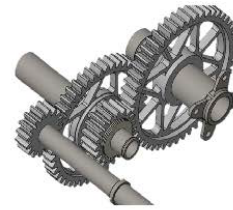
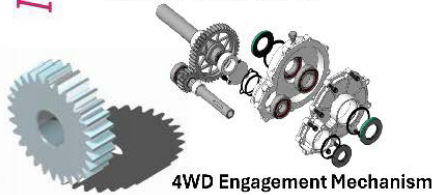


2025 Senior Design Projects

Mechanical Engineering

BAJA Capstone Project (2025)

The Baja Capstone Team was responsible for the design and manufacturing of a new SAE Baja Car for the Grove City College SAE Baja Club. This car will be maintained and raced for the next four years by the club in regional and national competitions. The main goals of this project were to simplify the design of the whole car, reduce overall weight, and increase drivetrain efficiency. To achieve these goals, the **frame was redesigned**, the **engine placement was changed** to better accommodate the transmission, **all gear ratios were mathematically modeled and optimized**, the **drivetrain was overhauled** by replacing the drive shaft and differentials with a direct drive belt, a **custom 4-wheel drive engagement mechanism** was implemented, **suspension geometry was analyzed and updated**, and a **new steering system** was designed. This car will be raced for the first time in June of 2025.

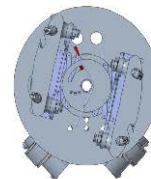
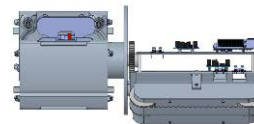
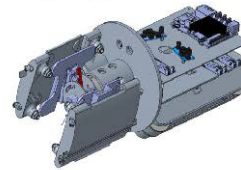


Mechanical Engineering

BPMI – Pipe Cleaning Robot (2025)

Project Requirements

- Debris Collection
 - Detect and collect any debris in the piping network
 - Non-magnetic metal chips <0.050", cloth fibers, dust
 - Special attention given to the crevice feature
 - Stretch goal of removing small pieces of tape and residue on the wall of the pipe
 - Stretch goal of collecting debris beyond the crevice feature
- Verification of cleanliness
 - Visual inspection
 - Wiping the interior surface of the pipe
- Robot Mobility
 - Robot must be capable of navigating piping feature without the need for physical manipulation
 - In the event of power loss, the robot must be able to be removed by a tether



Underwater Time of Flight ROV Mounted RGB Camera (2025)

Background

The Underwater Time of Flight (ToF) team worked in partnership with BeamSea Associates to develop a first-of-its-kind 3D Multicolored Time of Flight Camera.

Most ToF cameras only work in one color, but ours works with red, green, and blue by adapting an existing ToF camera to work in all three colors. We designed ours for underwater use, packaging it for deployment on a remotely operated vehicle (ROV).

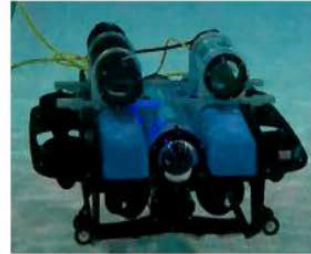
Goal

Create a waterproof enclosure system that can be mounted onto a submersible ROV.

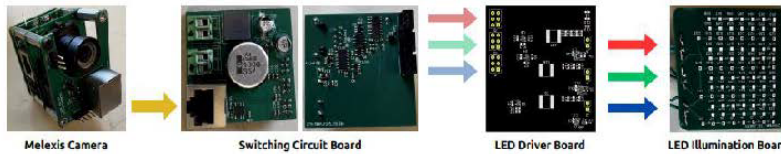
*Two tubes - one for our camera and the other for our LED system

*Custom made ring mounts, camera housing, and board inserts to help keep everything stable while ROV is in motion

*Tethered system with one power and one communications cable to above water control station



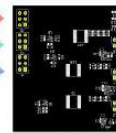
Camera/LEDs Mounted on the ROV



Melexis Camera



Switching Circuit Board



LED Driver Board



LED Illumination Board

Industrial Compressor Simulator (2025)

Goal: Develop a digital simulator that tests the FS Elliott's R1000/R2000 compressor control system

*Validate controller response to events, including load sharing and fault response

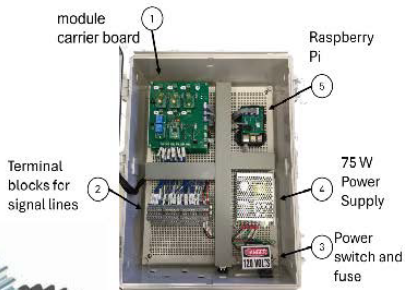
*Small form factor, configurable, expandable



R1000 Compressor Controller



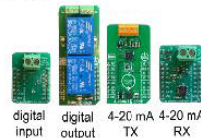
Enclosure and Panel Layout



User Interface



Supports up to 18 interchangeable signal modules



digital input digital output 4-20 mA TX 4-20 mA RX



GoVinci: Nuclear Heat Exchange

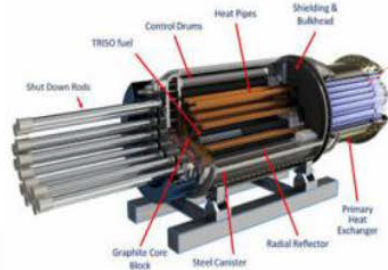
Project Goal (2025)

Design and manufacture a heat exchange sleeve for heat extraction from a heat pipe. The project is to be applied to Westinghouse's eVinci Microreactor - a 5 Mwe product currently in development.



Heat transfer sleeve applies to the primary heat exchanger

Make this as big as possible



Satellite Thrusters and Additive Research (2025)

The Objective



The goal of this project is to investigate how surface conditions resulting from additive manufacturing influence the nozzle coefficient and thrust direction in reaction control thrusters. The nozzles being studied generate less than 5N of force (1.12lbf) and will be tested using air as the cold gas.

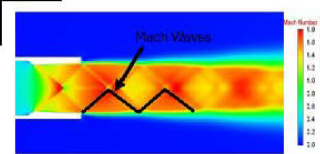
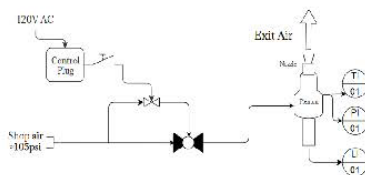


Image of Mach Waves from "A Numerical Approach and Study of the Shock-Wave Structure of Supersonic Jet Flow in a Nozzle"



Our Schematic

- P1 stored in our experimental setup.
- S10 air supplied at around 105psi
- 75psi in the plenum.
- Plenum module is constrained in the 2 axial directions while the 3rd is left unconstrained.



Blue Origin BE-4 Rocket Engine with Over-Expanded Flow Showing Normal Shock



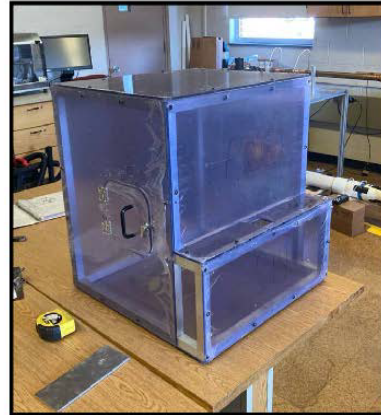
Vita In Vivo – ‘Life in Glass’ (2025)

Background:

- Supporting gut microbiome organ-on-a-chip research in the GCC biology department
- Microscopic imaging in an incubated environment is required to continue research in a current project
- Microfluidic tubing system is incompatible with existing incubator

Requirements:

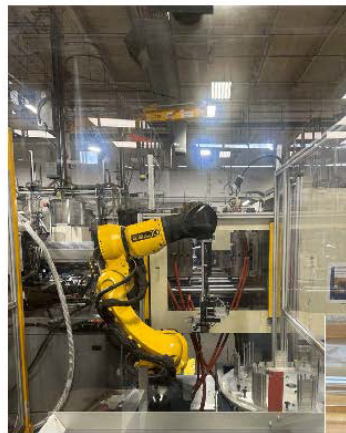
- Average temperature: 37°C (40°C/20°C)
- CO₂ concentration: 5% (±1%)
- Humidity maintained
- Access to the chip being studied
- Microfluidic tubing access point
- Made of easily sterilized material
- Fits onto a 48"x30" tabletop
- Microscope controls accessible
- Control system capable of storing periodic temperature and CO₂ data



Industrial Automation – APP (2025)

Scope: The product will serve two key purposes:

1. Assemble a power cable interface board
2. Assist an operator in performing a two-minute pressure test



- The assembly and testing process will be completed in five minutes or less per interface board.

Process

1. Plate and gasket loaded to the lazy susan
2. Pressure test
3. Plate loading and mount
4. Bushing tray loaded to conveyor
5. Gripper assembly
6. Assembling the bushings
7. Final assembly

