Objectives to Complete Before Meeting 2

Mechanical Engineering & Physics - Pep & Jeff

1.0 - Mechanical Fundamentals

- **1.1** - Members should research and understand the fundamentals of aerodynamic forces, such as lift and drag, understand mechanical advantage, such as how gears and gear ratios work, and understand axial and radial forces, torque/moment. These ideas will be fundamental as we move through the design of the project. I have attached some resources to go along with these that I think are very good.
    - https://www.youtube.com/watch?v=Cew5JF8q6eY - How EDF's Work
    - https://www.youtube.com/watch?v=E3i_XHlVCeU - How Lift Works
    - https://www.youtube.com/watch?v=JnYVz1TSmBQ - Mechanical Advantage
    - Understanding Aerodynamic Drag - Drag (Not as important)

Deliverable: Create a short write-up (half page) explaining these core Mechanical Engineering Topics. For the equations presented in these videos, also try to note them down within the write-up, as they will serve as a building block for other physical analyses.

2.0 - Thrust Source & Define Constraints

- **2.1** - Members should determine possible thrust outputs that we should work with. This aspect will be paired with looking at various EDFs and EDF sizes (70mm, 100mm, 120mm, or larger). Also, feel free to look into the actual design of EDF. We could also 3d print our EDF and purchase just a brushless DC motor, so I you to research both options. This will also determine our max outer diameter for the entire 3BSM (3 Bearing Swivel Module). Also, in terms of constraints, look at angle constraints like ±15 yaw with 95-degree pitch rotation. For resources, there should be several resources online, or simply ask cluade or ChatGPT to search for resources and give you ideas.

Deliverable: Create a short write-up (half page) that analyzes prospective thrust profiles, outlines some candidates for EDFs, or provides some description on designing it ourselves. Additionally, also note down our OD (Outer Diameter), and compile our angle constraints.

3.0 - Physics

- **3.1** - Members should define axes for our engine, and with that, consider loads that will be experienced due to thrust along the axial component and perpendicular component. Additionally, try to analyze and think of other forces on bearings, such as moment due to perpendicular force,s and then radial loads on the bearing. Additionally, members should start to research and consider other areas, like requirements for servo torque and gear ratio between bearing ring and pinion, noting down equations that describe these relations.

Deliverable: Create a short write-up (half page) that defines our coordinate axes and analyzes the other loads, forces, torques, and gear ratios that will be crucial as we start designing.

Electronics and Software - Ayaam & Vivienne

Note: Software and Electronics don't really have many tasks since really a lot of the first steps are mechanical, so I encourage everyone to look at the additional resources, and also watch the mechanical fundamentals, so that everyone can learn about all subsystems

1.0 - Power & Wiring Architecture

- **1.1** - Members should research candidates for ESCs (Electronic Speed Controller) and start looking at servo candidates online. A lot of this will be preliminary research, since the final parts will depend on the EDF and torque requirements, but having a sense of options will be beneficial for us. Also, design a system schematic that overviews our wiring connections and protocols being used. Along with that, also conduct some preliminary research on LiPO's; however, our exact voltages and amps will be finalized later.

Deliverable 1: Create a short write-up (half page) that outlines preliminary research on ESCs, LIPOs, and Servos.

Deliverable 2: System Diagram (You could use something like Eraser or maybe Lucid Charts to create this).

Additional Topics:

- https://www.youtube.com/watch?v=dJjxcjJOlN0&t=1s - ESC Circuitry
- Familiarize yourself with I2C, PWM, UART, and SPI
- PID Control - https://www.youtube.com/watch?v=wkfEZmsQqiA
- Buck Converter - https://www.youtube.com/watch?v=rfChSvb8FX0