

# Validation of GPS by Ground Scanning Radar

Generated with an on-board wide-angle FMCW radar for General Aviation

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Abstract—Many pilots in General Aviation use electronic add-ons aids in flight, which rely on satellite navigation information. This navigation information is often a single point of failure which is undesirable since the pilot relies on the information.

This paper presents the results of research whether a novel mobile radar station can be used to validate the navigation results from the GPS. The radar transmits signals to the ground, and compares the locations of the reflections to a digital map such as Google maps.

A test flight was performed with a radar system on board. Fifteen different methods for processing the images were investigated, and it was found that Ridge Operators and Entropy Detection are good methods to extract similar features in Google and radar images. These algorithms were always successful in picking the single correct GPS coordinate out of a pool of 300 false ones within 150m of the correct answer, except when the aircraft was making a turn and the radar was pointed to the sky.

It is concluded that a ground-scanning radar on board can be used to validate the results of a GPS, provided that the radar can observe recognizable features that can be compared to a digital map. The type of image processing used to extract the data is crucial for the application.