

# **Analysis of the Lift and Drag Forces over a Vertical Wing and the Study of its Trailing Vortices Effects**

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The importance of the analysis and investigation of the lift and drag forces over symmetrical wing is the basis for the understanding of many other aerodynamic phenomena that involve these kinds of aerodynamic bodies. More important is the direct impact that these forces have in the lives of daily air travelers. Trailing vortices are an important dilemma, especially in airports. The vortex generated by airplane's wing are very strong and they trail off for miles, impeding other aircraft to come close to them, in the past, accidents have occurred when a small aircraft is caught in the trailing vortex from a bigger plane ahead of them. This research is oriented primarily, towards the understanding of the fundamental concepts of lift and drag, how to estimate and calculate them using different methods. Subsequently, this research is directed towards looking at the trailing vortex that is produce in the wing, and to study the effects of these whirlpools in the performance of the wing. First, to analyze and calculate the lift and drag forces, the wing was constructed with a pressure tab system at mid-chord to measure the pressure differential over the airfoil, then using surface integrals and Navier-Stoke's theory, calculate the pressure coefficient over the wing area. With this, we calculated the lift and drag coefficients for this particular wing. To observe the trailing vortices for this wing we used a PIV (Particle Image Velocimetry) System to develop time dependent data that could be later correlated to observed vorticity and pressure drops in this region. A better understanding of the flow behavior will give us the opportunity to develop new wing geometry's that could be more efficient and more cost effective. Knowing how to predict the behavior of trailing vortices can be beneficial in airports and other areas where the aircraft traffic is intense.

This experiment is being conducted at the Low Speed Wind Tunnel facility in Clarkson University. The airfoil being tested is a NACA 0012.

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