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UAS Swarming for Three-Dimensional Wake Measurements of Building and Turbine Wakes JAMEY JACOB, RAKSHIT ALLAMRAJU, TAYLOR MITCHELL, VICTORIA NATALIE, Oklahoma State University — Three dimensional measurements of the wake upstream and downstream of buildings and turbines utilizing UAS are presented. Multirotor aircraft have been outfitted with sonic anemometers to measure windspeed and direction of winds aloft. Various studies have demonstrated using a fixed wing unmanned aircraft systems (UAS) to measure the wake of turbines. However, a novel approach is taken to measure multiple points simultaneously in the wake using highly coordinated and autonomous quadrotors UAS, aka swarming. The ability to perform such measurements is made possible due to the integration of fast response aerodynamic sensors with compact hardware that enables the UAS to be used in this operation. A proposed experimental testing scheme is to measure a three-dimensional profile of the boundary layers of wakes upstream and down of buildings and wind turbines. This insight provides a real-time full-scale measurements of the effects of building and turbines at high Re and determine the impacts of the boundary layer. The Oklahoma Mesonet and DOE ARM SGP Site are used for validation, and ground mounted ultrasonic anemometer is used for 3D validation of the wind vector estimates. Initial results are presented and discussed.

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