# GPS Aircraft Receiver Earth-Surface Multipath Reception

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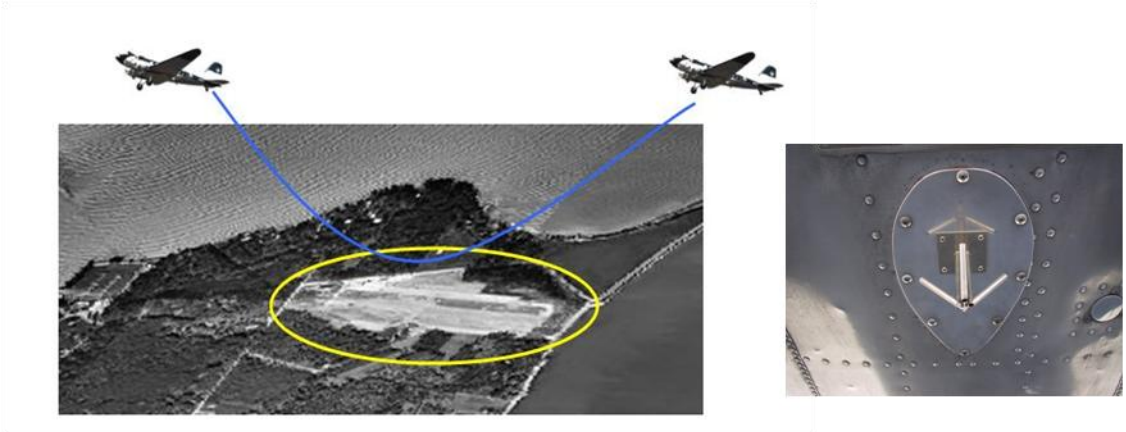

**DC-3 Flight test over Middle Bass Island, Lake Erie (left) to measure earth-surface induced multipath using both top-mounted and bottom-mounted (right) GPS antennas.**

For aircraft precision approach operations, earth-surface multipath as observed by a top-mounted aircraft GPS antenna degrades the accuracy of the pseudorange measurement. Of particular concern are stabilized approaches over water where the water reflection of the GPS signal could generate sustained multipath error. A novel multipath detection method is introduced in this work. It provides accurate estimates of multipath strength and fading frequency using a software-defined radio GPS receiver and radio frequency (RF) data collected from the top-mounted antenna. Combined with analysis results of flight test data collected from both a top-mounted and a bottom-mounted antenna, the new method allows for a realistic model of the Earth-surface multipath environment in post processing. Narrow-band and Wide-band airborne receivers are simulated, and their responses to Earth-surface multipath are evaluated using the model. The two receivers are found to have different code phase error signatures in the same multipath environment. Under different conditions, both receivers can experience smoothed pseudorange bias errors of up to 0.3 m.

Further reading: Zhu, Z. and Van Graas, F. , "Characterization of Earth-Surface Multipath Error for Aircraft GPS Receivers," Proceedings of the Institute of Navigation GNSS-2005 Meeting, Long Beach, CA, September 2005.

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