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Novel Aerodynamic Design for Formula SAE Vehicles[1] SAMUEL SENTONGO, AUSTIN CARTER, CHRISTOPHER CECIL, IOAN FEIER, United States Air Force Academy — This paper identifies and evaluates the design characteristics of a novel airfoil that harnesses the Magnus Effect, applying a moving-surface boundary-layer control (MSBC) method to a Formula SAE Vehicle. The MSBC minimizes adverse pressure gradient and delays boundary layer separation through the use of a conveyor belt that interacts with the airfoil boundary layer. The MSBC allows dynamic control of the aerodynamic coefficients by variation of the belt speed, minimizing drag in high speed straights and maximizing downforce during vehicle cornering. A conveyer belt wing measuring approximately 0.9 x 0.9m in planform was designed and built to test the mechanical setup for such a MSBC wing. This study follows the relationship between inputted power and outputted surface velocity, with the goal being to maximize speed output vs. power input. The greatest hindrance to maximizing speed output is friction among belts, rollers, and stationary members. The maximum belt speed achieved during testing was 5.9 m/s with a power input of 48.8 W, which corresponds to 45.8 N of downforce based on 2D CFD results. Ongoing progress on this project is presented.

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