equipment has a 1 Hz timemark even when the position is output at a higher rate and is typically not aligned with UTC.	Change first sentence to “GNSS position sources should output a time mark.” Also qualify the time of applicability in 4. p. (1) to (7) as “... and UTC time of applicability.”	Concur. Text changed.

53	EsterlineC MC	Appendix 2 4. q. (3) to (6)	GPS health message and FDE is not just guidance, it is part of the means of compliance. Outside SBAS coverage it is the only SIS error detection.	Change first sentence to "...sections 2.1.1.3 and 2.1.1.5 for SBAS, section 2.1.1.2 for GPS health message, and Section 2.1.2.2.2.2.2 for FDE." and deleted second sentence.	Concur. Text changed.
54	EsterlineC MC	Appendix 2 4. q. (7)	Incorrect DO-319 reference.	DO-316	Concur. Text changed.
55	Doug Arbuckle	2-3.d	A sentence in this section is colored blue, without any explanation of why or what this means.	Change text from blue to black or explain what special meaning is attributed to blue text.	Concur. Text changed.
56	Doug Arbuckle	4-1.n	A sentence in this section is colored blue, without any explanation of why or what this means.	Change text from blue to black or explain what special meaning is attributed to blue text.	Concur. Text changed.
57	<i>Boeing Commercial Airplanes</i>  1 of 13	Page8 Para 3- 1.c.(1)(b)	The proposed text states: “(b) <b>Uncompensated Latency.</b> ...uncompensated latency must be less than or equal to 0.6 seconds. ...” However, Appendix 3, para. 4.e. (page A3-3) also allows for overcompensation up to +200 msec.	Change para 3-1.c.(1)(b) to read as follows: “(b) <b>Uncompensated Latency.</b> ...uncompensated latency must be less than or equal to 0.6 seconds <b>(lagging), or less than or equal to 0.2 seconds (leading)</b> ...” “uncompensated latency must be less than or equal to 0.6 seconds”  Capture leading and lagging latency requirements under one heading to avoid confusion.	Concur. Text changed.

58	<i>Boeing Commercial Airplanes</i>  2 of 13	Page 12 Para 3-2.c.(3)	<p>The proposed text states:  <b>“(3) ADS-B IN capability.</b>  <i>... If the aircraft has both 1090ES and UAT ADS-B IN systems installed, both the 1090ES ADS-B IN and UAT ADS-B IN capability should be set accordingly.”</i></p>	<p>We recommend revising the text as follows:  <b>“(3) ADS-B IN capability.</b>  <i>... If the aircraft has both 1090ES ADS-B IN and UAT ADS-B IN systems installed, both the 1090ES ADS-B IN and UAT ADS-B IN capability should be set accordingly.”</i></p> <p>While this revision may appear minor, we consider that the term <i>"1090ES"</i> could cause confusion to the applicant, in that it could be construed as a transponder alone that has extended squitter capability, or a transponder system that has no ADS-B IN capability but is installed along with a UAT ADS-B IN system. Our revision would make this clearer as to the intent.</p>	Concur. Text changed.
59	<i>Boeing Commercial Airplanes</i>  3 of 13	Page 12 Para 3-2.c.(4)	<p>We question why this paragraph lists only <i>“selected heading”</i> and <i>“selected altitude”</i> as parameters that may be required when operating in foreign airspace, rather than including a general statement that the installation should include all ADS-B parameters required by the country of intended operation.</p>	<p>We recommend revising this section to state that any ADS-B parameters required by a country of operation should be included in the installation if operating within that country.</p> <p>The statement/requirement is not limited to the two parameters listed</p>	Concur. Text modified and moved to section 3-11.

60	<i>Boeing Commercial Airplanes</i>  4 of 13	Page 13 Para 3-3.a.	<p>The second sentence of the proposed paragraph states: <b>“a. Equipment eligibility.</b> ... <i>There are no unique minimum standards for position sources supporting ADS-B. ...</i>”</p> <p>However the fifth sentence states “... <i>The position source must also comply with the appendix 2 minimum performance standards. ...</i>” [emphasis added]</p>	<p>We recommend deleting the second sentence or clarifying the intent.</p> <p>The two sentences are in conflict with each other.</p>	Concur. Sentence deleted.
61	<i>Boeing Commercial Airplanes</i>  5 of 13	Page 22 Para 3-7.c.(5)(b)	<p>The proposed text states: <b>“(b) System safety assessment.</b> <i>Transmission of false or misleading information is considered to be a major failure effect and may not occur at a rate greater than 1x10-5 per hour for ADS-B systems. ...</i>”</p>	<p>We request further clarification of the term "per hour" as used in this section.</p> <p>Depending on how it is defined, the term will impact statistical calculation for safety analysis. ADS-B is active in many flight phases (in air, ground, terminal, taxi, etc.)</p>	Concur. Modified text to “per flight hour.”

62	<i>Boeing Commercial Airplanes</i>  6 of 13	Page 27 Para 4-1.a.	<p>The proposed text of the Note in this paragraph on “Systems interface testing” states:</p> <p><i>“Note: If simulating dynamic conditions during ground testing the ADS-B system, you must prevent being a source of interference to ATC or ADS-B IN equipped aircraft in the area. For example, transmitting airborne position reports with simulated airborne altitudes while on the surface will produce false targets for the ATC surveillance systems or airborne ADS-B IN equipped aircraft.”</i></p>	<p>We suggest the note be revised to add recommendations for what types of precautions or procedures are needed during the ground test to avoid interference to the ADS-B In equipped aircraft.</p> <p>More guidance is required in order to complete the ground test.</p>	<p>Not accepted. This language is similar to the TCAS ground test guidance. Existing Mode S ground test procedures should be adequate. Language changed to request testers to contact ATC before transmitting over the air.</p>
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63	Boeing Commercial Airplanes  7 of 13	Page 27 4-1.c.(1)	The proposed text states: “ <i>c. Rule Compliance. ...</i> <i>(1) Ensure the installed system meets its stated accuracy and integrity performance under all foreseen conditions. ...</i> ”	We recommend revising this text as follows: “ <i>c. Rule Compliance. ...</i> <i>(1) Ensure the installed system meets its stated accuracy and integrity performance under all foreseen conditions. <b>during ground test.</b> ...</i> ”  The phrase “ <i>under all foreseen conditions</i> ” is too broad and may include lab test, analysis, and flight test. Our suggested revision will clarify the intent in the context of this section of the AC	Concur. Text modified.
64	Boeing Commercial Airplanes  8 of 13	Page 27 4-1.c.(1)	<b>EDITORIAL COMMENT:</b> Unlike other sub-paragraphs in paragraph 4-1.c., sub-paragraph (1) lacks a title.	We suggest adding a title to sub-paragraph (1): <i>"Accuracy and Integrity Requirements"</i> .  Adding a title to this section will help guide the user to that appropriate information when needed	Concur. Text changed.

65	<i>Boeing Commercial Airplanes</i>  9 of 13	Page 31 Para 4-1.n.	<p>The proposed text states:  <b><i>“n. Mode 3/A code &amp; emergency code.</i></b>  <i>Demonstrate that the correct Mode 3/A code is transmitted. Also ensure 7500, 7600 and 7700 and IDENT are transmitted properly.</i>  <b><i>Note: Do not transmit the 7500, 7600, or 7700 emergency codes over the air during ground or flight testing. This is to ensure false alerts are not received by ATC.</i></b>  [highlight added]</p>	<p>We recommend removing the references to the 7500, 7600 and 7700 emergency codes in the second sentence of paragraph n. These should only be verified during bench TSO testing and should not be in a set of requirements for a certification ground test.</p> <p>The second sentence of paragraph n. and the Note are in conflict. Emergency codes will be verified during Minimum Operational Performance (MOPs) requirements testing.</p>	Concur. Text modified.
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66	<i>Boeing Commercial Airplanes</i>  10 of 13	Page 33 Para 4-3.d.(1)	The proposed text states: “(1) <i>Rule Compliance. “Review the data from the FAA ground system for the flight to ensure the installed system meets its stated accuracy and integrity performance under all conditions. ...”</i> ”	We recommend revising this text as follows: “(1) <i>Rule Compliance. Review the data from the FAA ground system to ensure that the installed system met its stated accuracy and integrity performance <b>under all conditions. during the flight test.</b> ...”</i>  The phrase “ <i>under all foreseen conditions</i> ” is too broad and may include lab test, analysis, and ground test. Our suggested revision will clarify the intent in the context of this section of the AC.	Concur. Text modified.
67	<i>Boeing Commercial Airplanes</i>  11 of 13	Page A1-4 Para 2.v. and Page A1-5 Para 2.y.	<b>EDITORIAL COMMENT:</b> The paragraph titled, <b><i>Navigation Integrity Category (NIC)</i></b> , and the associated <b><i>NIC Values</i></b> table are listed twice in the proposed AC.	Delete para 2.y. and Table 9.  Duplication of same information.	Concur. Text changed.

68	<i>Boeing Commercial Airplanes</i>  12 of 13	Page A2-3 Appx 2 Para 3.o.(2)	The last sentence of this proposed text states: “(2) ... <i>The FAA plans to implement a preflight availability determination system to assist operators in determining surveillance availability for ADS B prior to flight. This tool will consider the GPS constellation that is available at that time as well as the status of existing backup surveillance capability.</i> ”	We recommend that this statement be deleted.  The operational requirement to conduct a pre-dispatch Receiver Autonomous Integrity Monitoring (RAIM) check will force operators within the National Airspace System (NAS) to upgrade to WAAS/SBAS equipage to avoid the operational uncertainty of potential airplane grounding. The costs are substantial and were not included in the ADS-B cost/benefit analysis supporting the associated rulemaking.	Not accepted. The tool is not required. When implemented the tool will aid operators in determining if their installed equipment will meet the performance necessary for separation services along the route of flight.
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69	<p><i>Boeing Commercial Airplanes</i></p> <p>13 of 13</p>	<p>Page A3-2 Appx 3 Para 4.b</p>	<p>The proposed text states:  <b><i>“b. Latency applicability.</i></b>  <i>The 2.0 second total latency requirement applies to the aircraft position (latitude and longitude), position accuracy metric (NACP), velocity, and the velocity accuracy metric (NACV). The 0.6 second uncompensated latency requirement only applies to the aircraft position (latitude and longitude).”</i>  The 2.0 second total latency requirement is applied to the position accuracy metric NACp. However, Register 65H which contains NACp, is only broadcast at a nominal rate of 0.4 message/second (ref RTCA DO-260B, Table A-1), which equals once every 2.5 seconds. The proposed AC does not require Register 62H to be transmitted.</p>	<p>We recommend deleting the 2.0 second total latency requirement for NACp.</p> <p>The FAA requirement for total latency for NACp cannot be met via the international definition of the 1090 ES message set.</p>	<p>Concur. Position accuracy removed from the total latency applicability statement.</p>
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70	Garmin	1-2	<p>This section states that the AC applies to anyone applying for TC, STC, amended TC, or amended STC for the installation of the ADS-B Out system. The general content and some specific details throughout this AC imply that ADS-B Out functionality can be installed under a Field Approval. Various comments below will address those sections individually.</p>	<p>Allow for installations to be accomplished under Field Approval, or remove the suggested sections from the AC at this time.</p>	<p>No change required.</p>
71	Garmin	1-5.c.	<p>Includes the sentence:</p> <p style="padding-left: 40px;">ADS-B IN refers to an aircraft's ability to receive ADS-B information, such as ADS-B messages from other aircraft or Traffic Information Services-Broadcast (TIS-B), Automatic Dependent Surveillance - Rebroadcast (ADS-R), and FIS-B from the ground infrastructure.</p> <p>Including reception of FIS-B conflicts with the definition of ADS-B In as defined in AC 20-172A paragraph 1-1.a, which specifically excludes reception of FIS-B.</p>	<p>Change the sentence to:</p> <p style="padding-left: 40px;">ADS-B IN refers to an aircraft's ability to receive ADS-B information, such as ADS-B messages from other aircraft or Traffic Information Services-Broadcast (TIS-B) and Automatic Dependent Surveillance - Rebroadcast (ADS-R) from the ground infrastructure.</p>	<p>Concur. Text modified.</p>

72	Garmin	2-2	<p>Requires an AFMS for those ADS-B Out Systems that reside in a current approved transponder. This creates an undue burden on the STC applicant as well as the FAA.</p> <p>Additionally, if the requirement for an AFMS remains in the AC, why was the appendix with an example AFMS deleted?</p>	<p>Do not require an AFMS for those ADS-B Out systems that are integrated into a currently approved transponder. Proper announcement of the ADS-B functionality, as described in Paragraph 3-7 of this AC and a logbook entry should be sufficient for informing the crew/pilot that their aircraft is equipped with the functionality. The logbook entry should read: "The installed ADS-B Out system has been shown to meet the equipment requirements of 14 CFR 91.227." This approach is similar to that of current altimeter and altitude reporting tests and inspection requirements of 14 CFR 91.411. An operator has no way of knowing his altimetry system has been tested and inspected within the preceding 24 calendar month period without the presence of a logbook entry.</p>	<p>Not accepted. The FAA regional certification offices have different formats that they promote for AFM supplements. The example provided was not compliant with any of them. So they asked for the example to be removed. Manufacturers should add the quoted statement from section 2-2 to the AFM in a manner acceptable to the regional office.</p>
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73	Garmin	2-3.d.(2)	<p>This paragraph and subsequent example implies that the installer or operator is to modify an existing ICA for any interfacing source to an ADS-B Out piece of equipment. This paragraph is contradictory to the instructions and guidelines outlined in FAA Order 8110.54A Chapter 2 Paragraph 4 that states: “The applicant must assess existing ICA and then: (1) Develop and propose any necessary changes as supplementary instructions. He would then be responsible for furnishing, or making available, these supplementary instructions in accordance with 14 CFR 21.50(b)”.</p>	<p>Recommend removing this paragraph. The ICA developed for the ADS-B Out STC will address any affected maintenance requirements for interfacing equipment, i.e. GPS.</p>	<p>Not accepted. Modification of systems that interface or provide info to the ADS-B system must be clear in their applicable ICA that the ADS-B system be retested. Including this guidance in the ADS-B equipment ICA does not provide adequate visibility that the altering interfacing systems may negatively affect the ADS-B installation.</p>
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74	Garmin	3-2.c.(4)	<p>The paragraph includes the following new text:</p> <p>However, selected heading and selected altitude may be required when operating in foreign airspace. If operations are planned in a country that requires selected heading and selected altitude, follow the ADS-B equipment manufacturer’s installation guidance to interface selected heading and selected altitude.”</p> <p>Selected heading and selected altitude are data elements in the 1090 ES Target State and Status message, and this message is optional for Class A1/A1S and Class B1/B1S equipment per DO-260B section 2.1.12.1. Although the European Commission Implementing Regulation for ADS-B (no 1207 2011) can be interpreted to require Selected Altitude to be transmitted when Enhanced Surveillance is enabled, it is unclear whether the intent of the IR is to require that the Target State and Status message be transmitted.</p>	<p>Garmin recommends that the FAA confirm whether the intent of the rules of “operating in foreign airspace” is to make the optional Target State and Status message a requirement for operations.</p> <p>If the intent of those rules is to require transmission of the Target State and Status message, the language in this section should include that information.</p> <p>If the intent of those rules is NOT to require transmission of the Target State and Status message, this section should acknowledge that and update the language to be applicable only to equipment that transmits the Target State and Status message.</p>	<p>Concur. See comment 59 resolution. Target State and status message is required by the European ADS-B rule but not required in any other airspace at this time.</p>
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75	Garmin	3-3.b.(4)	<p>This paragraph implies that the crew/pilot will know which source is the more accurate position source by making statements such as:</p> <p style="padding-left: 40px;">If multiple sources are interfaced to the ADS-B, there must be a means for the flight crew to readily determine which source is selected.</p> <p>DO-260B Section 2.2.5.3 currently requires a transponder with ADS-B Out to provide automatic monitoring and switching if multiple position sources are used. This DO-260B requirement coupled with the annunciation of position source data loss requirement in Paragraph 3-7 of this AC provide sufficient indication to the crew in this regard.</p>	<p>Garmin's understanding is that the intent of this paragraph was to mitigate position source failure situations. Since a transponder that is certified to TSO-C166b will automatically switch between position sources based upon the DO-260B requirement, Garmin can see no added value to indicating the selected position source.</p> <p>Recommend deleting this paragraph.</p>	<p>Accepted. Text was changed to indicate a means of compliance other than display of position source. Although in an integrated system flight deck, having a display page available to determine the source in use is recommended.</p>
76	Garmin	3-7.b.(1)(a) and 3-7.b.(1)(b)	<p>ADS-B Device and Function failure annunciations. These paragraphs do not address those ADS-B Out systems that reside in a current approved 1090ES transponder.</p>	<p>Provisions should be added in each of these subparagraphs that allow for the Device/Equipment failure annunciation to be that of the transponder failure.</p>	<p>Not accepted. Section 3-7.b.(1)(b) already allows for the case where a single fail lamp is used to indicate either a ADS-B Equipment Failure or an ADS-B Function Failure. In this case, the flight manual/pilot's guide must indicate how to tell the difference between the two cases for the individual aircraft installation.</p>

77	Garmin	3-7.b.(1)(b)	<p>Includes the statement:</p> <p>The flight manual must describe the means to differentiate between annunciation of an equipment failure and a function failure if the failure annunciations are not unique.</p> <p>As previously stated, Garmin objects to the requirement to document operating limitations, normal operating procedures, and system description in an AFMS and feels these aspects can be documented adequately using other means.</p>	<p>Change the statement to:</p> <p>The system description required by section 2-2 is one acceptable means of compliance to describing how to differentiate between annunciation of an equipment failure and a function failure if the failure annunciations are not unique.</p>	Accepted. Text modified.
78	Garmin	3-7.b.(3) and its subparagraphs	<p>The text refers to use of a “blank” call sign when using the self-assigned temporary 24-bit address. 14 CFR 91.227 does not require the existence of a call sign in this condition. The term “blank” is too easily confused with a call sign that consists of only the “space” character, which is not allowed under the UAT TSO. The term “unavailable call sign” is a more accurate description.</p>	<p>Reword this section to avoid potential confusion over use of the term “blank call sign”.</p>	Concur. Text changed.

79	Garmin	3-7.c.(1)	Clarify whether the term “blank call sign” in this context refers to an “unavailable” call sign. The call sign is never allowed to be “blank” (i.e. consisting of eight SPACE characters). The term “anonymous (blank) call sign” is very confusing.	Reword the text to avoid potential confusion over the term “blank call sign”.	Concur. Text changed.
80	Garmin	3-8.b.(1)	This section addresses the use of an existing transponder antenna, but does not address the use of an existing UAT antenna.	Address the use of an existing UAT antenna.	Concur. Text changed.
81	Garmin	3-8.b.(3)(c)	This paragraph states:  Transmit power will be verified during ground test.  This statement seems redundant to the requirements specified in 4-1.k where the ground test requirements reside.	Delete statement.	Not accepted.
82	Garmin	3-8.b.(3)(d)	“Structural analysis.” Installation of the ADS-B Out functionality currently requires an STC. FAA AC 21-40A details the required data for STC applicants.	Delete statement.	Not accepted.

83	Garmin	4-1.n.	<p>This paragraph includes ensuring the emergency codes are transmitted properly; however, the Note in this paragraph explicitly states that the emergency codes are not to be transmitted during ground or flight testing. Testing the transmission of the emergency codes is not practical without additional guidance.</p>	<p>Recommend removing “&amp; emergency code” from the first sentence and changing the last sentence of this paragraph to:</p> <p style="text-align: center;"><i>Also ensure IDENT is transmitted properly.</i></p> <p>Also, change all blue text in the AC to “automatic” or black.</p> <p>Also, change “7500.7600” in the Note to “7500, 7600”.</p>	<p>Accept. Text modified.</p> <p>See ALSO comment 65.</p>
84	Garmin	4-5.c.	<p>This paragraph includes the statement:</p> <p style="padding-left: 40px;">Aircraft with data concentrators will have to re-accomplish the flight test, even if the equipment is identical.</p> <p>The AC should not disqualify reuse of STC data based solely on the type of architecture used in the previously approved installation, particularly when the STC data includes a latency analysis that accounts for any delays caused by a data concentrator.</p>	<p>Recommend revising the entire paragraph to read as follows:</p> <p style="padding-left: 40px;">The position source interface to the ADS-B equipment must be identical to that of the previous STC.</p>	<p>Not accepted. FAA agrees that it is possible to design data concentrators such that latency and update rate are not affected by different installations. However, the nature of legacy data concentrators is such that different aircraft configurations even of the same model may affect the performance of the data concentrator latency or update rates. The only way to mitigate this risk is by flying the individual aircraft to measure the performance of the installed system.</p>

85	Garmin	Appendix 1 2.v/Table 8 and 2.y/Table 9	Paragraphs 2.v/Table 8 and 2.y/Table 9 appear to provide duplicate information on the NIC parameter.	Remove duplicate paragraph 2.y and Table 9 information.	Concur. Duplicate table removed.
86	Garmin	Appendix 1 2.aa	<p>The definition for Single antenna bit states:</p> <p style="padding-left: 40px;">Indicates if the ADS-B equipment is transmitting through a single bottom-mounted antenna.</p> <p>This definition is not entirely consistent with the requirements of RTCA DO-260B section 2.2.3.2.7.2.4.5 which states:</p> <p style="padding-left: 40px;">At any time that the diversity configuration cannot guarantee that both antenna channels are functional, then the Single Antenna subfield shall be set to ONE.</p>	Change the definition to indicate that a diversity installation that cannot guarantee that both antenna channels are functional will also set the Single Antenna bit.	Concur. Text changed.
87	Garmin	Appendix 2 3.h	RTCA/DO-260B and RTCA/DO-282B are referenced for the velocity accuracy test. AC 20-138C also includes this test, as well as other tests to verify a GNSS position source for ADS-B out.	Replace the references to DO-260B and DO-282B with a reference to AC 20-138C, Appendix 4, sections A4-2 through A4-5 and A4-9.	Concur. Text changed to point to AC 20-138.

88	Garmin	Appendix 2 3.i	This paragraph uses both the term “airborne electronic hardware (AEH)” and the term “custom airborne electronic hardware”.	Suggest changing “custom airborne electronic hardware” to “AEH”.	Concur. Text changed. The word custom removed.
89	Garmin	Appendix 2 3.1 Note 2	Note 2 references AC 20-138C appendix 4 for additional information related to velocity latency, but there is no discussion of velocity latency in AC 20-138C.	Correct reference or remove Note 2.	Accepted. Text modified.
90	Garmin	Appendix 2 3.o.(2)	Typo in 2 <sup>nd</sup> to last sentence of the paragraph.	Change “ADS B” to “ADS-B”.	Concur. Text changed.
91	Garmin	Appendix 2 4.d.(3)	Grammatical errors in both the second to last sentence and last sentence.	Remove the following redundant text from the end of the second to last sentence:  “for an acceptable scaling method/additional guidance.”  Change the last sentence to:  “FDE requirements can be found in section 2.1.2.2.2.2.2.”  This will make the sentence consistent with the last sentence of Appendix 2 4.d.(4).	Concur. Text changed.

92	Garmin	Appendix 2 4.d.(4)	Grammatical error in second to last sentence.	Remove the following redundant text from the end of the sentence:  “for an acceptable scaling method/additional guidance.”	Concur. Text changed.
93	Garmin	Appendix 2 4.g	This section states that all revisions of TSO-C145 and C146 are required to output HFOM.  However, there is no minimum requirement for HFOM output for TSO-C145a and C146a equipment, as suggested in subsections (3) and (4) in this section.	Clarify that TSO-C145a and C146a equipment may not provide an HFOM output.	Concur. Text changed.
94	Garmin	Appendix 2 4.g Note	The note in this section references AC 20-138 Appendix 4 (GNSS Velocity Test).  The GNSS velocity tests defined in AC 20-138 appendix 4 are not relevant to horizontal accuracy.  The appropriate reference is AC 20-138C appendix 4 section A4-11 (Test to Demonstrate Horizontal Position Accuracy Metric)	Change the note to read:  “Use the latest revision of AC 20-138, Appendix 4, paragraph A4-11 (Test to Demonstrate Horizontal Position Accuracy Metric) for additional guidance.”  Alternatively, delete the note entirely if the contents of AC 20-138C, Appendix 4, section A4-11 are copied into this AC. (See Garmin comment on Appendix 2 section 4.g.)	Concur. Text changed. Note changed and Appendix 4 references placed in the appropriate TSO sections.

95	Garmin	Appendix 2 4.g (various subsections)	<p>Multiple incorrect references to "section 4 subparagraph l(7)" throughout this section.</p> <p>Section 4, subparagraph l(7) describes the test for HAE and vertical position accuracy metric outputs – not the test for horizontal position accuracy (HFOM).</p> <p>The test procedure for horizontal accuracy is not defined in this AC, but is defined in AC 20-138C Appendix 4 section A4-11 (Test to Demonstrate Horizontal Position Accuracy Metric).</p>	<p>Replace these references with a direct reference to AC 20-138C Appendix 4, section A4-11.</p> <p>Alternatively, copy the content of AC 20-138C Appendix 4, section A4-11 into this AC and reference it instead, as was done for the HAE and VFOM tests.</p>	Concur. Text changed.
96	Garmin	Appendix 2 4.k	RTCA/DO-260B and RTCA/DO-282B are referenced for the velocity accuracy test. AC 20-138C also includes this test, as well as other tests to verify a GNSS position source for ADS-B out.	Replace the references to DO-260B and DO-282B with a reference to AC 20-138C, Appendix 4, sections A4-2 through A4-5 and A4-9.	Concur. Text changed.

97	Garmin	Appendix 2 4.1 Note	<p>The note in this section references AC 20-138 Appendix 4 (GNSS Velocity Test).</p> <p>The GNSS velocity tests defined in AC 20-138 Appendix 4 are not relevant to vertical position accuracy.</p> <p>The appropriate reference is AC 20-138C Appendix 4 section A4-10 (Test to Demonstrate HAE Output and Vertical Position Accuracy Metric).</p>	<p>Change the note to read:</p> <p>“Use the latest revision of AC 20-138, Appendix 4, Section A4-10 (Test to Demonstrate HAE Output and Vertical Position Accuracy Metric) for additional guidance.”</p> <p>Alternatively, delete the note entirely as the contents of AC 20-138C Appendix 4 section A4-10 have been copied into this AC in Appendix 2, section 4.1.(7).</p>	Concur. Text changed.
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98	Garmin	Appendix 2 4.n	<p>In this section, the AC makes the following recommendation for SBAS equipment:</p> <p>“If the position source outputs the HPL on lateral error and approach exposure time, we recommend that the position source inflate the HPL by 3% in approach modes to ensure the integrity is appropriately bounded.”</p> <p>If the SBAS equipment only provides a single HPL output, inflating that output by 3% in approach mode would not be consistent with the requirements in DO-229D.</p> <p>The key point is that the integrator needs to know if the HPL scaling is different in approach mode so that the ADS-B equipment can account for this difference.</p>	Change recommendation to require position source manufacturers to specify if the HPL output is scaled differently in approach mode and how the ADS-B equipment can compensate for this scaling.	Concur. Text changed.
99	Garmin	Appendix 2 5	The term “tightly-coupled GNSS/IRU” is used without definition.	Change “tightly-coupled GNSS/IRU” to “tightly-coupled GNSS/IRS” to be consistent with the rest of the paragraph.	Concur. Text changed Definition is that the unit is compliant per section 5.a.

100	Garmin	Appendix 2 6.c	The term “loosely-coupled” is used without definition.	Define the term so its applicability can be determined by the reader.	Concur. Text changed Inserted the text “loosely coupled”. Definition is that the unit is compliant per section 6.c.2.
101	Joe White, A4A	Draft AC 20-165A, Appendix 2, page A2-3, paragraph o.	<p>Operators do not have sufficient information for making enduring plans on the types of positioning systems in which they should invest based on: the remaining service lives of their airplanes; the projected availabilities of GPS satellites; the NIC levels that will be provided across a range of availabilities of GPS satellites; and planned changes to the GPS constellation.</p> <p>Plans for positioning systems must take into account that significant changes to an airplane’s positioning system may require replacement of the FMS. This further highlights the need for planning based on the best information available on the performance of positioning systems across a range of potential satellite availability.</p>	<p>Revise subparagraph o. (1) to read as follows, and for consistency, replace Table 13 with the three new tables on the following page, to include more data.</p> <p>Revise subparagraph o. (1):</p> <p>“Analysis has shown the following estimated availabilities, (see Tables 13 and 14), across a range of operational availabilities of GPS satellites. The ADS-B Out rule assumes the minimum threshold of GPS satellite availability. The availability projected to provide NIC 7 improves when the GPS constellation is full of operational satellites, and in effect, it improves when NIC 6 is acceptable for a planned route.”</p>	Not accepted. AIR-130 will provide A4A a presentation with the additional information requested.

**Table 13. Predicted Percent of Time GNSS Will be Available and Provide NIC 7**

Positioning Service (receiver standard)	Available GPS Satellites						
	22	23	24*	25	26	27	28
GPS (TSO-C129) (SA Off)							
GPS (TSO-C129) (SA On)			≥ 89.0				
GPS (TSO-C145 or -C196) (SA Off)			≥ 99.0				
GPS/SBAS (TSO-C145/TSO-C146)**			≥ 99.9				

\* Minimum Threshold Constellation

\*\* Based on 50 or 100 percent WAAS availability

**Table 14. Predicted Percent of Time GNSS Will be Available and Provide NIC 6**

Positioning Service (receiver standard)	Available GPS Satellites						
	22	23	24*	25	26	27	28
GPS (TSO-C129) (SA Off)							
GPS (TSO-C129) (SA On)							
GPS (TSO-C145 or -C196) (SA Off)							
GPS/SBAS (TSO-C145/TSO-C146)**							

\* Minimum Threshold Constellation

\*\* Based on 50 or 100 percent WAAS availability

**Table 15. Historical Percent of Time GPS Satellites Available**

Number of GPS Satellites						
22	23	24*	25	26	27	28

\* Minimum Threshold Constellation

102	Kevin Bridges	App 2 para 3 (a)	<p>This para should be reworded from:</p> <p><b>Position.</b> The position source must provide a latitude and longitude output. Requirements and test procedures in TSO-C129/145/146/161/196 are sufficient and GNSS equipment with Technical Standard Order Authorization (TSOA) for the aforementioned TSOs require no additional qualification for the position output</p>	<p>Reword as follows</p> <p><b>Position.</b> The position source must provide a latitude and longitude output. Requirements and test procedures in TSO-C129/145/146/196 [We never looked and GBAS and you need to be very careful about including GBAS in the list like this. GBAS is very localized in its coverage (i.e., only within 30nm of an airport with GBAS) and there is no GBAS requirement to provide area navigation service in that range. Some GBAS systems may do so and some may not. I recommend deleting TSO-C161 or putting it in a note that, when available within GBAS coverage, TSO-C161 position outputs are acceptable. Also, why are these GNSS-specific TSOs being discussed in a ‘general’ requirements area? Don’t they belong in section 4?]are sufficient and GNSS equipment with Technical Standard Order Authorization (TSOA) for the aforementioned TSOs require no additional qualification for the position output.</p>	Concur. Text changed.
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103	Martin Gray Trig Avionics	Section 3-3 c (3).	Can you please include guidance on the setting of the SIL for sources that do not qualify for setting SIL = 3		Accepted. Added text to 3-3.c.3 to set SIL=0.
104	Martin Gray Trig Avionics	Section 3-1 b (1).	Clarification of SDA value to be set for installations that use certified equipment, but that equipment does not meet the performance requirements of the mandate. Currently the draft of 20-165 states that “installations with uncertified equipment should set the SDA = 0”, however this may lead installers to set a non zero SDA if the equipment is certified but does not meet the mandate.		Accepted. Added text to 3-1.b.2 to set SDA=0.