How Airfoil Designs Affect Aircraft Aerodynamics

Gomez, Mathias (School: Baton Rouge Magnet High School)

Aerodynamics is a massively important topic circulating in the aerospace industry. With over 40,000 flights a day in the United States alone, it's important to keep the aircraft safe, reliable, and efficient. Modern day wind tunnels are one of, if not the most useful tools available to aerospace engineers to simulate and test multiple different aircraft and designs, especially airfoils. Prioritizing lift and limiting drag in the most coherent way possible is the key to conserving fuel and saving money for airliners across the globe. But how much difference do these airfoils truly place on their respective airplanes? To learn more about differing airfoils I've focused on creating a DIY wind tunnel capable of running at multiple speeds and testing these airfoils at different angles. In order to measure quantifiable data, I utilized a load cell and an Arduino Uno in measuring the amount of lift while changing the angle the air strikes the wing. During experimenting, there was a noticeable difference between the used airfoils (symmetrical, semi-symmetrical, and flat-bottomed designs) as each design generated different amounts of lift which, in the real world, would favor certain types of aircrafts; such as long cargo planes, commercial jumbo-jets, smaller propeller airplanes, or military aircraft. In building my wind tunnel, I believe I've met my design criteria in being able to achieve accurate and visually stunning results even at a much smaller and limited scale.