

# TCAS II CHANGE PROPOSAL (CP)

DATE: 10 / 30 / 07

No.: 119

TCAS II Version: DO-185A (v7)  Other (Specify) \_\_\_\_\_

MOPS Function Area: Surveillance \_\_\_\_\_ Display Req'ts \_\_\_\_\_ CRS \_\_\_\_\_

CAS Pseudocode \_\_\_\_\_ Test Suites \_\_\_\_\_ Other

Volume I tests of TCAS communication (TCAS broadcast messages)

Priority: URGENT \_\_\_\_\_ Necessary  Optional \_\_\_\_\_

CP Type: ERROR \_\_\_\_\_ Enhancement  Evaluation Request \_\_\_\_\_

Editorial (Logic) \_\_\_\_\_ Editorial (Text) \_\_\_\_\_

## Description of Problem/Issue:

As described in ICAO paper WP ASP 01-12, 27 Oct 2006, "Detected Deficiencies in ACAS RA related transmissions," a prototype ACAS monitor is being used for data collection and analysis of ACAS transmissions in German airspace. A number of errors were noted in the ACAS transmissions, and Lincoln Laboratory reviewed the corresponding TCAS MOPS tests to see whether the existing tests are sufficient. For the most part, the tests provide complete coverage of ACAS transmissions. There are, however, two areas (RA Broadcast Interrogation Messages and TCAS Broadcast Interrogation Messages) in which an improvement could be made.

Background: RA Broadcast Interrogations are new to Version 7. They are broadcast by a TCAS aircraft at 8 second intervals during the period that an RA is active and include much the same information as the RA Report that is sent to a Mode S ground station. RA Broadcasts were added to allow RA activity to be monitored in areas where Mode S ground stations do not exist by using special 1030 MHz receivers on the ground. In RA Broadcasts, the reporting TCAS is identified by its Mode A and Mode C codes, rather than its Mode S address.

TCAS Broadcast Interrogation Messages are transmitted by a TCAS unit once per 8-10 seconds. They include the Mode S address of the transmitting TCAS aircraft and allow each TCAS unit to determine the number of other TCAS units (NTA) in the surrounding area. NTA is used by the TCAS surveillance Interference Limiting algorithms to determine the appropriate TCAS transmit power.

## Proposed Resolution:

1. The tests for the RA Broadcast Interrogation Message ( Volume I, Section 2.4.2.2.4.1, Scenarios A and B) are changed to more clearly state that the broadcast address (FFFFFF<sub>16</sub>) is required for this transmission.
2. An additional test of the TCAS Broadcast Interrogation Message is included (added to Volume I, at the end of Section 2.4.2.1.7.4.2) to more explicitly test that the broadcast address (FFFFFF<sub>16</sub>) is used in this transmission.

Details are given on the attached pages.

**Requester:** Ann C. Drumm

**Organization:** MIT Lincoln Laboratory

(The Lincoln paper, "Errors Observed during ACAS Monitoring and Sufficiency of Corresponding Tests in the TCAS MOPS," was submitted to the FAA on 15 and 30 June 2007 and discussed during the 27 June 2007 FAA bi-weekly TCAS meeting.)

**DISPOSITION OF CHANGE PROPOSAL (Per RWG):**

**DATE OF DISPOSITION** 12 / 11 / 07

**Rejected**             **Deferred**             **[Review Date:**        /        /        **]**

**Accepted**   x        **Modified**             **Withdrawn**       

**DISPOSITION OF CHANGE:**

**On Hold**             **Designing**             **Testing**             **Done**   x        **[Date:** 12 / 11 / 07 **]**

**Final Approval of Changes:**

**Signature:** Andy Zeitlin, RWG Chair

**Date:** 12 / 11 / 2007

## 1. Change related to RA Broadcast Interrogation Message

Proposed Changes to DO-185A, Volume I, section 2.4.2.2.4.1, “Transmission of RA Report to Mode S Sensor and RA Broadcast Interrogation to Other Ground Receivers,” Scenarios A and B.

In Scenario A, under “Expected Output,” *When testing with an RTCA/DO-185A compatible Mode S transponder:*

Change the two instances of UF=16, UDS=49 to read:

“UF=16, in MU: UDS=49, ARA=11100010000000, RAC=0000, RAT=0, MTE=0, AID=1010010011100, CAC=0011000101010, AP address\* = FFFFFFFF<sub>16</sub> at T= 31, 39, 47, 55, 63”

and

“UF=16, in MU: UDS=49, ARA=11100010000000, RAC=0000, RAT=1, MTE=0, AID=1010010011100, CAC=0011000101010, AP address\* = FFFFFFFF<sub>16</sub> at T= 66”

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In Scenario B, under “Expected Output,” *When testing with an RTCA/DO-185A compatible Mode S transponder:*

Change the two instances of UF=16, UDS=49 to read:

“UF=16, in MU: UDS=49, ARA=11000010000000, RAC=1000, RAT=0, MTE=0, AID=0101110110000, CAC=1001000101010, AP address\* = FFFFFFFF<sub>16</sub> at T= 30, 38, 46, 54, 62”

and

“UF=16, in MU: UDS=49, ARA=11000010000000, RAC=1000, RAT=1, MTE=0, AID=0101110110000, CAC=1001000101010, AP address\* = FFFFFFFF<sub>16</sub> at T= 65”

\* i.e., address before parity overlay added and after parity overlay removed

## 2. Change related to TCAS Broadcast Interrogation Message

Proposed Changes to DO-185A, Volume I.

Add the following new material at the end of the existing section 2.4.2.1.7.4.2:

“2.4.2.1.7.4.3 Correct Content of Transmitted TCAS Broadcast Interrogation Messages  
(2.2.3.9.3.2.4 b and 2.2.3.10.2.4))

This test verifies that the TCAS unit under test transmits correctly coded TCAS Broadcast Interrogation Messages for the entire period that the TCAS unit is powered on.

### Conditions:

TCAS initialized and operating.

### Expected Output:

Msgs: UF=16, with UD1 (bits 33-36) =3, UDS2 (bits 37-40) =2,  
MID (bits 65-88) = 24-bit address of own aircraft Mode S transponder,  
AP address\* = FFFFFFFF<sub>16</sub>

\* i.e., address before parity overlay added and after parity overlay removed

The UF=16 messages are transmitted such that, for any other TCAS II aircraft within 30 nmi. and at any azimuth, the nominal rate of own TCAS Broadcast Interrogation Messages arriving at that TCAS II is 1 per 8 to 10 seconds.

*Note: Use of directional antenna for TCAS Broadcast Interrogation Messages is tested in section 2.4.2.1.10.2.”*

## 3. Changes to Cross-Reference Tables

Modify Table 2-69, “Cross-Reference of Requirements to Associated Tests” as follows:

Insert the following line after the line starting 2.4.2.1.7.4.2:

“2.4.2.1.7.4.3	Correct Content of Transmitted TCAS Broadcast Interrogation Messages	2.2.3.10.2.4	TCAS Broadcast Interrogations
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Modify Table 2-70, “Cross-Reference of Associated Tests to Requirements” as follows:

Insert the following line after the line starting 2.2.3.10.2.4:

“  
2.4.2.1.7.4.3 Correct Content of Transmitted  
TCAS Broadcast Interrogation  
Messages”

