NOTICE OF PROPOSED AMENDMENT (NPA) NO 2009-03

DRAFT DECISION OF THE EXECUTIVE DIRECTOR OF THE EUROPEAN AVIATION SAFETY AGENCY

Amending Decision No. 2003/10/RM of the Executive Director of the European Aviation Safety Agency of 24 October 2003 on Certification Specifications, Including Airworthiness Codes and Acceptable Means Of Compliant, for European Technical Standard Orders («CS-ETSO»)

Update to European Technical Standard Order ETSO-C119b

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A. EXPLANATORY NOTE

I. General

1. The purpose of this Notice of Proposed Amendment (NPA) is to envisage amending Decision 2003/10/RM of the Executive Director of 24 October 2003[1] on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders (CS-ETSO). The scope of this rulemaking activity is outlined in Terms of Reference (ToR) ETSO.007b and is described in more detail below.

2. The European Aviation Safety Agency (hereinafter referred to as the Agency) is directly involved in the rule-shaping process. It assists the Commission in its executive tasks by preparing draft regulations, and amendments thereof, for the implementation of the Basic Regulation[2] which are adopted as "Opinions" (Article 19(1)). It also adopts Certification Specifications, including Airworthiness Codes and Acceptable Means of Compliance and Guidance Material to be used in the certification process (Article 19(2)).

3. When developing rules, the Agency is bound to follow a structured process as required by Article 52(1) of the Basic Regulation. Such process has been adopted by the Agency's Management Board and is referred to as "The Rulemaking Procedure"[3].

4. This rulemaking activity is included in the Agency's Rulemaking Programme for 2009. It implements the rulemaking task ESTO.007b Update to ETSO-C119b Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II.

5. The text of this NPA has been developed by the Agency. It is submitted for consultation of all interested parties in accordance with Article 52 of the Basic Regulation and Articles 5(3) and 6 of the Rulemaking Procedure.

II. Consultation

6. To achieve optimal consultation, the Agency is publishing the draft decision of the Executive Director on its internet site. Comments should be provided within 6 weeks in accordance with Article 6(5) of the Rulemaking Procedure. Comments on this proposal should be submitted by one of the following methods:

CRT: Send your comments using the Comment-Response Tool (CRT) available at **http://hub.easa.europa.eu/crt/**

E-mail: **Only** in case the use of CRT is prevented by technical problems these should be reported to the CRT webmaster and comments sent by email to NPA@easa.europa.eu.

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[1] Decision No 2003/10RM of the Executive Director of the Agency of 24.10.2003 on certification specifications, including airworthiness codes and acceptable means of compliance, for European Technical Standard Orders (« CS-ETSO »). Decision as last amended by Decision 2008/012/R of the Executive Director of the Agency of 28 November 2008.

[2] Regulation (EC) No 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC (OJ L 79, 19.03.2008, p. 1)

[3] Management Board decision concerning the procedure to be applied by the Agency for the issuing of opinions, certification specifications and guidance material (Rulemaking Procedure), EASA MB 08-2007, 13.6.2007

Correspondence: If you do not have access to internet or e-mail you can send your comment by mail to:
Process Support
Rulemaking Directorate
EASA
Postfach 10 12 53
D-50452 Cologne
Germany

Comments should be submitted **by 24 April 2009**. If received after this deadline they might not be taken into account.

III. Comment response document

7. All comments received in time will be responded to and incorporated in a comment response document (CRD). The CRD will be available on the Agency's website and in the Comment-Response Tool (CRT).

IV. Content of the draft decision

8. The text of this NPA has been developed to introduce the revised Minimum Operational Performance Standards (MOPS) for Traffic Alert and Collision Avoidance System II (TCAS II) as detailed in EUROCAE Document ED-143 dated September 2008. A number of changes to the current TCAS II version 7.0 logic have been introduced in ED-143. The major changes are to resolve two deficiencies that have been identified, these being;

   - failure of TCAS II to reverse the Resolution Advisories (RA) when a reversal is required to resolve the threat of collision.
   - frequent instances of flight crews unintentional incorrect manoeuvres in the wrong direction to the "Adjust Vertical Speed" RA

9. This NPA also introduces the optional MOPS for TCAS II Hybrid Surveillance, as detailed RTCA, Inc. Document DO-300 dated December 13, 2006

The envisaged change to Decision 2003/10/RM Certification Specification CS-ETSO is:

10. Subpart B - Index 1, Introduction of amended ETSO–C119c. Traffic Alert and Collision Avoidance System (TCAS) Airborne Equipment, TCAS II

11. The update to ETSO-C119c is necessary as the applicable MOPS have been revised by EUROCAE ED-143 and introduces the option of Hybrid Surveillance. The update also introduces new Appendices 1 and 2 that introduces a number of differences to the referenced standards.

V. Regulatory Impact Assessment

12. Purpose and Intended Effect

a. Issue which the NPA is intended to address

Adoption of the revised MOPS will provide the certification standard for equipment manufactures to produce compliant equipment.

b. Scale of the issue

Only three manufacturers currently hold ETSO Authorisation for TCAS II equipment. The Agency does not anticipate a significant increase in the number of manufacturers.

c. Brief statement of the objectives of the NPA

This NPA introduces the revised MOPS that have been developed by EUROCAE and RTCA, Inc. The revised MOPS eliminate the identified deficiencies within the current TCAS II version 7.0 logic. This will permit the equipment to provide an RA reversal when required to resolve the threat of collision. It will also provide for better and less ambiguous instruction to flight crew that should eliminate any unintentional incorrect manoeuvres in the wrong direction to the "Adjust Vertical Speed" RA. The introduction of the optional Hybrid Surveillance function will results in a decrease of Mode S interrogations, thus improving Radio Frequency environment.

13. Options

a. The options identified

Option 1 - Do nothing.

Option 2 - Update the ETSO specifications to introduce the revised MOPS.

b. The preferred option selected

The preferred option is option 2.

14. Sectors concerned

The introduction of the updated ETSO-C119c will mainly affect the associated equipment manufacturers.

15. Impacts

a. All identified impacts

i. Safety

Following a series of mid-air encounters in which safety margins have been lost, including two accidents (Yaizu 2001 and Überlingen 2002), two major reasons for the loss of separation have been identified:

- failure of TCAS II to reverse some RA when a reversal is required to resolve the threat of collision;
- frequent instances of flight crews unintentional incorrect manoeuvres in the wrong direction to the "Adjust Vertical Speed" RA.

These studies have been evaluated by EUROCAE and RTCA and have resulted in the publication of revised MOPS (ED-143 and DO-185B) that address these issues.

In applying option 1, no reduction in the risk of a mid-air encounter will occur as a result of aircraft equipage. It has been estimated that the probability of a mid-air collision is 2.7×10^{-8} per flight hour due to the identified deficiencies within the current version 7.0 software, according to a EUROCONTROL sponsored study[4]. Thus, once the equipment has been installed into multiple aircraft, a positive safety benefit will be achieved due to the elimination of the identified deficiencies within the current TCAS II version 7.0 logic.

ii. Economic

Compliance with this ETSO standard is voluntary and is not a prerequisite for equipment installation. However, the establishment and the application of harmonised standards on subjects of common interest provide the basis for equipment approvals independent from aircraft approvals. This has a positive effect on the market value and applicability of this equipment.

iii Environmental

[4] EUROCONTROL document – Decision criteria for regulatory measures on TCAS II version 7.1 Safety Issue Rectification Extension Plus Project (SIRE+ Project), ACAS/08-103 dated 25 July 2008

No impact expected.

iv. Social

No impact expected.

v. Other aviation requirements outside EASA scope

No impact expected.

b. Equity and fairness in terms of distribution of positive and negative impacts among concerned sectors.

All applicants are equally affected. Compliance with this amended ETSO standard is voluntary. The impact will need to be assessed individually by the concerned industry sectors if compliance to the standard is short.

16. Harmonisation

The FAA is planning to issue an updated TSO-C119b during the 2nd quarter 2009. The technically content of the proposed ESTO update has been harmonised with the FAA TSO.

17. Summary and Final Assessment

a. Comparison of the positive and negative impacts for each option evaluated

Maintaining the do nothing option, will result in no long term safety improvements while having no direct impact on the aviation community. The use of option 2 will result in the introduction of equipment conforming to the revised standard and hence achieving a positive safety benefit. As an application for approval is voluntary the economic cost associated with compliance will need to be addressed by the individual organisation.

b. Final assessment and recommendation of a preferred option

Adopting option 2 is the preferred option; this will bring additional safety benefits, with minimal cost to the industry. Thus, reducing the probability of a mid-air collision currently identified as 2.7×10^{-8} per flight hour due to the identified deficiencies within the current version 7.0 software, in the long term.

B. DRAFT DECISION

The text of the amendment is arranged to show deleted text, new text or new paragraph as shown below:

1. deleted text is shown with a strike through: ~~deleted~~
2. new text is highlighted with grey shading: new
3. ….

   indicates that remaining text is unchanged in front of or following the reflected amendment.

I Draft Decision CS-ETSO

SUBPART B – LIST OF ETSOs (INDEX 1 AND INDEX2)

INDEX 1

~~ETSO-C119b TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) AIRBORNE EQUIPMENT, TCAS II~~

ETSO-C119c TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) AIRBORNE EQUIPMENT, TCAS II

ETSO-C119~~b~~c

Date : ~~24.10.03~~

Date: xx.xx.2009

European Aviation Safety Agency

European Technical Standard Order

Subject: TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS) AIRBORNE EQUIPMENT, TCAS II

1 - Applicability

This ETSO gives the requirements that new models of traffic alert and collision avoidance system airborne equipment must meet in order to be identified with the applicable ETSO marking.

2 - Procedures

2.1 - General

Applicable procedures are detailed in CS-ETSO Subpart A.

2.2 - Specific

None.

3 - Technical Conditions

3.1 - General

3.1.1 - Minimum Performance Standard

Standards set forth in EUROCAE Document ED-143 Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) dated September 2008 ~~Radio Technical Commission for Aeronautics (RTCA) Document DO-185A dated 16 December 1997~~, as modified by **Appendix 1** of this ETSO.

The optional functionality set forth in RTCA, Inc. Document DO-300, Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance, dated December 13, 2006, Sections 2 and 3, as modified by **Appendix 2** of the ETSO may be included.

3.1.2 - Environmental Standard

See CS-ETSO Subpart A paragraph 2.1.

3.1.3 - Computer Software

See CS-ETSO Subpart A paragraph 2.2.

3.1.4 - Electronic Hardware Qualification

If the article includes a complex custom micro-coded component, the component must be developed according to EUROCAE ED-80 (RTCA DO-254), Design Assurance Guidance for Airborne Electronic Hardware, dated April 2000.

3.2 - Specific

~~None~~

3.2.1 Failure Condition Classification

Failure of the function defined in paragraph 3.1.1 of this ETSO has been determined to be a hazardous/severe-major failure condition. The applicant must develop the system to at least the design assurance level commensurate with this failure condition classification.

4 - Marking

4.1 - General

Marking is detailed in CS-ETSO Subpart A paragraph 1.2.

4.2 - Specific

None.

5 - Availability of Referenced Document

See CS-ETSO Subpart A paragraph 3.

APPENDIX 1

HIGH-LEVEL PSEUDOCODE

Replace ED-143 Volume II Attachment A page 8-P16 with the following:

```
PROCESS Set_up_display_outputs;

<Determine advisory annunciation precedence>
IF (an RA is to be displayed this cycle)
    THEN  IF (increase rate RA issued)
              THEN  CLEAR reversal, maintain rate, and altitude crossing flags;
                    IF (increase rate RA was not present last cycle)
                        THEN indicate that RA changed to increase rate this cycle;
              ELSE  CLEAR indication that increase rate RA was present last cycle;
                    IF (RA requires maintenance of rate)
                        THEN  SET maintain rate indication;
                            CLEAR sense reversal indication, if any;  <announce maintain>
                        ELSE  IF (previous cycle's RA was dual negative AND current RA is
                                    either single negative or positive)
                                THEN CLEAR maintain rate indication;
                    IF (sense of previously displayed RA has been reversed)
                        THEN  CLEAR altitude crossing flag;  <Reversal needs to be
                                announced even if the reversed RA is altitude crossing>
                              CLEAR maintain rate indication;  <If reversing maintain RA>
                    IF (RA is preventive) <Initial preventive neg. or VSL RA or weakening>
                                          <Note:  All positive RAs are now corrective>
                        THEN  IF (RA is dual negative) <Don't Climb/Don't Descend>
                              THEN  SET maintain rate indication;  <announce maintain>
                                  ELSE  CLEAR maintain rate indication;
                                        IF ((positive Climb is weakening to negative Don't
                                            Descend OR (positive Descend is weakening to
                                            negative Don't Climb AND not weakening due
                                            to extreme low altitude condition)) AND not
                                            weakening due to multiaircraft "sandwich"
                                            encounter with both up-sense and down-sense
                                            VSLs)
                                          THEN  indicate that weakened RA is corrective;
                                                <Results in green "fly-to" arc plus
                                                corrective aural annunciation for initial
                                                weakening>
                              Set displayed-model-goal rate to 0 fpm;  <RA display device
                                will use prescribed vertical rates for neg. & VSL RAs>
                        ELSE  IF (RA is corrective negative or VSL)
                                  THEN  CLEAR maintain rate indication;
                                        Set displayed-model-goal rate to 0 fpm;
          CLEAR clear of conflict flag;
    ELSE  CLEAR maintain rate indication;  <no RA is to be displayed this cycle>
          Set displayed-model-goal rate to 0 fpm;
          IF (an altitude-reporting threat became non-altitude-reporting during preceding RA)
              THEN  CLEAR track drop and clear of conflict flags;
              ELSE  IF (a threat's track was dropped during preceding RA)
                        THEN  CLEAR clear of conflict flag;
PERFORM Load_display_and_aural_info; <Load display information to be sent to the RA display,
                                      TA display and aural annunciation subsystem.>

    END Set_up_display_outputs;
```

LOW-LEVEL PSEUDOCODE

Replace ED-143 Volume II Attachment A page 8-P17 with the following:

```
PROCESS Set_up_display_outputs;

   IF (any bit in G.RA(1–10)EQ $TRUE)
      THEN  IF (G.ANYINCREASE EQ $TRUE)
               THEN  CLEAR G.ANYREVERSE, G.MAINTAIN, G.ANYCROSS;
                     IF (G.PREVINCREASE EQ $FALSE)
                        THEN  SET G.ANYCORCHANG, G.PREVINCREASE;
               ELSE  CLEAR G.PREVINCREASE;
                     IF ((G.RA(1) EQ $TRUE AND G.ZDMODEL GT P.CLMRT AND
                           G.ZDOWN GT P.CLMRT) OR (G.RA(6) EQ $TRUE AND
                           G.ZDMODEL LT P.DESRT AND G.ZDOWN LT P.DESRT))
                        THEN  SET G.MAINTAIN;
                              CLEAR G.ANYREVERSE;
                        ELSE  IF ((G.CLSTROLD EQ 4 AND G.DESTROLD EQ 4) AND
                                    (G.CLSTRONG EQ 0 OR G.DESTRONG EQ 0))
                                 THEN  CLEAR G.MAINTAIN;
                     IF (G.ANYREVERSE EQ $TRUE)
                        THEN  CLEAR G.ANYCROSS;
                              CLEAR G.MAINTAIN;
                     IF (G.CORRECTIVE_CLM EQ $FALSE AND
                           G.CORRECTIVE_DES EQ $FALSE)
                        THEN  IF (G.RA(2) EQ $TRUE AND G.RA(7) EQ $TRUE)
                                 THEN  SET G.MAINTAIN;
                                 ELSE  CLEAR G.MAINTAIN;
                                       IF (G.CLSTRONG EQ 4 AND
                                           G.CLSTROLD EQ 8 AND
                                           G.DESTRONG EQ 0)
                                           THEN  SET G.CORRECTIVE_CLM,
                                                       G.ANYPRECOR;
                                           ELSE  IF (G.DESTRONG EQ 4 AND
                                                       G.DESTROLD EQ 8 AND
                                                       G.CLSTRONG EQ 0 AND
                                                       G.EXTALT EQ $FALSE)
                                                       THEN  SET G.CORRECTIVE_DES,
                                                                   G.ANYPRECOR;
                              G.ZDMODEL = 0;
                        ELSE  IF (G.RA(1 and 6) EQ $FALSE)
                                 THEN  CLEAR G.MAINTAIN;
                                       G.ZDMODEL = 0;
            CLEAR G.ALLCLEAR;
      ELSE  CLEAR G.MAINTAIN, G.ANYINCREASE;
            G.ZDMODEL = 0;
            IF (ANYALTLOST EQ $TRUE)
               THEN  CLEAR ANYTRACKDROP, G.ALLCLEAR;
               ELSE  IF (ANYTRACKDROP EQ $TRUE)
                        THEN  CLEAR G.ALLCLEAR;
   PERFORM Load_display_and_aural_info;

END Set_up_display_outputs;
```

STATECHARTS

Replace ED-143, Volume II, page 125, Section 2.1.11.2, State Corrective_Climb with the following:

Transition(s): Yes → No

Location: Advisory_Status$_{s\text{-}261}$ ▷ Corrective_Climb$_{s\text{-}123}$

Trigger Event: Composite_RA_Evaluated_Event$_{e\text{-}C2}$

Condition:

					OR
	Climb_RA_Weakened$_{m\text{-}374}$	T	T	.	T
	Climb_Goal$_{f\text{-}467}$ = 0 ft/min	F	T	.	T
	Own_Tracked_Alt_Rate$_{f\text{-}564}$ > Climb_Goal$_{f\text{-}467}$	T	.	.	.
AND	Own_Tracked_Alt_Rate$_{f\text{-}564}$ > –300 ft/min$_{(HYSTERCOR)}$	.	T	.	T
	Own_Tracked_Alt_Rate$_{f\text{-}564}$ ≤ 300 ft/min$_{(HYSTERCOR)}$	.	T	.	.
	Descend_Goal$_{f\text{-}473}$ = 0 ft/min	.	T	.	.
	Not_Meeting_Descend_Goal$_{m\text{-}411}$	.	.	T	.
	Descend_Goal $_{f\text{-}473}$ < 100,000 ft/min$_{(HUGE)}$	.	.	.	T

Output Action: Corrective_Climb_Evaluated_Event$_{e\text{-}C2}$

Notes: *1.* ***Description:*** *Transition out of corrective climb occurs for a weakened climb RA condition when either the own aircraft altitude rate exceeds a non-zero climb goal or the aircraft is considered level (i.e., within hysteresis) for a zero climb and descend goal. This transition also occurs whenever the aircraft is not meeting the current descend goal or there is a simultaneous opposite-sense VSL due to a multiaircraft encounter.*

2. ***Pseudocode Reference:*** *Corrective_preventive_test, Set_up_display_outputs.*

Replace ED-143 Volume II, page 127, Section 2.1.11.3, State Corrective_Descend with the following:

Transition(s): Yes → No

Location: Advisory_Status$_{S-261}$ ▷ Corrective_Descend$_{S-229}$

Trigger Event: Corrective_Climb_Evaluated_Event$_{e-C2}$

Condition:

					OR		
	Descend_RA_Weakened$_{m-378}$	T	T	.	T	T
	Descend_Goal$_{f-473}$ = 0 ft/min	F	T	.	T	T
	Own_Tracked_Alt_Rate$_{f-564}$ < Descend_Goal$_{f-473}$	T	.	.	.	.
	Own_Tracked_Alt_Rate$_{f-564}$ < 300 ft/min$_{(HYSTERCOR)}$	.	T	.	T	T
AND	Own_Tracked_Alt_Rate$_{f-564}$ ≥ –300 ft/min$_{(HYSTERCOR)}$	.	T	.	.	.
	Climb_Goal$_{f-467}$ = 0 ft/min	.	T	.	.	.
	Not_Meeting_Climb_Goal$_{m-410}$	.	.	T	.	.
	Extreme_Alt_Check$_{m-378}$	.	.	.	T	.
	Multiple_Threats$_{m-403}$	.	.	.	F	.
	Climb_Goal$_{f-467}$ > –100,000 ft/min$_{(HUGE)}$	.	.	.	.	T

Output Action: Corrective_Descend_Evaluated_Event$_{e-C2}$

Notes*:** **1.** ***Description: *Transition out of corrective descend occurs for a weakened descend RA condition when (1) the own aircraft altitude rate is less than a non-zero descend goal, or (2) the aircraft is considered level (i.e., within hysteresis) for a zero climb and descend goal, or (3) the aircraft is not meeting the current climb goal, or (4) a descend RA is weakened to a zero climb rate goal under extreme low altitude against a single threat aircraft, or (5) there is a simultaneous opposite-sense VSL due to a multi aircraft encounter.*

2. ***Pseudocode Reference:*** *Corrective_preventive_test, Set_up_display_outputs, Extreme_altitude_check.*

Changes to TSIM

Modify the following programs that are compiled into the TSIM simulation program or that provide input data to that program as follows:

Trans7.dat

```
[Corrective_Climb, Yes -> No]
Base_Number = 2.1.11.2
Trigger = Composite_RA_Evaluated_Event
Output = Corrective_Climb_Evaluated_Event

!Climb_RA_Weakened;                    T  T  .  T
Climb_Goal = 0;                        F  T  .  T
Descend_Goal = 0;                      .  T  .  .
Own_Tracked_Alt_Rate > Climb_Goal;     T  .  .  .
Own_Tracked_Alt_Rate > 0 - HYSTERCOR;  .  T  .  T
Own_Tracked_Alt_Rate <= HYSTERCOR;     .  T  .  .
!Not_Meeting_Descend_Goal;             .  .  T  .
Descend_Goal < HUGE;                   .  .  .  T
*** The row above and new column is added by Hui Men (JHU/APL)
2008.12.12 IP-15

…

[Corrective_Descend, Yes -> No]
Base_Number = 2.1.11.3
Trigger = Corrective_Climb_Evaluated_Event
Output = Corrective_Descend_Evaluated_Event

*** Begin:  Hui Men (JHU/APL) 2007.08.27 CP116

!Descend_RA_Weakened;                  T  T  .  T  T
Descend_Goal = 0;                      F  T  .  T  T
Climb_Goal = 0;                        .  T  .  .  .
Own_Tracked_Alt_Rate < Descend_Goal;   T  .  .  .  .
Own_Tracked_Alt_Rate < HYSTERCOR;      .  T  .  T  T
Own_Tracked_Alt_Rate >= 0 - HYSTERCOR; .  T  .  .  .
!Not_Meeting_Climb_Goal;               .  .  T  .  .
!Extreme_Alt_Check;                    .  .  .  T  .
Multiple_Threats;                      .  .  .  F  .
*** End:  Hui Men (JHU/APL) 2007.08.27 CP116
Climb_Goal > 0 - HUGE;                 .  .  .  .  T
*** The above row and new column is added by Hui Men (JHU/APL)
2008.12.12 IP-15
```

S7.c

```
Line 946

&& g_disp_else->de_strong == 0) // added by Hui Men (JHU/APL) on 2008.12.12 for
IP-15

Line 961
&& g_disp_else->cl_strong == 0
      // added by Hui Men (JHU/APL) on 2008.12.12 for IP-15
```

APPENDIX 2

1. Modify RTCA/DO-300, Minimum Operational Performance Standards for Traffic Alert and Collision Avoidance System II (TCAS II) Hybrid Surveillance as follows.

2. Add new section 2.2.11, Hybrid Surveillance Indication in the Data Link Capability Report.

2.2.11 Hybrid Surveillance Indication in the Data Link Capability Report

Note: The Data Link Capability Report format specified in EUROCAE ED-143, Volume I uses bit 69 to indicate whether the TCAS unit is hybrid surveillance capable. Bit 69=0 indicates 'hybrid surveillance not fitted.' Bit 69=1 indicates 'hybrid surveillance fitted.'

There are five TCAS-related bits in the Data Link Capability Report (Bits 48 and 69-72). These five bits are set or cleared as appropriate by the TCAS unit and sent to the Mode S transponder for downlink to a Mode S ground sensor. Execution of the default EUROCAE ED-143 logic will clear bit 69, meaning that in order to set bit 69, an implementer must modify the TCAS logic so that bit 69 will be set to one when the logic is executed. For details, see EUROCAE ED-143 Volume II, "Interface: Data_Link_Capability_Report," and EUROCAE ED-143 Attachment A, "PROCESS Send_owndata_to_trans."

If hybrid surveillance is implemented in a EUROCAE ED-143 capable TCAS unit, then the implementer should ensure that TCAS sets bit 69=1 in the five bits sent to the transponder.

3. Replace Section 2.4.2.6**,** Test 1, Success Criteria, Intruder 1 with the following

Intruder 1
Verify that the acquisition interrogations have RL=0.
No more than two interrogations spaced by 60 sec of intruder aircraft from T=10 to T=114 are performed against this intruder.
All interrogations after T=10 are crosslink interrogations. UF=0, RL=1, and BDS=5.
Only one interrogation every 10 sec of intruder aircraft from T=115 to T=200.
After T=10 Surveillance Mode always marked as not Normal (Reduced).
Verify that the passive data is provided to the CAS Logic/Displays by at least T=10.

4. Replace Section 2.4.2.7, Test 1- Passive to Active, Intruder Aircraft #2 with the following.

Intruder Aircraft #2
Altitude = 19,500 ft at T=0
Altitude Rate = -1,500 FPM
Range = 2.9 NM
Relative Speed = 0 kt
At T=75 the intruder is terminated.

5. Replace Section 2.4.2.7, Test 1-Passisve to Active, Intruder Aircraft #3 with the following.

Intruder Aircraft #3
Altitude = 4,500 ft at T=0
Altitude Rate = 1,500 FPM
Range = 2.9 NM
Relative Speed = 0 kt
At T=75 the intruder is terminated

6. Replace Section 2.4.2.7, Test 3-Passive to Active Abnormal Conditions, Intruder Aircraft #7 with the following.

Intruder Aircraft #7
Altitude = 17,000 ft at T=0
Altitude Rate = 0 FPM at T=0
Range = 7.0 NM
Relative Speed = -144 kt at T=0
At T = 20 the active range jumps to 10 NM (moving the active range causes the active data to fail the revalidation).
At T=120 the intruder is terminated.

7. Replace Section 2.4.2.7, Test 3-Passive to Active Abnormal Conditions, Success Criteria, Intruder 1 with the following.

Intruder 1
Verify that the track is under passive surveillance.
By T=26, UF=0 and RL=0 for all interrogations.
The continuous track is maintained.
The altitude reporting status is changed between T=20 and T=33.
After T=26 the track is updated using active data and is non-altitude reporting.

8. Replace Section 2.4.2.7, Test 3-Passive to Active Abnormal Conditions, Success Criteria, Intruder 7 with the following.

Intruder 7
Verify that the intruder is tracked using passive data from T=10 to T=20.

At approximately T=40 the intruder qualifies for revalidation based on the passive data having a closure rate and satisfies the 2nd condition (range tau) specified in §2.2.6.1.5. The revalidation attempt fails because the active range position does not follow the passive range position. As a result of the failed revalidation, the track must transition to active surveillance within 3 sec of the failed revalidation attempt, which must occur by T=46.

Verify that after the failed validation attempt but before the track becomes active that RFLG is set false. Surveillance Mode is NOT set to Normal until a new track based on active data is presented to the CAS logic.
Verify that only one track for this intruder (with the same Mode S address) is provided to the CAS logic for the entire test.

Verify that the new active track has a different track number than the passive track or that some other mechanism is employed to guarantee that the CAS logic treats the active track as a NEW track.

9. Replace Section 2.4.2.7, Test 4-Active to Passive Abnormal Conditions with the following.

Test 4 – Passive to Active Abnormal Conditions

The equipment manufacturer must design a test or analysis which demonstrates that the requirement in §2.2.7.1.2 that an aircraft not be a threat before transitioning to passive surveillance has been implemented. Because this is a precautionary requirement, test of this may not be possible at the "black box" level.

10. Replace Intruder Aircraft No. 68 in Table 2 Section 2.4.2.10.Verification of DF17 Decoding with the following.

Intruder Aircraft No	Own Latitude (deg)	Own Longitude (deg)	Intruder Latitude (deg)	Intruder Longitude (deg)	Intruder Altitude (ft)	Planar Range (NM)	Slant Range (NM)	Bearing (deg)
….	….	….	….	….	….	….	….	….
68	-5	6.25	-5.1	6.25	11000	5.9742	5.9766	180.000
….	….	….	….	….	….	….	….	….

11. Replace Section 2.4.2.11 Verification of Monitoring Requirements, Test 1, Success Criteria, Intruder 1 with the following.

Intruder 1
Verify that the acquisition interrogations have RL=0.
No more than one interrogation of intruder aircraft from T=10 to T=59.
At least by T=65 the intruder is interrogated once every 5 sec indicating a transition to active surveillance. Verify that the track is not dropped.

12. Replace the second note of paragraph a. of Section 3.3.Hybrid Surveillance Flight Test with the following.

Note: Previous hybrid surveillance flights have shown that the New York City area provides the stressful environment necessary for proper evaluation of TCAS Mode S Hybrid surveillance. The most effective flight path has proven to be a 5 NM orbit over the John F. Kennedy Terminal Area. Other locations would be suitable as long as they meet the requirements specified here and in Ref. A.