

**RTCA Special Committee 209 / EUROCAE WG49**

**ATCRBS / Mode S Transponder MOPS Maintenance**

**Joint Meeting #11**

**RTCA Headquarters, Washington, DC**

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**Loss of Mode A Code change alert after a switch-off/on**

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**SUMMARY**

This Working Paper comes back on the issue of the loss of Mode A code change on some Mode S installations. It proposes to eliminate one cause of loss by clarifying what is done when the transponder leaves the standby condition. Similarly this WP is also proposing to force the broadcast of the data-link capability register when leaving the standby condition.

## 1. Introduction

Several cases of loss of Mode A code change have been seen in Europe. Some cases have been investigated.

One case has been explained by the use of a “bizarre” installation where the pilot could change the Mode A code on the standby transponder and wait more than 18s before switching from transponder 1 (with the old mode A code) to the transponder 2 with the new Mode A code.

Another case has been reproduced on the ground on one type of transponder (not installed on commercial aircraft) by changing the Mode A code and switching off/on the transponder. In such a case the alert is lost during the switch-off/on cycle while the new Mode A Code remains memorized, correctly displayed and used by the transponder.

A similar issue exists with the register 10<sub>16</sub> (data-link capability) and 20<sub>16</sub> (Aircraft Identification) on dual installation. If the pilot switches from transponder 1 to transponder 2 there is nothing to tell the ground that it is a new transponder with possibly different capability and different aircraft identification. The ground system continues to use the configuration linked to the first chain. This could result in the extraction of register not supported by the second chain or in supported register non-extracted.

This issue has already been discussed in ICAO ASP (see TSG 4 Flimsy 3) and possibly in the transponder MOPS meeting which was held just after in February 2008 however the result of the discussion is not clear.

This WP proposes to come back on this issue and to eliminate the loss a Mode A code change by requiring the transponder to set an alert once it is leaving the Off or standby condition. Similarly this WP is also proposing to force the broadcast of the data-link capability register when leaving the standby condition. The case of the aircraft Identification needs to be discussed as it is a data not changing very often.

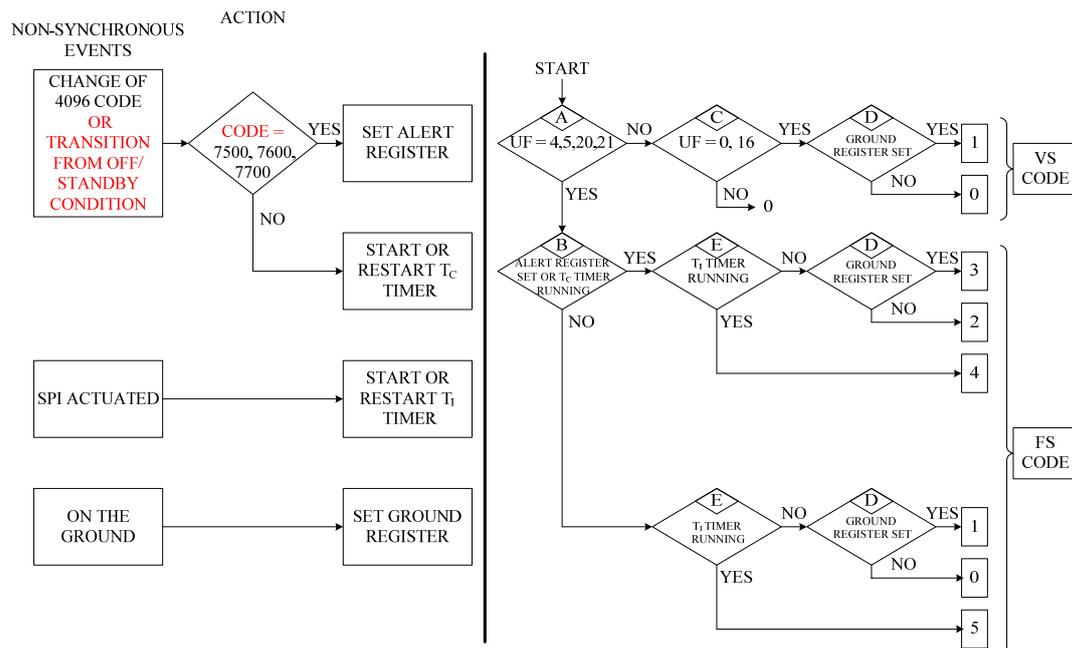
## 2. Proposed requirements

### 2.2.18.2.7 Flight Status and Vertical Status Protocols (Figure 2-17)

Mode S-equipped aircraft **shall** report details of their flight status. The source of and the rules for such reports are as follows:

- a. Alert – The transponder **shall** transmit the 4096 identification code in ATRBS Mode A replies and in the ID field of downlink format DF=5. This code can be changed by the pilot, and when a change is made an alert condition **shall** be established. If the identification code is changed to 7500, 7600 or 7700, the alert condition **shall** be permanent. If the identification code is changed to any other value, the alert condition **shall** be temporary and self-cancelling after 18 ±1 seconds (TC timer). The TC timer **shall** be retriggered and continued for 18 ±1 seconds after any change has been accepted by the transponder function. Transponder memorizing the last mode a code entered. **When transitioning from Off or standby condition to any operational mode, the transponder shall set the temporary alert condition.** The alert condition **shall** be reported in the FS field. The permanent alert condition **shall** be terminated and replaced by a temporary alert condition when the identification code is set to a value other than 7500, 7600 or 7700.

In this case Fig 2-17 should be modified as follows:



For register 10 and 20 the requirement could be:

### 2.2.19.1.12.6.3 Updating of the Data Link Capability Report

At intervals not exceeding four seconds, the transponder compares the current basic data link capability status with that last reported and if a difference is noted, initiates a revised basic data link capability report by Comm-B broadcast for BDS1=1 and BDS2=0.

The transponder shall initiate, generate and announce the revised basic data link capability report even if the aircraft data link capability is degraded or lost. To support this requirement, the transponder shall set the BDS subfield for the basic data link capability report.

When leaving the standby condition the transponder shall initiate, generate and announce a Comm-B broadcast of the basic data link capability report.

*Note: The setting of the BDS code by the transponder ensures that a broadcast change of the capability report will contain the BDS code for all cases of data link failure (e.g., the loss of the transponder data link interface).*

### 3. Proposed test

Add a test at the end of

#### 2.5.4.7 Procedure #7: FS and VS Protocol/Code Tests

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#### Alert when leaving standby condition

Change the input of the ID function to a value other than 7500, 7600 or 7700.

Wait 18s.

Set the transponder to Standby condition

Set the transponder to return to normal condition

Verify that the Mode A Code, temporary alert is set (FS field value is 4 or 5 and SSS=2 when the transponder is ES capable) for 18 ±1 seconds after leaving the standby condition.

#### Change the input of the ID function to 7500

Set the transponder to Standby condition

Set the transponder to return to normal condition

Verify that the Mode A Code alert is set (FS field value is 4 or 5 and SSS=2 when the transponder is ES capable).

Repeat the test with 7600 and 7700.

Add a test at the end of

#### 2.5.4.20 Procedure #20: Extended Capability Report

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Set the transponder to Standby condition

Set the transponder to return to normal condition

Verify that the transponder has initiated, generated and announced a Comm-B broadcast of the extended capability report.

#### 4. Action

The meeting is invited to discuss the proposed approach:

- for Mode A code change (when leaving the off condition or when leaving the standby condition or only when the Mode A Code is kept during a power on/off cycle),
- for data-link capability,
- and for Aircraft Identification (nothing proposed in this WP) however it may be consistent to foresee something as we now request to have the possibility to change the Aircraft Identification during flight.

# Appendix A

8 February 2008

## TSG 4 Flimsy 3

As discussed during ICAO ASP TSG 4 regarding Action Item ASP03-24 in relationship to Working Paper WP/ASP03-16.

It is suggested that a new requirement be currently added to DO-181 and ED-73 as:

When transitioning from OFF or standby to any operational mode, the transponder shall set a temporary alert, initiate, generate and transmit a data link capability report broadcast and a flight ID broadcast.

*Note: This requirement supports the acquisition of aircraft data by the ground system, as well as the reacquisition after switching from one transponder to the other.*