

RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS (DO-282) , Revision A

Meeting #21

**Results of a Quick Study Estimating the Acquisition
Range for UAT Transmitters**

**Presented by: Larry Bachman & Mike Castle
JHU - APL**

SUMMARY

Simulations of aircraft and/or ground stations equipped with the UAT datalink were simulated to determine the range of acquisition of the UAT track when the Mode Status payload alternates inclusion of flight plan ID and 4096 code. This paper highlights the analysis of the results and issues of the simulations. Results from simulations are presented in terms of the range at which UAT receivers have received state and ID/Status data from UAT transmitters in both the LA 2020 and CE 2015 interference environments.

Quick Study Estimating the Acquisition Range for UAT Transmitters

Mike Castle & Larry Bachman
Johns Hopkins University Applied Physics Laboratory

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The numbers shown for acquisition ranges should be considered a quick estimate, and have the potential to be biased by the simulation assumptions. Sample size, starting range, the velocity of the aircraft, and the interference environments would all be further verified if it were determined that further study was desired.

Assumptions

- The baseline for all assumptions is to be found in the RTCA UAT MOPS (DO-282), Appendix K.
- The CE 2015 environment is not exactly the same as was simulated for the results shown in DO-282. Recent upgrades in MAUS allow us to calculate DME powers more precisely, and further study is necessary to set the proper values for DME/TACAN parameters in a CE 2015 environment.
- Starting range for the aircraft depended on the equipage type and is shown in Table 1. A1L and A0 aircraft are generally assumed to be limited to 18,000 ft. altitude ceilings, so the starting range was decreased so probe aircraft would be within line-of-sight for a ground receiver

Table 1 - Parameters for Transmitting Probe Aircraft Being Acquired by Ground-based UAT Receiver

Equipage	Start Range Air-Air (NM)	Start Range Air-Gnd (NM)	Speed (knots)	Altitude Min. (feet)	Altitude Max. (feet)
A3	150	200	450	25,000	40,000
A2 / A1H	100	200 / 160	450 / 300	25,000	40,000
A1L / A0	75	160	300	18,000	15,000

- Mode status payloads (encoded in UAT payload type codes #1 and #3, see DO-282 2.2.4.3) are assumed to alternate between including flight plan ID and 4096 codes on each transmission of that payload type code.
- Acquisition of a UAT transmitter for a ground receiver is defined as receiving data of at least one state vector payload, one Mode Status payload with flight plan ID included, and one Mode Status payload with 4096 code included.

- Acquisition of a UAT transmitter on an airborne receiver is defined as receiving data of at least one state vector payload and one Mode Status payload with flight plan ID included.
- Results are shown as the range from two successive 99th percentiles. The acquisition range for each probe aircraft flying towards the receiver is calculated 500 times, and the 99th percentile range is taken for that transmitter. The 99th percentile of 500 ranges is then taken as the acquisition range of that transmitter equipage class.

Results

Table 2 shows the results for air-ground acquisition for the LA 2020 and CE 2015 scenarios. Table 3 and Table 4 show the results for air-air acquisition for the LA 2020 and CE 2015 scenarios, respectively.

Table 2 - 99/99 Percentile Air-Ground Acquisition Ranges for Both Scenarios

Transmitter Equipage	Start Range for Probes (NM)	LA2020 Ground Receiver	CE 2015 Ground Receiver
A3	200	193	192
A2	200	183	182
A1H	160	147	149
A1L	160	140	141
A0	150	121	121

Table 3 - 99/99 Percentile Air-Air Acquisition Ranges for LA 2020 Scenario

Receiver Equipage	Transmitter Equipage (Initial Range)		
	A3 (150 NM)	A2/A1H (100 NM)	A1L/A0 (75 NM)
A3	121	55	27
A2	130	55	26
A1	115	49	25
A0	117	50	24

Table 4 - 99/99 Percentile Air-Air Acquisition Ranges for CE 2015 Scenario

Receiver Equipage	Transmitter Equipage (Initial Range)		
	A3 (150 NM)	A2/A1H (100 NM)	A1L/A0 (75 NM)
A3	125	54	25
A2	122	53	25
A1	107	50	24
A0	101	49	24

Table 5 compares the acquisition ranges of A1L/A0 transmitters between the alternating Mode Status payload and the non-alternating (standard definition with only flight plan ID) case.

Table 5 - 99/99 Percentile Air-Air Acquisition Ranges for CE 2015 Scenario

Receiver Equipage	Alt. MS Acq. Range (NM) in LA (from Table 3)	FPID-only Acq. Range (NM) in LA	Alt. MS Acq. Range (NM) in CE (from Table 4)	FPID-only Acq. Range (NM) in CE
A3	27	30	25	29
A2	26	28	25	30
A1	25	25	24	25
A0	24	24	24	24