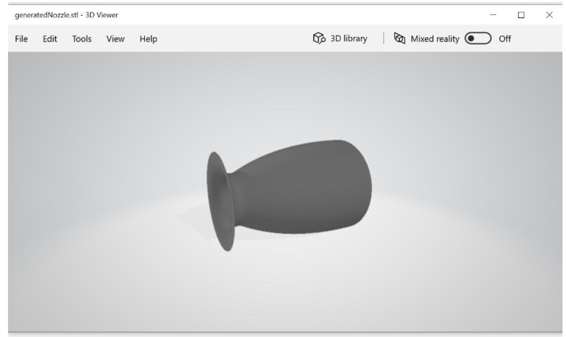
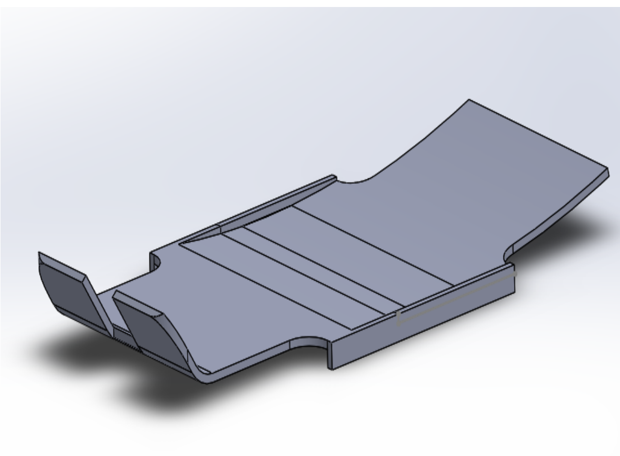
Portfolio

Supersonic Nozzle Website - cdnozzle.com

A website that uses approximate optimization and the method of characteristics to generate an .stl file of a supersonic converging-diverging nozzle given a few basic parameters. It ties together standard python, numerous python libraries, a flask framework, and basic web development skills to locally render an .stl file in seconds through your browser.



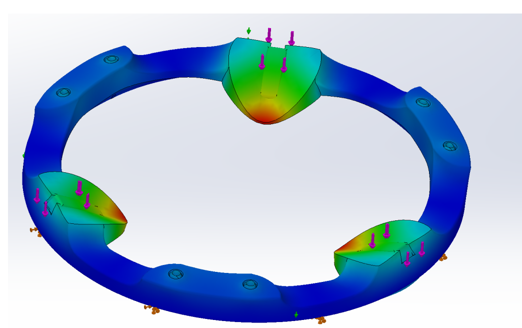
RC Car - Custom Floorboard



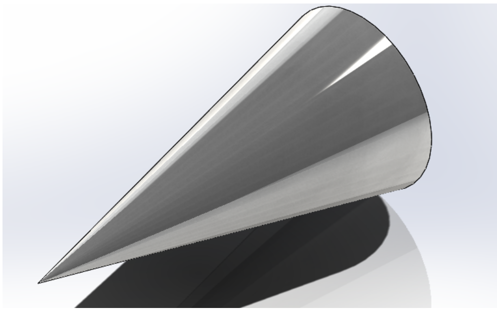
After watching the porpoising of F1 cars early in the 2022 season, I was interested in exploring the effect further. Porpoising in F1 can mainly be attributed to regulation changes related to the floorboard of the car that emphasize the use of the ground effect. Porpoising is turbulence associated with the ground effect. I was able to minimic the ground effect on a smaller scale by designing and 3D printing a floorboard for my RC car that was inspired by an upside down airfoil, and the skirt of the Lotus 78. I tested my design in a make-shfit wind tunnel using a hair dryer.

Whistler-Blackcomb Rocket - Recovery Interface

This is the upper structure housing the recovery bay, roll-control system, avionics, and payload. I used topology optimization, buickling, and static simulations to test different properties of my design. It involved numerous iterations, and has since been manufactured and tested. The flight-ready part is set to be made soon.



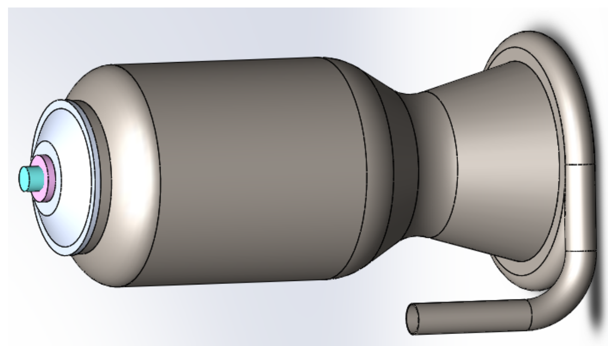
Research Paper - Testing the Efficiency of Rocket Nose Cones



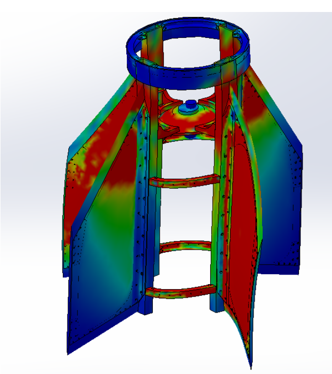
I wrote a research paper on the aerodynamics of rocket nose cones using the simulation software OpenRocket, and Aerolab. I tested six different types of nose cones at seven different fineness ratios (a length-to-radius ratio of the nose cone), and plotted my data on various graphs. While the experiments themselves were quite straightforward, the project helped me understand the aerodynamics of rockets at a fundamental level. It also taught me how the effect of drag changes when traveling at subsonic, sonic, and supersonic speeds.

Research Paper - Modeling Heat Flux of Rocket Engine

I presented a comparative study of heat flux modeling for our regentively-cooled liquid bipropellant rocket engine at the Canadian Combustion Institute Conference. This study was important for better understanding how much, and where heat is being produced within our engine. By having a better idea of our heat flux, we can more efficiently design our regentive cooling system. For this study we used Cantera software to model three correlations: Bartz, Sieder-Tate, and Dittus-Boetler.



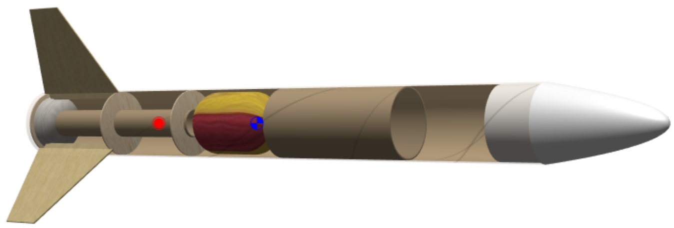
Whistler-Blackcomb Rocket - Thrust Structure and Fin Can



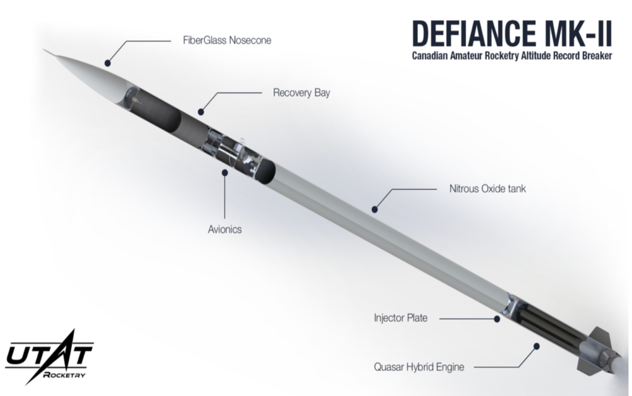
The thrust structure's purpose is to efficiently transfer the force produced by the engine to the rest of the rocket. It is usually one of, if not the largest internal structure because it withstands the largest forces. My design has gone through various iterations to account for wind forces, and changes to the engine design. Like for the recovery interface, I have used topology, and static simulations throughout the design process to optimize for the strength-to-weight ratio of the part.

Domino - L1/L2 Certification Rocket

I lead the design of the “Domino” rocket on the University of Toronto Aerospace Team. The purpose of this project was to create a rocket that was cheap, straightforward to build, and maximized reliability. In doing so, we made it seamless for new members to get their Tripoli L1 and L2 high power rocketry certification. As part of this process I also made my own L1-caliber rocket.



Defiance Mk. II - Airframe

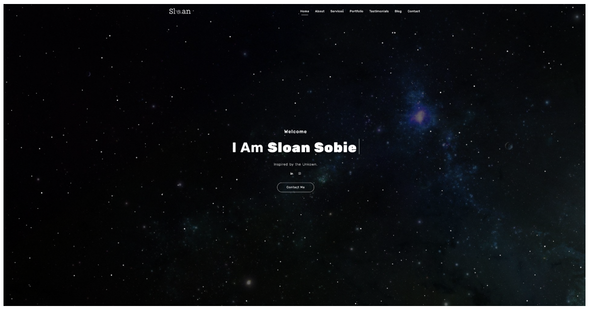


I helped build the airframe of the hybrid rocket “Defiance Mk. II” on the University of Toronto Aerospace Team. Some of my tasks included making CAD models of different parts of the airframe, finding new methods to manufacture composites, and performing shear, and tensile tests to maximize various structural properties of the composites. I worked on this project from when I started in grade 10 and finished in grade 12.

Google Big Query - Using ML To Predict Horse Racing

Google BigQuery is a serverless data warehouse that can analyze petabytes of data and generate machine learning algorithms through SQL requests. I wanted to learn more about the capabilities of cloud computing platforms and thought that learning how to use Google BigQuery would be a good place to start. Fundamentally, it taught me that when it comes to machine learning, an algorithm is only as good as the data that it uses. I was able to find a reasonably good dataset of over 200,000 data points to predict the outcome of horse races based on 33 different parameters. My program predicted the position a horse would finish in a race to a 65% accuracy.

Personal Website - sloansobie.com



I made my personal website sloansobie.com. While I could have just used a no-code tool, I wanted to learn more about web development through an actual project. Designing this site reinforced my pre-existing knowledge of HTML, CSS and Javascript, and taught me about some more complex Javascript and CSS libraries.

ERC 20 Token - Kepler Coin

A token based on the ethereum blockchain used for smart contracts. They are similar to bitcoin or other cryptocurrency in the sense that they are an infungible blockchain-based asset, except they are issued on the Ethereum network instead of their own blockchain. I created my own ERC 20 token called Kepler Coin as a way to learn more about the underlying technology behind cryptocurrency and other blockchain technologies. Kepler Coin can be viewed on the Ethereum ledger here