

Abstract

Masters of Engineering Degree (Mechanical)

Project Title:

Design, Build, Fly Competition

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In this project, we designed, analyzed, manufactured, and tested a custom remote-controlled airplane which ended up competing in the 2013-2014 Design Build Fly Competition. The goal of the project was to produce an aircraft that could successfully complete each of the four missions specified by the competition rules, meet all listed requirements, and maximize the team's total flight score.

We attempted to accomplish this by creating an aircraft design that met all of the competition constraints, performed well in all four of the competition missions, and minimized the aircraft's weight. The first mission of the competition was a taxi mission, requiring the aircraft to navigate a course of rough terrain without becoming airborne. All subsequent missions were flight missions: one empty and two carrying internal payloads. The payloads consisted of wooden blocks of various shapes and weights, some of which required specific orientation within the aircraft. The plane must also take off within a 40 foot runway.

A careful analysis of the competition scoring showed the most important scoring parameter of the aircraft to be weight, followed by speed and the quantity of payloads carried. These requirements and scoring analyses were used to generate a design consisting of a conventional configuration with minimized weight, a single tractor motor, tricycle landing gear, conventional tail, and capacity for two Mission II payloads. These attributes were all chosen with the direct intention of increasing overall competition score.

We constructed several prototypes of our design in order to validate our analysis and expected performance. This process uncovered a number of unforeseen problems and areas for improvement. Three iterations of the design were built and tested during the months leading to competition.

At competition, the plane placed 30th out of 80 teams. Much of the reason for the lower than expected finish was due to the oversight of wind during the design process. During all of our flight attempts at competition, persistent 20 to 30 miles per hour winds greatly impeded the forward progress of our plane, which negatively impacted our flight score. Had this been taken into account during design, the wings could have been designed smaller and the propulsion system increased. Although we did not do as well as we have liked, the competition served to be an invaluable learning experience.