# Precise Velocity Estimation Using a Stand-Alone GPS Receiver

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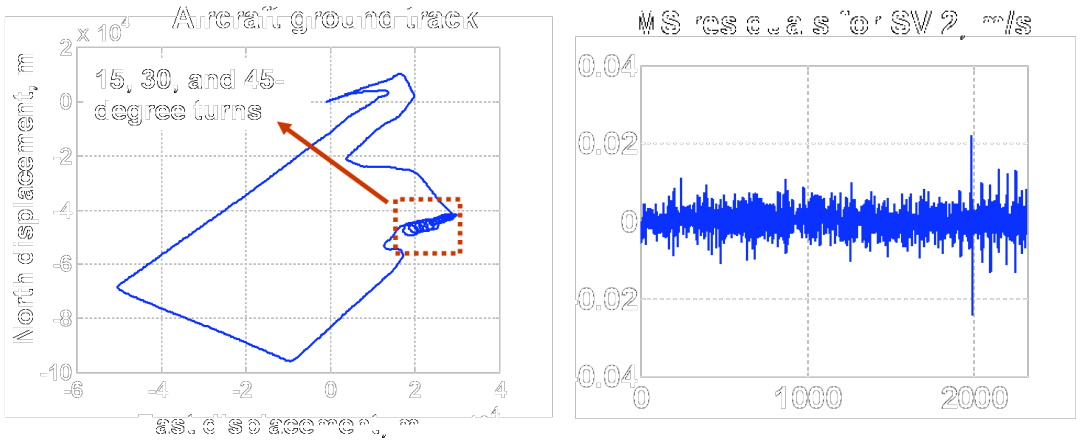


**Precise GPS Velocity Flight Test. Left: Aircraft ground track showing the medium-dynamics segment with bank angles up to 45 degrees. Right: In-flight velocity residuals for SV PRN 2 with a bias of 0.01 mm and noise of 0.4 mm/s**

Stand-alone GPS receiver velocity algorithms were developed and flight tested. A dual-frequency GPS receiver is subjected to medium aircraft dynamics of up to 1 g (9.8 m/s$^2$), with aircraft bank angles of up to 45 deg. Velocity errors were determined for static and in-flight conditions. In-flight results were evaluated against a post-processed, differential kinematic GPS solution, and by an evaluation of the velocity estimation residuals. Differences between the stand-alone velocity solution and a post-processed differential velocity solution were found to be at the 2-4 mm/s-level (1-sigma) for horizontal velocity components, and 9.7 mm/s (1-sigma) for vertical velocity. Since these differences include noise contributions from three GPS receivers, stand-alone velocity errors are expected to be smaller than these results. This is also indicated by the stand-alone velocity residual biases, which were found to be on the order of 0.1 mm/s or less, while residual standard deviations ranged from 0.4 to 3.2 mm/s.

Further reading: F. van Graas and A. Soloviev, "Precise Velocity Estimation Using a Stand-Alone GPS Receiver," *NAVIGATION: Journal of The Institute of Navigation*, vol. 51, no. 4, 2004.