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Turbulent Wake Induced by a Seal-Whisker-Inspired Power Turbine Blade WEI ZHANG, ROBERT AHLMAN, CURTIS FLACK, Cleveland State University, VIKRAM SHYAM, NASA Glenn Research Center — Power turbines operate over a large range of flow incidence and at relatively low Reynolds numbers (Re). For a fixed-wing aircraft at cruising altitude, it is challenging for current power turbine blades to maintain desirable aerodynamic performance as the Re number has dropped to substantially lower than that at sea level. Therefore, it is imperative to improve the aerodynamics of turbine blades in low Re regimes. However, the performance of state-of-the-art turbine blades for aero-propulsive systems has plateaued. Inspired by the exceptional hydrodynamics of harbor seal whiskers, this study applies the key features of the three-dimensional undulating morphology of seal whiskers to the turbine blade leading edge. Turbulent wake flows generated by a seal-whisker-inspired variable speed power turbine (VSPT) blade are quantified and compared against a baseline untreated VSPT blade in a water tunnel using Particle Image Velocimetry (PIV). Focus is on the wake velocities and turbulence statistics at a range of angles of attack (AOA = – 10 to 10 degrees). Results of the seal-whisker-inspired blade will be used not only to improve the design of power turbine blades, but also to inform a wide variety of bio-inspired aerodynamic applications.

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