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Evaluation of methods of winds aloft measurement for use in skywriting

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Abstract

In this dissertation the suitability of four winds aloft calculation methods were evaluated for their suitability in skywriting applications. The methods were real-time vector subtraction, and flying patterns of perpendicular vectors, arbitrary vectors and a constant-rate full circle, none of which require specialised sensing hardware. The sensitivity to errors in the measurements that each method depends on was characterised, and simulations were performed to verify the behaviour of each method to varying errors in the measurements. The four methods were also evaluated in real-world conditions using an aircraft fitted with measurements systems commonly found on general aviation aircraft, and the results were compared to weather balloon measurements taken simultaneously, and at the same location as the trials. The most commonly used vector subtraction method was found to be the least suitable for determining the wind due to the dependance on a large number of inherently inaccurate measurements. The circular pattern method was least susceptible to measurement error, but was the most sensitive to pilot inaccuracy.