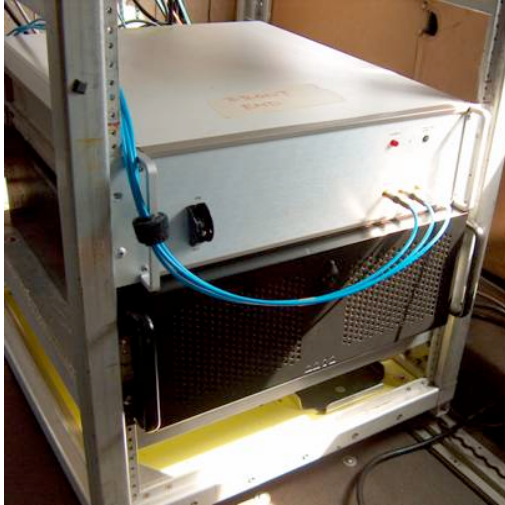


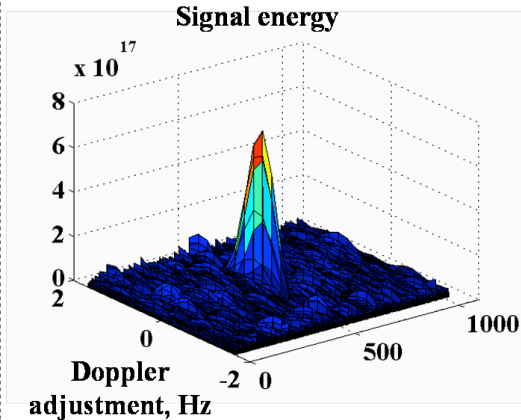
Deep GPS/Inertial Integration Flight Test

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Sponsor: Federal Aviation Administration (FAA)



SV 30 (CNR ~ 15 dB-Hz)



Deep GPS/Inertial flight test. Left: Equipment rack with GPS receiver and Low Cost Inertial Measurement Unit. Right: Example of GPS satellite signal acquisition at 15 dB-Hz during a 90-degree aircraft turn (the signal is 50 times weaker than the tracking threshold for a commercial GPS receiver)

A deeply integrated GPS/low-cost IMU system has been developed and applied to re-acquire and track GPS signals with low carrier-to-noise ratio (CNR). The system provides continuous carrier phase tracking without requiring knowledge of navigation data bits. Signal re-acquisition and continuous carrier phase tracking at the centimeter-level were demonstrated for an aircraft in-flight during a 90-degree turn. Reliable signal acquisition and tracking were demonstrated for signals at 15 dB-Hz, which is 17 dB (or a factor of 50) below the tracking threshold of unaided GPS receivers. To achieve this level of deep integration, the IMU data and the GPS data were time-synchronized to achieve centimeter-level agreement between the IMU-derived velocities and the GPS velocities. Furthermore, the IMU was not co-located with the GPS antenna, which required the use of advanced lever arm compensation algorithms. The flight test demonstration was the first of its kind and the results were reported in September of 2004.

Further reading: A. Soloviev, S. Gunawardena, and F. van Graas, "Deeply Integrated GPS/IMU for Low CNR GPS Signal Processing: Flight Test Results and Real Time Implementation," *Proceedings of the Institute of Navigation GNSS-04 Meeting*, Long beach, CA, September 2004.