RTCA Special Committee 186, Working Group 5

ADS-B UAT MOPS Maintenance

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NAC_V Encoded Value Definition Clarification In Response to Action Item 23-04

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Summary
This Working Paper addresses Action Item 23-04 which requested that I produce an addition to the proposed Appendix on NAC_V which will also be used in the Appendix J of DO-260B.

NAC_V Encoded Value Definition Clarification – S. R. Jones

GPS derived velocity is currently encoded as a NAC_V having a 95% error bound of 10 m/s. Although this bound will accommodate derived velocity lags at fairly severe turn rates, it over-bounds by a substantial amount the 95% velocity error of about 0.2 m/s expected in stable flight. This misrepresentation of expected GPS velocity quality has led application designers and simulators to faulty impressions of the potential value of the instantaneous velocity provided in the GPS state vector.

Velocity lag errors have long been an issue in the use of ATC automation derived velocity with radars as the sensor input. Assurance that better velocity is available when flight dynamics permit is obtained by separately specifying acceptable ATC tracker errors for stable and turning tracks. The STARS requirement on estimated heading error is indicated by values tabulated below.

Heading Accuracy (RMS degrees)

Speed (kts)	Stable Flight Heading error	Transient Tracks Heading error
100	12	51
250	6	30
400	3	31

Based on experience with GPS, and without requiring changes to the GPS receiver acceptance test requirements, there seems to be no risk in adding some clarification to the NAC_V definition indicating that considerably better than the high turn rate limiting encoded error value should be expected in the normal flight conditions which apply for the supported application. Even a statement in the definition that normally experienced errors should be less than one tenth the encoded maximum value would help (and still seems conservative).