Designing, Building, and testing a model remote controlled aircraft

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This year long project began by determining what the capabilities of the given parts were. The design team was given an electric propulsion system to use. Not much was known about how the motor would perform, and which propeller should be chosen, so experiments were conducted to determine what was at hand. A test stand was built to characterize the propulsion system. Three different classes of propellers were tested to determine how diameter, pitch, and number of blades affected the thrust of the propulsion system. It was determined that the diameter of the propeller had the greatest affect on the amount of thrust that was produced. The propeller chosen for the plane was a two blade 20x8 prop, meaning that the diameter was 20 inches, and the pitch of the blades was 8 inches.

After the propulsion system was characterized, the team had to determine a wing design. To do this the team looked at planes that have stable and high lift flight characteristics. A common airfoil among these types of plane is the USA-35B. This airfoil has the characteristic of having a flat bottom and a curved top, which the team discovered aids in stability in flight. Small test models of the wing were created and tested in the wind tunnel to determine the lift and drag characteristics of the USA-35B airfoil. After choosing the airfoil shape the structure of the wing needed to be addressed. As per the design criteria of the project the wing had to be able to withstand a 25lbf static load. This was taken into account when creating the structure, and it was calculated that the main pine spar, in which the rest of the wing was built off would be able to hold the load. The design criteria stated that the wing could have a wingspan no longer that 10 feet, so in order to maximize lift a 10 foot wingspan was chosen.

The final piece that needed to be included in the design was to include instrumentation that would measure altitude and airspeed in flight. An Arduino microprocessor with a static pressure/temperature sensor, and a differential pressure sensor attached. The Arduino needed to be programmed in order to recognize and record data from these sensors to its internal memory. The data could then be retrieved after a flight and analyzed.

The test flight of the plane proved to be successful. During the first flight the plane showed a tremendous amount of lift and stability in flight. The plane was able to take off the ground in less than 20 feet of runway, and flew a large circle around the field. The plane landed into the wind and suffered no damages. On the second test flight the plane showed similar flight characteristics, with high lift and stability in flight. As the plane attempted to land the wind speed increased and tipped the plane as it was near the ground. The plane hit on its nose and damaged the front half of the fuselage. The plane was only damaged on its fuselage, and will be able to be rebuilt and fly again.