Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Scaling effects on aerodynamic interactions of rotorcraft around boundaries DARIUS CARTER, MEGAN MAZZATENTA, SHIJIE GAO, CARMELO DI FRANCO, NICOLA BEZZO, DANIEL QUINN, University of Virginia, LINK LAB COLLABORATION — The growth of the Micro Aerial Vehicle (MAV) industry is outpacing our understanding of how MAVs behave in cluttered environments. Search and rescue and product delivery – two key MAV applications – occur in tight, confined spaces filled with complex obstacles. Our current understanding of how MAVs interact with boundaries is based primarily on helicopter models, which were designed for high Reynolds-number single-rotor flows. To support better flow models of MAV-boundary interactions, we will measure the lift forces and flow of small quadrotors near a side wall, ground, ceiling, and water surface. To see how our results scaled, we measured differently-sized propellers in these same conditions. Using Particle Image Velocimetry, we quantified the momentum flux of the rotors and evaluated the assumptions made by the existing ground and ceiling models. Better physical models offer a way to predict MAV's reaction to environmental disturbances, which is critical for certifying that MAVs can operate safely near or in cooperation with humans. Better models could offer physics-based situational awareness, which could reduce the need for heavy sensors and cameras and free up payload on small, lightweight MAVs.

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Date submitted: 31 Jul 2019 Electronic form version 1.4