Integrating the Magnus Effect onto a Streamline Airfoil to Increase the Lift to Drag Ratio

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The goal of this experiment was to determine if integrating the Magnus Effect onto an airfoil would result in a higher lift to drag (L/D) ratios than a normal airfoil. This was done by creating a “Magnus Effect Airfoil” and comparing it against a standard airfoil at different angles of attack. The Magnus Effect Airfoil was a 3D printed airfoil with moving skin on the top surface to imitate the magnus effect (much like a treadmill). Because this study was only focused on induced drag, a normal airfoil was simulated by turning the moving surface off. To simulate different flight conditions the Magnus Effect Airfoil was tested at a 0 degree angle of attack (AOA) and 5 degree AOA. At a 0 degree AOA the Magnus Effect Airfoil had a L/D ratio that was 77% higher than a normal airfoil. However, at a 5 degree AOA the Magnus Effect Airfoil had a L/D ratio that was 21% less than the normal one. This proved the hypothesis for a 0 degree AOA but disproved it for a 5 degree AOA. This possibly points towards lower L/D ratios at higher angles of attack because it may be apt to stall at lower angles of attack than normal because of boundary layer separation between the moving and non moving surface. However, the Magnus Effect Airfoil did increase the efficiency of the wing at a 0 degree AOA which has huge implications for the aerospace industry for more efficient airplanes. Also, more research will be conducted on different flight conditions and changing the location of the moving surface .

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