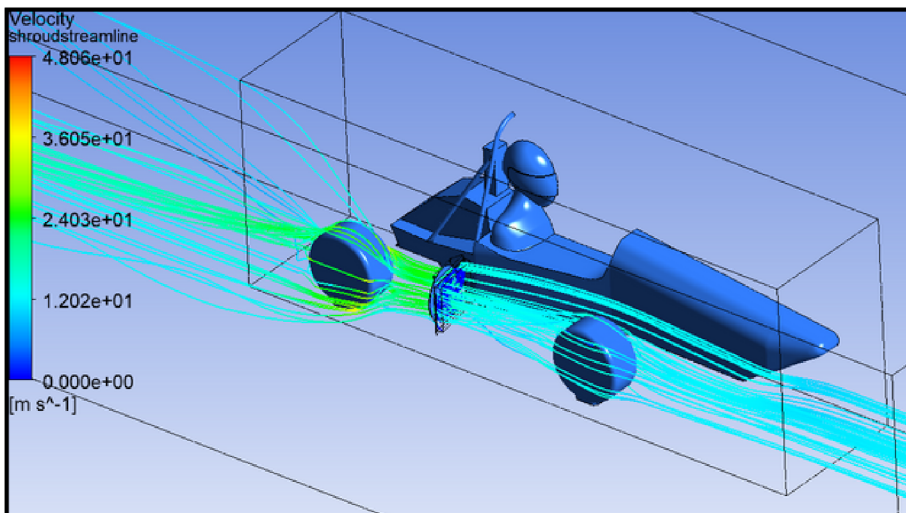
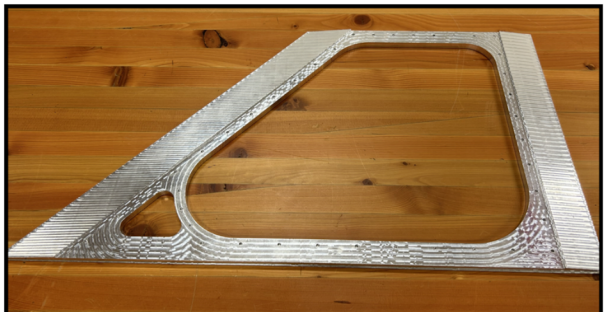
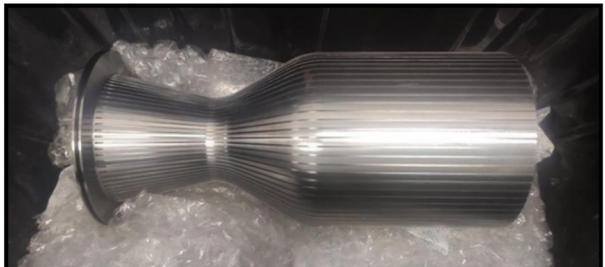
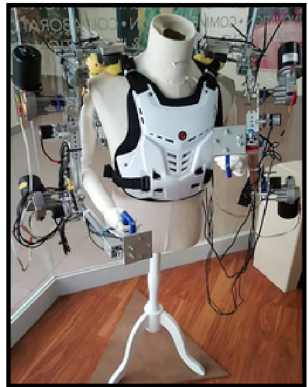
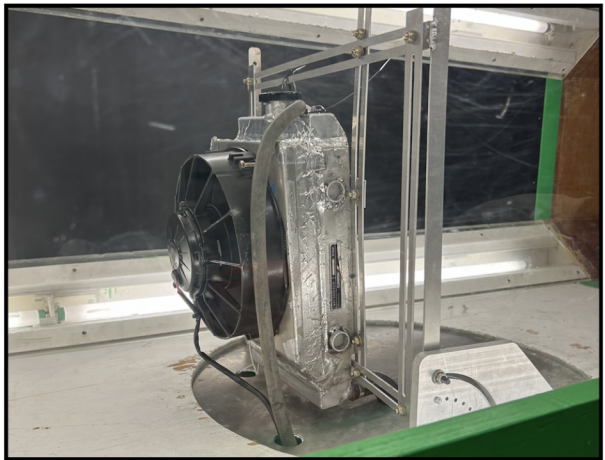
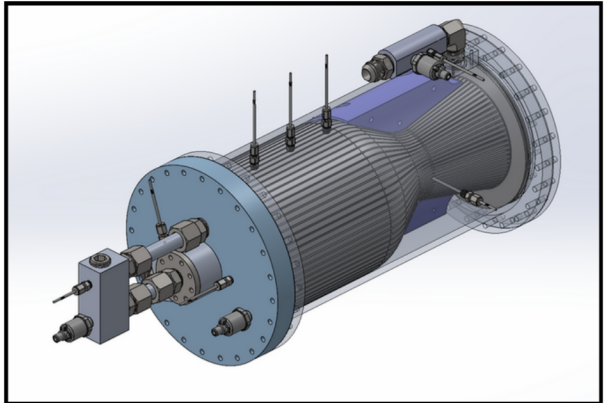


The following is a compilation of the non-NDA work I have participated in during my engineering career. Please enjoy!

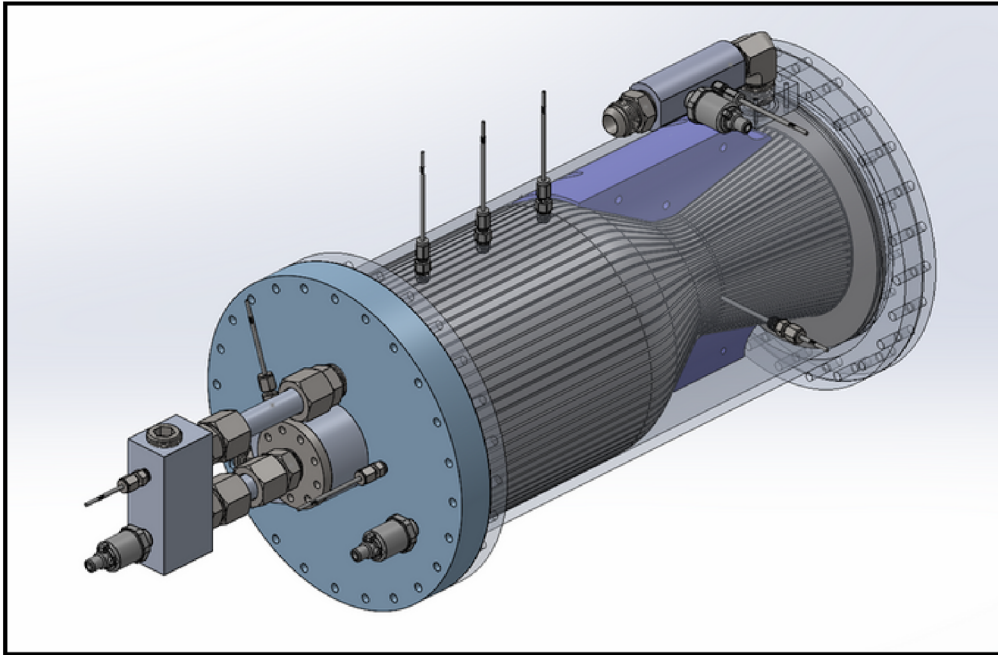
TABLE OF CONTENTS

PROJECT	PAGE
Moon & Mars Industries	1-2
UBC Formula	3
UBC Rocket	4-8
Other Projects	9-11

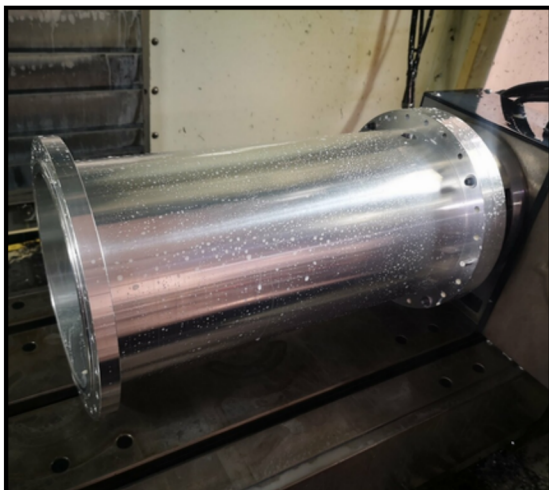


MOON & MARS INDUSTRIES - 2023

REGENERATIVELY COOLED ROCKET ENGINE



- Primary responsibility to design and manufacture a 12kN thrust, liquid bipropellant, LOX/Kerosene, regeneratively-cooled rocket engine prototype for pathfinding engine technology for a suborbital sounding rocket engine
- Implemented thermodynamic, fluids, chemical, material, and structural concepts in full-stack design and validation of the regenerative cooling system to keep the engine under thermo-structural failure in steady state conditions.
- developed a 1-D heat exchanger calculation model, from first principles supersonic nozzle flow, gas convective heat transfer and coolant convective heat transfer correlations, was able to determine best liner material for high temperature steady-state operation of a rocket engine with 2700C combustion temperatures
- Partially machined via in-house CNC, liaised with external machine shops to manufacture critical parts to tight-tolerance spec
- Priorities for the engine were: cost-effectiveness, safety, reliability, data-collection, modularity, and ease of manufacturing/assembly



- (Top) Rocket Engine inner liner (SAE 4340)
- (Left) Rocket Engine outer jacket (Al 6061)

MOON & MARS INDUSTRIES - 2023

MISCELLANEOUS



- Beckhoff PLC industrial automation controller
- initial programming for rocket engine test stand and water flow rig in Structured Text (IEC 61131-3)



- Fuel injector faceplate in-house CNC milling of stainless 304 @ 12000rpm



- (Left) Part of a rocket engine injector water cold-flow test rig capable of 10kg/s water flow for 20s



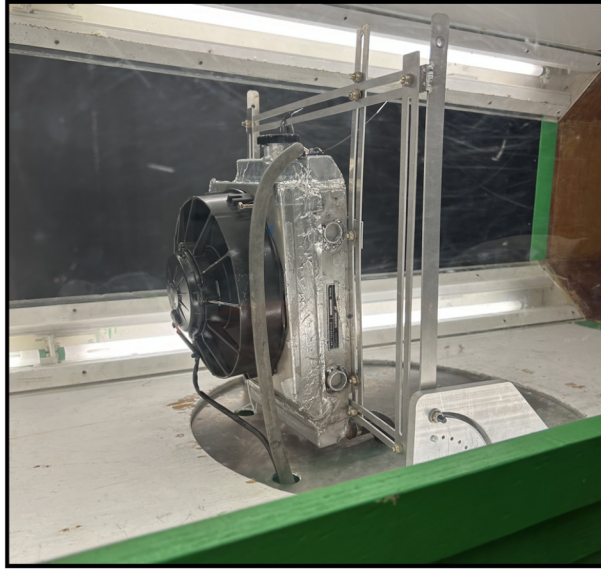
- Partially-assembled 12kN rocket engine assembly



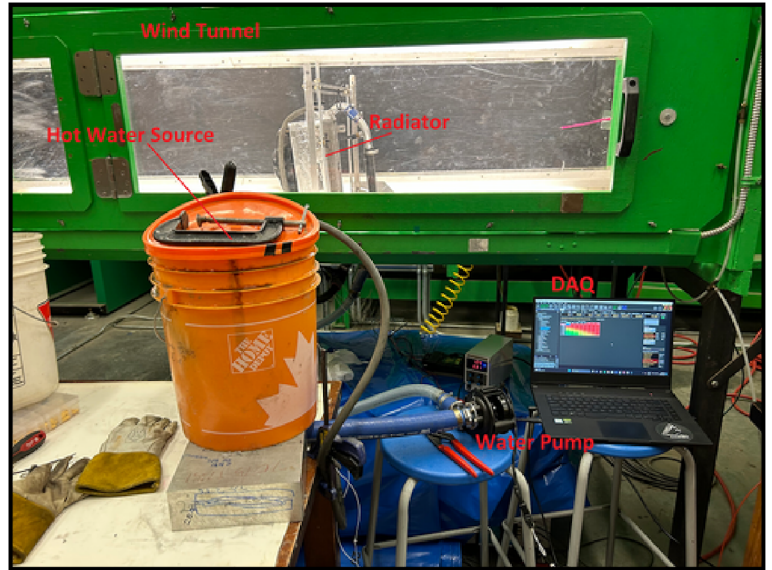
- CNC machined Aluminum flow restriction volume half-section

3 FORMULA UBC- 2023

COOLANT SYSTEM PERFORMANCE CHARACTERIZATION + OPTIMIZATION



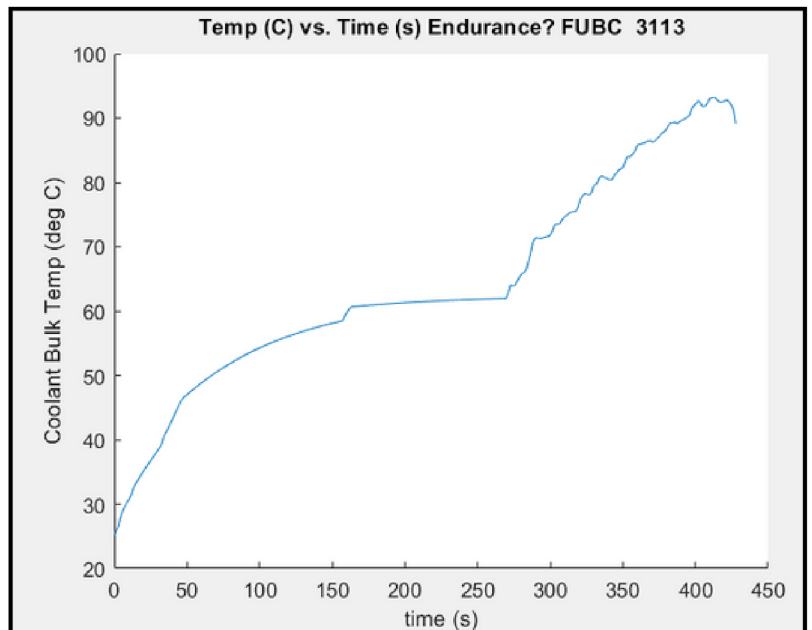
- Automotive radiator in wind tunnel for heat transfer characterization testing



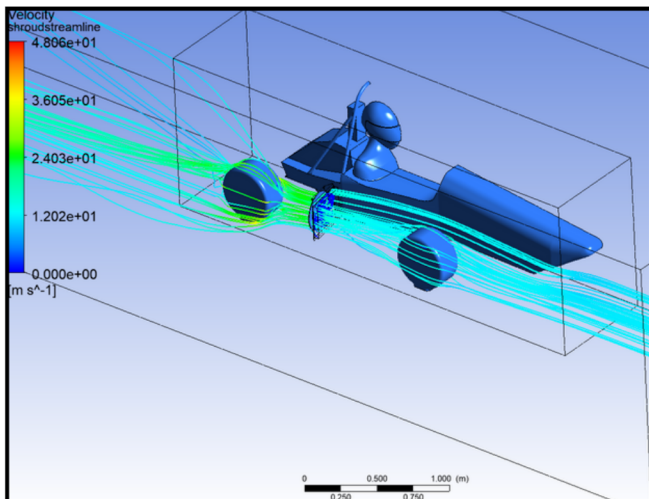
- Hot water fluid system setup with automotive DAQ for data collection of radiator inlet and outlet water temperatures over time



- 7kW resistive heating element to boil water for radiator testing



- (Top) Predictive MATLAB Script matching theoretical heat exchanger model to real autocross run engine coolant temperatures.
- (Left) ANSYS Fluent 3D CFD modelling of half-car aerodynamics. Includes:
 - Radiator experimental porosity definition
 - Fan Curve implementation
- Goal: To successfully model air mass flow rate through an automotive radiator model as an approximate predictive model for proposed cooling system configuration and performance



UBC ROCKET - 2022

STRUCTURES - COMPRESSION TESTER

- Designed and led the effort to create a 12ft tall, 10T compression tester for 18" diameter rocket propellant tanks and aerostructures
- Structural Steel C-channel construction, adjustable compression heights, hydraulic car-jack actuation, disc load cell force sensing, in-house calibration and testing



Compression testing setup for testing 18" diameter, 72" tall carbon fiber bodytube



Compression tester fit test for hexapod thrust structure compression testing



Manual Machining setup for dowel pin holes



Assembled compression tester 12ft tall steel C-channel beams



Assembled compression tester C-channel cross-beams (2x) with hydraulic jack (bottom) and load cell mount (top)

UBC ROCKET - 2022

MISCELLANEOUS



- 4-thruster cold gas roll-control rotary test stand test bed for rotary PID control scheme.



- Pintle-style injector water flow testing



- Pyrotechnic parachute reefing line cutter utilizing e-match and black powder



- Small, 3kN low-cost heatsink + film-cooled rocket engine

UBC ROCKET - 2020

METAL NOSECONES + MISCELLANEOUS

- Design and manufacturing of prototype **stressed-skin semi-monocoque nosecone fairing** for supersonic sounding rocket
- Custom tooling, aircraft flush-rivets, aluminum internal stringers/ribs, stainless steel waterjet single-piece stressed skin
- Experienced machinist with manual and 3-axis CNC, supported almost all projects



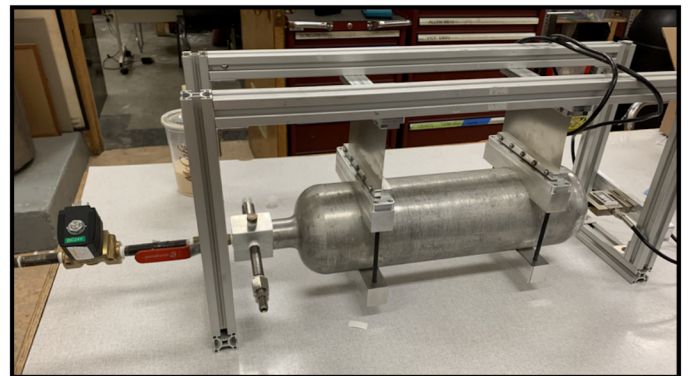
- Aluminum 6061 nosecone internal structure of stringers + ribs



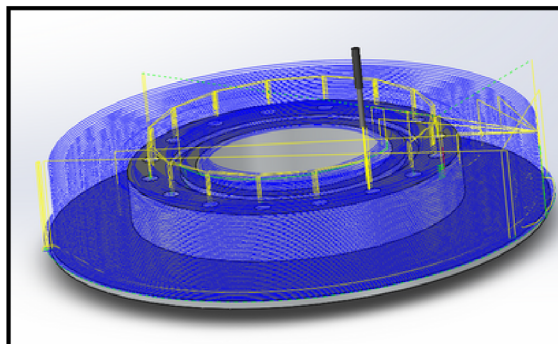
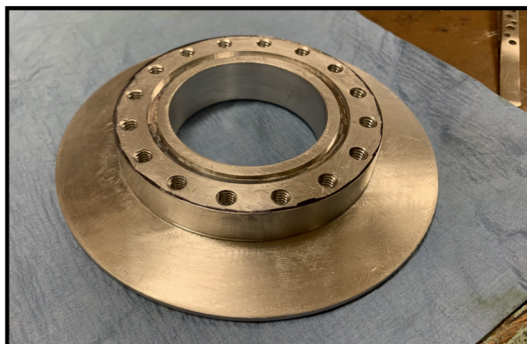
- Completed metal semi-monocoque nosecone fairing



- Flush-riveting stainless skin process requiring pneumatic flush rivet gun and bucking bar



- cold-gas reaction control thruster tester



- In-house CNC machined composite fuel tank endcap insert and HSMworks toolpath

COMPOSITES MANUFACTURING

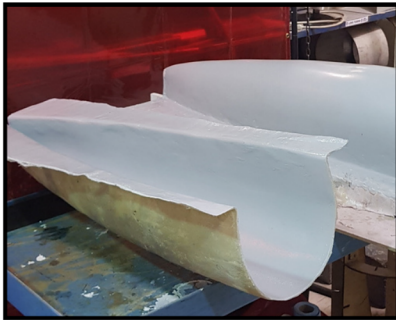
- Experienced at carbon fiber composite manufacturing. Capable of performing wet layups, vacuum layups, and vacuum infusions
- Used software like Autodesk Heliux Composite to spec carbon fiber structures
- Created large scale flight prototypes like bodytubes and nosecones from carbon fiber



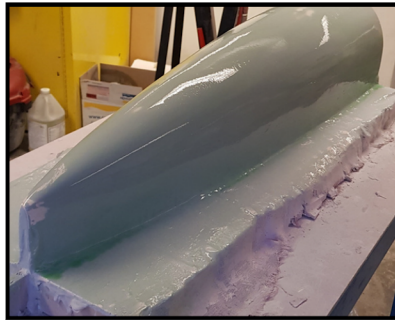
- Large 18" diameter CFRP tube vacuum infusion test



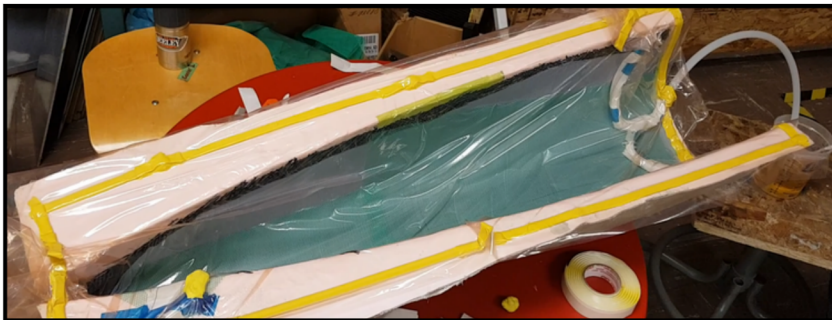
- Final mounted carbon fiber tube sections for crush testing



- Fiberglass waxed gelcoat female and male nosecone fairing mold



- Waxed male mold being treated with chemical release agent



- Carbon fiber nosecone fairing vacuum infusion in process

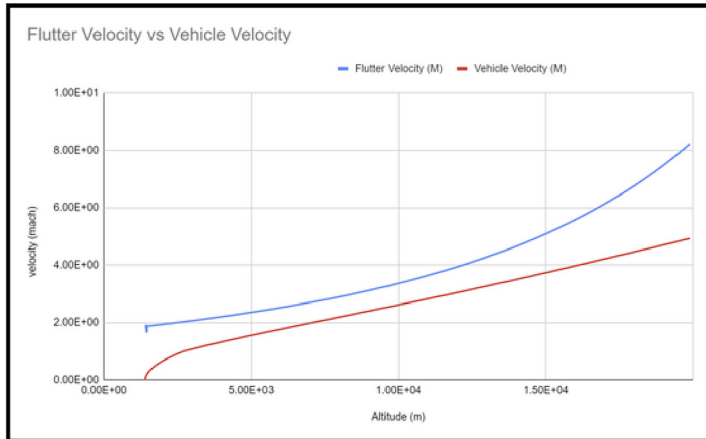


- Complete, full-scale, 18" diameter 72" tall rocket bodytube section

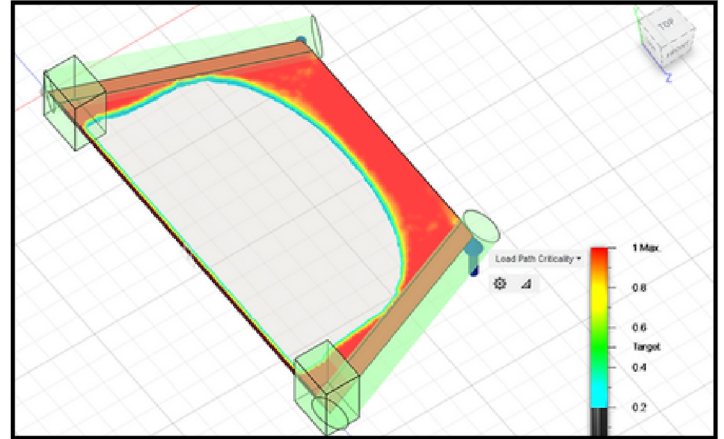
UBC ROCKET - 2019

AEROELASTIC FLUTTER IMPROVED FIN

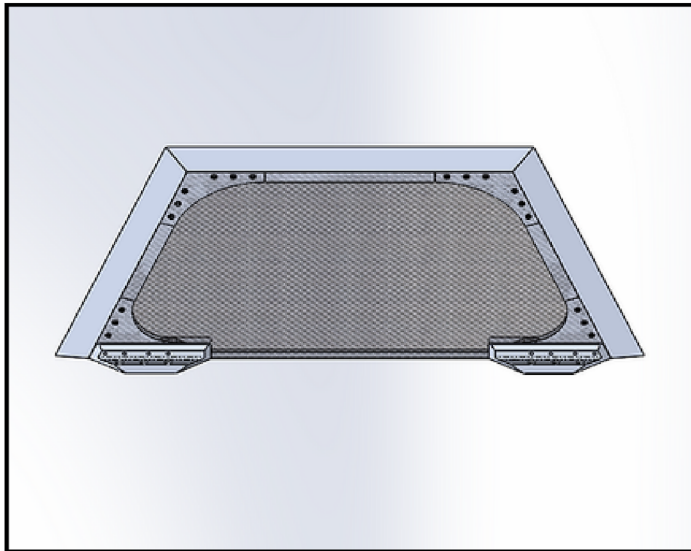
- Developed a MATLAB model based on NACA technical report to predict sounding rocket stabilizer fin aeroelastic flutter velocity along flightpath projections
- Conducted topology optimization in Fusion360 to inform high stiffness, low weight fin design
- CNC-Machined stabilizer fin frame initial prototype



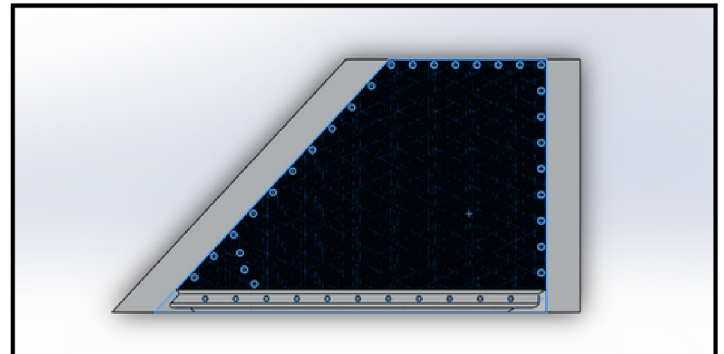
- Excel/MATLAB aeroelastic flutter speed vs. flightpath speed calculations



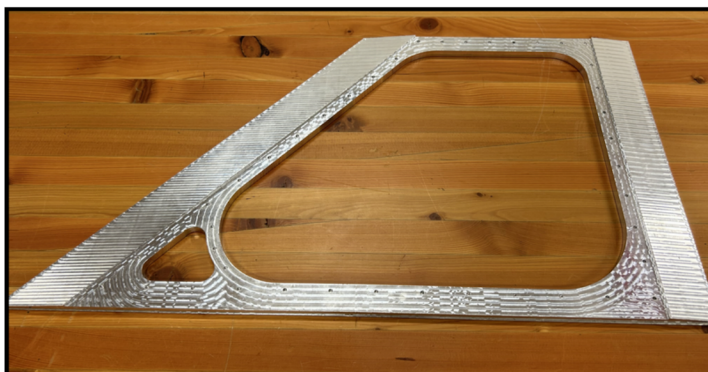
- Autodesk Fusion360 topology optimization for improved bending/torsion stiffness to weight ratio



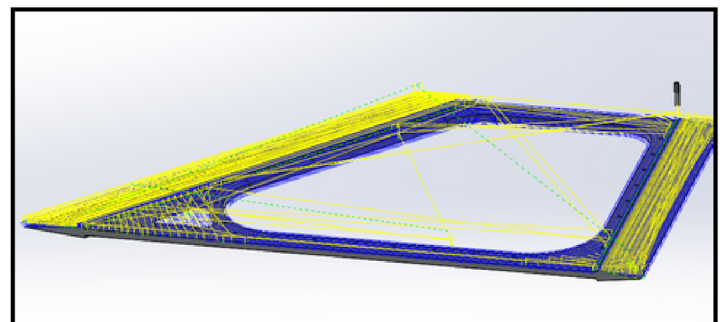
- Initial CAD model of prototype fin based on Fusion360 topology optimization model



- Version 2 CAD model of CNC machinable, topology optimized fin geometry with carbon fiber skin panels



- Final in-house CNC milled fin frame



- optimized fin CNC machining tool path done in HSMworks

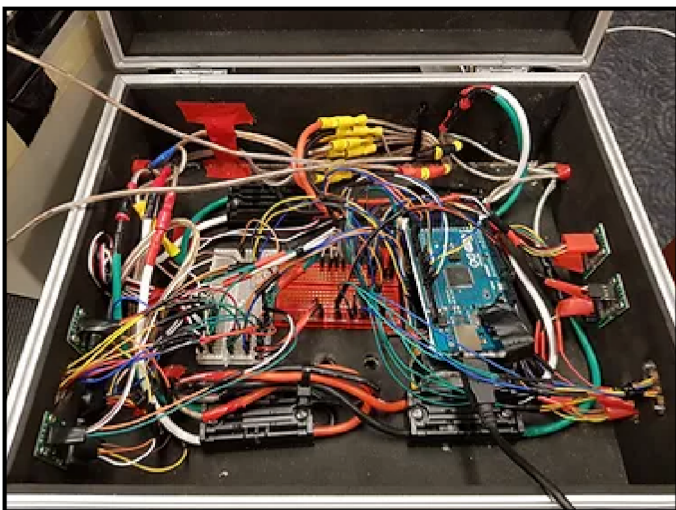
OTHER PROJECTS

POWERED EXOSKELETON - HIGH SCHOOL

- Pursued an independent project to design and develop an upper extremity exoskeleton built from off-the-shelf components to assist in light duty repetitive tasks
- Spent over 600 hours pursuing this project, learned a lot about electromechanical and mechatronic systems as a high school senior
- Controlled via Arduino MEGA, 3-axis load cell for user input, optical encoder for position tracking, brushed DC motor + controller for actuation, very basic closed-loop position feedback system for response to user force input



- Finished exoskeleton project on display on a mannequin representing how the user would wear the device

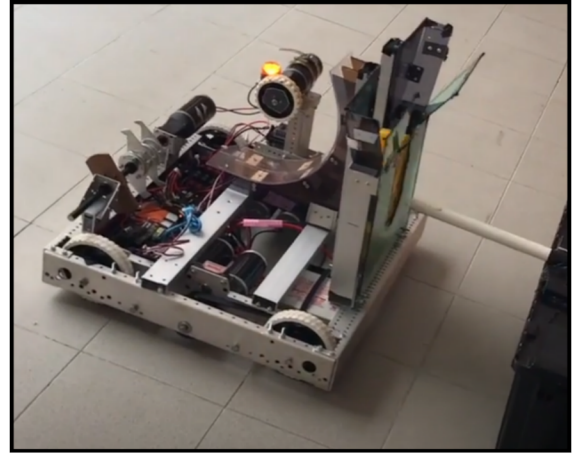
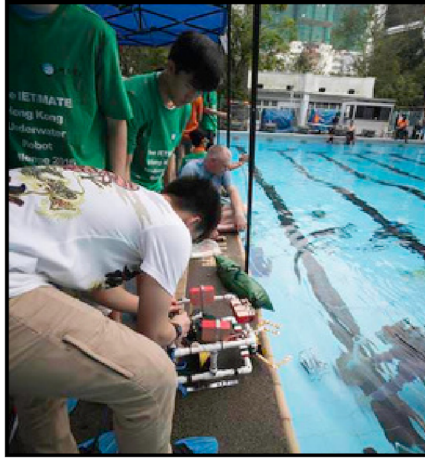


Features:

- Arduino MEGA
- HX711 load cell amplifiers for 3D load cell
- Talon SRX brushed DC motor controller
- High torque worm-gear DC motor actuators
- Optical rotary encoders for shoulder and elbow joints
- Very jerky but managed to lift and hold a 2kg object in front of me

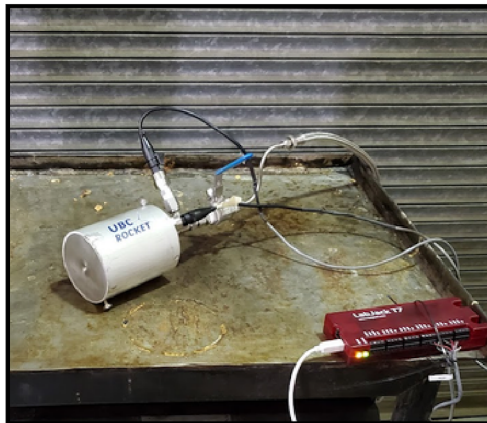
HIGH SCHOOL ROBOTICS

- Co-captained a MATE Underwater Robotics team (Houston World Comp, 2016)
- Co-captained a FIRST Robotics team (Sydney Regional Competition, 2017)



UBC ROCKET - WEEKNIGHT SALAMI ENGINE

- Created a salami-GOX hybrid rocket engine with the team in one night to understand rocket engine fundamentals (and to eat hot salami)



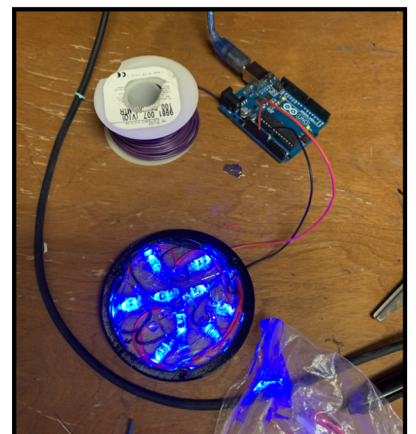
ELECTRIC SKATEBOARD

- Designed and fabricated a custom electric skateboard modification for a longboard
- Arduino, LiPo battery, potentiometer speed control, brushless DC motor + ESC
- Worked for 3 weeks, aliexpress battery kicked out



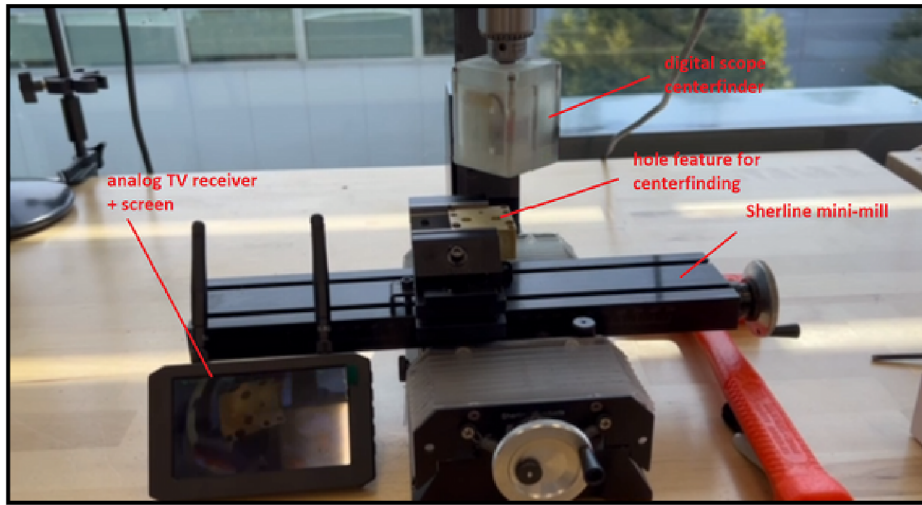
ARC REACTOR HALLOWEEN COSTUME

- Designed and built a prop "arc reactor" for a "casual Tony Stark" Halloween costume
- 3D printed housing, 9V battery, diffusion paper, blue LEDs
- A hit at the engineering halloween party :)



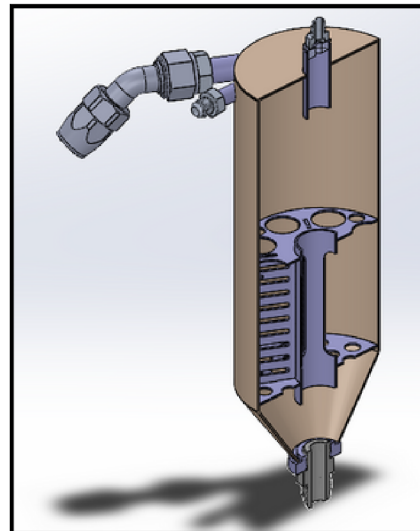
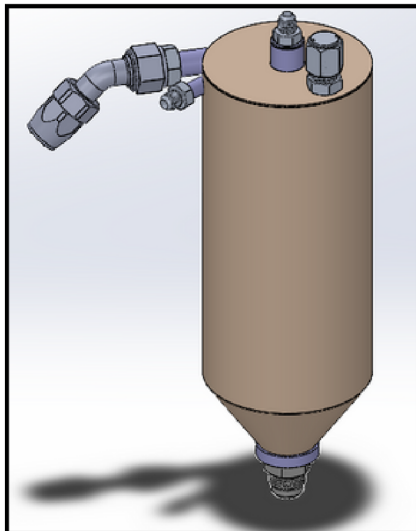
OTHER PROJECTS

WIRELESS MICROSCOPE CENTERFINDER FOR MANUAL MILL



- (Top left) Digital microscope centre-finder mounted in a Sherline mini-mill. FPV drone camera and electronics mounted in a resin 3D printed housing and aluminum shaft. Analog NTSC receiver + screen for centerfinding observation
- (Top right) Observation screen setup for hole/edge finding. Accurate to ~2-3 thou
- Inspired by the custom device used by Dan Gelbart in his shop tour youtube video ([Link](#))

FORMULA UBC - OIL SYSTEM REDESIGN



- Presently ongoing project to design and manufacture an improved lubrication system for the Honda CBR600RR engine for the 2024 UBC Formula SAE vehicle
- Project Scope:
 - Oil reservoir design + manufacturing
 - Oil sump pan re-manufacturing
 - Improved oil fitting anti-leak performance and serviceability
 - Integrated cyclonic air-oil separation
 - Improved anti-slosh baffle design
 - Improved cornering G-force lubrication performance