Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Adapting unmanned aerial vehicles for turbulence measurement[1] BRANDON WITTE, JACOB HELVEY, JON MULLEN[2], MICHAEL THAMANN[3], SEAN BAILEY, University of Kentucky — We describe the approach of using highly instrumented and autonomous unmanned aerial vehicles (UAVs) to spatially interrogate the atmospheric boundary layer's turbulent flow structure. This approach introduces new capabilities not available in contemporary micro-meteorological measurement techniques such as instrumented towers, balloons, and manned aircraft. A key advantage in utilizing UAVs as an atmospheric turbulence research tool is that it reduces the reliance on assumptions regarding temporal evolution of the turbulence inherent within Taylor's frozen flow hypothesis by facilitating the ability to spatially sample the flow field over a wide range of spatial scales. In addition, UAVs offer the ability to measure in a wide range of boundary conditions and distance from the earth's surface, the ability to gather many boundary layer thicknesses of data during brief periods of statistical quasi-stationarity, and the ability to acquire data where and when it is needed. We describe recent progress made in manufacturing purpose-built airframes and adapting pre-fabricated airframes for these measurements by integrating sensors into those airframes and developing data analysis techniques to isolate the atmospheric turbulence from the measured velocity signal.

[1]This research is supported by NSF Award CBET-1351411
[2]Currently at Ford Motor Company
[3]Currently at General Atomics

Sean Bailey
University of Kentucky

Date submitted: 27 Jul 2015 Electronic form version 1.4