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B.S. MECHANICAL ENGINEERING

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GPA: 3.55

OVERVIEW

ABOUT ME

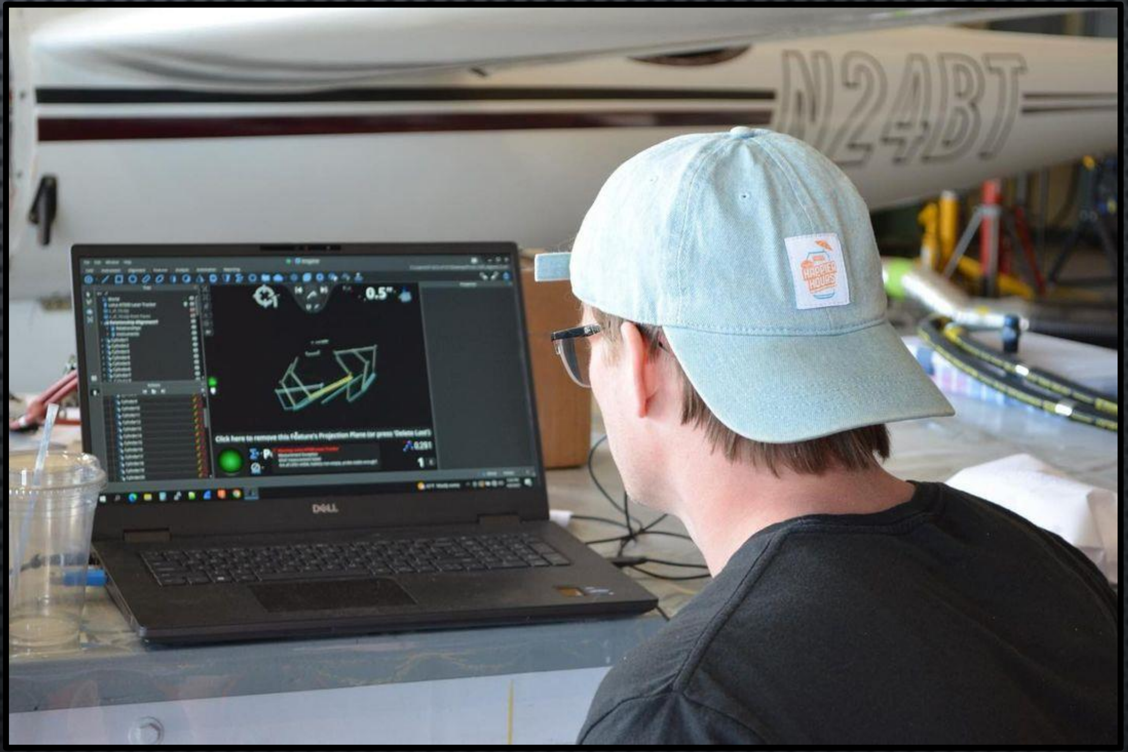
Hello, I’m Andy, a recent Mechanical Engineering graduate from Cal Poly SLO in 2023. I am looking for a full-time position working with highly driven colleagues solving the hardest problems. I am primarily interested in Mechanical design/analysis and the integration of mechanical and electrical systems, I also love to code. I have experience in mechanical design, structural analysis, robotics, controls, and embedded system programming. I am eager to put my theoretical and hands-on experience to use at a fast and cutting-edge workplace. Aside from engineering, I love to spend time in the outdoors surfing, hiking, and biking, as well as reading, playing piano, and watching sports.

PROVE OVERVIEW

- Student lead Engineering club focused on sustainability and breaking world records
  - Comprised of ~25 engineers of all disciplines
  - Organized into sub-teams: Aeroshell, Mechanical, High Voltage, and Low Voltage
- Current Project MILA, an Electric sports car designed to travel 1200 miles on a single charge
- As a member of PROVE for four years I touched many aspects of MILA
  - Mounting design ~1 Year
  - Mold Design and Manufacturing ~2 years
  - Aeroshell Team Lead ~2 years
  - Battery Structure Design / Analysis ~1 year

AEROSHELL TEAM LEAD

- Lead team of 7-10 engineers over 2 years of design, analysis, and manufacturing
- Provided technical Feedback on Mechanical and aerospace designs
  - Hinging mechanism design and manufacturing
  - Composite panel mounting mold design
  - Starr CCM CFD models and verification
  - Composite panel manufacturing
- Planned integration of 35 individual composite panels with steel frame chassis
- Organized prototyping of composite manufacturing techniques
- Updated Aeroshell Shape with NX Realized Shape



COMPOSITE MOLD DESIGN

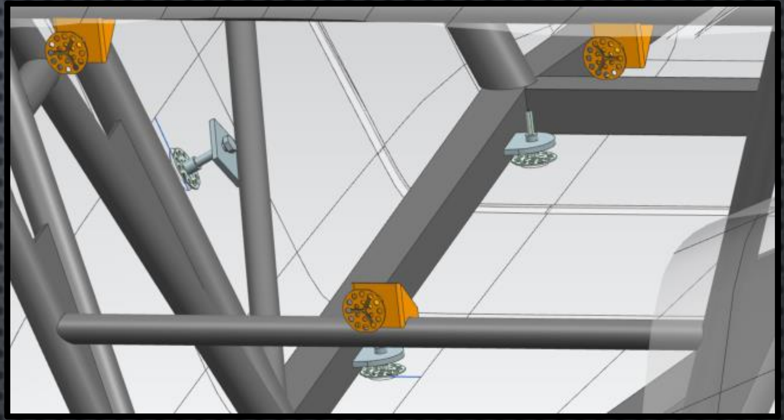
- Utilized Siemens NX CAD to convert a 2D panel into a machinable mold
  - Performed draft analysis to confirm machinability
  - Verified CAD model with Geometric analysis

- Combined panels where applicable to reduce machining time by 50%

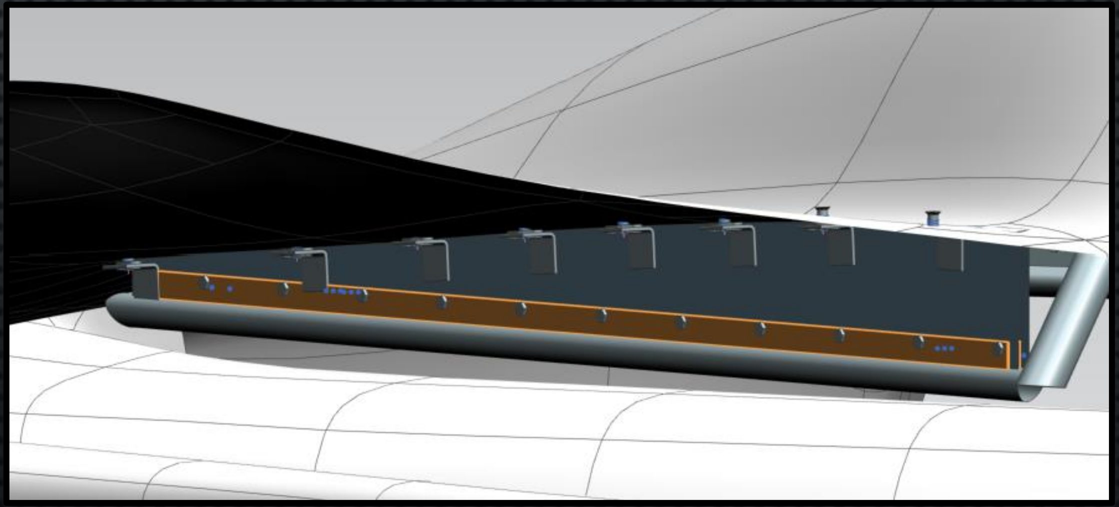
- Performed CAM on 10+ molds using Fusion 360
  - Machined molds out of HDU foam
  - Utilized fast and efficient toolpaths to reduce machining time while minimizing post-processing
  - Machined on a 5-axis CNC Router

- Manufactured individual panels with wet and pre-preg hand layups

AEROSHELL MOUNTING DESIGN



- Designed various mechanical connections to bridge gaps between the steel chassis and outer composite, aeroshell panels
- Learned extensive knowledge of composite properties and analysis to develop feasible mounting solutions
- Verified structural aspects of designs using hand calcs and Siemens Ansys FEM software
- Designs heavily influenced by ease of integration and adjustability to account for tolerance issues
- Designed mounts for 3 locations on the car: trunk, rear fairing bulkhead, and front bumper
  - Utilized big head mounts and bulkheads to bridge gaps with adhesive and bolted connections

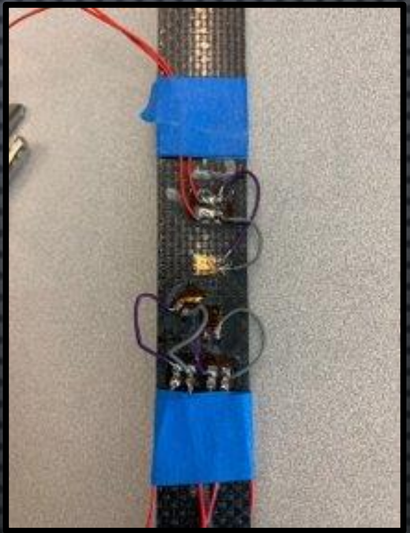


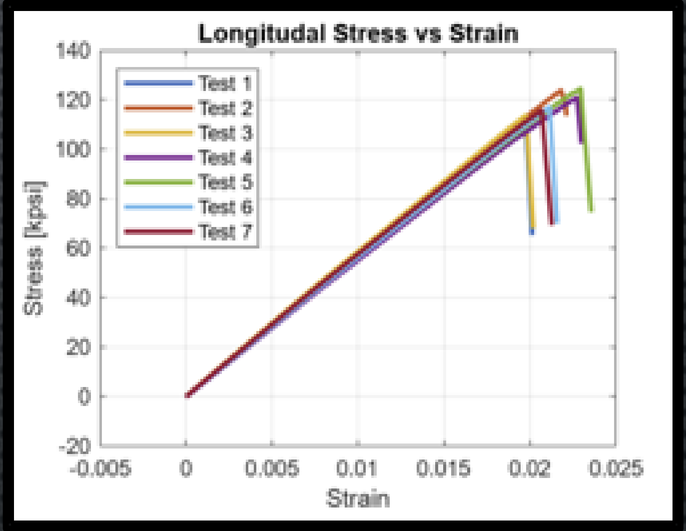
BATTERY STRUCTURE

- Senior Project designing a structure to house MILA’s 2000lb battery packs
  - Designed to withstand 3G acceleration loads in all directions, and a 20G front crash load
  - Optimized to reduce weight while providing a safety factor of 1.5 in a front crash
- The project scope included the ground-up design, analysis, verification, manufacturing, and testing
- Design Highlights:
  - Carbon Fiber sandwich panel secondary structure
  - Aluminum core, carbon fiber sandwich panel bottom plate
  - Steel C-Channel Supports
  - Steel plate horizontal supports
  - Aluminum threaded inserts for integration

BATTERY STRUCTURE – MATERIAL TESTING

- Due to freezer failure the composite pre-preg needed to be tested to verify material properties
- Material: Hexcel AGP-193P/8552S resin
    - Due to circumstances two additional pre-preg rolls were analyzed, although less in depth
- 10” x 20” x 4 ply test panel to allow 9 test samples for the longitudinal and transverse directions, and one sample for strain gauge analysis
- Used a Tensile tester to determine the longitudinal and transverse ultimate strengths and elastic modulus
- A strain gauge rosette was used to determine shear modulus and Poisson’s ratio
- End values resulted in < 10% error from rated values





Model P3 Strain Indicator and Recorder

Date/Time	Ch 1	Ch 2	Ch 3	Ch 4
	ue	ue	ue	ue
2/9/2023 6:51:33 PM	-00031		+00420	+00546
2/9/2023 6:51:34 PM	-00042		+00511	+00685
2/9/2023 6:51:35 PM	-00046		+00551	+00757
2/9/2023 6:51:35 PM	-00048		+00568	+00809
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2/9/2023 6:51:42 PM	-00060		+00681	+01133

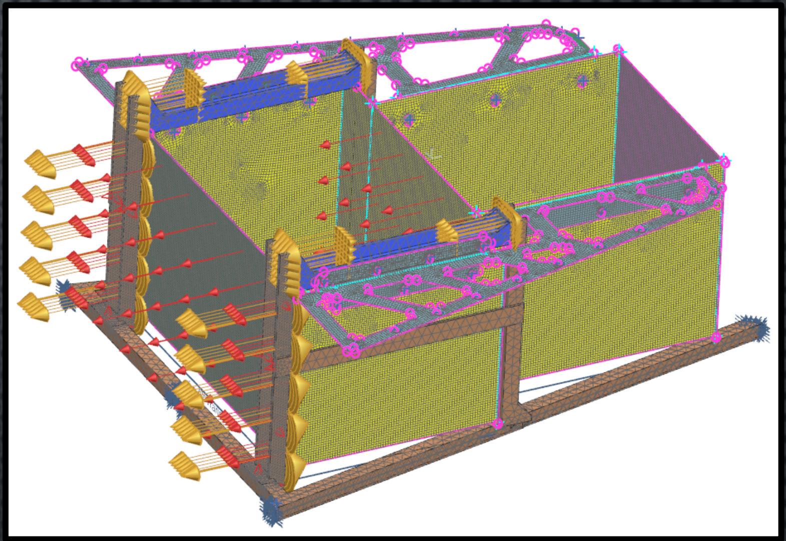
BATTERY STRUCTURE – STRUCTURAL DESIGN / ANALYSIS

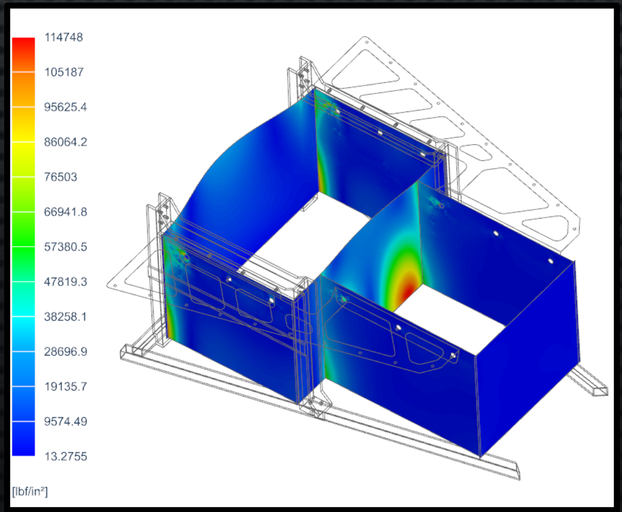
- Initially used hand calcs (beam and plate theory) to size components and walls

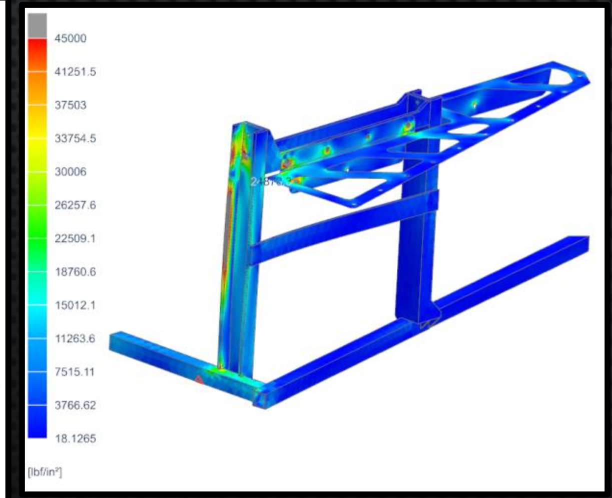
- Before developing a full FEM, we verified smaller FEMs with feasible hand calcs
  - Laminate and Plate Theory compared with composite shell elements in Siemens Ansys for < 1% error
  - Solved beam solutions compared with 3-D elements for < 10% error (B.C. varied slightly)

- Developed full FEM using Siemens ANSYS software
  - Secondary structure modeled with shell elements glued together at seams
  - Steel members modeled with 3-D elements and contact boundary conditions
  - Bolted connections modeled with RB3 elements
  - Modeled rest of chassis as fixed B.C.

- Steel Horizontal plate optimized for weight using fusion





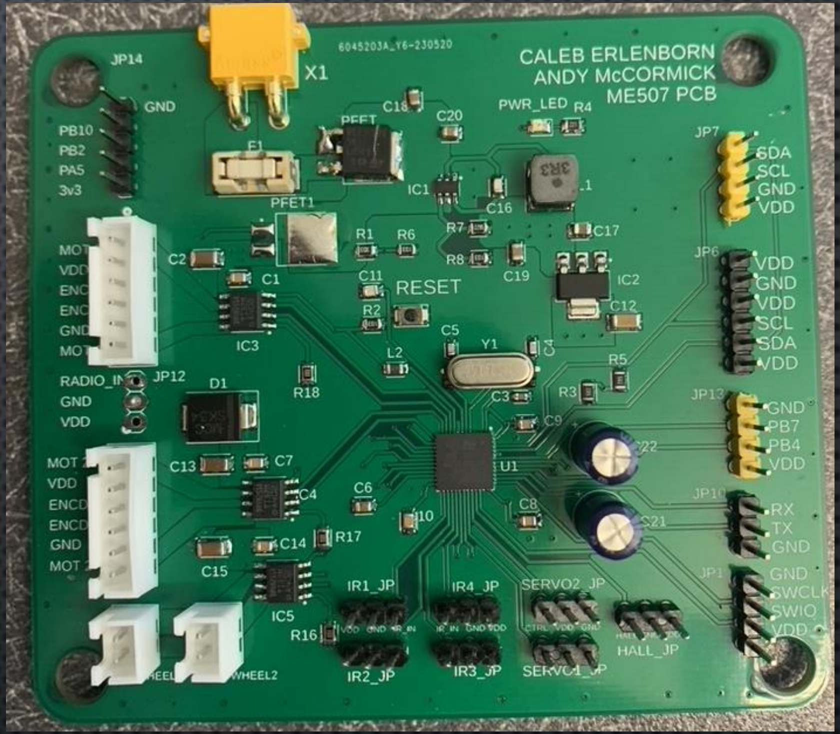


BATTERY STRUCTURE – MANUFACTURING

- All Manufacturing and Integration done in house
- Secondary structure
  - Individual sandwich panels made with pre-preg carbon fiber and HDU foam
  - L-Channel fasteners made using a wet-layup
  - All box sides glued together using 20+ clamps, structural adhesive, and an integration jig to verify tolerances
- Bottom Plate made with aluminum honeycomb core
- Steel Horizontal supports cut on waterjet
- Steel C-Channel Brackets cut and welded, integrated with bolts
- Aluminum threaded inserts made on the CNC and manual lathe, fastened with structural adhesive

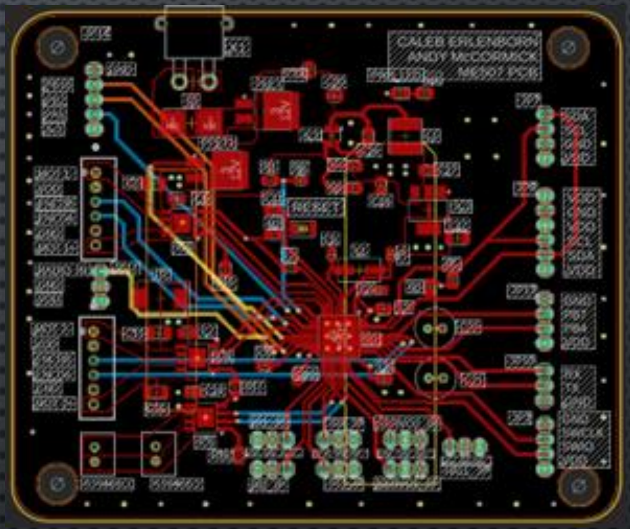
MECHATRONICS OVERVIEW

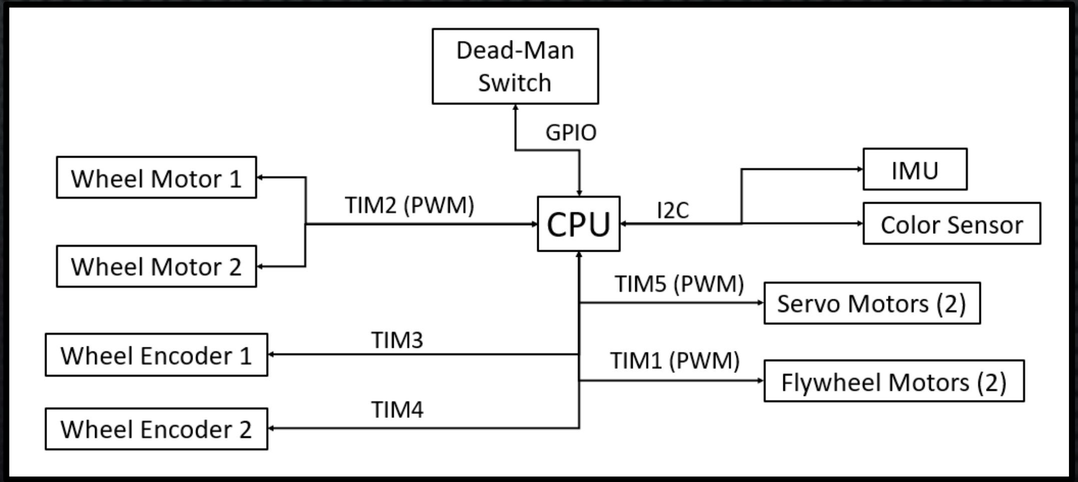
- Over the course of 1.5 years, I completed 5 Mechatronics specific course and 3 in depth mechatronics projects
- The classes highlighted control theory, model creation and validation using MATLAB, electronic design and analysis, and embedded system programming
- Each course highlighted a specific process of the robotic design process
  - ME 304 focused on microcontroller logic and electronics
  - ME 404 focused on the programming side and used a higher-level language, Micropython
  - ME 507 integrated what was learned in previous classes and added the design and integration of a custom PCB



MECHATRONICS – CPP ADVANCED CONTROLS

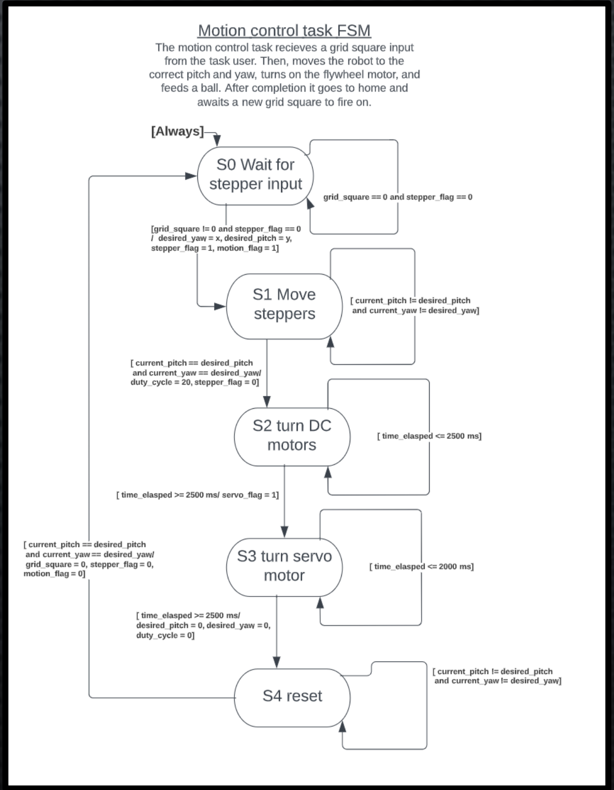
- Autonomous robot designed to traverse a playing field a pick up and sort ping pong balls
- Custom PCB designed in fusion 360 to include: STM32 micro controller, 12V – 5V – 3.3V power regulation, motor driver, I2C communication, GPIO pins, and Crystal Oscillator
- General approach: read encoder data and IMU heading to determine home and current position
- Programmed in C++ using the STM API
- Developed C++ classes for each driver (IMU, Motor, Encoder, IR Sensors, color sensors)
  - Ran all tasks using a sort, move, and location tasks programmed as individual C++ classes
- Only the group able to move around the board and accurately sort colored balls

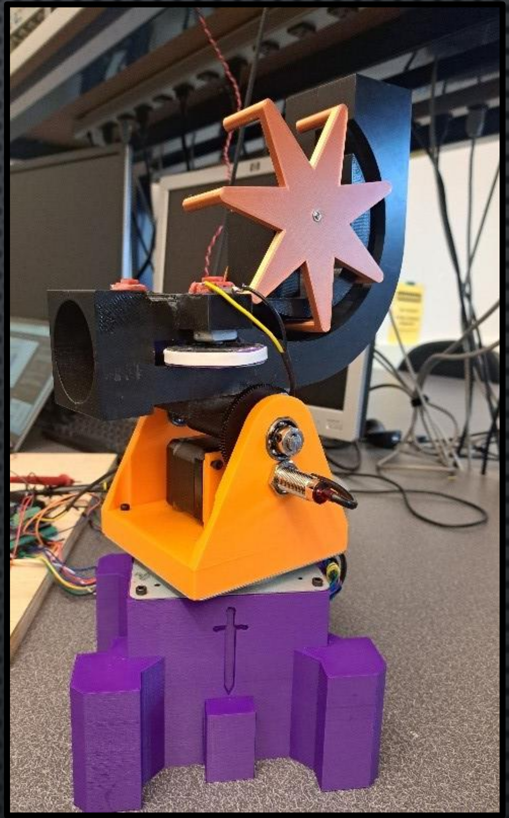




MECHATRONICS – MICROPYTHON PROJECT

- Autonomous Robot designed to play battleship by shooting ping pong balls to specific locations
- Programmed on the STM32L467G microcontroller using micropython and the pyb library
- Robot design consisted of a turret moved by two stepper motors, two fly wheels, and a speed control stepper motor to feed balls
- Electrical design included two stepper driver interfaced over SPI, and a motor controller hat
- Programming approach utilized cooperative multitasking and a scheduler, along with individual movement tasks
- Robot won for accuracy and consistency





MECHATRONICS – ASSEMBLY DEVELOPMENT PROJECT

- Majority of project consisted of designing a motor controller and validating a Simulink model of the system and controller
- Programmed in assembly language using the Motorola S12XD microcontroller
  - Strategy uses cooperative multi tasking and over 2000 lines of code
- Before implementing closed loop control, system was simulated in MATLab with Simulink
  - Using and outDAC motor data was obtained to validate the Simulink model
- After validating the system was stable, the loop was closed the motor controller was used
- As seen on the adjacent graphs, model and system data lined up extremely well meaning we could close the loop with confidence