

Abstract Submitted
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**Experimental Measurement of Flow Field Around a Rotary Wing
Unmanned Aircraft for Evaluation of Onboard Anemometer Placement¹**

ALYSSA AVERY, SEABROOK WHYTE, JAMES BRENNER, VICTORIA NATALIE, JAMEY JACOB, Oklahoma State University — CLOUD-MAP is a collaboration between multiple universities to develop and evaluate unmanned aircraft technologies to place atmospheric sensors in otherwise hard to reach areas in the atmosphere. To determine the effectiveness of ultrasonic anemometers mounted on rotary wing aircraft, multirotor aircraft have been outfitted with sonic anemometers to measure windspeed and direction of winds aloft. The experiment maps the in-flow around a multirotor using multiple diagnostics, including PIV, ultrasonic anemometers, multi-hole probes, and impeller anemometers. Evaluation begins with flow measurements around a fixed single multirotor arm and followed up with multiple rotors with increasing fidelity for in-flight UAS. Multirotors are also be placed in a wind tunnel and angled to simulate a sonic anemometer crosswind measurement. Comparisons with flight modes are made utilizing the OSU Gust and Shear Wind Tunnel Areas while validation tests are performed with tower mounted anemometers both at the Oklahoma Mesonet and the DOE ARM SGP Site. Areas of general quiescent flow are found absent of large scale disturbances or turbulent fluctuations. Results detail the accuracy of sonic anemometer measurements from mounted while on the multirotor in flight.

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