Mechanical Engineering Portfolio

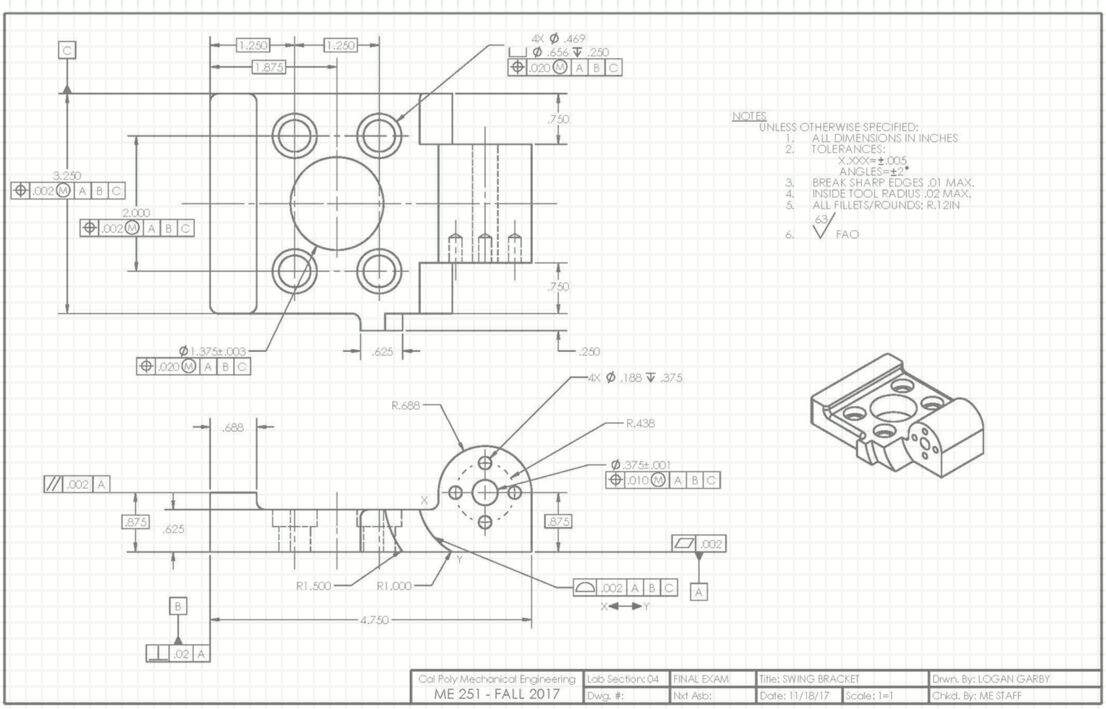
Logan Garby

BSME Cal Poly San Luis Obispo

logangarby@gmail.com

(720) 438-8278

Table of Contents



2D CAD Drawing Example shown in detail on pg.12

Introduction

In June of 2021, I graduated cum laude from Cal Poly, San Luis Obispo with a BS in Mechanical Engineering, and a concentration in Mechatronics. At Cal Poly I discovered a love for design, controls, embedded electromechanical systems, power systems, and coding.

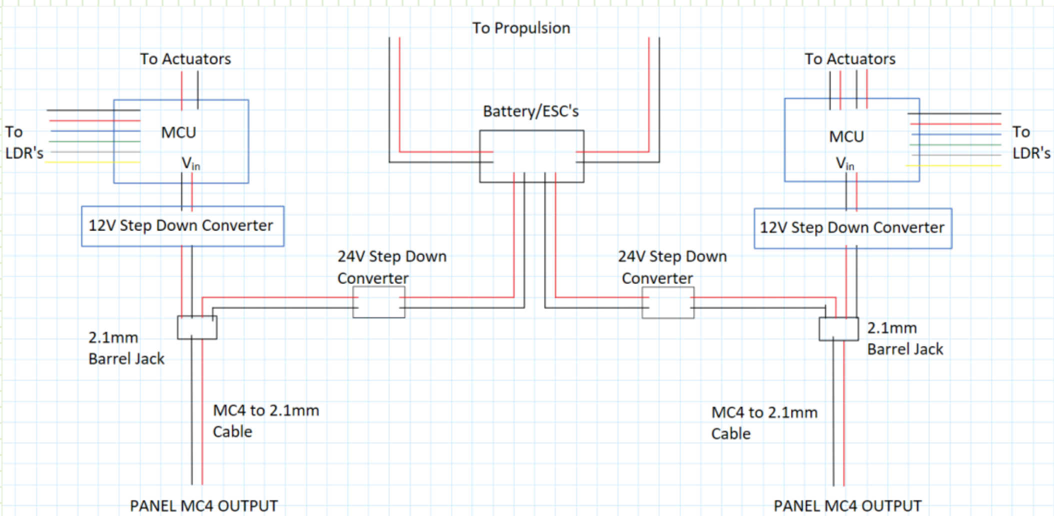
I am looking for a position where I can learn, excel, grow, and contribute as a professional, high-functioning engineer. I am highly motivated, organized, and communicate well.

In my free time, I like to socialize with my friends, golf, lift weights, cook, and spend time outdoors camping, fishing, skiing, mountain biking, and discovering new places. I also love to play tennis, guitar, and work on designing, building, or repairing personal engineering projects.

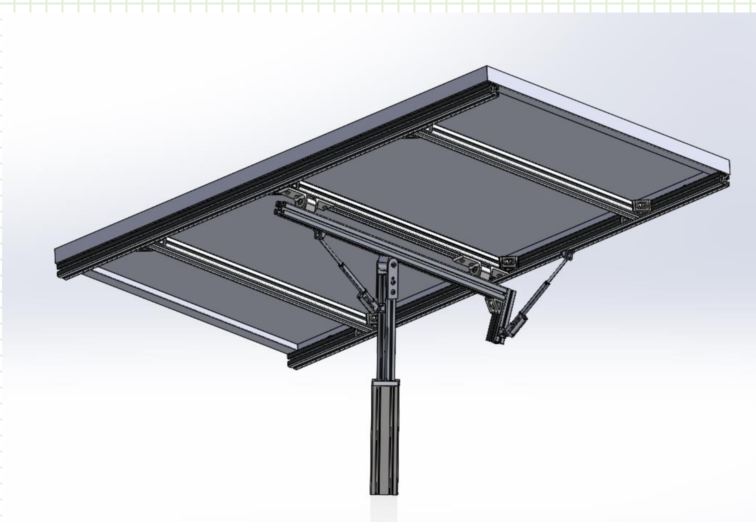
Solar Tracking Mechanism

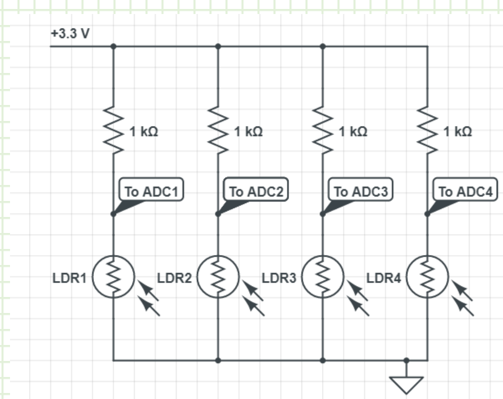
My senior design project for the Cal Poly Solar Regatta Team tasked us with designing and building the mechanism on a solar powered boat to continuously point the solar panels at the sun throughout the duration of the race. The goal of this system was to increase the available power for the boats propulsion by improving solar capture efficiency.

- I designed, built, and coded all electromechanical systems and mechatronics.
- I also led the in-person team (project occurred during COVID) to manufacture the product.



Above: Electromechanical system design.



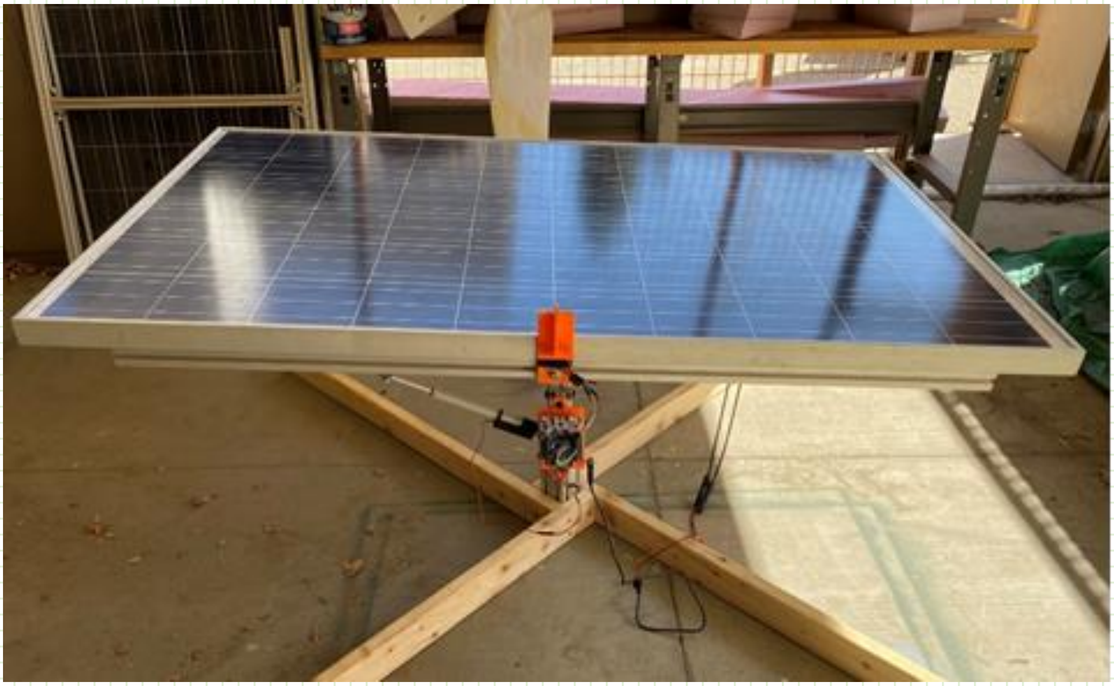


Bottom Right: LDR photoresistor circuit for light source direction detecting.

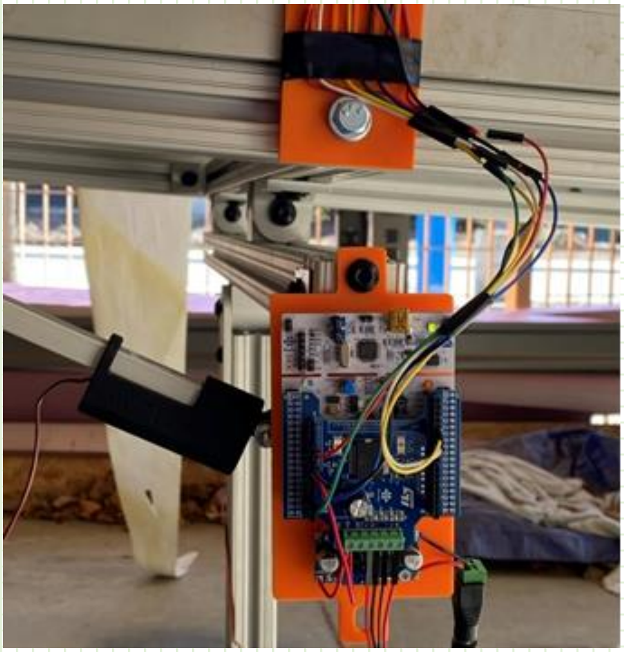
Bottom Left: CAD rendering of final mechanism assembly

Solar Tracking Mechanism

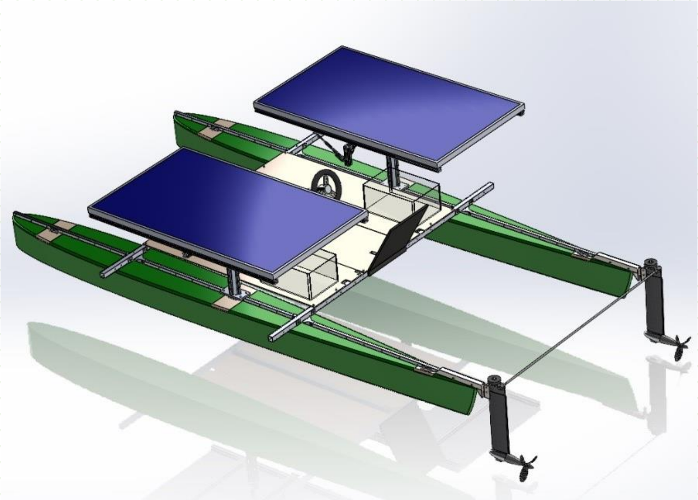
Check out this [YouTube link] for a video demonstration of the tracker



Above: Completed and working solar tracking mechanism



Bottom Left: Nucleo STM32 microcontroller and motor driver used to control system, read LDR circuit, and power actuators.

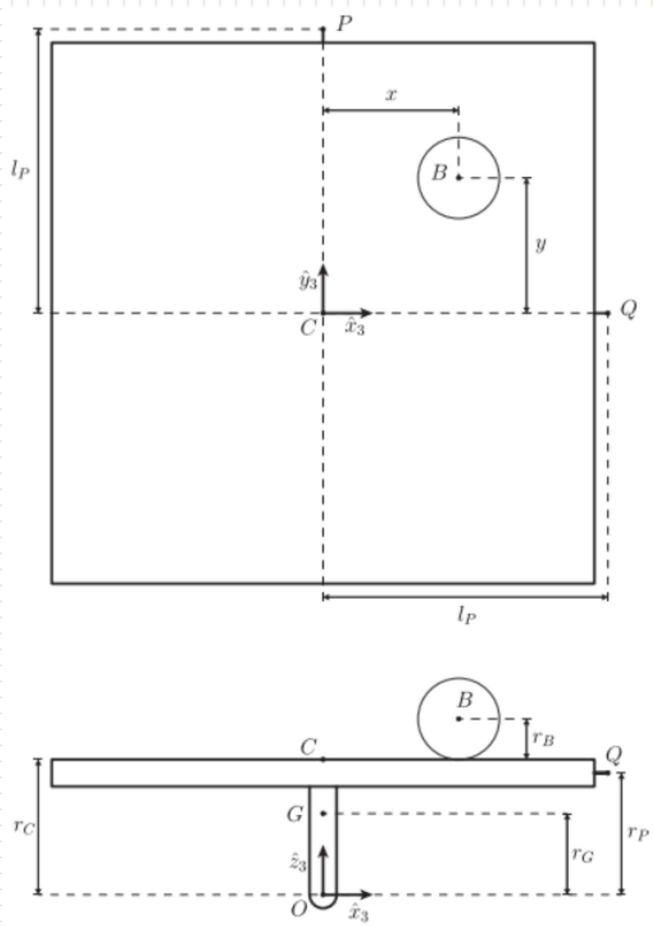


Bottom Right: CAD rendering of entire competition race boat including propulsion, steering, and solar panel mechanism.

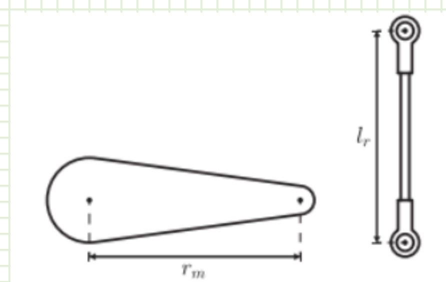
Balancing Board

A year-long project for my mechatronics concentration, which tasked me with keeping a ball balanced on a platform despite being disturbed.

- Applied kinetics and kinematics to create equations of motion and solve them, obtaining a 4th order state space matrix representation.
- Used symbolic MATLAB to perform a Jacobian linearization.
- Utilized classical control theory and Simulink to model closed loop PID system control.
- Assembled/soldered components and programmed a microcontroller to control the system using Python.



Left: Top down and side view of the platform showing the defined parameters.

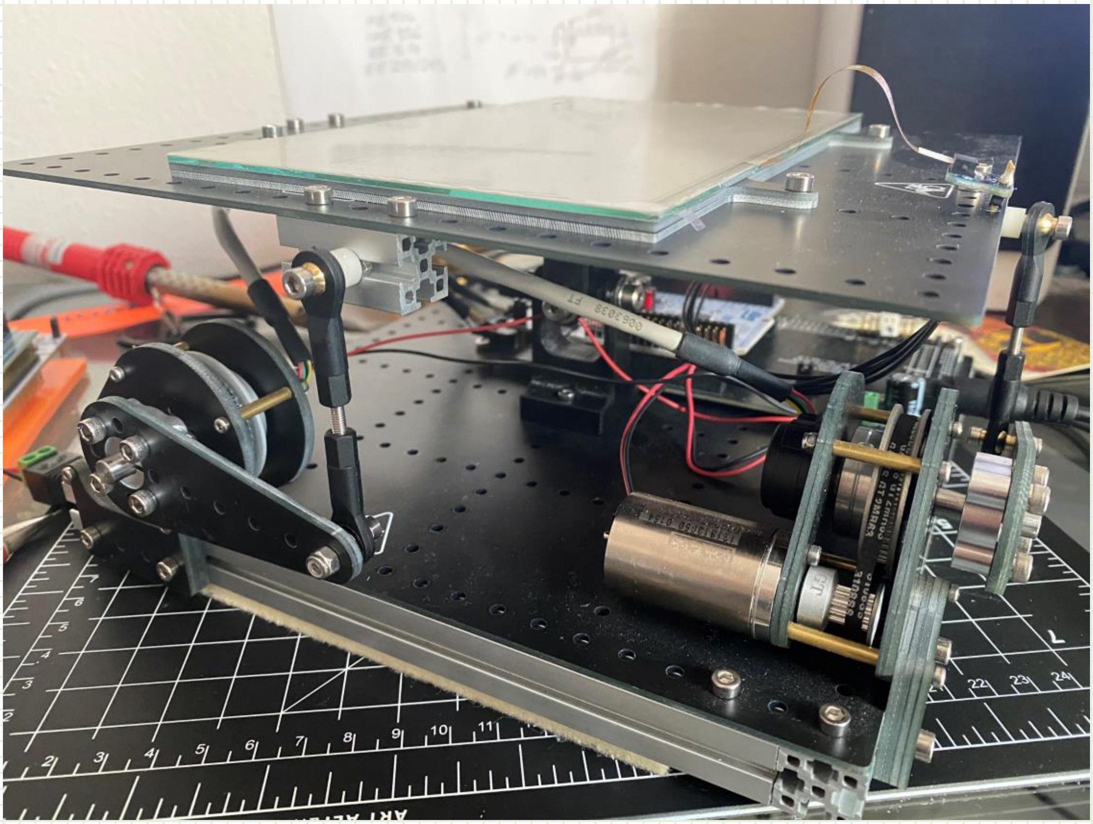


Right: Side view of the Motor lever arms used to control the platform.

Check out this [Bitbucket link]to see the MATLAB code used.

Also visit this self-built website for more info on the project, including python file documentation and other mechatronics projects: lgarby.bitcucket.io

Balancing Board



Above: Assembled balancing board with lever arms, 2 DC motors/encoders, and resistive touch panel.

See it in action with this [YouTube link]

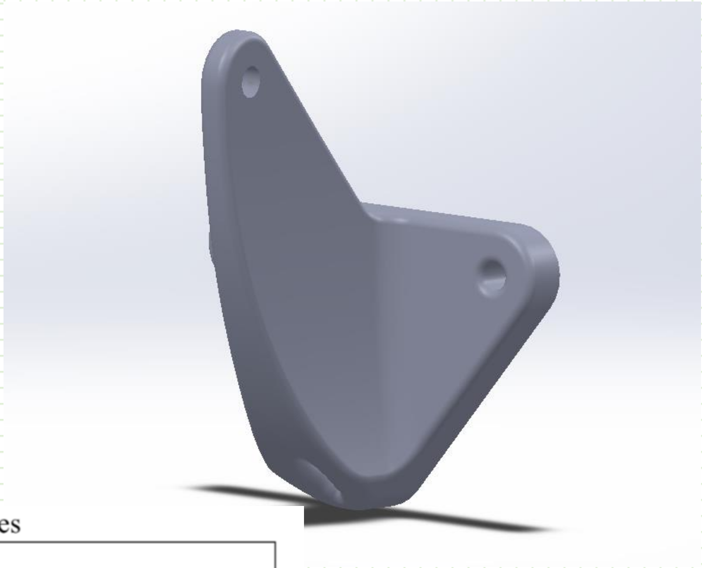
Right: Adafruit FCP touch sensor breakout board.

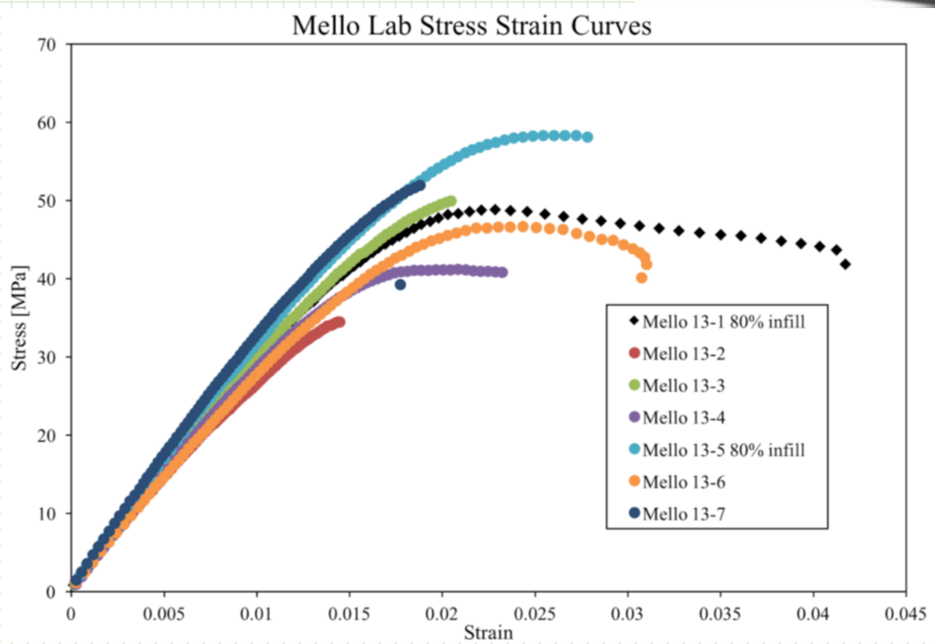
Aircraft Fuel Tank Fixture

Given specific geometric requirements, allowable deflection, and maximum load, I was tasked to design a part that minimized material used while meeting requirements.

- Tensile strength tested chosen material (PLA).
- Analyzed test data to get experimental tensile strength, yield strength, and modulus of elasticity.
- Conducted a multitude of SolidWorks FEA simulations.
- Used a weighted decision matrix to narrow down best designs.
- 3D printed and tested final design which held 2.35 times the designed load.

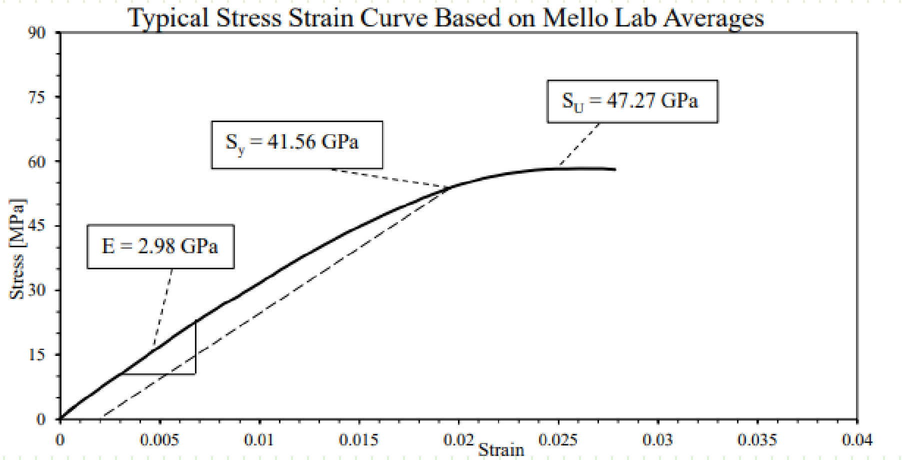
Right: Final selected part design based on design matrix and FEA performance.



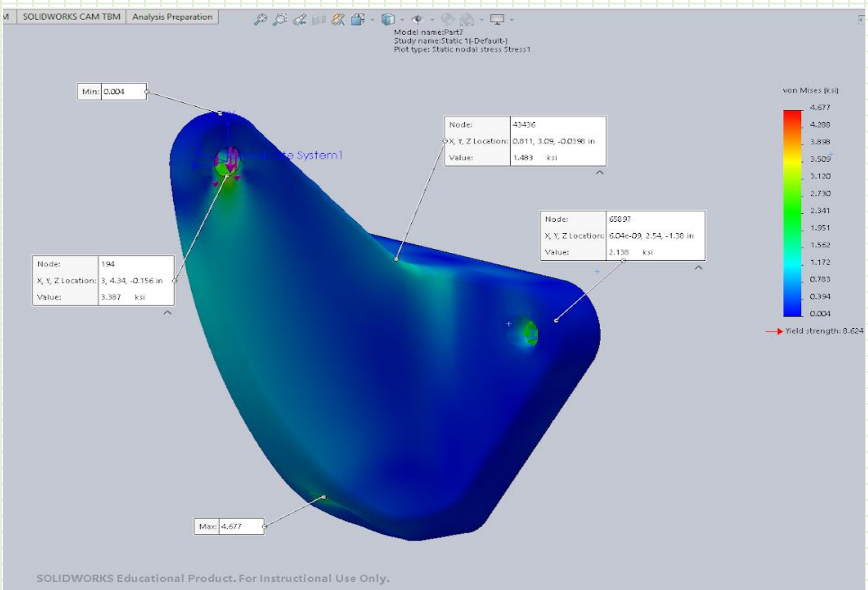


Left: Experimental stress strain curves from 7 different tensile strength tests.

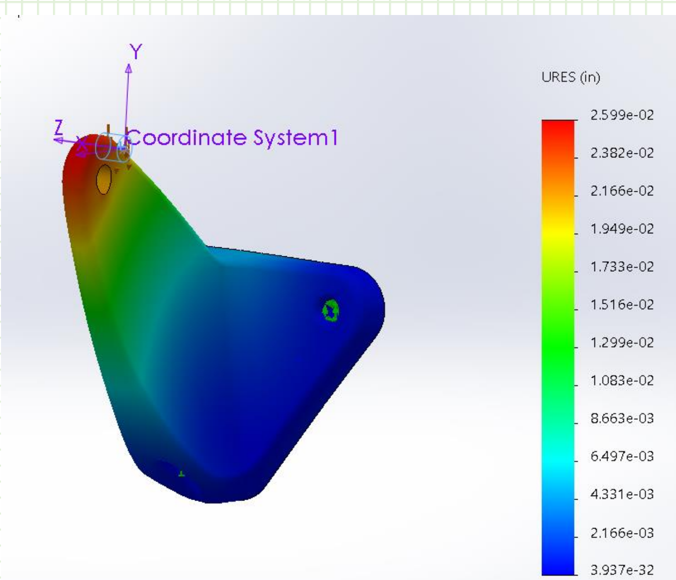
Aircraft Fuel Tank Fixture



Top: Stress strain curve showing calculated average yield strength, ultimate tensile strength, and modulus of elasticity.



Middle: Von Mises stress FEA simulation results showing max stress of 4.677 ksi (safety factor of 1.85).



Bottom: Deflection FEA results. Linear regression of deflection results resulted stiffness of 9619.3 lbf/in (well under required 2000 lbf/in stiffness.

Elementary School Heating System Design

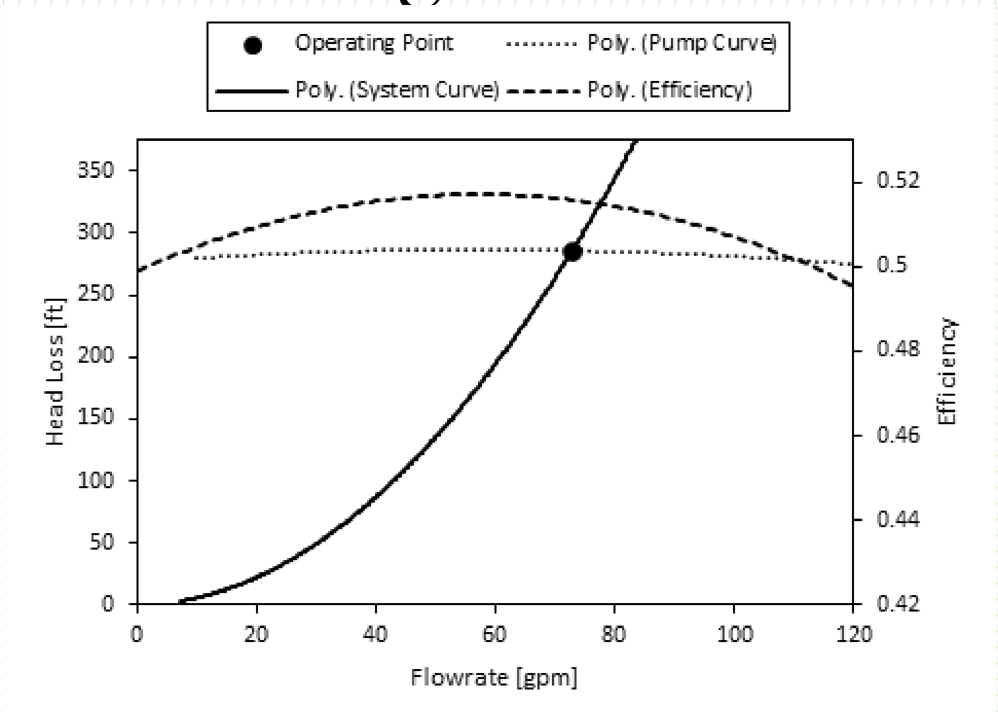
This capstone thermodynamics project required calculating heat loads, selecting radiators, designing a piping network, calculating pipe diameters, selecting pumps, analyzing heat loss, and sizing heat exchangers in order to fully design, from start to finish, a heating system for a small elementary school.

Above: Second floor piping diagram, showing supply and return water lines, name, and radiator placement

Below: Efficiency extraction fraction, heat, work, and energy loads calculated from Rankine power plant cycle analysis. Calculated using Engineer Equation Solver (EES) simulations.

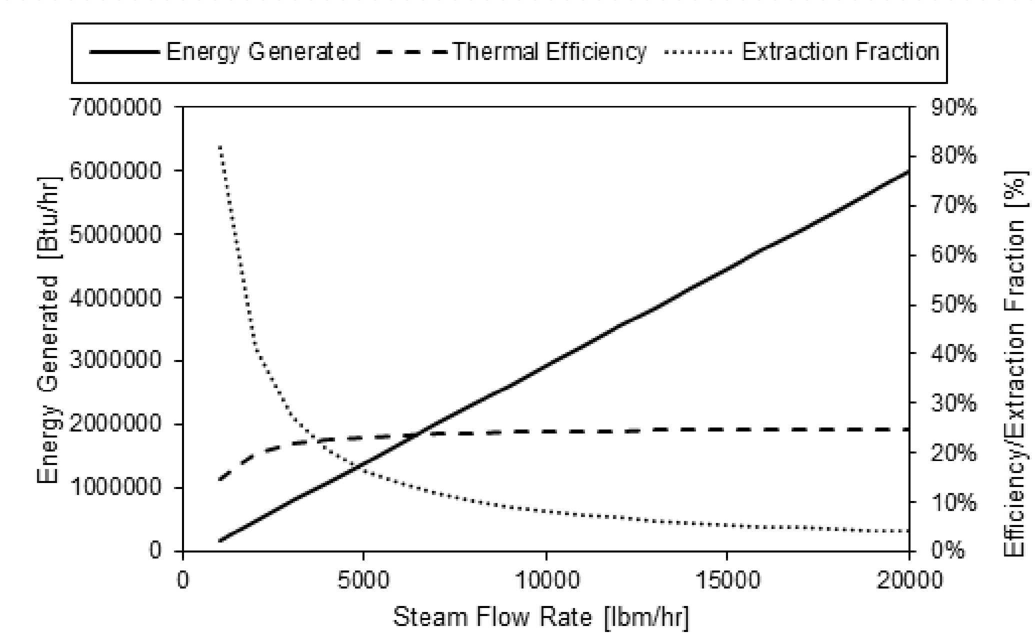
Turbine Work Out	Heat Transfer In	Heat Transfer Out	Q_{load}	Electric Power	Thermal Efficiency	Steam Extraction Fraction
Btu/hr	Btu/hr	Btu/hr	Btu/hr	Btu/hr	%	%
2,931,000	12,040,000	8,356,000	757,580	2,777,000	24.28	8.199

Elementary School Heating System Design



Above: Pump and system curve comparing head loss and efficiency at a variety of flowrates

Below: Energy generated, thermal efficiency, and extraction fraction in response to varied steam mass flow rate.



2D CAD Drawing Example