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High Speed Focused Schlieren Flow Visualization of Shock Induced Dynamic Stall[1] PATRICK BOWLES, DUSTIN COLEMAN, THOMAS CORKE, FLINT THOMAS, University of Notre Dame, MARK WASIKOWSKI, Bell Helicopter — Focused Schlieren images of the leading edge flowfield ($0 \leq x/c \leq 0.10$) of a modern helicopter rotor-blade airfoil are presented in order to document the development of shock waves during compressible light dynamic stall at moderate subsonic freestream Mach numbers ($M_\infty \in [0.2,0.6]$). The focused Schlieren system was designed to provide a "macro" image of the near (suction) surface boundary layer and shock features with a marginal depth of focus, effectively eliminating density distortions associated with the windtunnel (plexiglass) walls or the (polycarbonate) rotating airfoil endplates. A high-speed camera operating at up to 4 kFPS was used to capture the dynamic behavior of the shock, leading-edge separated shear layer and dynamic-stall vortex during the pitching cycle. These images were then correlated with static pressure time series on the airfoil surface. The effect of leading-edge roughness was then investigated. Under certain conditions, this was shown to alter the shock development and shock streamwise propagation. The effect that the shock formation had on the pitch-moment stability for these different conditions is then presented.

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