Virginia Military Institute

2009 SAE Aero Design Competition

Design Team:

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Advisor:

Colonel Arthur

Summary:

For the team's senior design project, the team was tasked to construct an aircraft in accordance to the SAE Aero Regular Class rules The chosen design was the rectangular one which provided ease of manufacturing and a more advantageous way to house fuel, electric motors, and a payload. The wing was a significant portion of the design due to the fact that without a well designed wing, the plane would not be able to lift off of the ground. The tail design was attained using formulas found in an engineering textbook written by Raymer. The engine was a standard two horsepower engine with no modifications; this was used in all calculations and test fights. Lastly, the team had to design the interior of the fuselage to provide enough space to house a 25 pound payload for testing. Moreover, the team knew it needed to accommodate the servos and fuel tank in the same area, thus the team constructed the payload bay with enough area to house all needed components of the aircraft.

The process in which the team went about creating the plane started with the use of a program called VisualFoil. This allowed the team to view an airfoil with its

coefficients of lift and drag. Next, the team printed out the model that it felt best suited the design requirements and that model was the NACA 6510 airfoil. The team then determined the stresses at the critical points where they are at their max and calculated the factors of safety for both shear and bending loads. These factors of safety were 20 for bending and 22 for shear, which the team considered to be more than acceptable. The team determined various variables for the aircraft such as the lifting force, the velocity to take off, and ground roll.

After completion of the aircraft, the team took the plane to a local field with a short dirt strip in order to perform a test flight. During take-off the landing gear was not sturdy enough to keep the plane stable and was swaying too much, causing the plane to struggle getting into the air. During the attempted launch, the plane caught a cross wind which shifted the plane on its weak landing gear right when it was beginning to lift off causing it to veer far off the runway. The team established that a redesign of the landing gear was in order and that future groups must make sure to design a sturdy landing gear as the stability of an aircraft is greatly affected by it. Additionally, the team discovered that the wing would not be able to support an additional 25 pound load due to manufacturing issues, thus it is stressed that future groups are meticulous with their designs to ensure that objectives will be met.