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EML 4551C: Senior Design I

Dr. McConomy

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**Current State**

The current design has undergone many iterations and revisions based on research, and feedback from the NASA student launch panel, Dr. McConomy, the team’s advisor Tom McKeown, last year's team, and many others. The team has completed the proposal for the NASA student launch competition and the Preliminary Design Review. Both were extensive deliverables that outlined the team's designs and methodologies to the NASA review panel. The Preliminary Design Review included a presentation. The main revisions the panel had for the team were the thrust structure design, material selection concerns, and payload considerations.

The leading vehicle design features a G12 fiberglass tube with a PETG printed ogive nose cone. This design has an aluminum tail cone to reduce pressure drag. The tail cone was originally going to be made from PETG but due to concerns from the NASA panel that it would not be able to undergo the compressive stresses and heat from the motor, the team made a design change. The flight computer is the Altus Metrum TeleMetrum. The thrust will be transmitted through centering rings and a motor retainer. The motor that will be used for full scale is an L850 motor. The payload design will feature a mono-copter that controls its speed and orientation with an electric ducted fan and thrust vectoring fins.

The leading design for the team has been modeled in both Solidworks and OpenRocket. Additionally, subscale part manufacturing and assembly has been started. The team began receiving parts and materials on November 15th, 2023. The next NASA deliverable, Critical Design Review (CDR), has been started. The team has made substantial progress on the CDR document. Most of the subscale parts are in. The nose cone has been 3D-printed and the body tube is being cut by the machine shop and they are manufacturing the aluminum tail cone.

**Forecast**

The team will complete subscale manufacturing, assembly, and launch for two vehicles by December 16th. If the first launch fails, the team will have a second vehicle manufactured to launch on the same day. If this fails again, the team will launch again on January 2nd. The team will also complete the CDR deliverable. This will include analyzing the flight data from the subscale demonstration flight. The team will need to have 2 full-scale flights in the spring before the competition flight. First, the team will need to assemble and launch a vehicle to demonstrate that the design operates correctly on a full scale. This flight is due March 4th, 2024. After this, the team will analyze the data and write the flight readiness report, also due on March 4th. The team will also need to perform an integrated flight test to demonstrate that the payload concept operates correctly. This flight is due by April 1st. Finally, the team will need to build and launch a vehicle for the competition that will be on April 13th.

**Problem Areas**

The team has identified many problems. First, this project requires large deliverables that have strict deadlines. The team has identified time management as a problem area because of the large throughput of work required. Next, the team has concerns that the vehicle may be too heavy to achieve the expected altitude. The team has factored this into design decisions and is finding ways to cut weight without sacrificing vehicle integrity. The team is also concerned that the current payload design may be too complicated to work properly for the payload demonstration flight. There are also budgetary concerns; demonstration flights for this project require many parts. The team has a strict budget and if the team cannot find ways to cut costs, they will have to find new sources of money.