Unmanned Aerial Systems Competition

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Mission Requirements

- Waypoint Navigation of a 1- or 2-mile course as shown in figure #1
- Package drop at a prescribed location as shown in figure #2
- Package delivery, package records impact force.
- Total flight time requirements are at a minimum of 10 minutes.

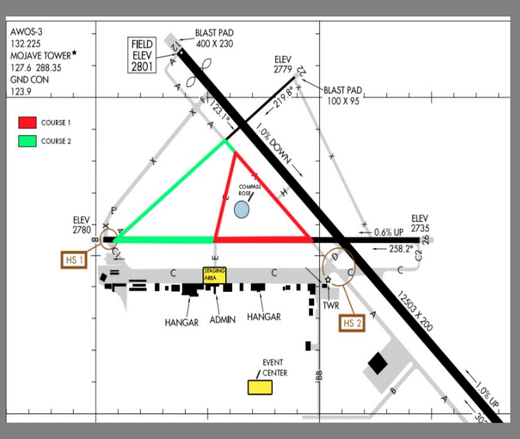

Figure #1

Figure #2

Abstract

The tasks of this competition is for our multidisciplinary team to design and assemble a drone with the capabilities to accomplish the mission requirements that mirror what UAS (Unmanned Aeriel Systems) applications. We are seeing UAS drones deliver packages, autonomous flight, and entertainment. Using CAD, Ardu-Pilot Mission Planner, and hands on assembly the team will be able to accomplish the goals that allow us to complete the tasks of the competition at the Mojave Air and Space port. Each member was able to showcase their skills to develop and design our UAS. To have an efficient drone, a goal was to have a 2 to 1 thrust per gram ratio. We conducted multiple motor, battery, and propeller combinations to find the most efficient power system while minimizing weight as much as possible without removing any important components.

Power System Requirements

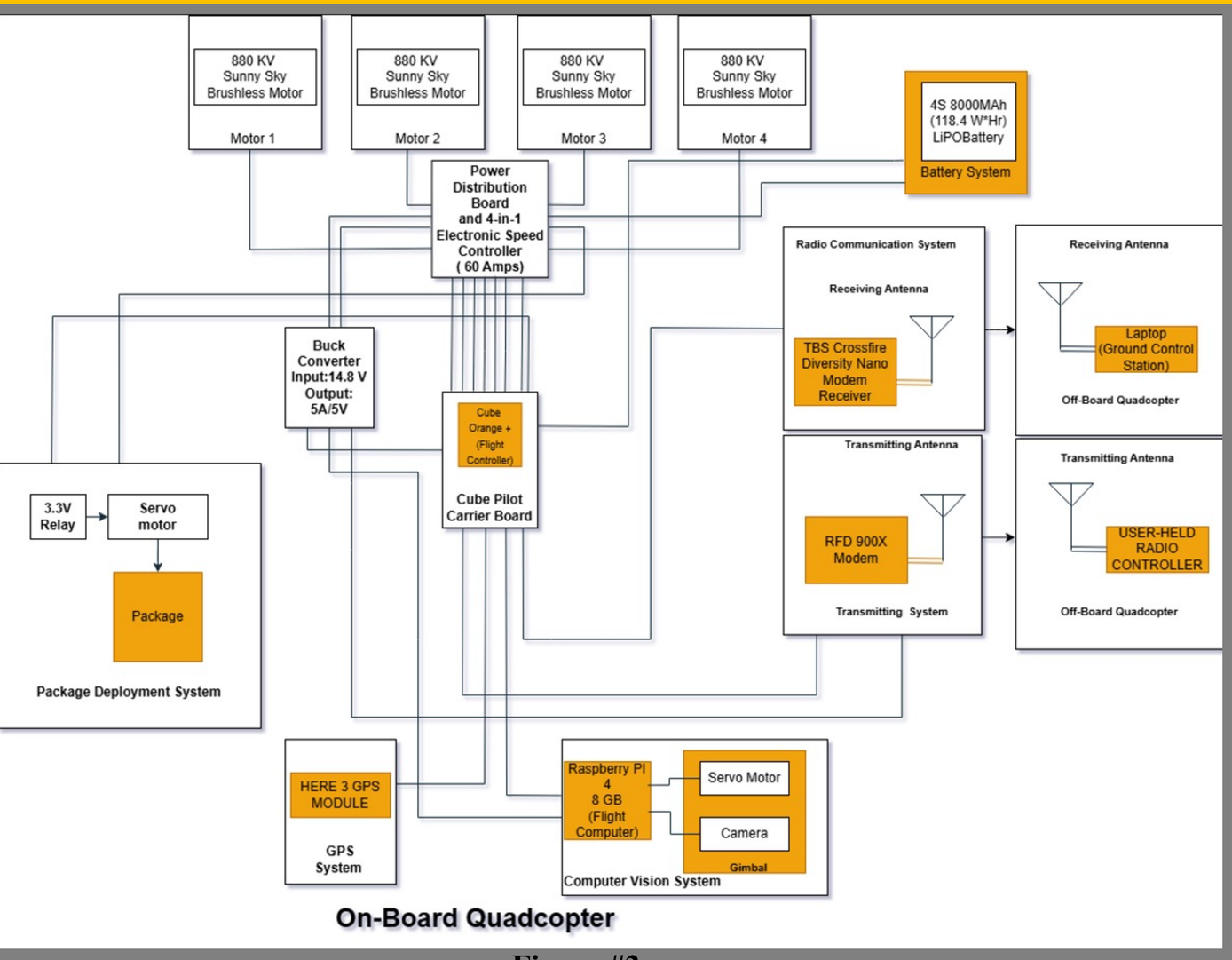

Figure #3

- A motor produces up to 1.3kg of force at maximum speed.
- The flight time of the drone is 10-25 minutes.
- Telemetry data acquired from the drone in real time is sent back to the Ground Control Station.
- Implemented failsafe voltage thresholds to return the drone to the station.
- Flight Controller run Ardu Pilot to allow GPS-based navigation and Autonomous flight.
- The communication system can reach up to 3.10 miles in length

Design Approach

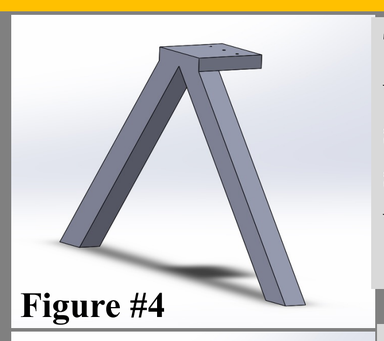

Figure #4

This design was too rigid, with straight legs that weren't flared outwards, making the drone less stable during landing. The legs were one solid piece, so if one broke, the whole part had to be reprinted, which took more time and material.

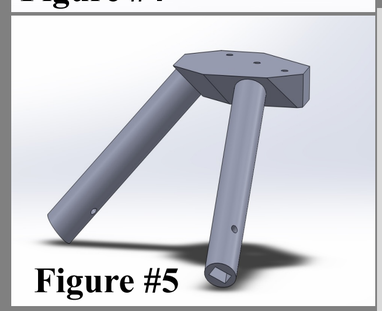

Figure #5

We moved on from this design because we wanted to incorporate a carbon fiber leg that was purchased by a previous semester's team. The two cylindrical extrusions in this version interfered with the geometry needed to properly mount that carbon fiber leg.

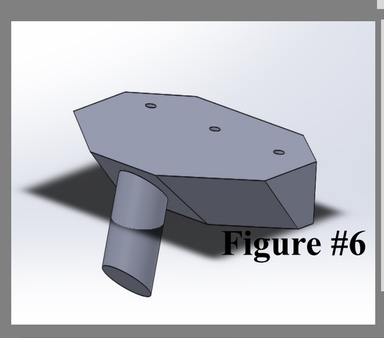

Figure #6

We realized this design had a major issue with shear stress acting on the cylindrical extrusion, especially during landing. This stress concentration made the leg prone to breaking on impact, so we needed a more robust connection.

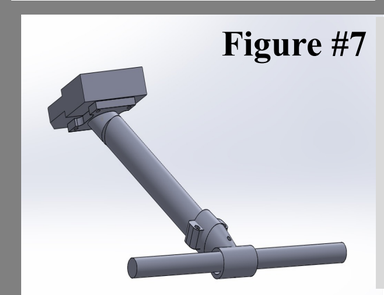

Figure #7

We chose this design because it could handle more stress during landing, reducing the chance of failure. It also allowed us to incorporate the carbon fiber legs like in the third design but with a stronger and more reliable connection.

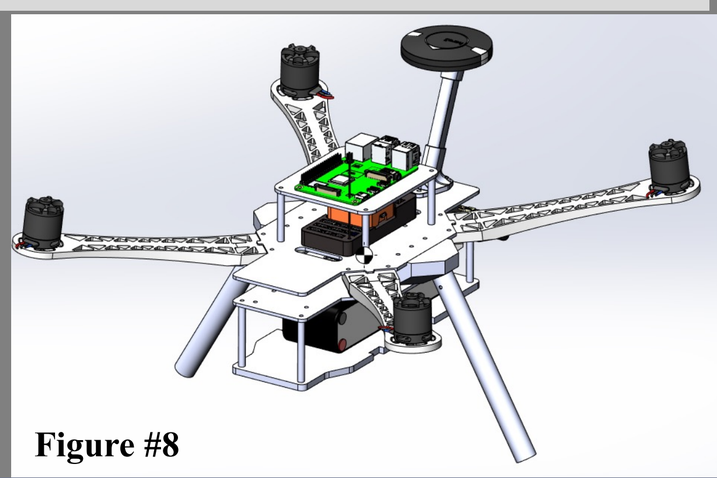

Figure #8

Conclusion

- Successfully designed, assembled, and flight-tested a UAV that met all mission requirements of the competition.
- We made multiple design iterations for different components of the drone and selected the versions that best suited the specific functions we needed, focusing on performance, durability, and ease of assembly.
- Demonstrated effective multidisciplinary teamwork and applied real-world engineering skills in a competitive setting.

The Team