Alternative Approach for Ground Control to Inhibit Mode A/C and Mode S All-Call Replies for Surface Aircraft

(Presented by the TSG Chairman)

Revision 1

Summary

The TSG was tasked to provide a means to control the on-the-ground condition for aircraft operating without a squat switch. The TSG developed a SARPs CP to provide ground control of the surface status via modification to commends in the TCS subfield (WP-ASP07-03R1). This CP was approved by the WG at the September 09 Montreal meeting.

When Change 1 to DO-181D was reviewed on a RTCA/EUROCAE teleconference in April 2010, TCAS manufactures objected to ground control of the OTG status. This WP proposes a simpler technique for inhibiting unnecessary replies that does not affect the reported OTG status.

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BACKGROUND

- The TSG was tasked to provide a means to control the on-the-ground condition for aircraft operating without a squat switch.

- The TSG developed a SARPs CP to provide ground control of the surface status via modification to commends in the TCS subfield (WP-ASP07-03R1).

- This CP was approved by the ASP WG at the September 2009 Montreal meeting.

- The TSG considered the development of a complementary aircraft based technique in addition to the ground control at the January 2010 meeting.

- The consensus was that no additional technique was needed in addition to the ground based technique.

- This was reported by the TSG at the recent meeting and was accepted by the WG

Review of Need for Control of the On-The-Ground Condition

- The only reason for controlling the OTG status of aircraft without a squat switch is to inhibit replies to Mode S All-Call and Mode A/C interrogations while on the surface.

- These replies represent a significant source of unnecessary interference at an airport.

- Ring around can occur since transmit SLS may not be effective at all locations on the surface.

Disadvantages of the Current Approach

- When Change 1 to DO-181D was reviewed on a RTCA/EUROCAE teleconference in April 2010, TCAS manufacturers objected to ground control of the OTG status.

- The concern was that incorrect setting of the OTG status by the ground (or a hacker) could cause TCAS to ignore a possible airborne threat.

- This problem would be mitigated by the OTG validation test, but the MOPS exempts the smallest class of aircraft and helicopters from validation.

- A second disadvantage is that the change for ground control OTG status is very complex, since this status is covered in a number of paragraphs.

Alternative Technique for Ground Control

- Modify the TCS commands in DO-181D §2.2.23.1.7 to only add the requirement to inhibit replies to Mode S All-Call and Mode A/C interrogations when commanded to report the surface format.

- This will satisfy the intent of the ground control of OTG status but will be acceptable to the TCAS community since there is no change to the vertical status reported to TCAS.

- A second change is needed to require the OTG validation test (§2.2.18.2.7) to also terminate the TCS command to inhibit All-Call and Mode A/C replies if the validation test indicates that the aircraft is airborne.

- This second change is needed to protect the surveillance provided Mode S or Mode A/C interrogators.

2.2.23.1.7 Subfields in SD for Extended Squitter

The SD field contains the following information if the DI code is 2:

TCS, the 3-bit (bits 21 – 23) Type Control Subfield in SD, **shall** control the position type reported by the transponder and its response to ATCRBS and Mode S All-Call interrogations. These commands ~~**shall** only affect the format type reported, they~~ **shall not** change the aircraft determination of its on-the-ground condition. The commands for codes 1 and 2 **shall** be able to refreshed for a new period before timeout of the prior period.

Note 1: *Thus aircraft without the means to set the on-the-ground condition will continue to report code 6 in the CA field, and an aircraft with the means to set the on-the-ground condition that has determined that it is in the airborne state will continue to set code 5, independent of the Extended Squitter format that is emitted.*

The following TCS codes have been assigned:

TCS Codes	Description
0	No position type command
1	Use surface position type ~~for the next 15 seconds~~and inhibit replies to ATCRBS and Mode S All-Call interrogations for the next 15 seconds.
2	Use surface position type ~~for the next 60 seconds~~and inhibit replies to ATCRBS and Mode S All-Call interrogations for the next 60 seconds.
3	Cancel surface type command and the command to inhibit replies to ATCRBS and Mode S All-Call interrogations
4 – 7	Not assigned

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

c. Validation of declared on-the-ground status

Note 2: *For aircraft with an automatic means of determining vertical status, the CA field reports whether the aircraft is airborne or on the ground. ACAS II acquires aircraft using the short or Extended Squitter, both of which contain the CA field. If an aircraft reports on-the-ground status, that aircraft will not be interrogated by ACAS II in order to reduce unnecessary interrogation activity.*

For Aircraft with an automatic means for determining the on-the-ground condition, transponders that have access to at least one of the following parameters (ground speed, radio altitude, airspeed) **shall** perform the following validation check:

If the automatically determined air/ground condition is not available, or is "airborne," no validation **shall** be performed.

If the automatically determined air/ground condition is available, and the "on-the-ground" condition is being reported, then the air/ground condition **shall** be overridden and changed to "airborne":

Ground Speed > 100 knots OR Airspeed > 100 knots OR Radio Altitude > 50 feet

Note 3: *For Extended Squitter installations, the on-the-ground validation is optional for Aircraft reporting ADS-B Emitter Category Set "A" codes 0, 1 or 7 as defined in the latest version of RTCA/DO-260A, §2.2.3.2.1.2.*

Note 4: *Modern aircraft with integrated avionics suites commonly contain sophisticated algorithms for determining the air/ground state based on multiple aircraft sensors. These algorithms are customized to the airframe and designed to overcome individual sensor failures. These algorithms are an acceptable means to determine the air/ground state and do not require additional validation.*

Proposal

- It is proposed that the TSG consider adopting the technique proposed in this WP for inhibiting unwanted replies from surface aircraft operating without a squat switch.

- The alternative technique represents a much simpler revision to the Mode S SARPs.

- It accomplishes the goal of the OTG control without causing concerns from the TCAS community.