

RTCA Special Committee 186, Working Group 3

ADS-B 1090 MOPS, Revision A

Meeting #17

Air-to-Air Performance For Class A2

Presented by William Harman

SUMMARY

At the December meeting, I presented simulation results showing air-to-air performance for Class A3 receivers, for both the LA2020 environment and the Low Density environment (Working Paper 1090-WP-16-08). This work has subsequently been extended to apply to Class A2. This paper presents the performance for A2 to A2 and for A3 to A2 in the LA2020 environment.

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1. Pulse-Level Simulation

The pulse-level simulation is used to determine reception probability as a function of received signal power level. The simulation results, plotted in Figure 1, show a comparison between MTL = -79 dBm (class A2) and MTL = -84 dBm (class A3), for the LA2020 environment (24,000 Mode A/C fruit per second).

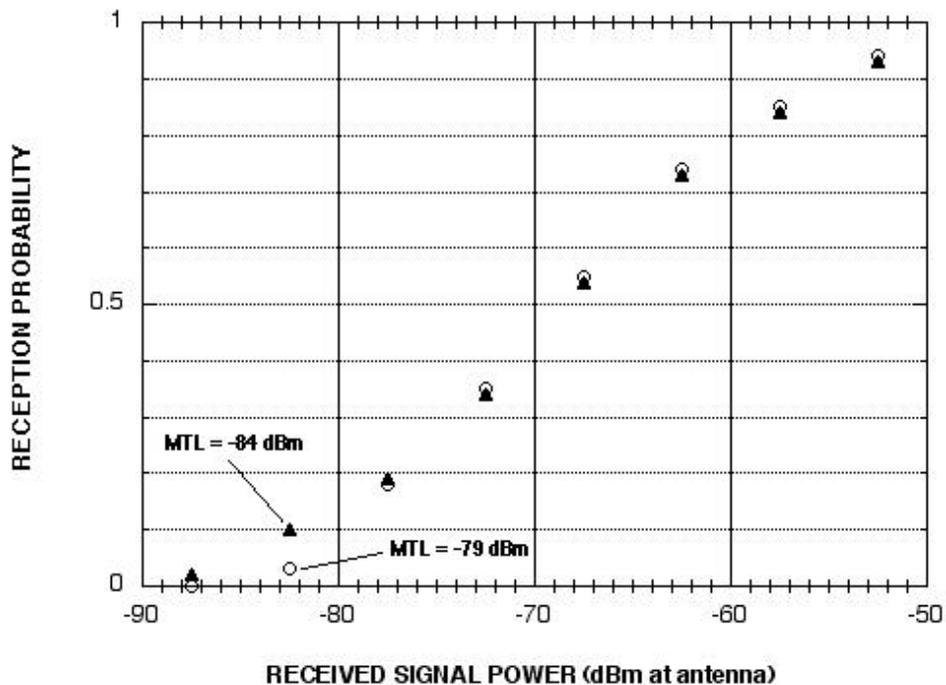


Figure 1. Pulse-Level Simulation results (bottom antenna receptions).

The results indicate that the only significant effect is near MTL. Class A2 reception probability is reduced in the vicinity of the MTL power level, and otherwise nearly the same as for class A3. A curve fit was applied to the data in Figure 1, for use in the Track-Level Simulation (Figure 2).

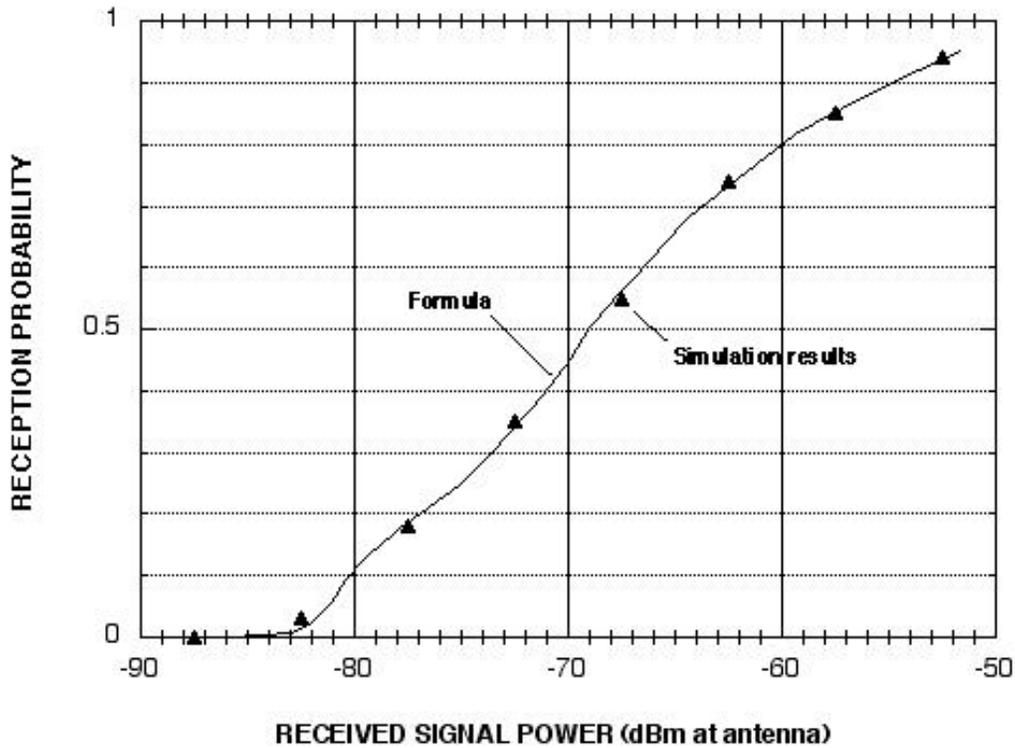


Figure 2. Curve fit to simulation results.

2. Track Level Simulation

Using the curve fit shown in Figure 2, the Track-Level simulation was run for 1000 aircraft pairs (one aircraft transmitting and one receiving). The formulation of the simulation is documented in Appendix P of the MOPS. The simulation includes co-site interference in the form of 93% receiver availability.

For the case of A2 to A2 aircraft pairs, the results are as follows.

Table 1. Simulation Results for class A2 to class A2 in LA2020.

| Range NM | Rec. prob. 95 percentile | Surveillance T95/95 (sec.) | TSR T95/95 (sec.) |
|-------------|-----------------------------|-------------------------------|----------------------|
| 10 | 0.597 | 0.8 | 4.1 |
| 15 | 0.418 | 1.4 | 6.9 |
| 20 | 0.333 | 1.8 | 9.2 |
| 25 | 0.255 | 2.5 | 12.7 |
| 30 | 0.209 | 3.2 | 16.0 |
| 35 | 0.145 | 4.8 | 23.9 |
| 40 | 0.105 | 6.8 | 33.8 |
| 45 | 0.068 | 10.6 | 53.2 |
| 50 | 0.048 | 15.2 | 76.1 |
| 55 | 0.032 | 23.0 | 115.1 |
| 60 | 0.014 | 53.1 | 265.6 |

The other case to consider is class A3 transmissions received by class A2 aircraft. The only difference between this case and the first case is the higher power level of the A3 transmitters. In the model being used by Working Group 3, A3 transmitters are between 53 and 56 dBm whereas class A2 transmitters are between 51 and 54 dBm. This difference affects the results as a 2 dB change in ranges for each level of performance. Therefore the results in Table 1 can be converted to the following results for the A3 to A2 case.

Table 2. Simulation Results for class A3 to class A2 in LA2020.

| Range NM | Rec. prob. 95 percentile | Surveillance T95/95 (sec.) | TSR T95/95 (sec.) |
|-------------|-----------------------------|-------------------------------|----------------------|
| 12.3 | 0.597 | 0.8 | 4.1 |
| 18.9 | 0.418 | 1.4 | 6.9 |
| 25.2 | 0.333 | 1.8 | 9.2 |
| 31.5 | 0.255 | 2.5 | 12.7 |
| 38 | 0.209 | 3.2 | 16.0 |
| 44 | 0.145 | 4.8 | 23.9 |
| 50 | 0.105 | 6.8 | 33.8 |
| 57 | 0.068 | 10.6 | 53.2 |

These results are plotted in Figures 3 and 4, where they are compared with the MASPS standards. Air-to-air surveillance is seen to satisfy the MASPS standards in both cases, A2-A2 and A3-A2. Air-to-air communication of TSR information (Figure 4) satisfies the MASPS standards for A3-A2, whereas in the case of A2-A2, performance fall short of the MASPS beyond about 24 nmi.

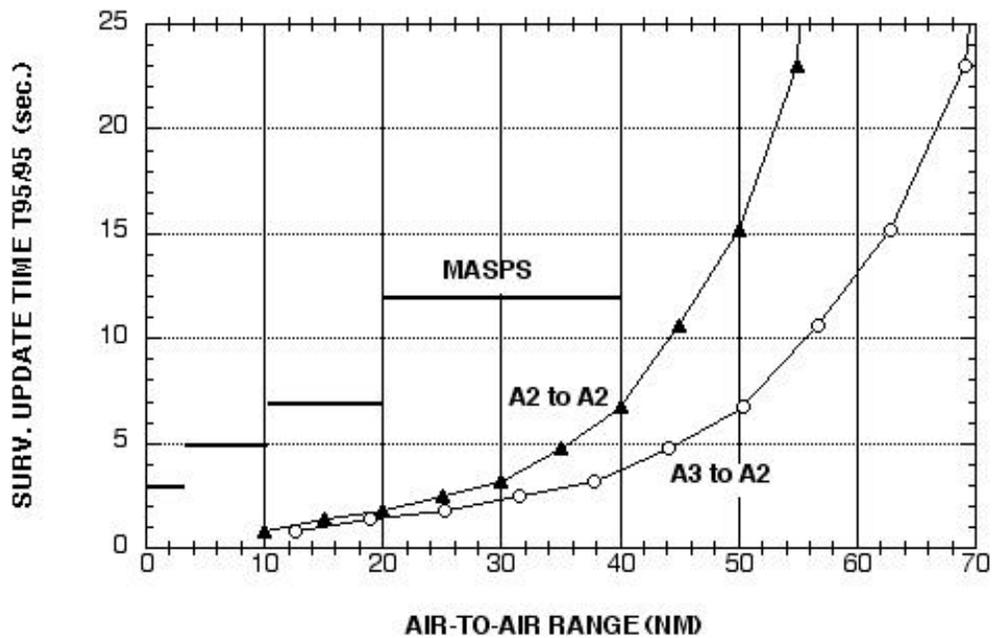


Figure 3. Simulation Results (LA2020) Compared with Surveillance Standards.

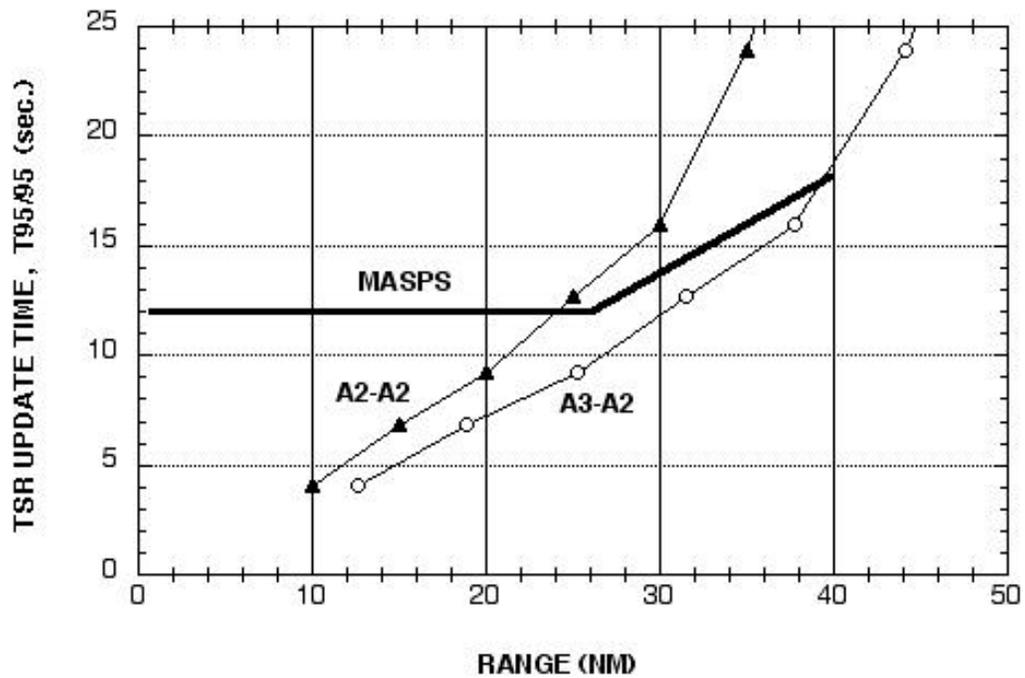


Figure 4. Simulation Results for TSR Communication in the LA2020 environment.