University of New Hampshire

**Magnus Effect on a Cylindrical Airfoil**

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# Abstract

Our goal was to evaluate the Magnus Effect around cylindrical airfoils. Using the University of New Hampshire wind tunnel we tested rotating cylinders at different mean wind velocity and rotation speeds (RPM). By keeping the velocity in the wind tunnel constant and changing the RPM of the cylinder we were able to track the trend of the lift force. This test was completed for four different wind speeds at approximately: 12 m/s, 16 m/s, 20 m/s, 24 m/s; and three different cylinder radiuses at: 0.0290 m, 0.0419 m, and 0.0641 m. We ran an additional test on the smallest cylinder radius at constant RPM and for a range of wind speeds from approximately 11 m/s to 30 m/s to more closely see the effect of just the wind speed on lift. Theoretically, we expected to see a linear increase in lift as we increased wind speed or RPM, and quadratic growth when increasing the cylinder radius. What actually occurred was an apparent plateau at our range of tested RPM and wind speeds with our size of cylinders. Despite seeing the expected increase in lift with radius, the total magnitude of lift was not nearly as close to our theoretical values. For our smallest cylinder we reach a Reynolds number as high as 1.128x105, which is well above an appropriate Reynolds number and are now creating vortex shedding behind our cylinder which reduced the experimental lift force.

# Introduction

Our goal was to evaluate the effects of the Magnus Effect on a rotating cylinder at different rotational speeds and wind speeds. Using the Kutta-Joukowski lift equation –

(1)

Where is the lift force, is the density of the fluid, is the length of the cylinder, and is the vortex strength, given by –

(2)

Where is the radius, and is the angular velocity of the cylinder. From these two equations we theorized that at higher wind speeds, rotational speeds, and cylinder radius that we would generate more lift. The lift is dependent on the radius squared so it was expected the radius would have the largest effect of the lift force. [1]

# Methods

# Results and Discussion

# Summary and Conclusion

# References

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| [1] | "National Aeronautics and Space Administration," 5 May 2015. [Online]. Available: https://www.grc.nasa.gov/www/k-12/airplane/cyl.html. |

# Appendix