JOURNAL #1

GOALS

- Assemble quadcopter by mounting hardware and electronics onto the chassis
- Complete Eagle PCB design tutorials by Jeremy Blum
- Research quadcopter dynamics and Euler angles
- Complete job shadow
- Research crowdsourcing and begin a fundraising campaign

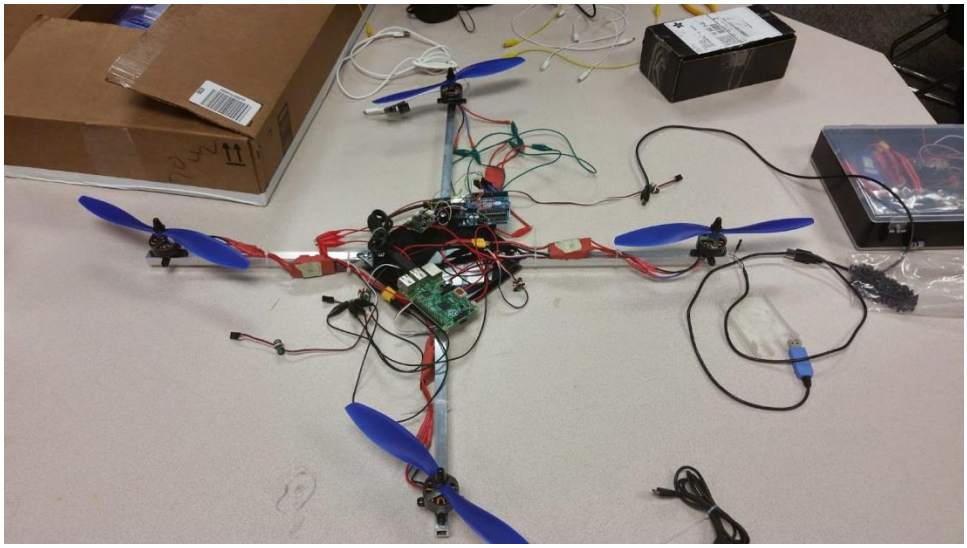
RESEARCH

My research fell into two areas: electronics and working with the quadcopter. I began working on an EDX course covering electronics. I was only able to work into the beginnings of the course, which covered basic electronic components. Concepts such as Ohm's law were covered (V=IR), power (P=IV), and how capacitors and resistors add in series and parallel. The Eagle tutorials by Jeremy Blum went through the design process of a simple PCB. Each video detailed a different aspect of the project: schematic design, board design, and CAM output. The schematic design portion covered basic components and wiring techniques in Eagle. The board design is the actual design of the physical board. The CAM output covers the process of manufacturing boards. While working with the quadcopter, I was able to vehicle and its components through our various tests. One area of improvement was the propeller mounting. I found the appropriately sized spacers for our propellers and learned to use a precision screwdriver to better tighten the screw caps. This provided a much more firm and reliable propeller mounting. We were also able to learn the orientation of the quadcopter. We labeled the motors and wired them to run in the correct X style where the top left/bottom right and top right/bottom left rotate the same way. We labeled the props according to their rotation as well. If a prop is mounted to the wrong motor, it doesn't produce thrust and can detach. I learned to tap aluminum. I had to tap eight holes to mount the motors. I improved my soldering skills by soldering bullet and XT60 connectors between the batteries/escs and motors/escs. The connections require a large amount of solder and heat which can cause the XT60 connectors to melt if the timing is not correct. Another practical skill I learned was using a lipo charger. Because lipos are composed of multiple cells, it is important that during charging, the individual cells are charged equally. If the batteries are discharged too much, they can puff which could cause fire or explosion. One battery slightly puffed, but after balancing the cells and not using it for a few days, it returned to normal.

ACCOMPLISHMENTS

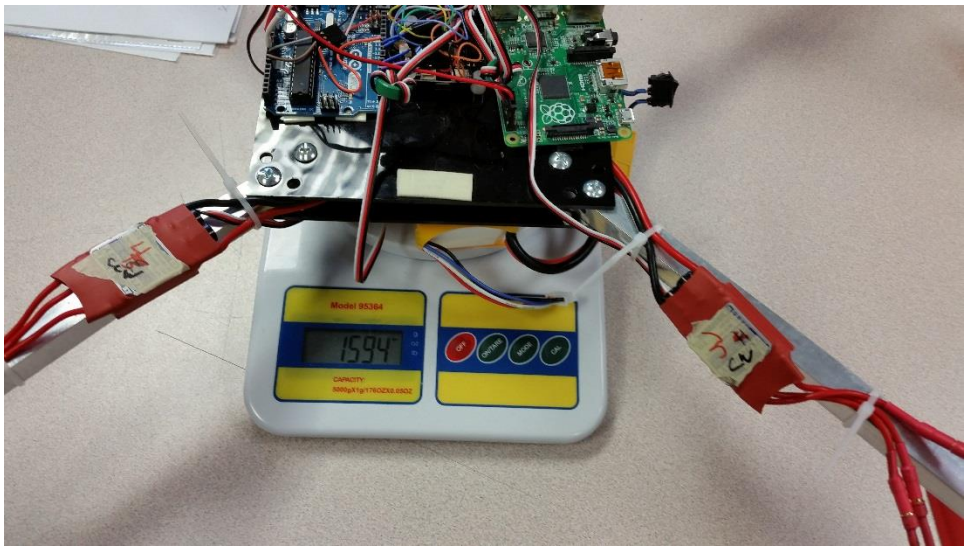
- Assembled test quadcopter per previous designs
- Completed job shadow at Lockheed Martin
- Integrated microcontroller power supplies to make the vehicle require only one battery
- Completed all Eagle PCB tutorials (1-3) provided by Jeremy Blum

Finishing the initial chassis was a big step in the project. At this point, the electronics were not organized or mounted.



Once the electronics were mounted, including the battery, the quadcopter was attached to a weighted base for testing after the electronics were stably mounted.

The chassis weighs approximately 1600 grams, which is relatively lighter than the expected 2000 grams from the initial project proposal. One small, but major, improvement was adding a switch, which can be seen on the right side of the quad (black box). Before I added the switch, the only way to power on and off the quadcopter was disconnecting the battery.



REFLECTIONS ON GOALS AND TIMELINE

As I've learned more about our project, I've realized many flaws in the timeline. A lot of the research I did and the things I worked on were based on what Jason and Drew needed to work on their aspects of their project. For example, I spent time wiring the esc power connections together to make testing easier. I was unable to complete much of the EDX course I planned on taking (6.002x) because it was a much more rigorous course and was somewhat irrelevant to our purposes. I was also hindered because many of the resources to the course were blocked at school. Instead, I began working on a material sciences course. Also, the PCB tutorials were not completely helpful. We circumvented the need, at this point, to create PCBs or design any difficult circuits. By using the power distribution systems of the ESCs, Arduino, openpilot, and RPi, we were able to power each component with just the main battery. The research about electronics was still useful. For our final design, it may still be useful or required to have a separate battery or power distribution system aside from the main one we are using now. The job shadow went flawlessly. We were able to learn a lot from a variety of people working in several different areas at Lockheed Martin.