JOURNAL #2

GOALS

- Research common UAV materials
- Research manufacturing methods
- Research various UAV designs and take into consideration possible design features
- Begin brainstorms by hand and in SolidWorks

RESEARCH

The bulk of my research at this point is focused towards the final design. The three main areas are material selection, manufacturing methods, and other designs. Based on advice from Frank Beafore, one of my advisers, I have been heavily researching garolite, a type of fiberglass-epoxy laminate with similar properties to carbon fiber. There are several different types of garolite. At this point, for garolite, I will either use hard and strong (xx) or G-10. Both are available on McMaster Carr. XX is about a third of the price of G-10. G-10 has the same tensile strength but much better impact strength. At selecttech, they used thin garolite sheets and milled them using carbide tooling. This is one of my top options for material selection. I've also looked into aluminum, 3D printing, and other plastics like acrylic and HDPE. HDPE is commonly used in hobbyist robots. It is about half the density of G-10 and 1/7th the price. It is also easier to work with.

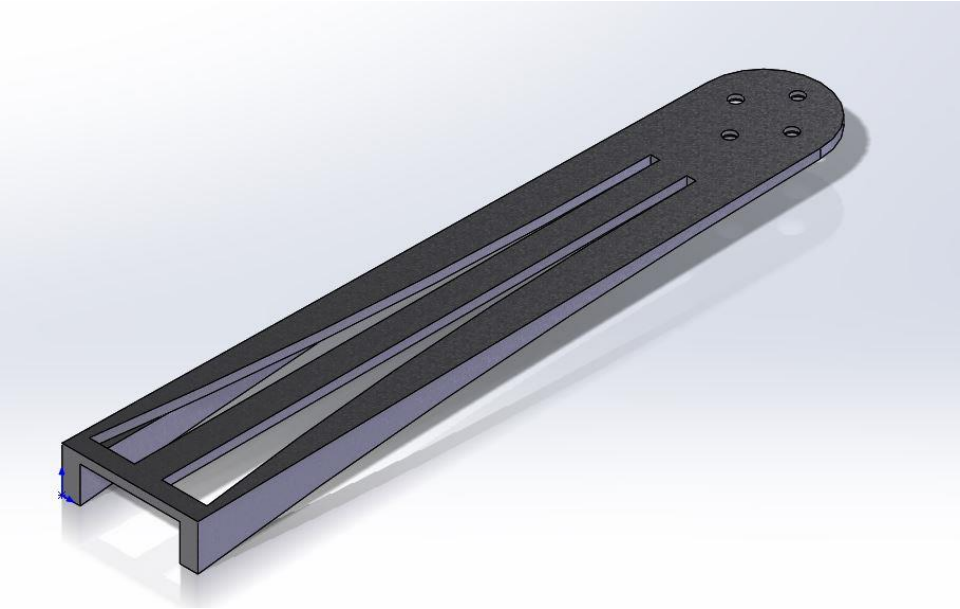
I've also started some basic tutorials with Solidworks simulation and analysis as well as learning about factor of safety. There are several ranges for factor of safety. It must be greater than one. It should be 5 or 6 when loads are repeatedly taken on and off or when stresses change from tension to compression. When the part is subject to repeated shock loading it should be greater than 10. In some cases, such as complex forces or uncertainties, it could be as high as 40 or more These are general guidelines. For most of the quadcopter's parts, factor of safety will not need to be very high, but for some key parts like the arms and landing gears, it must be much higher. The max force a part can withstand can be found by multiplying the factor of safety by the force used during the simulation.

Another area of research was my design features. This was a small aspect. By researching other quadcopter builds, I have compiled a list of features I want to design and possibly implement into the project. Some of these features are a drop mechanism/payload system, camera gimbal, and suspension system for landing gears. There are also several minor design considerations I

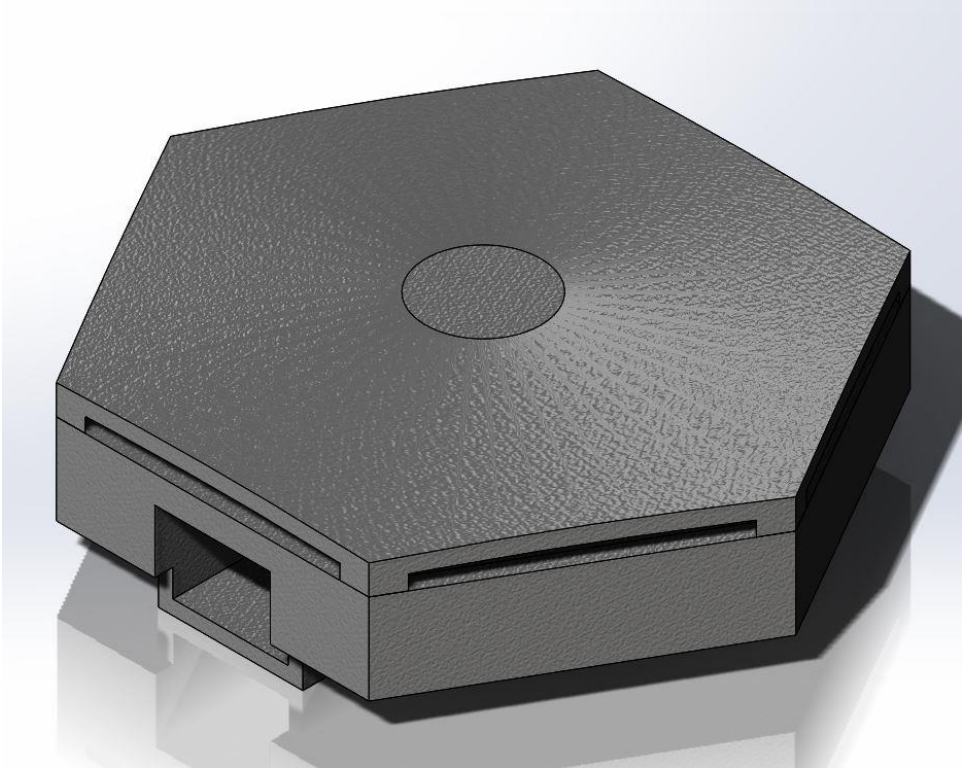
have such as making it fit through doors and designing it for easy wire storage. Because we are solidifying the electronics we will need, I will be able to better design around those.

ACCOMPLISHMENTS

- Researched materials, specifically garolite
- Learned about new manufacturing methods that may be options for the final design
- Found several UAV designs and aspects of those that could be useful for the final design
- Began brainstorming possible chassis, arms, and design features.



This is an idea for the arms. I would like to remove some material from the center of the arms and use it for support material underneath. Hopefully, this would reduce the material needed. I would also like to have mounting for the esc's and a way to route wires through the arm. At the end, holes can be seen for mounting the motors. This will remove the need for motor mounts and further simplify the design and construction.



One idea for the chassis is to have a compartment to mount the battery. One of the biggest flaws of the current design is that the battery is either exposed or difficult to remove for charging. The design above is compartmentalized for the battery, microcontrollers, and flight board. As we decide what further electronics and sensors we will use, I will modify the design to incorporate them. Currently, we have to make mounts for each additional sensor we want to use.

This is a general idea of what the final assembly will look like. It will have a similar multilayered design to our current one. The arms will act as spacers between the top and main compartment of the chassis. Ideally, we would 3D print the design, but due to budget constraints, we will most likely laser cut or mill cheaper material and assemble it similarly to our current design.

REFLECTIONS ON GOALS AND TIMELINE

At this point, my goals work very well together. Learning about materials ties directly into manufacturing, which goes hand in hand with design. This is very helpful because I'm able to research multiple areas at one time. The downside to this is that it changes my timeline. Before, I had a progression to my research and design, but at this point, all the research is interdependent. Because of this interdependence, my timeline has become more vague. I now have to work on the design as a whole, cycling between research and design. As I learn more from my research, I can change my designs, which leads me to have more questions for research and so on. It would have been extremely helpful to have access to the carbon fiber printer. Making small test parts would help me learn the considerations necessary to use this new technology. By learning the machine, I could possibly change my designs to use it more effectively. Mid year presentations and wrestling tournaments were two major setbacks for my progress. Presentations took a decent amount of time to prepare and listening to everyone else's presentations was a major roadblock. Also, wrestling tournaments severely limited the time I was able to spend with the group. Weekends are a crucial time for us to collaborate and really delve into the project. We are much more productive when our work is interrupted by other classes and tasks.