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Experimental studies of the rotor flow downwash on the Stability of multi-rotor crafts in descent[1] MARCEL VEISMANN, CHRISTOPHER DOUGHERTY, MORTEZA GHARIB, Caltech — All rotorcrafts, including helicopters and multicopters, have the inherent problem of entering rotor downwash during vertical descent. As a result, the craft is subject to highly unsteady flow, called vortex ring state (VRS), which leads to a loss of lift and reduced stability. To date, experimental efforts to investigate this phenomenon have been largely limited to analysis of a single, fixed rotor mounted in a horizontal wind tunnel. Our current work aims to understand the interaction of multiple rotors in vertical descent by mounting a multi-rotor craft in a low speed, vertical wind tunnel. Experiments were performed with a fixed and rotationally free mounting; the latter allowing us to better capture the dynamics of a free flying drone. The effect of rotor separation on stability, generated thrust, and rotor wake interaction was characterized using force gauge data and PIV analysis for various descent velocities. The results obtained help us better understand fluid-craft interactions of drones in vertical descent and identify possible sources of instability.

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