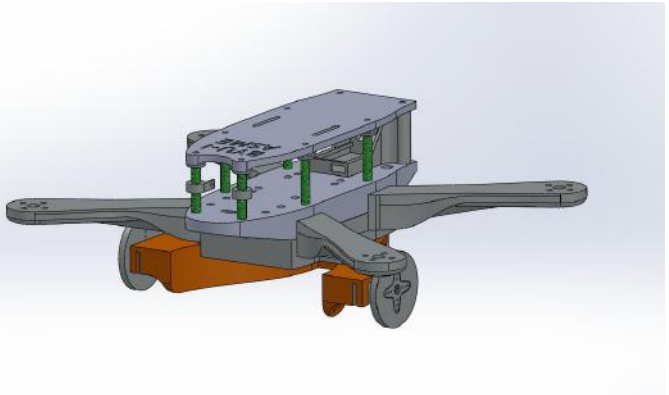
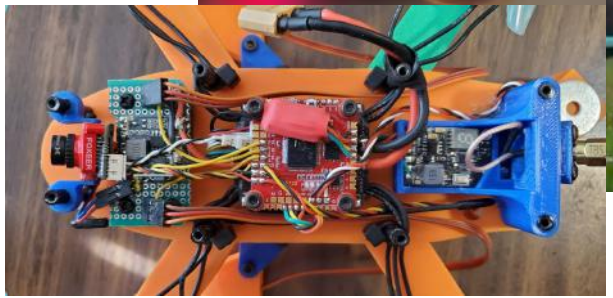
Matthew Archibald

Portfolio

3D Printed Racing Drone

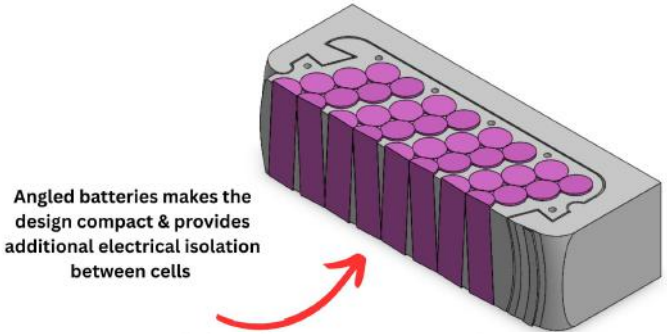
- 2nd Place win in worldwide ASME competition against 28 teams
- Two cameras, one for flight and the other for driving.
- Electromagnet for picking up payload cubes
- Hand soldered, assembled, and configured
- Designed much of the airframe and made parts easily replaceable
- Custom firmware configuration and protoboard for servo wheel and electromagnet control
- Led the team project and did most of the heavy lifting
- Link to video on LinkedIn



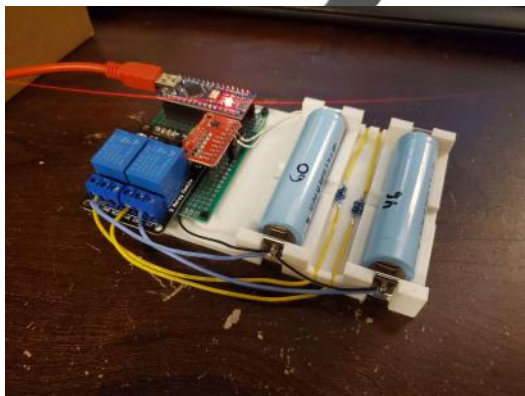


Battery for Ebike

- Using spot welding and battery knowledge to build 4x 8s 4p Lifepo4 batteries
- Batteries are matched based on internal resistance
- Built my own battery IR tester
- Quick lock rotating dovetail joint secures 5 of 6 degrees of freedom to hold batteries to bike frame
- Angled batteries allow spacing for easy welding with 2x4 diagonal nickel strips, and provide additional isolation between cells in series.
- Batteries are constructed in 8s configurations so they can be balance charged using readily available FPV drone chargers, and not need BMS units.

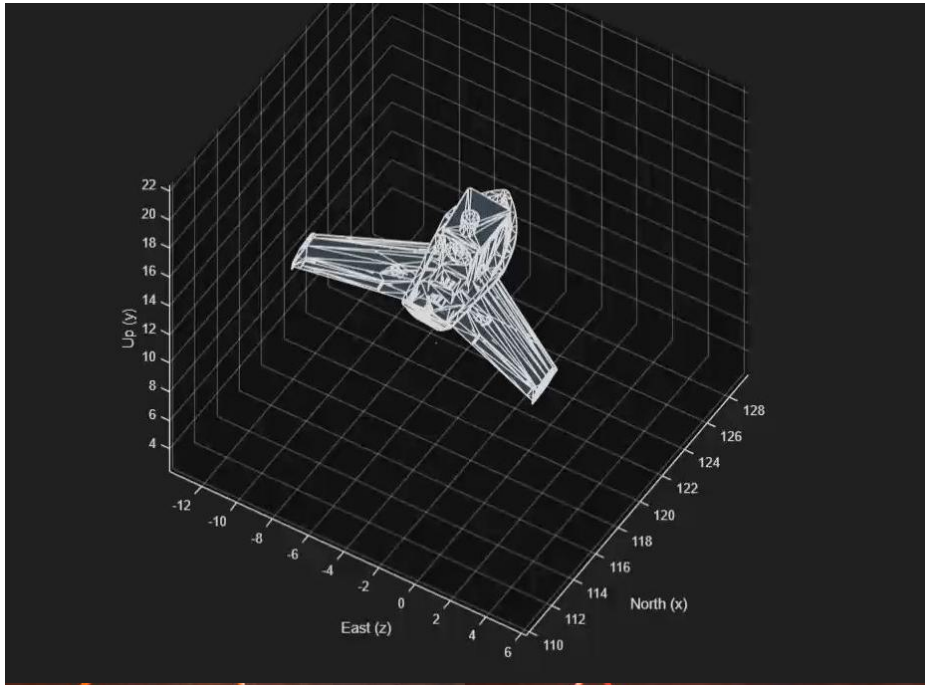


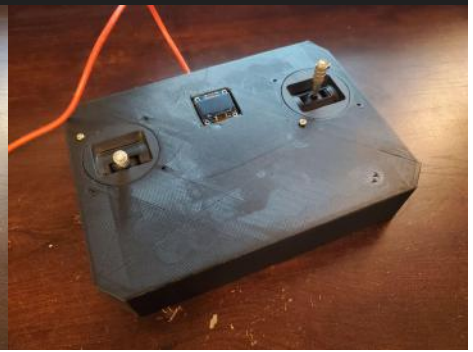
Quick Lock Battery Case Design



Matlab Flight Simulator

- Flight simulator built entirely in Matlab
- Skeleton code was provided and I completed the following:
- Flight dynamics solved using Runge Kutta
- Orientation tracked using quaternions
- Forces included from motor/propellor torque, thrust, drag, lift, gravity
- Semi-realistic flight characteristics using inertias, masses, and areas measured from an actual remote control airplane
- Controlled via serial from an Arduino based controller





Remote Control Airplanes

- Have built and flown RC Airplanes and quadcopters since 2018
- Hundreds of hours spent soldering
- Experienced with flight control software such as Betaflight, iNav and Ardupilot.
- Built airframes and parts using foam board, 3D printing, or laser cutting
- Several are capable of autonomous flight

Autonomous Flying Wing

- Programmed in C++
- Converts PPM inputs to PWM and Dshot output
- Flies manually and logs inputs and outputs for system identification purposes
- Identified state space will be used for successive control loop closure and root locus design
- Will be capable of flying autonomously between GPS waypoints and landing
- Graduate school level project from a class I audited
- Work in progress using content from the course, and adding extra code to my liking

Arduino RC Car

- Hand built Arduino based transmitter/receiver and telemetry system
- Coded entirely without AI
- Tilt steering control, various sensor feedback
- Top speed of 35 mph
- Failsafes coded in for runaway protection safety
- Over 100 hours of work.
- Heavily modified traxxas T-Maxx, converted from nitro to electric.
- Link to video on Linkedin

Composite Flying Wing

- Learned how to operate a CNC hotwire foam cutter used for cutting custom airfoils, and also fixed the machine after wiring was damaged. It runs GRBL Hotwire firmware on an Arduino Mega and lets you independently control each side to create tapered wings
- Worked with a friend to layup his fiberglass composite slope soaring flying wing design. Gained hands on experience with composite layup.

3D Printing

- Worked as BYU-Idaho's Engineering Makerlab Manager. Vastly increased 3D printing output through repairing and expanding the 3D printer selection.
- Built a scheduling and password automation based off of Microsoft Bookings and Power Automate.
- Hundreds of hours experience 3D printing, troubleshooting and fixing 3D printer problems
- Experienced designing parts to be 3D printed
- Modified Ender 3 running Klipper with a Raspberry Pi

Other Projects

- Open Source Proffieboard Lightsaber. Modeled and 3D printed electronics chassis, and programmed board.
- Various FPV drones. Green Drone is used for agile flight around obstacles. Blue drone is built for Mid-Range high speed endurance flights.
- Carbon Fiber Frames, hand picked and soldered components.
- Configured in Betaflight or Inav

Other Projects

- HID USB Game Controller using Arduino Pro Micro and hijacked RC Car remote
- Brushless motor & 3D printed flywheel Nerf Blaster
- 3D printed Mandalorian Helmet
- 3D printed Pinewood derby propelled by brushless motor and TPU wheel
- Powder coated & plasma cut door sign and 3D printed door hook.