

Abstract Submitted
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Propellers in Partial Ground Effect JIELONG CAI, SIDAARD GUNASEKARAN, University of Dayton, MICHAEL OL, Folderol, LLC, ANWAR AHMED, Auburn University — The classical result for propellers (or any rotating wing) operating parallel and in close proximity to an unbounded flat-plate, is increase in thrust and decrease in power-required, for a given rotation-rate. We examine extreme cases, where the ratio of ground-proximity to propeller-diameter is 0.1 or less. We also reverse the propeller direction, for a ceiling effect. The limiting case for small ground separation is halving of power-required. However, this depends strongly on the ratio of propeller pitch to diameter. For large ratios (approaching 1), ground-effect offers almost zero benefit. For small ratios (on the order of 0.5), best results are obtained. We also consider a finite ground-plane as a circular disk. For a ratio of disk diameter to propeller diameter of 0.5, ground-effect is nil, while for a ratio of 1, full ground-effect is restored. Flow visualization gives the explanation: there is a circular time-averaged dividing streamline on the ground-plate, within which the projection of the flow is swirling, but outside of which the flow is radial. For ground-plate-disks of diameter smaller than this dividing streamline, propeller thrust is measured to resemble that in free-air, while for larger disks there is a strong ground-effect.

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