

RTCA Special Committee 209
ATCRBS / Mode S Transponder

Meeting #4

Honeywell, Olathe, Kansas
18 – 19 October 2006

Proposal to Test for TCAS Whisper – Shout Compatibility

Prepared and Presented by Don Walker
Honeywell

SUMMARY

The TCAS MOPS defines Whisper-Shout steps for the purpose of decluttering ATCRBS replies. The assumption of the TCAS spec is that the transponder will not be able to detect a pulse if it is below the MTL of the receiver. There is no requirement or test in DO-181C that enforces this assumption. This paper proposes adding a requirement and test to close this hole between the TCAS and Transponder MOPS.

1.0 Introduction

The TCAS MOPS defines Whisper-Shout steps for the purpose of decluttering ATCRBS replies. The assumption of the TCAS specification is that the transponder will not be able to detect a pulse if it is below the MTL of the receiver. There is no requirement or test in DO-181C that enforces this assumption. This paper proposes adding a requirement and test to close this hole between the TCAS and Transponder MOPS.

2.0 Issue

The TCAS MOPS defines Whisper - Shout steps for the purpose of decluttering ATCRBS replies. These steps are implemented by controlling the amplitude of the S1 pulse relative to P1. If P1 is above MTL and S1 is below, the transponder should reply. However, there is no requirement in DO-181x that requires the transponder to behave this way. As a result, newer designs have been released that did not initially behave that way.

Honeywell has taken measurements of our Mode S equipment and have a rough idea of what is realistic behavior for fielded units over temperature. Other vendor's equipment may vary from our data, and even our data will vary from unit to unit. However, we believe that the following requirement can be realistically met by existing equipment and satisfies the operational goals of the TCAS system. It still needs to be validated by TCAS experts that the proposed threshold is theoretically adequate. We recommend that Lincoln Labs perform that analysis.

3.0 Proposed Requirement

With P1 at MTL and S1 at MTL - 3 dB, the transponder **shall** reply to ATCRBS interrogations 70% of the time or more.

4.0 Conclusion

This requirement may seem loose, but it accurately reflects currently fielded units over temperature plus some margin. At ambient conditions, most units perform quite well and reply 90% of the time. The problem essentially is that at high temperature, the receiver does not continue to perform that well. Our analysis of the TCAS II Whisper-Shout steps, combined with the requirement above, shows that in a single round the probability of a single ATCRBS reply is still greater than 90%.