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Change 1 -to- EUROCAE ED-143

MINIMUM OPERATIONAL PERFORMANCE STANDARDS FOR TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM II (TCAS II)

Change 1 to ED-143
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EXECUTIVE SUMMARY

This Change 1 document specifies a change to the TCAS II requirements contained in EUROCAE document ED-143/RTCA document DO-185B. The rationale for the change is described in change proposal CP123, which was approved by the WG-75/SC-147 Requirements Working Group.

The first part of the change concerns an aspect of the TCAS multi-aircraft logic. It affects the “middle” aircraft of a multi-threat situation, and removes the feature that would have required a green arc to accompany that aircraft’s RA.

The second part of the change clarifies the coding of certain bits reporting Hybrid Surveillance capability within the Data Link Capability Report, to be consistent with a change made to DO-300.

Section 1 provides the text changes to Volume I.

Section 2 provides changes to the Pseudocode in Volume II, Attachment A.

Section 3 provides changes to the state charts in Volume II.

Section 4 provides changes to the TSIM data set that is specified for the verification of the TCAS implementation. This material is not part of ED-143/DO-185B, but is accompanying material distributed by FAA, not by RTCA.

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1 - CHANGES TO VOLUME I

The following correction is needed in order to more accurately describe the behavior of the multi-aircraft logic when own aircraft is "projected in the middle".

2.2.5.3.3 Multi-Aircraft Logic

NOTE: *Special rules are invoked when a TCAS-equipped aircraft is involved in a multiple-aircraft encounter. The pilot of the aircraft with "projected clear airspace above" is told to CLIMB, and the pilot of the aircraft with "projected clear airspace below" is told to DESCEND. Aircraft "projected in the middle" are told to limit their climb and their descent until the aircraft above or below are no longer in conflict.*

The selection of a positive DESCEND advisory in a multi-aircraft situation is also subject to the performance limitations of the TCAS aircraft when it is near the Descend Inhibit altitude threshold. In this case, a negative DON'T CLIMB will be selected instead of DESCEND.

The multi-aircraft logic has been designed to prevent premature level-off RAs when own is to pass between two threats vertically. This requires retention of a positive RA until certain criteria have been met so that vertical separation is maximized. The multi-aircraft logic also includes the ability to model and select Increase Rate RAs and sense reversals to better resolve situations that are deteriorating due to adverse maneuvers by own aircraft or one of the threats. (The ability to generate an Increase Rate RA is subject to the INCREASE CLIMB and INCREASE DESCENT inhibit indications and thresholds.) The logic also performs an unbiased evaluation of all new threats to select the optimum RA against all rather than constraining the RA to be selected against the second or third threat by the initial choice against the first.

Following is the change needed to the coding of the data link capability report:

2.2.3.9.3.2.3.2.1 Coding of Data Link Capability Report - DO-185A,B Systems

Bits 48, 69, 70, 71 and 72 are used to convey TCAS capability information as follows:

<u>Bit(s)</u>	<u>Coding</u>
48	0 = TCAS failed or on standby 1 = TCAS operating
69	0 = Hybrid surveillance not operational 1 = Hybrid surveillance fitted and operational
70	0 = TCAS generating TAs only 1 = TCAS generating TAs and RAs
72,71	TCAS Version 0,0 = RTCA DO-185 0,1 = RTCA DO-185A 1,0 = RTCA DO-185B and ED-143 1,1 = Future versions (see registers E5 ₁₆ and E6 ₁₆ in Ref. L)

2.2.3.9.3.2.3.2.2 Coding of Data Link Capability Report - FAA TSO-C119A Systems

Bit 48: Bit 48 = 1 indicates that the TCAS/transponder interface is operational and that TCAS is reporting RI=2 or 3 for use in the air-to-air Reply Information field (2.2.3.9.3.1.14).

Bits 69, 70: On-Board Resolution Capability Bits - Bits 69 and 70 form a capability code subfield which indicates aircraft's on-board resolution advisory generation capability.

The codes are:

- 0 = No on-board resolution advisory generation capability.
- 1 = An on-board vertical-only resolution advisory generation capability exists.
- 2 = An on-board vertical and horizontal resolution advisory generation capability exists (not applicable to FAA TSO-C119A systems).
- 3 = Not assigned.

Following is the change needed to a test procedure, as a result of the change made to section 2.2.3.9.3.2.3.2.1:

2.4.2.2.5 TCAS Capability Reporting (2.2.3.13.2.2.4 and 2.2.3.13.2.2.1)

(text omitted)

When testing with an RTCA/DO-185A,B compatible Mode S transponder:

Msgs: DF=20 with BDS=16, bits 48, 69, 70, 71, 72 = 0xy01 at T=4 and 64
DF=21 with BDS=16, bits 48, 69, 70, 71, 72 = 0xy01 at T=9 and 69
DF=20 with BDS=16, bits 48, 69, 70, 71, 72 = 1x001 at T=24, 34
DF=21 with BDS=16, bits 48, 69, 70, 71, 72 = 1x001 at T=29, 39
DF=20 with BDS=16, bits 48, 69, 70, 71, 72 = 1x101 at T=44, 54
DF=21 with BDS=16, bits 48, 69, 70, 71, 72 = 1x101 at T=49, 59

Where x=0 if hybrid surveillance is not operational
x=1 if hybrid surveillance is fitted and operational
y=don't care

2 - CHANGES TO PSEUDOCODE

The pseudocode changes needed to implement change proposal CP123 follow. Only a single pseudocode program is affected, `Set_up_display_outputs` (ED-143/DO-185B, Volume II, Attachment A, pages 8-P16 and 8-P17). Both the published ED-143/DO-185B version (BEFORE) and the revised version (AFTER) of both the high-level and low-level pseudocode are shown below. The changes in the AFTER versions are highlighted.

In addition to the changes needed to implement the change proposal, it was noted that the published version of the low-level pseudocode is missing a needed "G." reference to the global data structure G, and that is also fixed and highlighted.