CubeSat Reaction Wheel Attitude Control Platform
9/19 Meeting

EMBRY-RIDDLE
Aeronautical University

EasyControls.org

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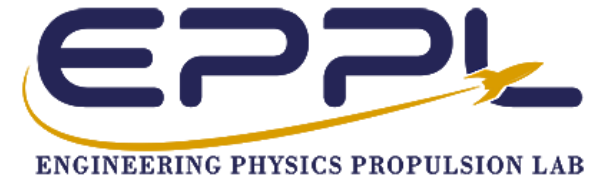
General Updates

- **GitHub** will be our primary repo:
  - Make account if you don't have one yet
  - Will house code, weekly meeting slides, relevant documentation
  - **Justin Hartland > CubeSatAttitudeControlPlatform**

- Action item Excel sheet is live and posted on Discord for reference

Current Project Goal

- Produce functioning attitude controller by **9/25**
  - 1 DoF for now

- Ignite Grant Paper submission by **9/30**

- Move on to ACTIV while CubeSat continues development
  - CubeSat required to test ACTIV

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[Ryan] + Heat set inserts added to Cubesat

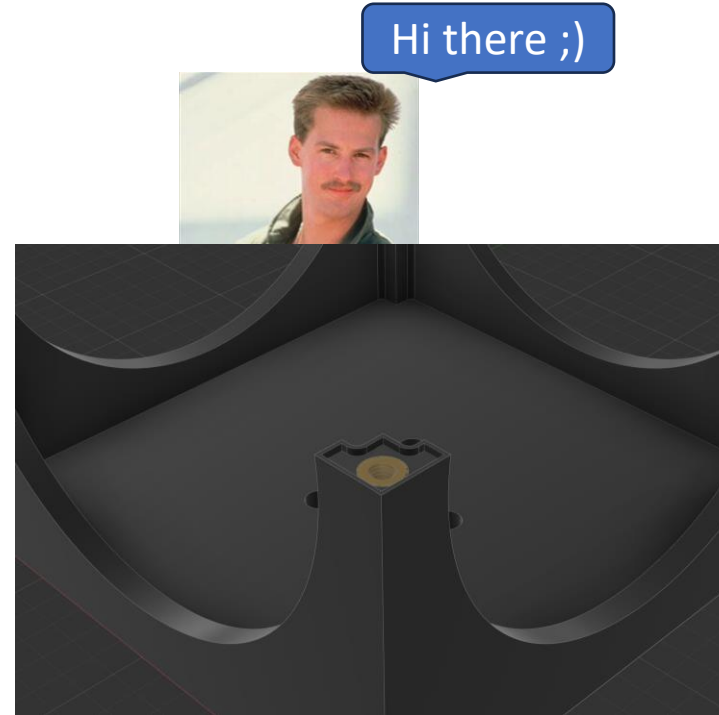**Progress completed this past week**
- Added Heat set inserts to bottom cubesat bus module
- Added protrusions for stability to all cubesat bus modules
- Adjusted countersunk hole for top cubesat bus module
- Added protrusions for stability when bus modules are together
    - need to test fitment/new tolerances
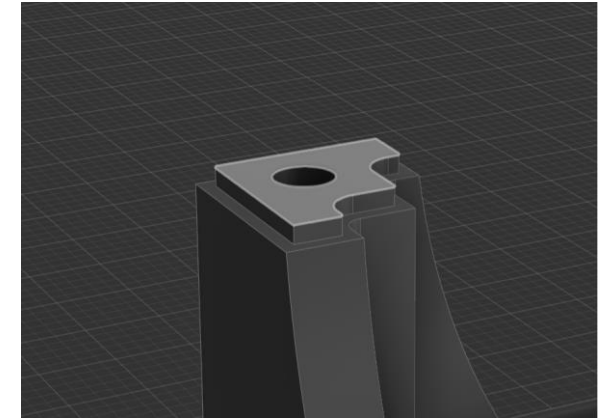   - need to make new features parametric

Goals for next week
- Work on controller code?

Anticipated challenges
- None yet

Middle Bus Protrusion

Bottom Bus Inserts

[Justin] Obtain filtered Euler angles from IMU, apply controller
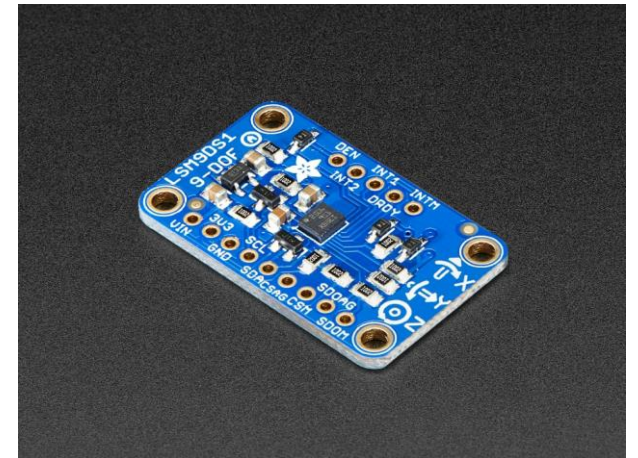
Progress completed this past week

-Steady Euler angles obtained using Madgwick filter (Demo!!) [complete]

-Controller not applied, but software is ready to be integrated [<50%]

Goals for next week

-Once next iteration of CubeSat bus is complete, reattempt controller application

Anticipated challenges

-Mounting motor on motor mount plate (epoxy torqued off upon motor acceleration, **must use bolts**)

-Electromagnetic disturbances created by motor effecting IMU data

[Ella] Rotary Connectors
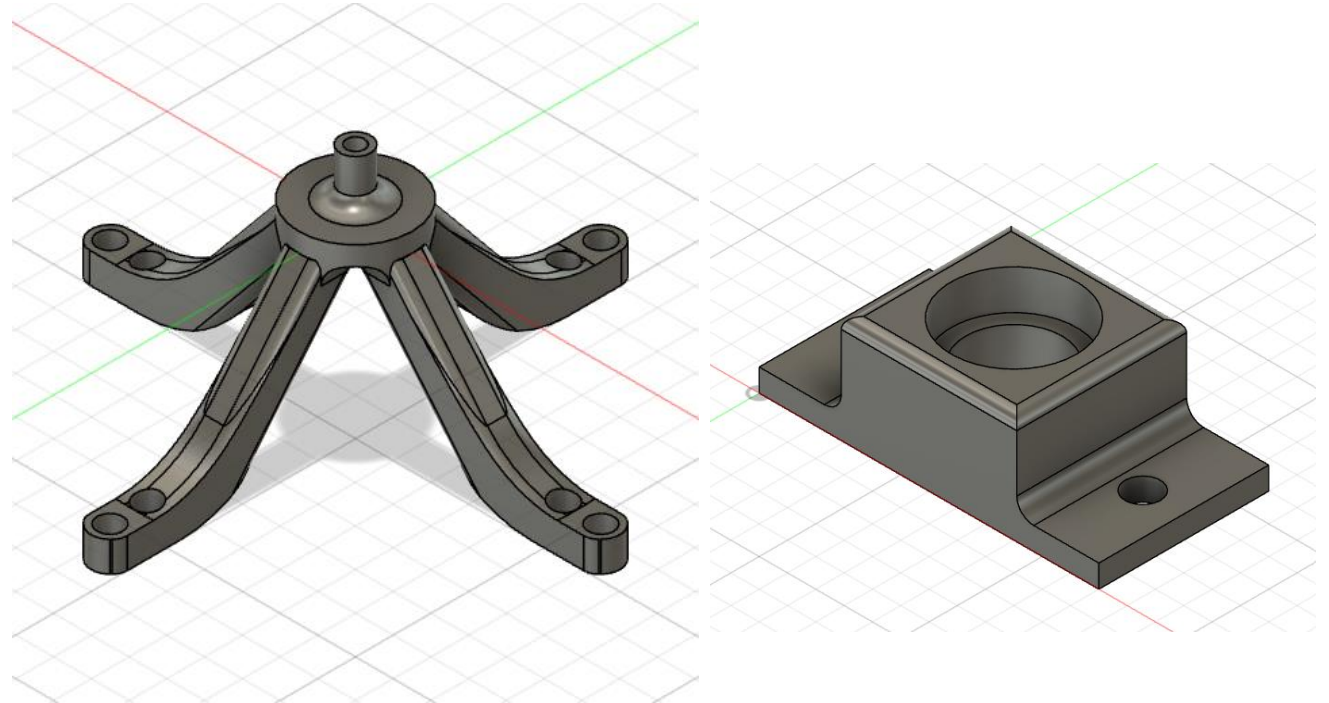
Progress completed this past week

- Designed new claw for 1U
- Reusing baring mount from 1.5U design
- Highlight based on: <mark>Complete</mark>

Goals for next week

- Design supports for electrical system inside the cube

Anticipated challenges

- Relearning Fusion360
- Constraint malfunctions
- Problem with Pattern tool (wouldn't work for me)
- Help from Justin and Isaac

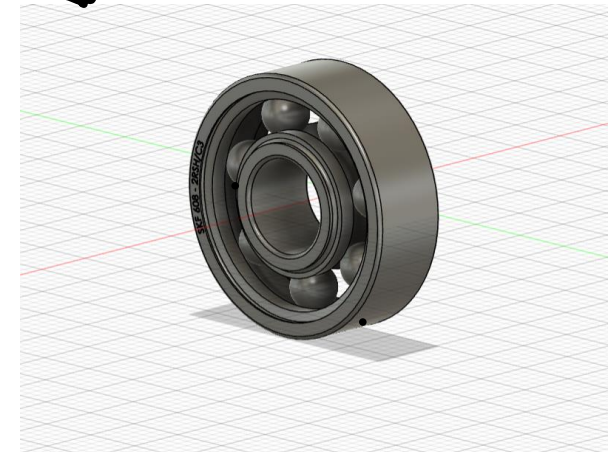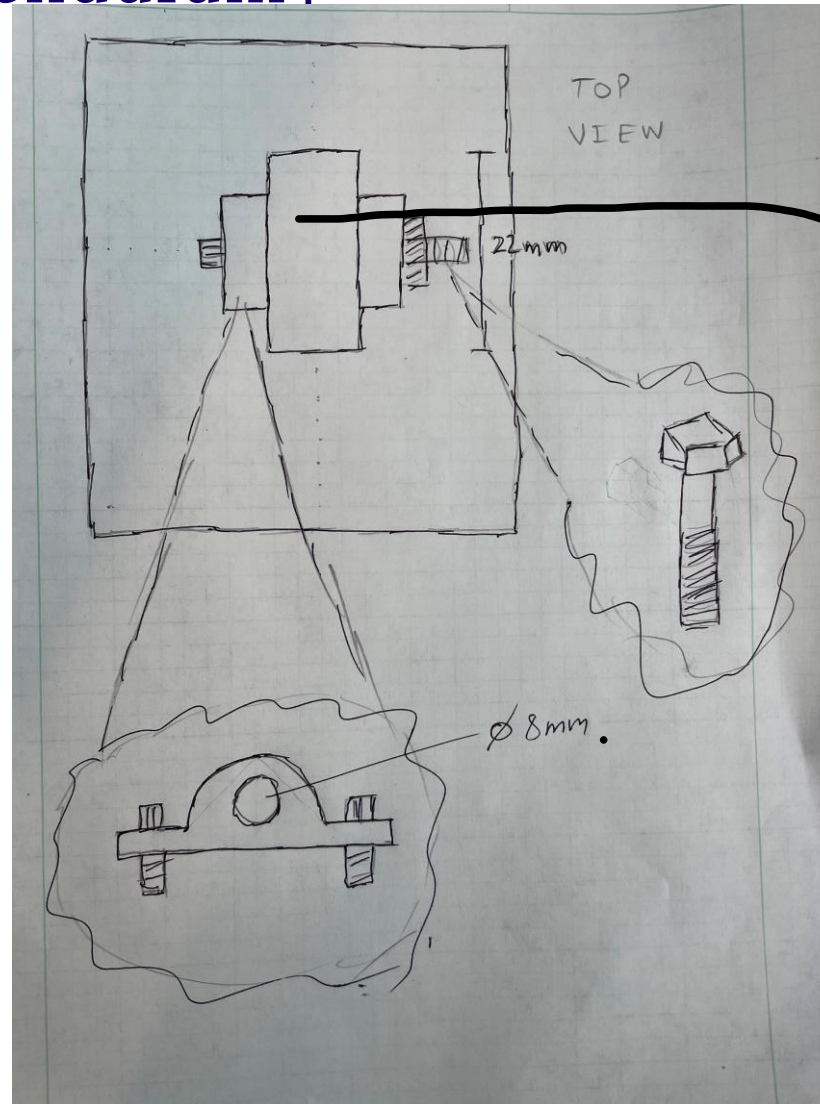# [Vishal] + [New Inverted Pendulum]

Progress completed this past week

-Working on new pin connection between the stand and pendulum

-Using a skateboard ball bearing to reduce friction

-Slot fit between Pendulum arm and ball bearing

-Highlight based on: <mark>50%</mark>

Goals for next week

-Complete CAD Model

Anticipated challenges

-Need to get a lot better at Fusion 360

[Isaac] Daisy chaining O-Drives

Progress completed this past week

-prepping for new o-drives and compatibility

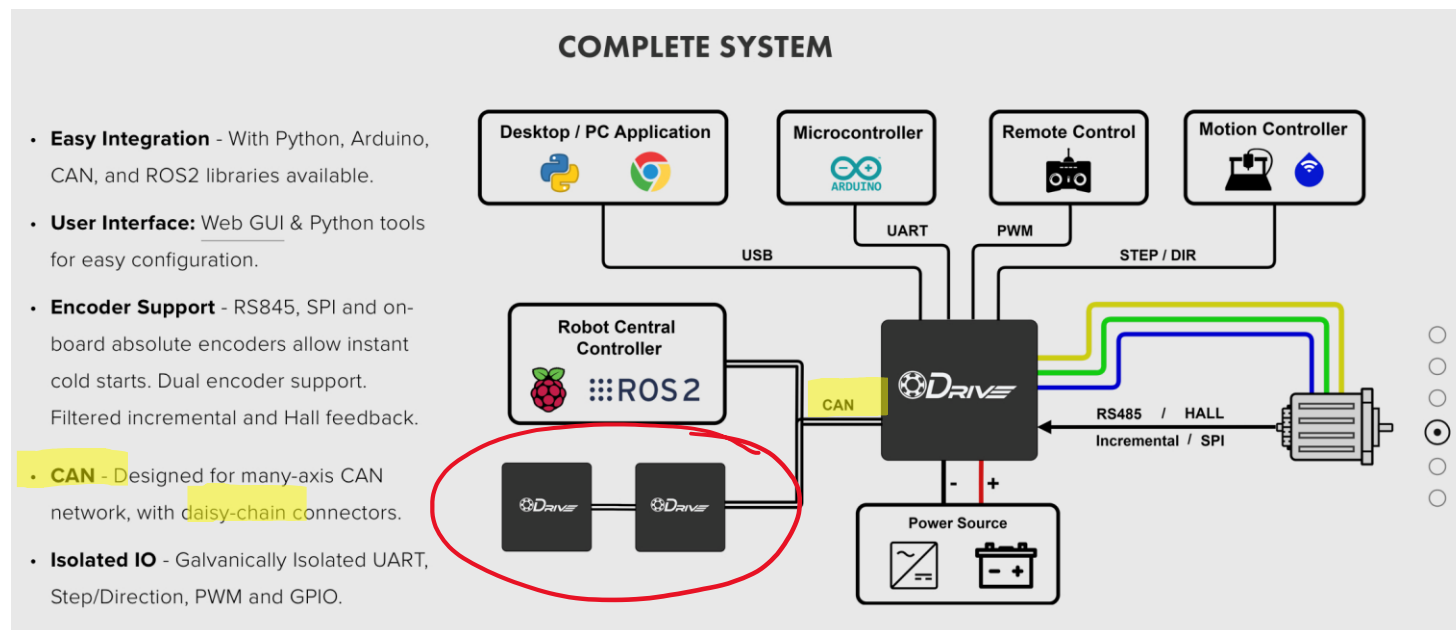-only one mention for o-drive communication

-need a CAN?

Highlight = Complete

Goals for next week

Determine final CAD for daisy chaining

Look forward to 2DOF and 3DOF

Anticipated challenges

N/A

COMPLETE SYSTEM

- **Easy Integration** - With Python, Arduino, CAN, and ROS2 libraries available.
- **User Interface:** Web GUI & Python tools for easy configuration.
- **Encoder Support** - RS845, SPI and on-board absolute encoders allow instant cold starts. Dual encoder support. Filtered incremental and Hall feedback.
- **CAN** - Designed for many-axis CAN network, with daisy-chain connectors.
- **Isolated IO** - Galvanically Isolated UART, Step/Direction, PWM and GPIO.

[Jacob] + [Increase Reaction Wheel's MOI]
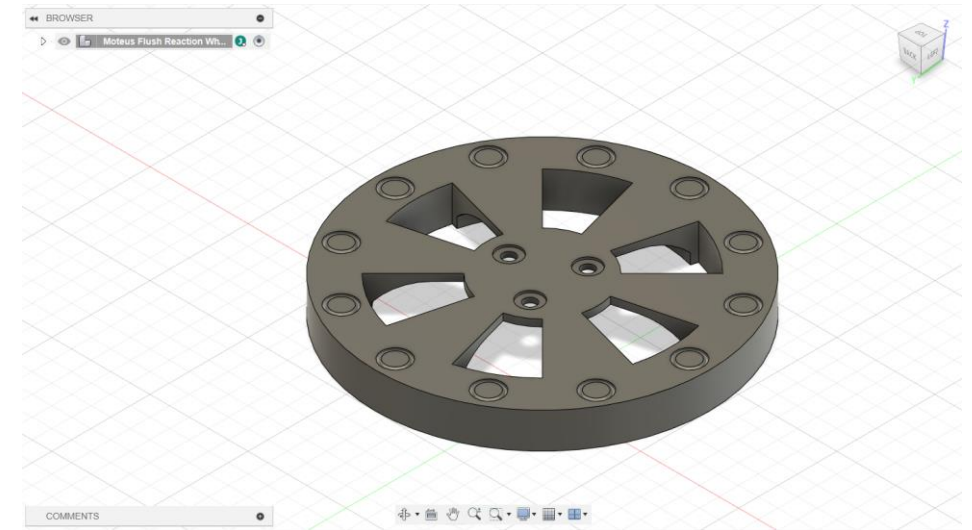

Progress completed this past week

-Found potential weights to be substituted for stainless steel bolts (Tungsten fishing weights). MOI increase of around 10% when looked at in fusion.

-Changing the width and height of the wheel would contribute greater.

Goals for next week

-Discuss what a desired increase in MOI would be. Increase wheel diameter reasonably.

Anticipated challenges

N/A

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Dylan + Electronics
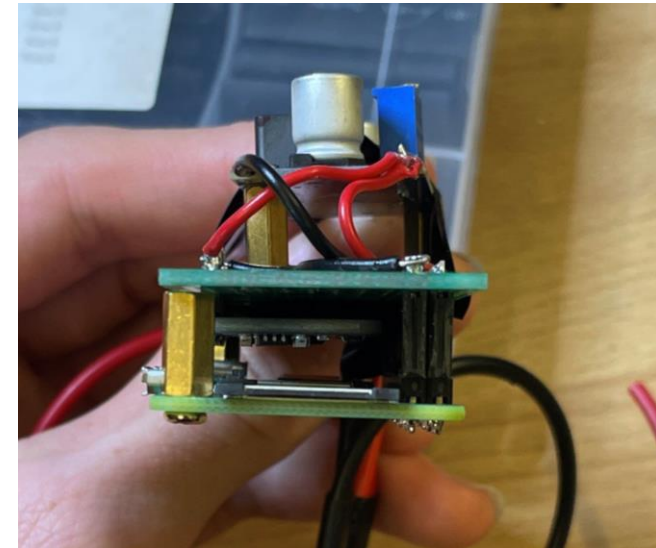
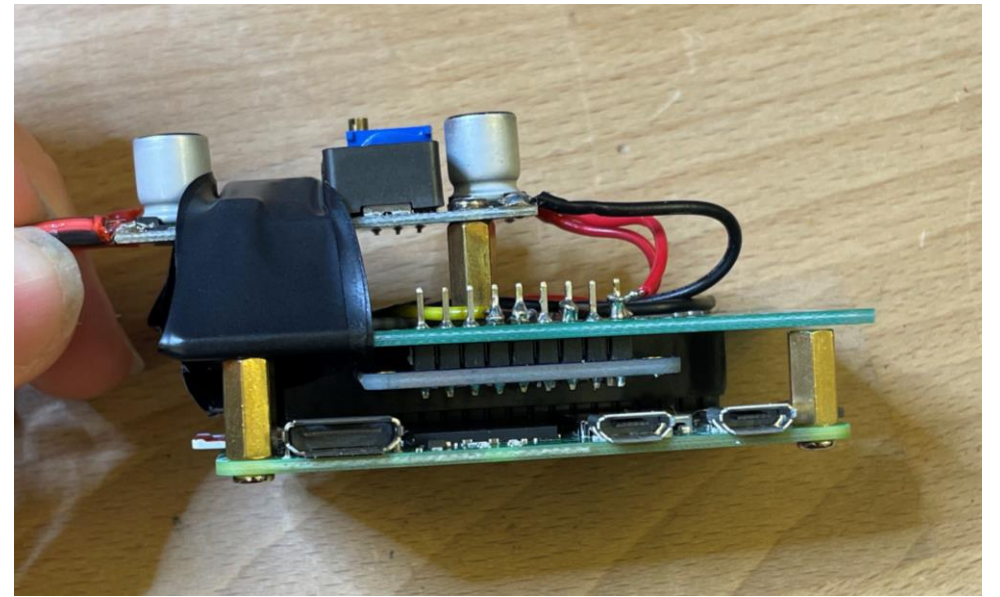**Progress completed this past week**

- <mark>Created protype electronics board with Raspberry Pi, IMU, and buck converter</mark>

Goals for next week

- Start Official PCB Design

Anticipated challenges

-N/A

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Various tasks for upcoming week

- **Hardware**
  1) Integrate electrical system into CubeSat bus (Ella)
  2) Finalize motor mount strategy (bolts rather than epoxy)
  3) Consider higher quality bearings w/ less friction (lubricant?)
  4) Assemble 2 DoF + configs and consider CoM compensation (Isaac)

- **Electrical**
  1) Solidify ODrive daisy-chain strategy for 2 DoF + (Isaac)
     - Compile list of required electronics and provide example code prior to purchase
  2) Include voltmeter to current electrical system, PCB (Dylan)

- **Software**
  1) Apply negative feedback and PID controllers to system (Ryan)
  2) Compile resources for expanding into 2 DoF +

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[Assignee] + [Task Title]

Progress completed this past week

    -[Discuss progress]

    -Highlight based on: Complete, >50%, <50%

Goals for next week

    -[Discuss goals]

Anticipated challenges

    -[discuss challenges, request assistance if needed]

[Relevant photos if needed]

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