

RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS

Meeting #3

GPS – UAT Coupling

Presented by Chris Moody

SUMMARY

GPS--UAT Coupling

Chris Moody

Areas of Interest

- Making 1 PPS time mark available to UAT
 - jitter and bias between Tx and RX 1PPS place limits on accuracy of independent range measurement
- How to specify the valid time of the ADS-B position information
 - asynchronicity between measurement time and transmit time

1 PPS Time Mark

- GPS vs UTC time can vary by integral number of leap seconds AND up to 1 usec offset--
 - no clear requirement for one or the other in GPS standards
 - leap seconds is no issue for avionics
- If GPS/UAT in separate LRUs, unit and installation dependent delays can exist in the 1PPS output
 - lightning protection filter (up to ~300ns reported by Garmin)
 - required by DO-160D
 - cable length, type (up to ~300ns reported by Garmin)
 - number of units being driven by each 1PPS output (?? ns)

Minimizing 1PPS bias

- Require common time reference--probably UTC since this is used in ARINC 743A
- UAT/GPS in single LRU
 - eliminates cabling and lightning protection uncertainty--but requires additional--or shared GPS antenna
- Have avionics installer calibrate out the delay bias as part of install procedure
 - would it require periodic check?
 - may not be popular...
- If none of these are practical, worst case bias between any given TX/RX pair could be 1.5 - 2.0 usec

1 PPS Jitter

- No universal standard for this?
- +/- 300 ns may be reasonable worst case

Time of Validity

- Similar to 1090, have a UTC coupled case and a non-UTC coupled case
- For UTC coupled case
 - use UTC second prior to transmission as valid time (simplest for low end self contained units)
 - extrapolate only if necessary (from prior second) due to inadequate time between position measurement and transmit time
 - worst case extrapolation time could be around 1.5 seconds
 - alternatively extrapolate/measure to 0.2 sec UTC epoch like 1090
 - reduces worst case latency to around 1 second with 1 hz measurement rate
- Basically consistent with 1090 approach relative to air carrier implementation