RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #15

Action Item 10-3
Rate for Transmitting ID Squitters

Presented by William Harman

SUMMARY

We have used a simulation to determine whether the ID transmission rate can be reduced to one per 5 seconds. To do this, we made a comparison of performance in two cases, using one transmission per 5 seconds in one case and one transmission per 2.5 seconds in the other. The results indicate that performance is essentially the same. The conclusion is that the ID transmission rate can be made one per 5 seconds. This Working Paper addresses Action Item #10-3.

Rate for Transmitting ID Squitters

The rate for transmitting ID squitters can be much lower than surveillance, because the information remains constant. Previous work indicated that the rate should be approximately one transmission per 5 seconds, or perhaps one per 2.5 seconds. A track-level simulation at Lincoln Laboratory can be used to evaluate reception performance for such cases, so an action item was placed on Lincoln to determine whether a rate of one per 5 seconds would be satisfactory.

FORMULATION OF STUDY

The simulation is formulated as an encounter between two aircraft, flying toward each other at high speeds (Figure 1). Both aircraft are flying at 600 knots, so the combined closing rate is 1200 knots. The simulation begins when the aircraft are 180 nmi apart. The simulation includes top and bottom antennas on both aircraft, odd-format and even-format position squitters, and requires reception of an even message and an odd message within 10 seconds before making a global decode of the position.

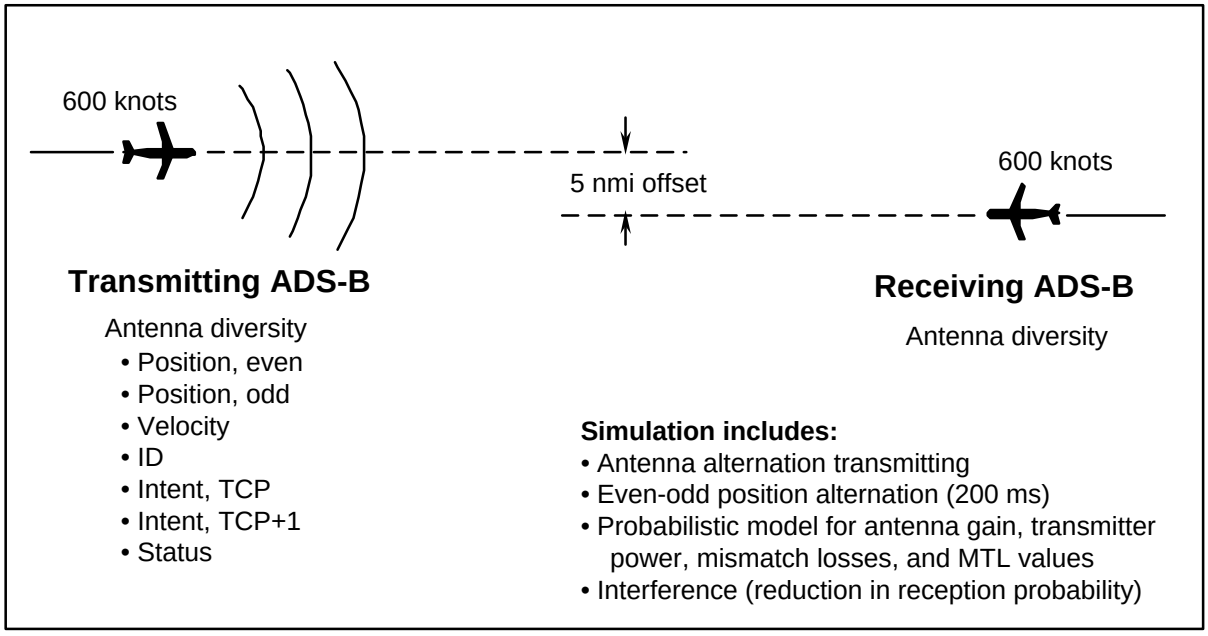

Figure 1. Formulation of the simulation.

We ran this simulation for a case of very high interference. Specifically it was the maximum interference environment measured in Frankfurt, Germany. The ATCRBS fruit rate is 30,000 fruit per second. Also, Mode S interference is included for both short and long format Mode S fruit from all aircraft. The total interference environment is characterized by a curve giving reception probability as a function of received power level. This curve, which was generated previously by a companion pulse-level simulation, is given in the European report ["1090 MHz Extended Squitter Assessment Report," FAA and EUROCONTROL, June 2002]

and is also given in a working paper from our previous meeting ["Transmitter Power for Class B2," Harman, 1090-WP-14-13, 25 Sept. 02].

The ADS-B messages used in this simulation consisted of position, velocity, ID, and the two out-of-date TCP messages with the accompanying Status message. Status, TCP, and TCP were each transmitted at a rate of one per 1.8 seconds. These specifics are different from the new TS-report configuration and the futuristic TC-report configurations, but I believe that the simulation in this older version will nevertheless provide the comparison of interest now.

RESULTS

The simulation results can be summarized as follows.

For ID transmission rate = one per 2.5 sec.
Range (95%) for surveillance acquisition = 55 nmi
Range (95%) for full track acquisition = 44 nmi
(simulation of 1000 trials)

For ID transmission rate = one per 5 seconds,
Range (95%) for surveillance acquisition = 56 nmi
Range (95%) for full track acquisition = 44 nmi.
(simulation of 1000 trials)

Of course we would not expect to see any change in surveillance performance as a result of the change in ID rate, and the results are consistent with that.

Seeing no significant change in the range for full track acquisition, I conclude that the lower ID rate is satisfactory. This answers the question we are addressing.