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The effects of leading edge roughness on dynamic stall JOHN HRYNUK, Army Research Lab — Dynamic stall is a fundamental flow phenomenon that is commonly observed for insect flight and rotorcraft. Under certain conditions a leading edge vortex forms generating large but temporary lift forces. Historically, computations studying dynamic stall on airfoil shapes have struggled to predict this vortex formation time and separation point. Reduced order models and CFD have performed well when experiments have been performed to develop separation models, but this has limited the development of robust design tools. The current study looks at the effect of leading edge surface roughness on the formation of the Dynamic Stall Vortex (DSV). Roughness elements were applied to the leading edge of a NACA 0012 airfoil and PIV data of the vortex formation process was recorded. Measurements were taken at a Reynolds number of Re = 12,000 and baseline smooth NACA 0012 data was also recorded for comparison. Surface roughness elements, below the typical scale modeled by CFD, are shown to change DSV formation angle and location.

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