Boeing VTOL

Overview
For this project Boeing asked three teams to develop a cargo system to be integrated with a quadcopter. The cargo system is required to pick up tennis balls of varying weight. Each team is also required to learn how to pilot the quadcopters as the teams will participate in a competition upon completion of the project to determine which team has the best overall design.

Objectives
The competition is organized as follows: the quadcopter will retrieve tennis balls from a ball corral with a 15 foot diameter, release them at a location fifty feet away, and repeat for fifteen minutes. The overall challenge is to see which helicopter team can transport the most and largest variety of tennis balls. There will be three tennis ball weights and they are worth different points. The heavier the tennis ball, the more points the team receives. Limitations: the quadcopter is required to fly for about 15 minutes, the batteries only last 7 minutes, and the quadcopter will have to lift tennis balls weighing up to 1Kg.

Approach
- Customer Need and Mission Parameters were gathered from Boeing Sponsors and Team Pilots
- Patent Searches were Completed to Initiate Brainstorming and Ensure no Patent Infringement
- Concept Generation and Selection were used to Determine how to Design and Integrate the Retrieval Device to Quadcopter, and in Modifying the Quadcopter Itself i.e. motors and propellers
- Increased Motor and Propeller Size, and Battery Number
- Four Servomotors and Re-enforced Composite Arms used to Retrieve tennis balls Over a Wide Area
- Teams met with Sponsors via Google Video Chat Once a Week, Sponsors visited Campus Twice
- Center of Mass Calculations were done to Determine Vehicle Stability (Avoid Inverted Pendulum)
- SolidWorks Models and Finite Element Analysis were Completed to ensure Durability
- A Prototype was Manufactured and went through Flight and Operation Testing Prior to Competition
- Final Performance Testing was the Competition itself which was Judged by the Boeing Sponsors
- Team Hella-Kitty (Boeing 3) Utilized Two Free Channels on the Spektrum DX-7 Controller
  - One to Control the Retrieval Mechanism
  - One to control the Response Rate of the Vehicle (Real-Time Stability for Changes in COM)

Outcomes
- Team 3 (Hella-Kitty) Won the Competition
  - Transported the Most Balls Across Course
  - Scored the Most Points in the Least Amount of Time
  - Demonstrated the Best:
    - Stability of Quadcopter
    - Control over Retrieval Device
    - Piloting
- Design Transferrable to Multiple Fields
  - Emergency Medicine, Parcel Delivery, Combat Supply Drop