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Investigation of Dynamic Shock-Vortex Interactions in Compressible Low Reynolds Number Flows WAYNE FARRELL, MICHAEL KINZEL, University of Central Florida — As the Martian environment combines very low atmospheric density with a lower than Earth speed of sound, rotorcrafts such as NASA's *Ingenuity* craft operate in a unique compressible low Reynolds Number (Re) flow regime. A preliminary study of dynamic stall using forced oscillation tests of a NACA 5605 airfoil in the aforementioned flow regime has showcased a new phenomenon called dynamic shock-vortex interactions. At a Re number, Mach number, and reduced frequency range of ˜16000, .55, and .05 - .1 respectively, it was observed that during the pitch up motion, shock and vortex formations at the leading edge occur simultaneously. The resulting flow field showcases a shock-vortex interaction where the leading edge shocks are displaced from the airfoil surface as a result of the leading edge vortex formations. Additionally, these leading edge shocks are dynamically decomposed across the leading edge vortices and advected downstream. Based on these findings a complete evaluation of this novel shock-vortex interaction will be studied using higher fidelity CFD modeling on a 3D propeller mesh. Characterization of these shock-vortex interactions in terms of flow field parameters and aerodynamic load dynamics will be studied.

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