PORTFOLIO

NEEMISH TEJASWI

2023

About Me

I am passionate about utilizing technology to positively impact people's lives and strive to create meaningful experiences. My expertise lies in product engineering, with a strong background in mechanical and thermal systems design, manufacturing, computational simulations, and materials. I am dedicated to conceptualizing ideas and going all the way to realize them.

I have extensive experience in design and manufacturing, and excel at hands-on building, testing, and troubleshooting hardware. Throughout my career, I have worked with a range of teams, including tightly knit research teams, multi-disciplinary research and project teams, large teams with over 20 members, and global design teams spanning multiple time zones. My diverse engineering experiences and hands-on approach allow me to juggle multiple hats throughout the development cycle. Happiest in a fast paced, collaborative, and driven environment tackling complex problems.

Contact

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Breakfast of Champions

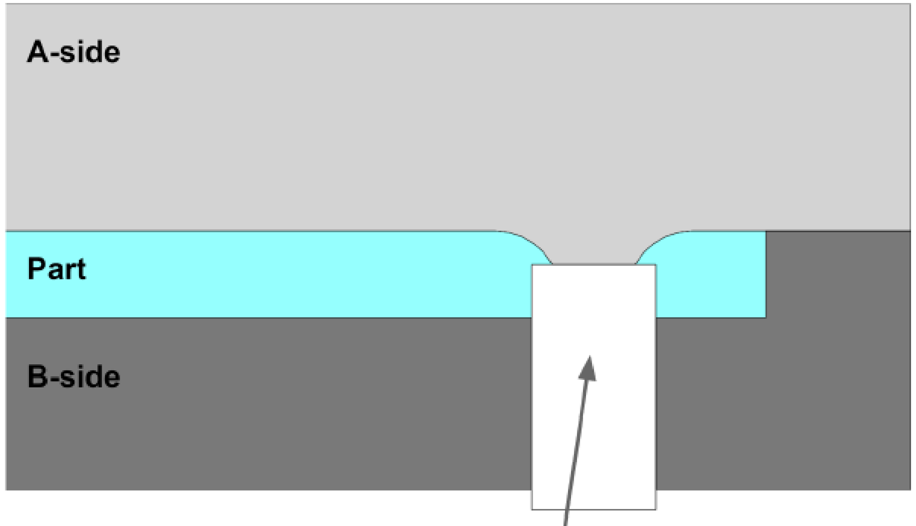
PROCESS: Injection Molding, CNC Machining, Vinyl Cutting

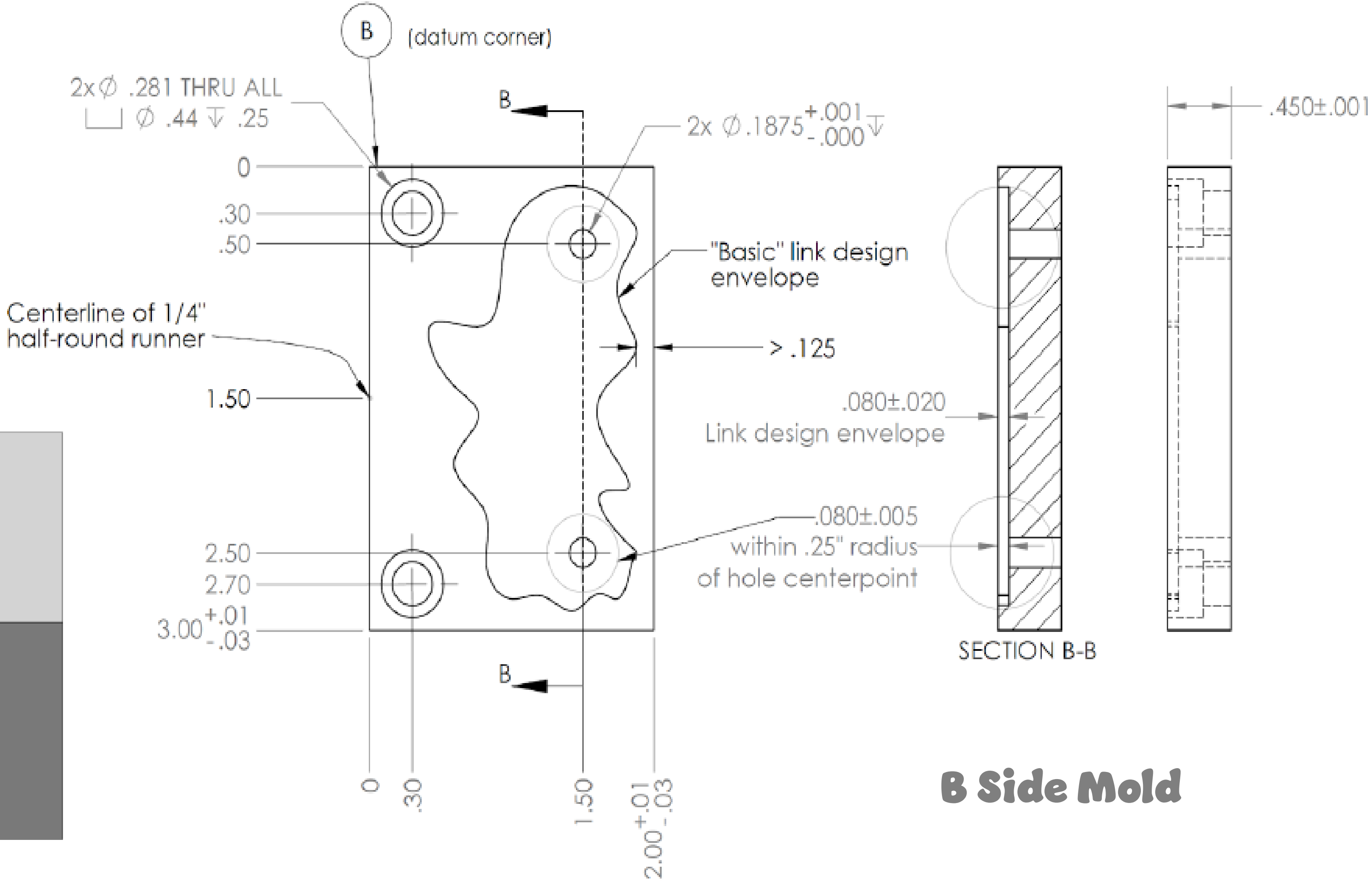
MATERIALS: Polypropylene, Aluminum, Sticker Vinyl

OVERVIEW

The goal of this project was to build up my familiarity and get more comfortable with injection molding by making some polypropylene parts.

I was tasked to design a part that would fit inside the envelope described on the right.





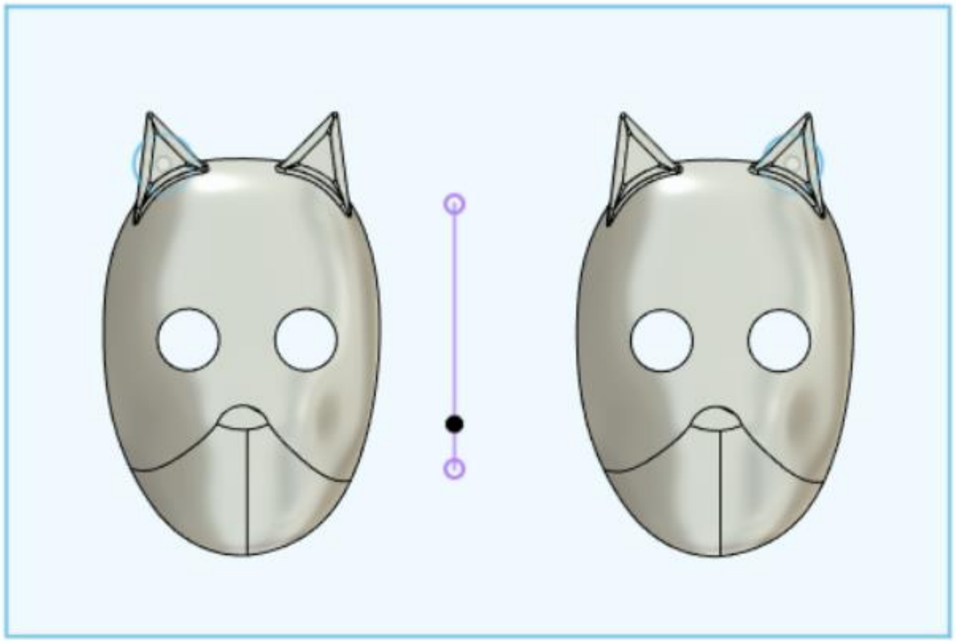
B Side Mold

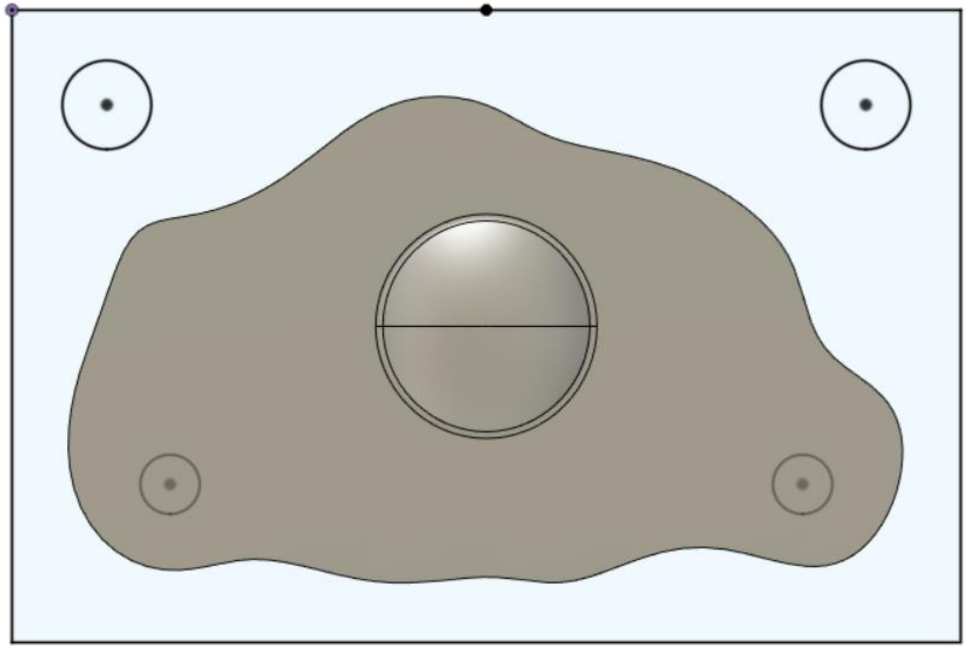
For this project, I created my B side mold that would mate with a standard A side mold in the machine.

DESIGN IDEATION

Breakfast of Champions

After some quick napkin sketches, I quickly converged towards a cat and a fried egg. I decided to CAD both designs to see how the end results might look like given that my sketches were both low resolution and fidelity.





I generally, struggled with contextualizing my cat face in the mini-mold as the aspect ratio of the mold and part envelope did not make a lot of sense. I tried playing around with having two faces in a mini-mold with ejector-pin-holes through the ears, but the vision never really came together.

My next design was fired egg, one of my favorite breakfast food (at least when I have the time to eat it). I felt the design was more suitable for the project given the 2D-ish nature of a fired egg. I also felt it had the right amount of surface modeling involved for the scope of this project as opposed to my cat face. I decided to prototype it next.

PROTOTYPING

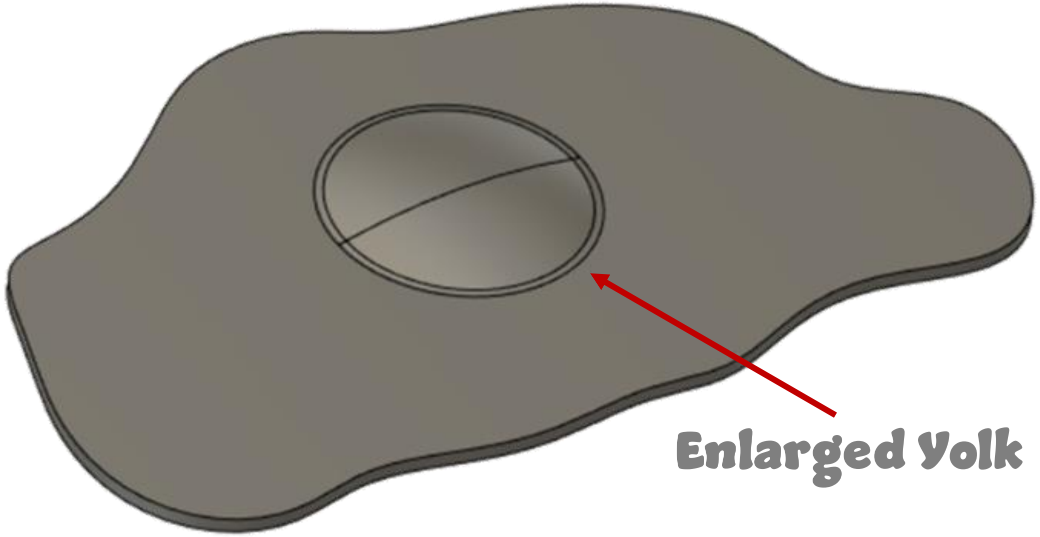
Breakfast of Champions

For prototyping, I chose 3D printing as my main tool. It allowed me to quickly make a realistic looking prototype of my to be injection molded part.

3D Printed Egg

I felt the cost to results trade off for 3D printing really made it worth for my part. My print took about 15 mins, had high fidelity and low resolution. This exercise allowed me visualize my part and I could identify potential design changes.

Based on my printed part, I decided that I needed to make my egg yolk bigger. While modeling it in CAD I felt that it was adequate, the use of guided lofts to make it the perfect shape made the yolk appear a little bit smaller that desired.



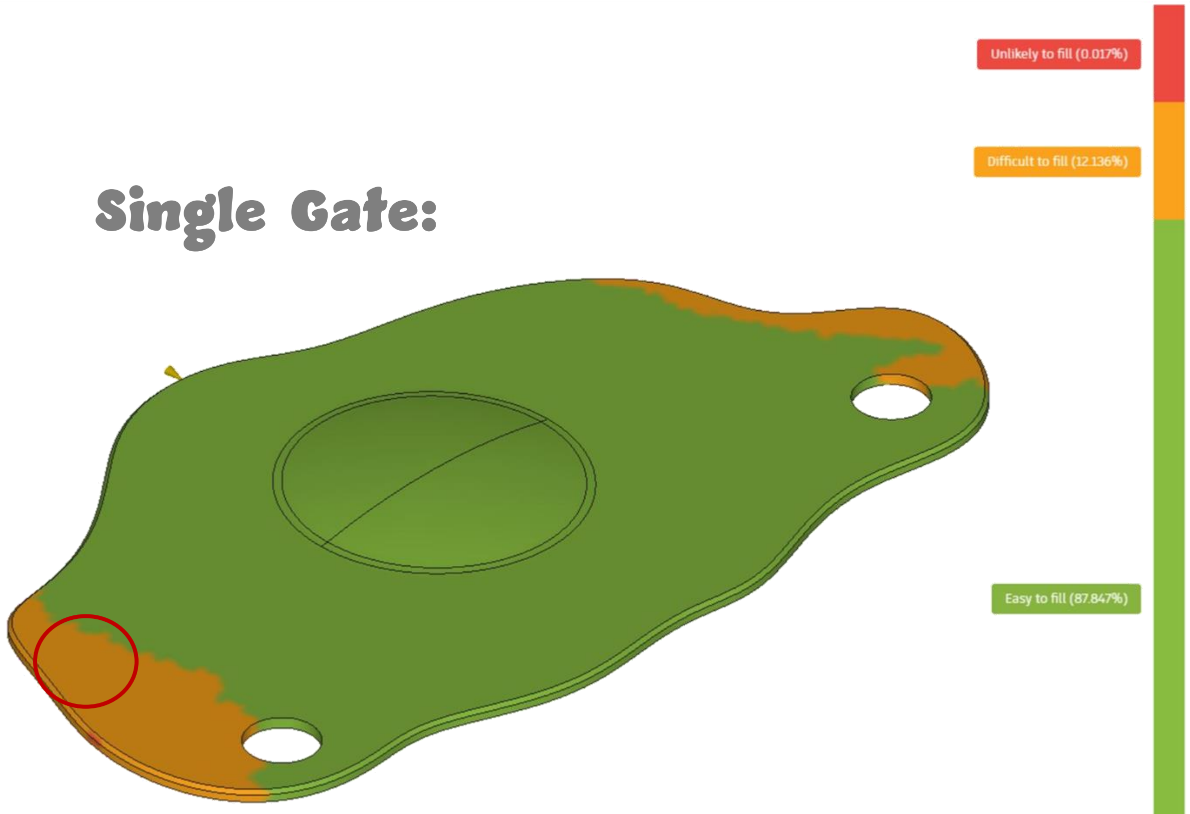
Once I was satisfied with the design and form of egg, I then turned to simulations to get injection molding insights about my part. So, I set up a study in Fusion 360.

SIMULATION

Breakfast of Champions

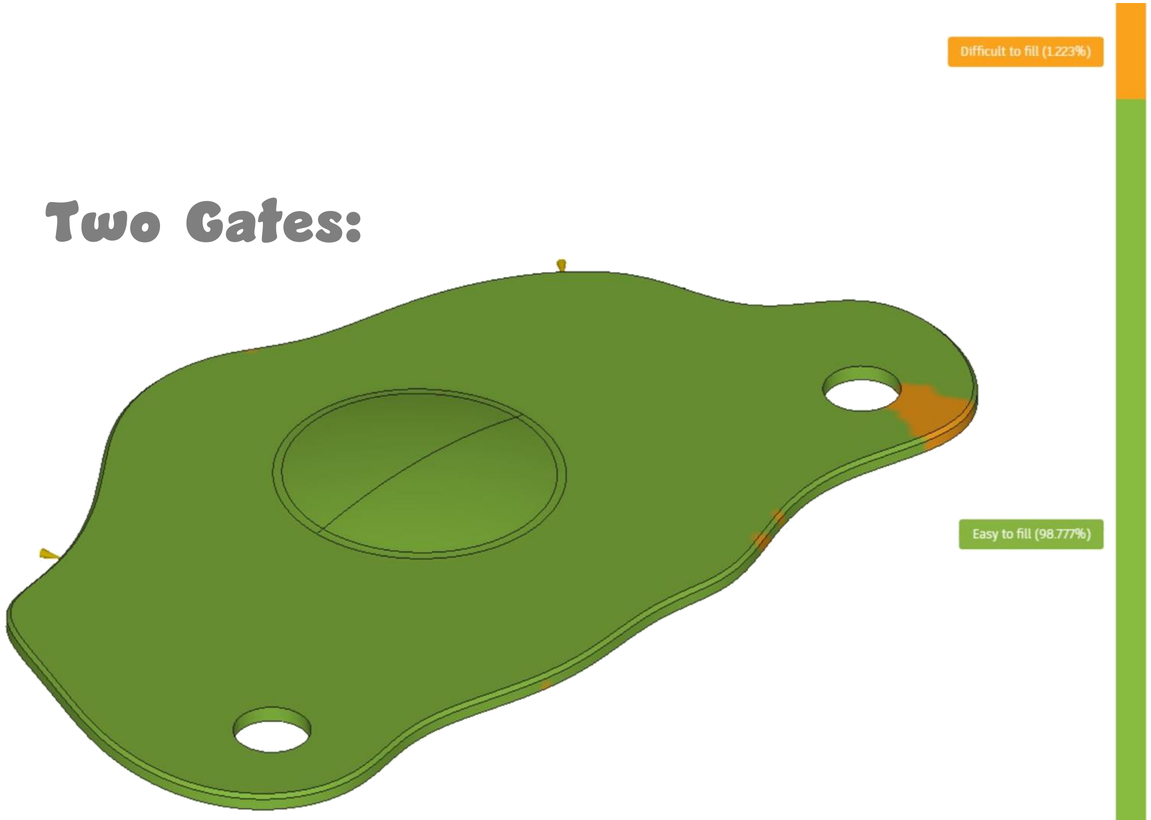
Typically, an injection molding study is comprehensive with lot different considerations involved in it. However, for this simple mini-mold project my main considerations were part gating, visualizing the fill and identifying defects like knit lines

Single Gate:



I started out by placing a single gate right down the middle. However, my simulations predicted a tiny impossible to fill region along with a large difficult to fill region.

Two Gates:



I added another gate along the edges and moved them around a couple of times to find the optimal positioning shown above with no impossible to fill regions and a tiny difficult to fill region.

SIMULATION

Breakfast of Champions

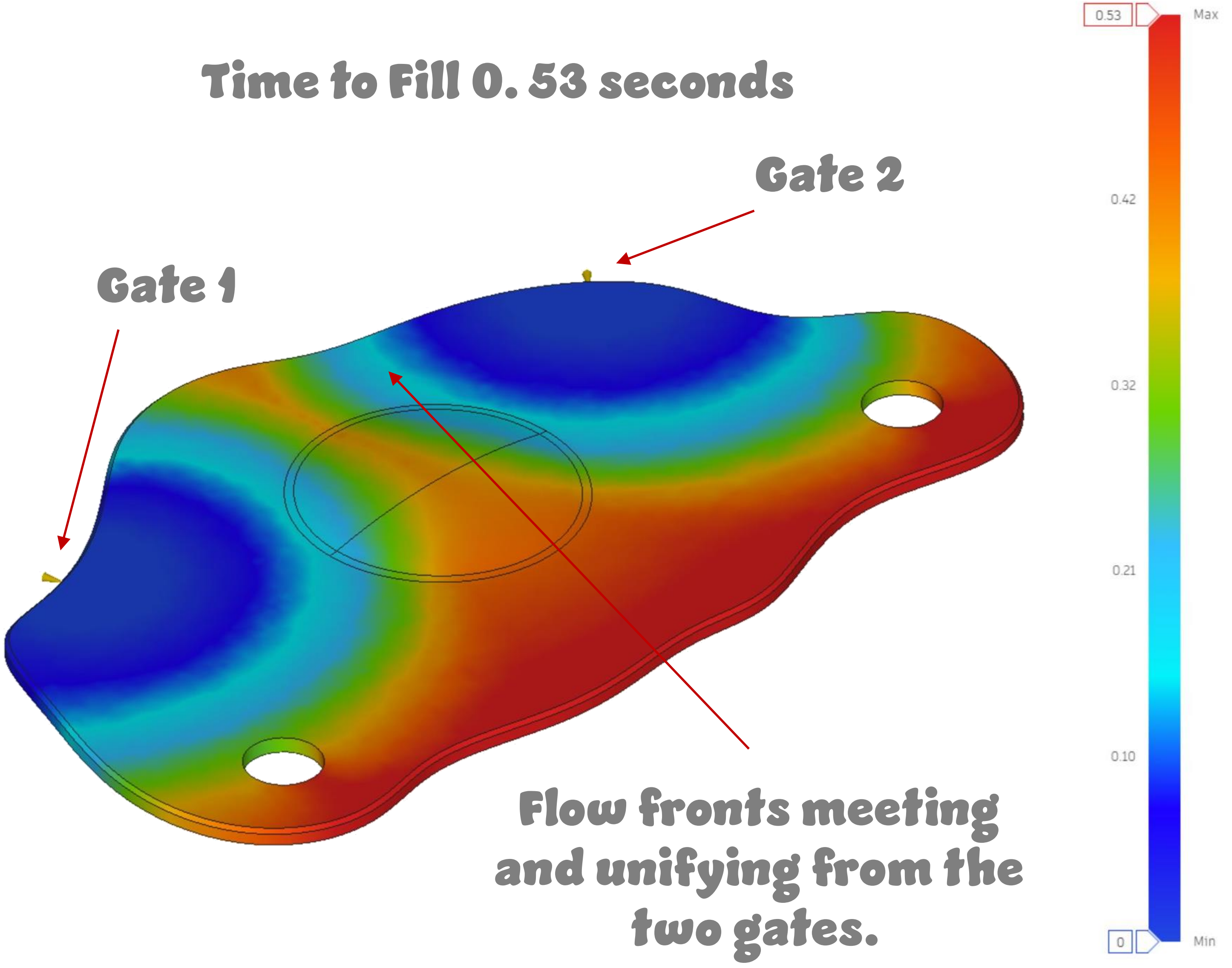
I looked at the fill animation generated by Fusion 360 study to visualize my mold filling.

This helped me set some expectations of what to expect once I would have machined my mold and done some short shots at the Arburg machine.

Lastly, I looked at possible defects that might arise in my part. Given, that I was using two gates to fill my mold I was naturally concerned about a big weld line in the middle where the flow front from the two gates would meet. I also expected small knit lines near the hole in my part as they to flow front separation locally.

I looked at defect predictions made by Fusion next.

Time to Fill 0. 53 seconds

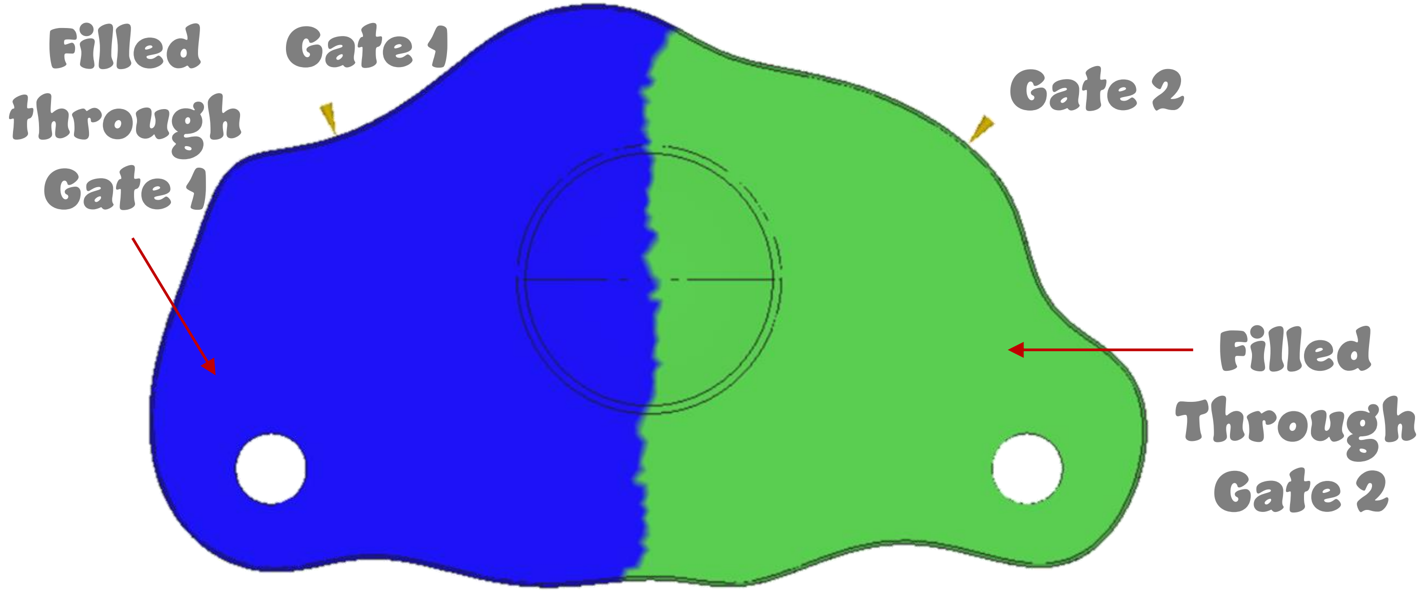


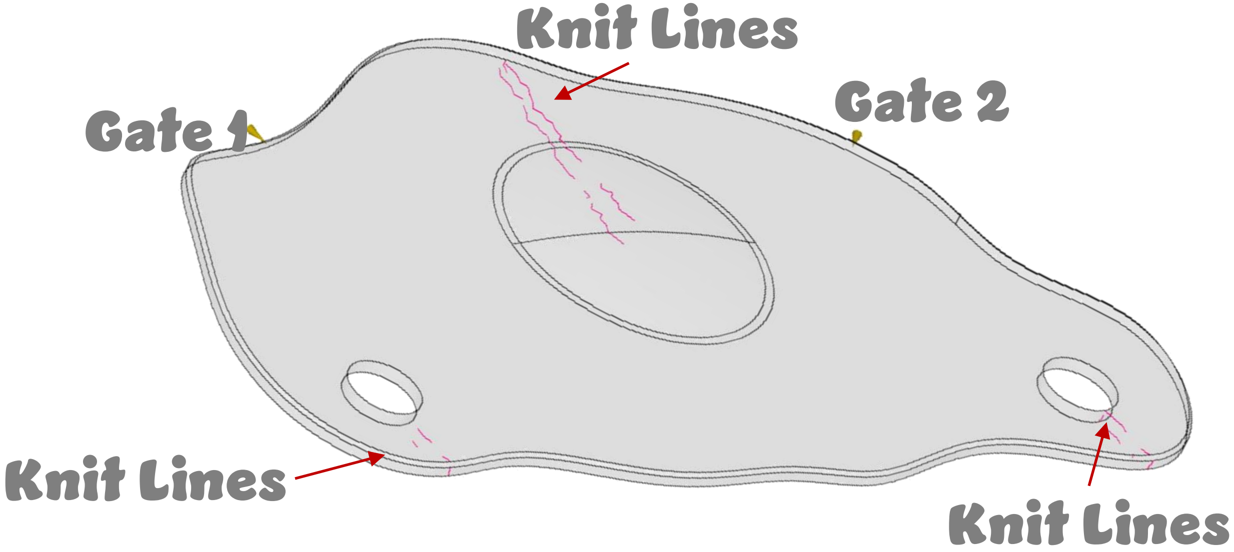
SIMULATION

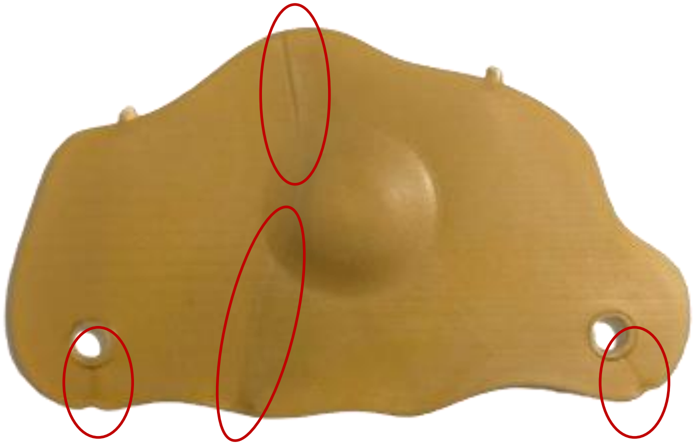
Breakfast of Champions

As expected, Fusion predicted a large knit line where the two flow fronts met and small knit lines around features like holes.

In addition to the flow fronts meeting these knit lines were a function of the part thickness and resulting cooling of material as the mold fills. The part most of my fried egg was about 0.050” thick which played into it.



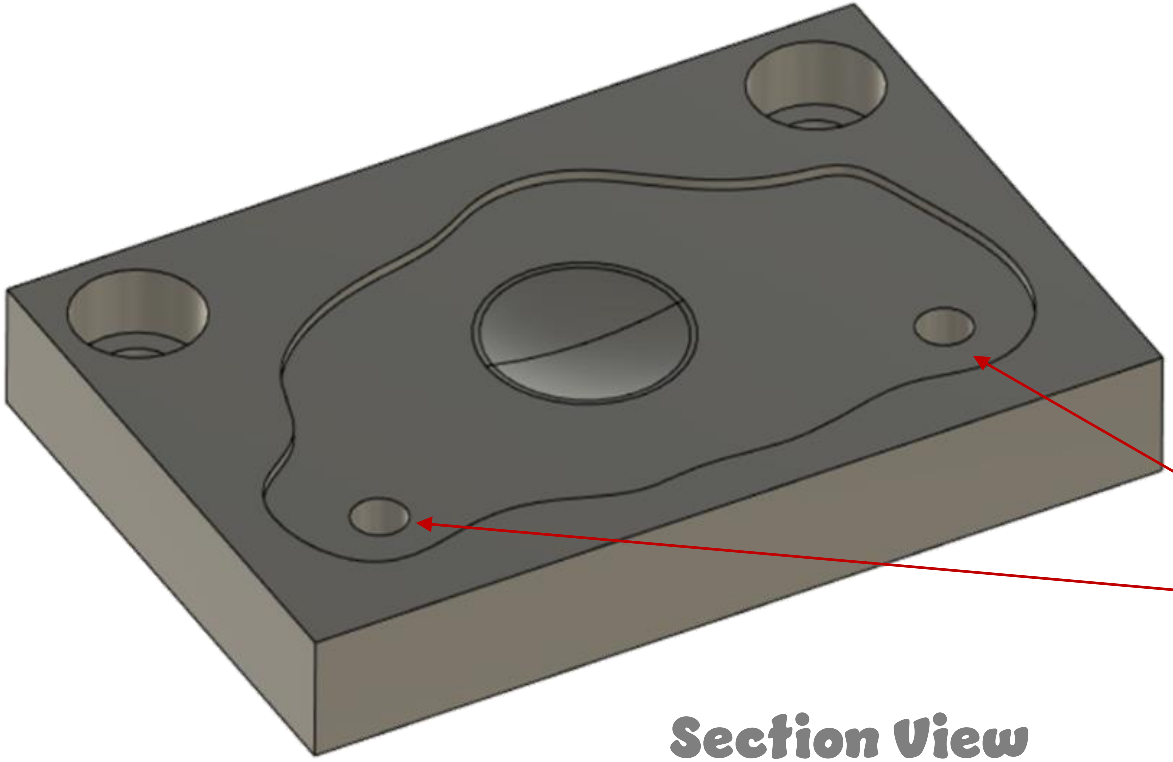




Knit lines tend to show up more in metallic colors. Luckily, for me my ideal part was white, and I did not have to worry about this too much.

MOLD DESIGN

Breakfast of Champions

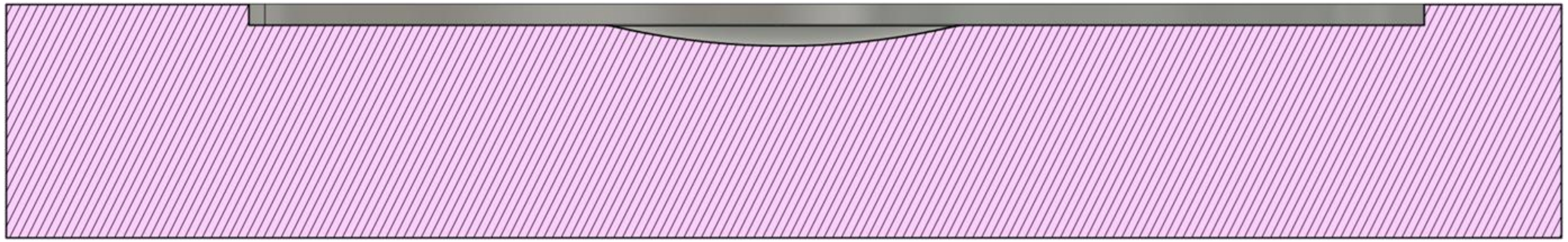


With all these considerations I went on to create a CAD model of my mold which would be made from square aluminum stock.

The mold apart from being a negative of my part had two counter bores for ¼ - 20 TPI socket head screws and holes for ejector pins that together with A side would form the hole in my part.

Through holes where ejectors pins would sit flush with the mold.

Section View



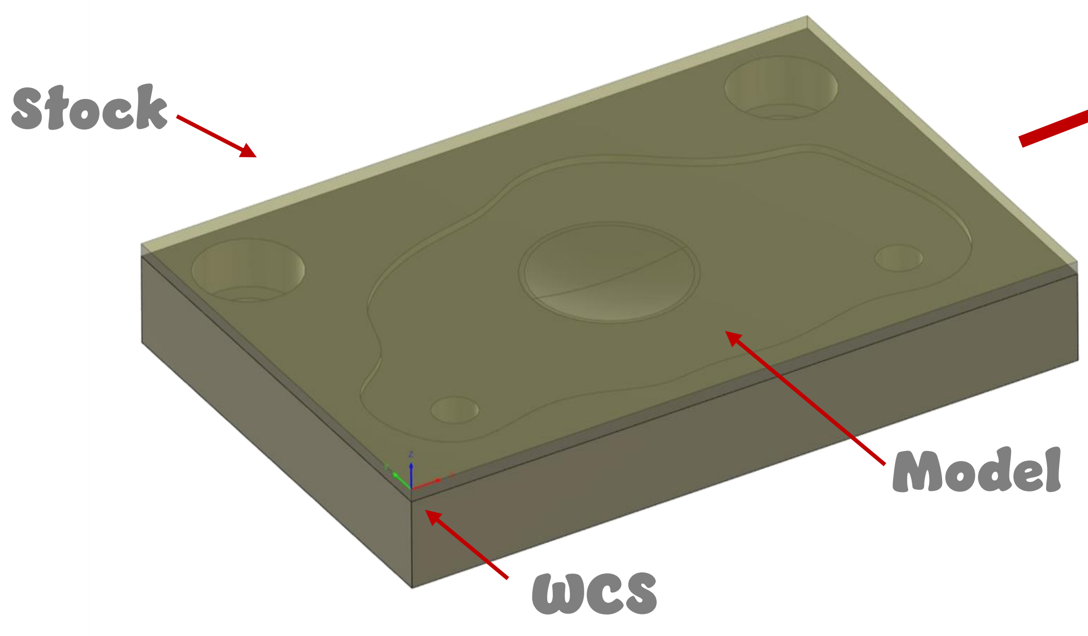
For this project, I was designing only the B-side of the mold that would mate with a standard already in-place A side mold.

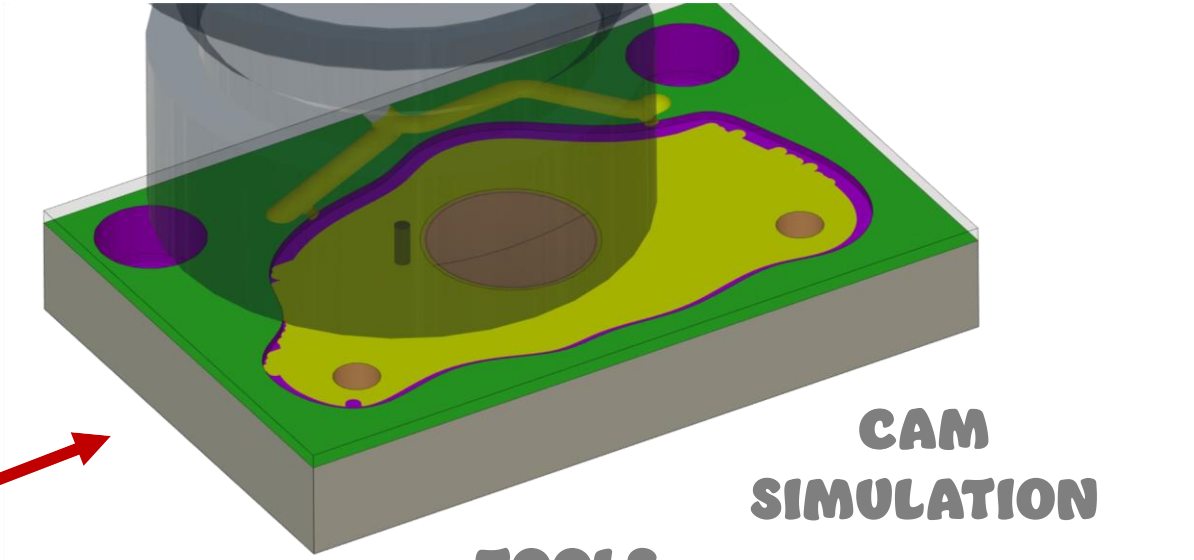
MOLD MACHINING

Breakfast of Champions

With my design locked the next step was make the mold. The mold was machined from aluminum stock on a Hass VF2 CNC.

The work setup was standard and straightforward as the stock was already squared and all the machining was going to happen on the inside. I set up my operations in Fusion 360 to generate tool paths and G code.





CAM SIMULATION

TOOLS

1. 2” FACE MILL
2. #2 SPOT DRILL
3. 3/16 TWIST DRILL
4. 1/8 BALL END MILL
5. 1/16 BALL END MILL
6. ¼ FLAT END MILL
7. 1/16 FLAT END MILL

CNC MACHINING

Breakfast of Champions

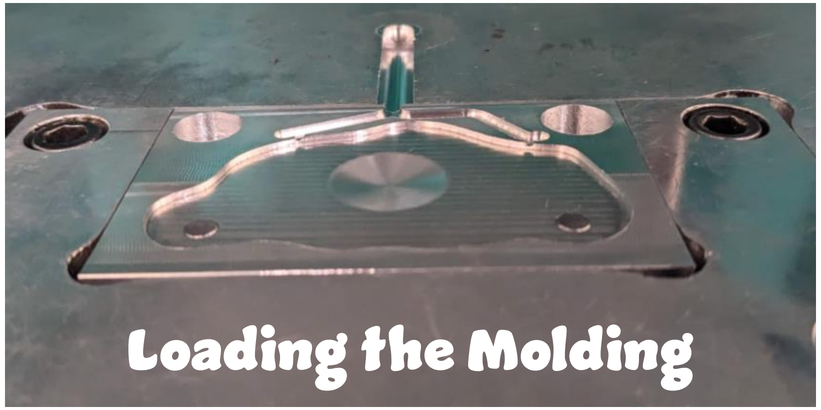
1 Hour 5mins
11 Operations

INJECTION MOLDING

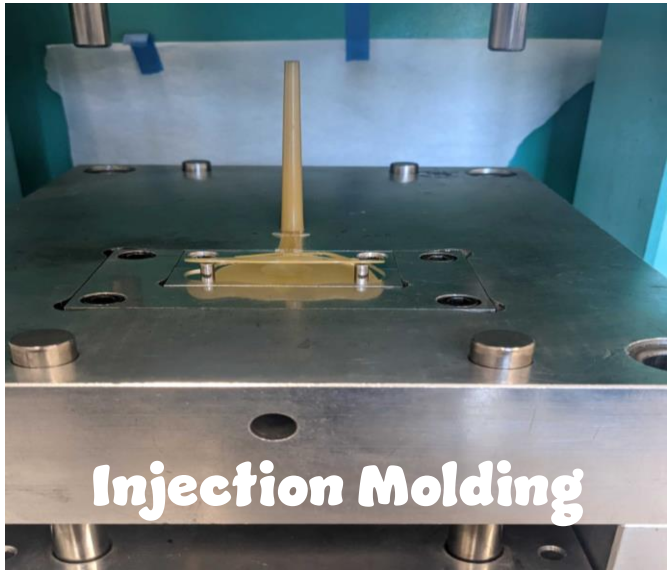
Breakfast of Champions

I started out by learning how to navigate the Arburg control and how to create my first program on the machine followed by process tuning to churn put successful parts.

Arburg Control



Loading the Molding



Injection Molding

Process Tuning Flow:

Started with an estimated volume and recommended parameters for PP

→ Increased Volume till the mold would fill.

→ Created a two stage switch over & played w/ injection rates.

→ Fined tuned volume for both stages till the part came out without any flash.

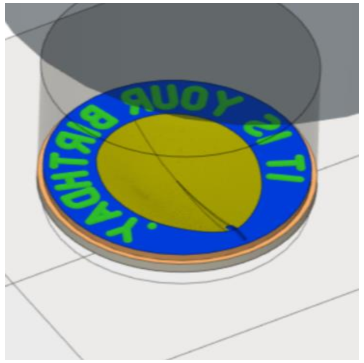
RESULTS

Birthday Tags

PROCESS: Injection Molding, CNC Machining

MATERIALS: Polypropylene, Aluminum

CAD



CAM

Machined Insert

Molded Part

CNC Machining

Injection Molding

Stacked Parts

I designed and machined my own Aluminum mold inserts to create injection molded tags that I can hand out to my friends and family on their birthdays. The tags can be stacked together and carry the perfect birthday message for everyone, a statement of fact that is. I molded the tags on a single shot vertical injection molding machine out of polypropylene in different colors.

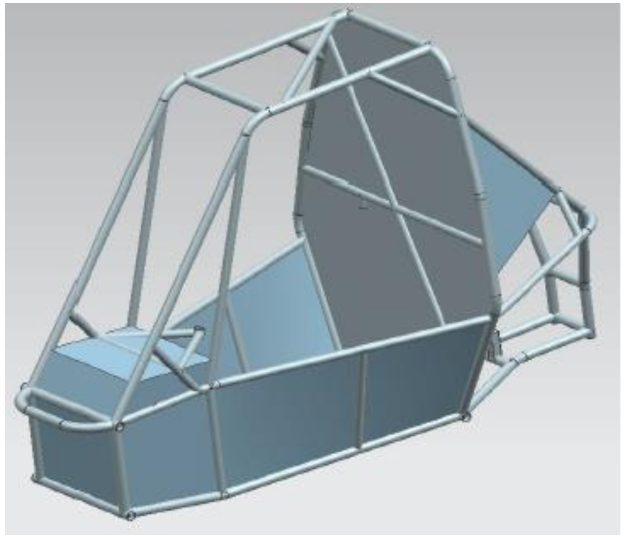
Baja SAE

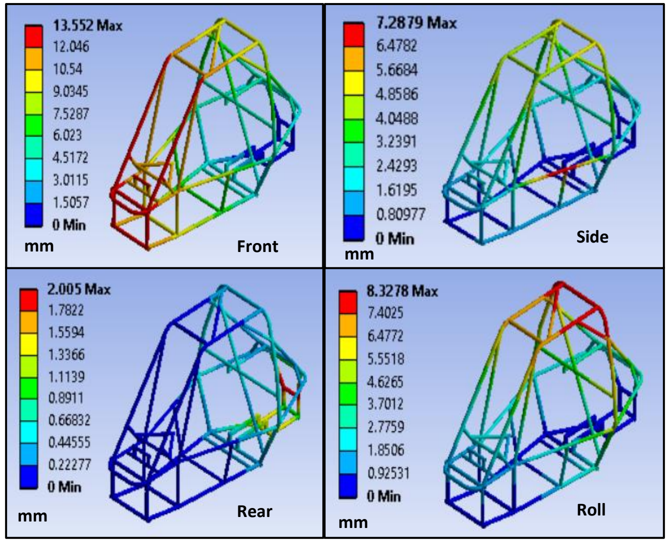
I designed, built and raced off-road race vehicles for over two years to take part in Baja SAE, an inter collegiate design series competition.

During my time with the team, I worked on finite element analysis, CAD modelling, ideating and evaluating new designs, generating concepts for DfM, data acquisition in addition to being a chassis welder for the team.

Baja SAE

As the lead frame designer, I owned all aspects related to structural performance, material selection, tubing & sizing. I carried out static and modal analysis of the frame and explored analysis techniques like Explicit dynamics for structural design.





CAE Team
Structural Performance

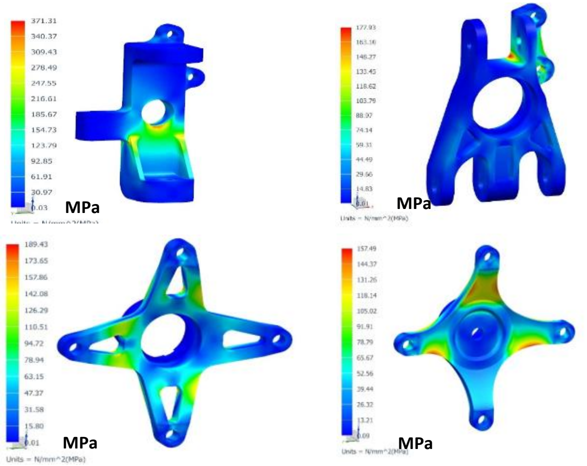
Design Integration Team
Subsystem Mounting

- Positioning of key bracing members
- Design trade offs between Performance, Clearances, and Mounting decisions
- Sizing for Primary and Secondary Tubing
- Incorporate Mountings into Structural Members

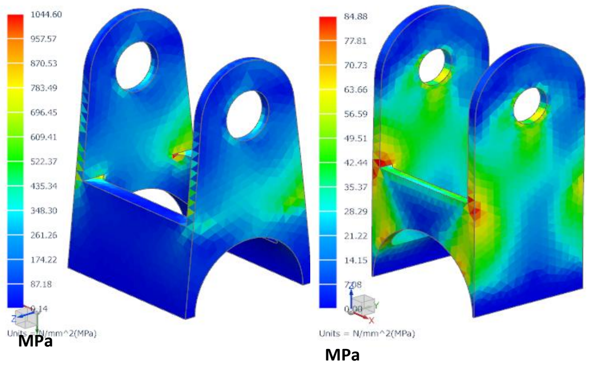
Material	AISI 4130
Tube OD	29.2mm / 25.4mm
Tube Thickness	1.65mm / 1mm
Primary Flexure	2787.6 Nm^2

Baja SAE

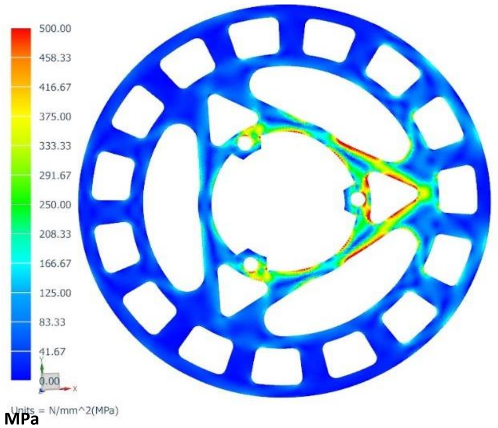
I carried out structural analysis for different wheel assembly components, developed design concepts, assisted in full vehicle assembly and worked on introducing a data acquisition initiative which was our first foray as a team to gain insights via sensors.



Upright and Hubs

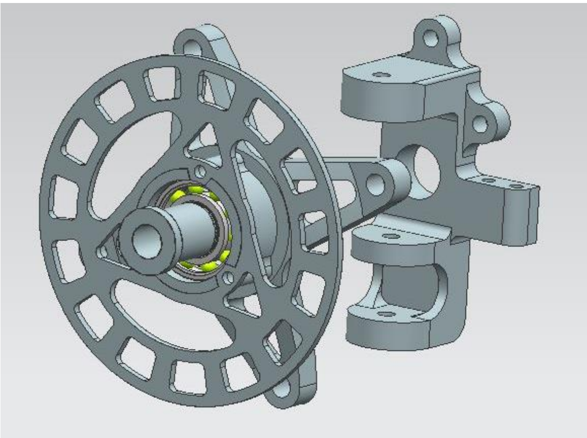


Control Arm and Suspension Mounts

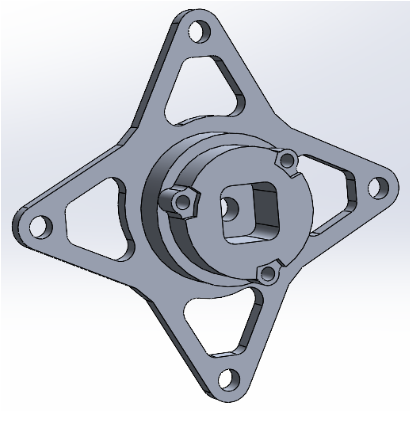


Brake Rotor

Front Upright Joint

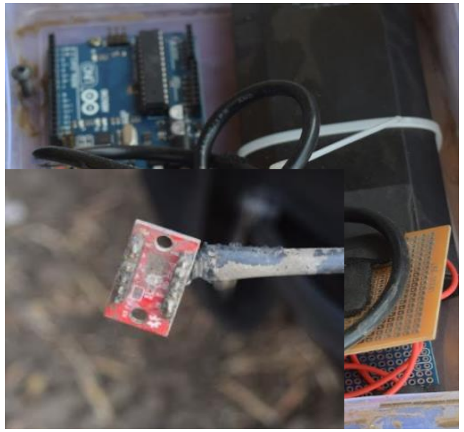


Front Wheel Assembly



DFM Concept

Testing



Data Acquisition

Baja SAE

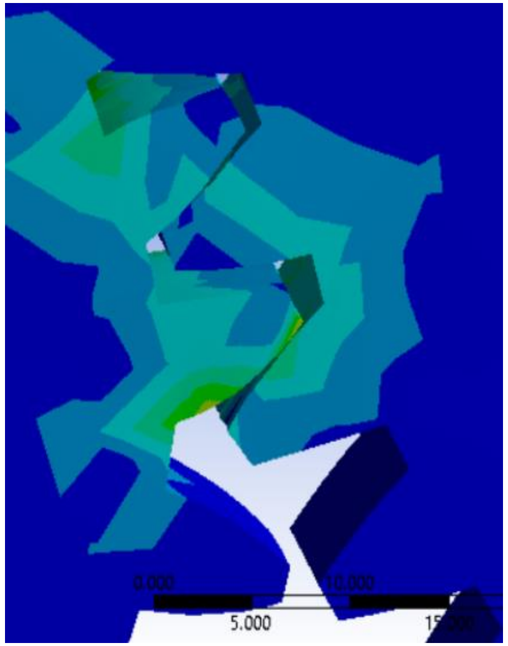
During the manufacturing phase of the vehicle, I was a chassis welder for the team where I utilized TIG with ER 70S2 as the filler material to weld AISI 4130 chromoly with a 2% Thorium Tungsten electrode under DCEN configuration.

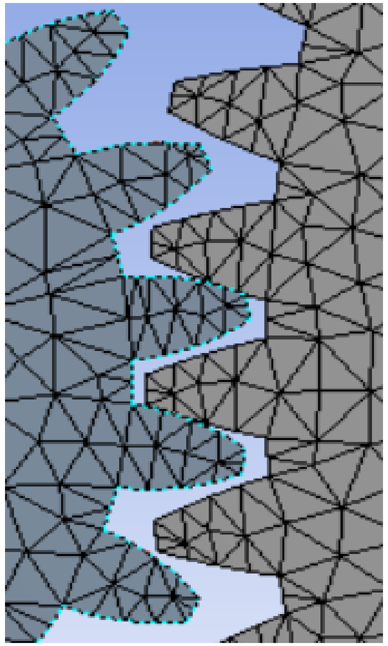
Apart from being a chassis welder for the team, I worked on finishing the chassis and control arms via air gun spraying. I took lead on installing bearings and wheel sub assemblies, I made fixtures for welding and notched tubes to prep for welding.

Baja SAE

I carried out the kinematic design for a two-stage constant transmission ratio compound gearbox with an overall targeted reduction of 9.35.

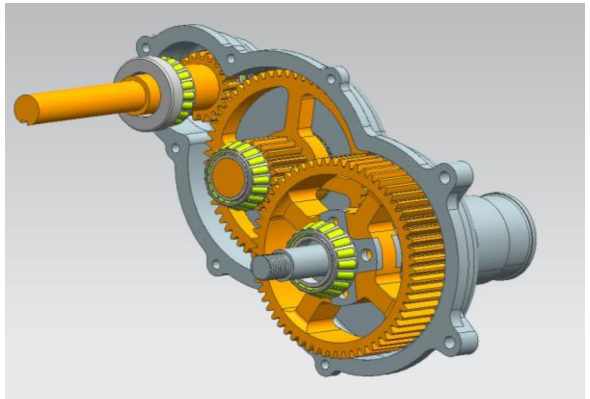
Overall Ratio	9.35
kW	7.5
Stages	2
Reduction per Stage	3.058
Input RPM	8372
Output RPM	881
Zg	74
Zp	24





I also performed FEA (static and dynamic) on the gears, shaft and carried out hand calculations for verification.

For gear, the hand calculations were carried out based on the Lewis bending strength of the gear teeth.



10 HP 3600 RPM B&S Engine → CVT Belt Drive → Constant Ratio Gear Box → Drive and Half Shafts → Wheels

Powertrain Architecture

Baja SAE

Leadership, Collaborative Culture, and Inclusion are important to me as person, and I strived to create a good working environment for my team and lead by example whenever possible.

People Led in CAE Team

People Led in DAQ Team

Managed people in Welding Group

2019 TEAM

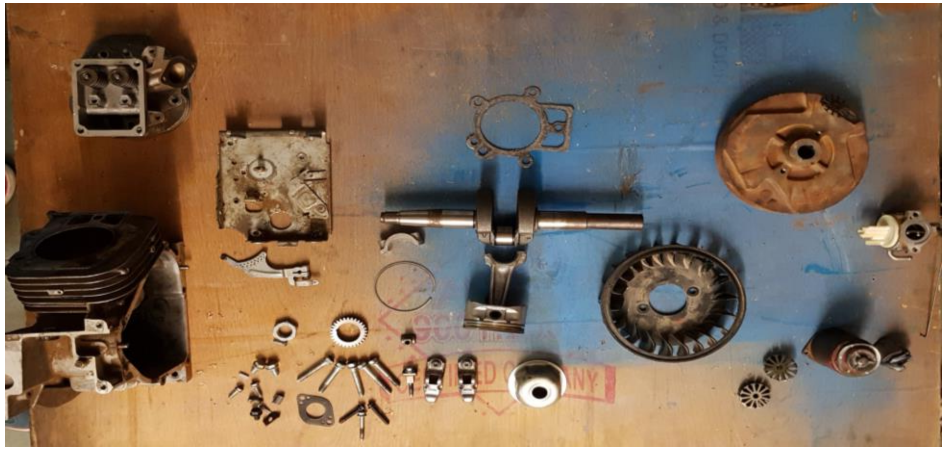
Cross-functional Collaborators

Main Collaborators

Established a data acquisition team, which went on to become a standalone sub team in the future.

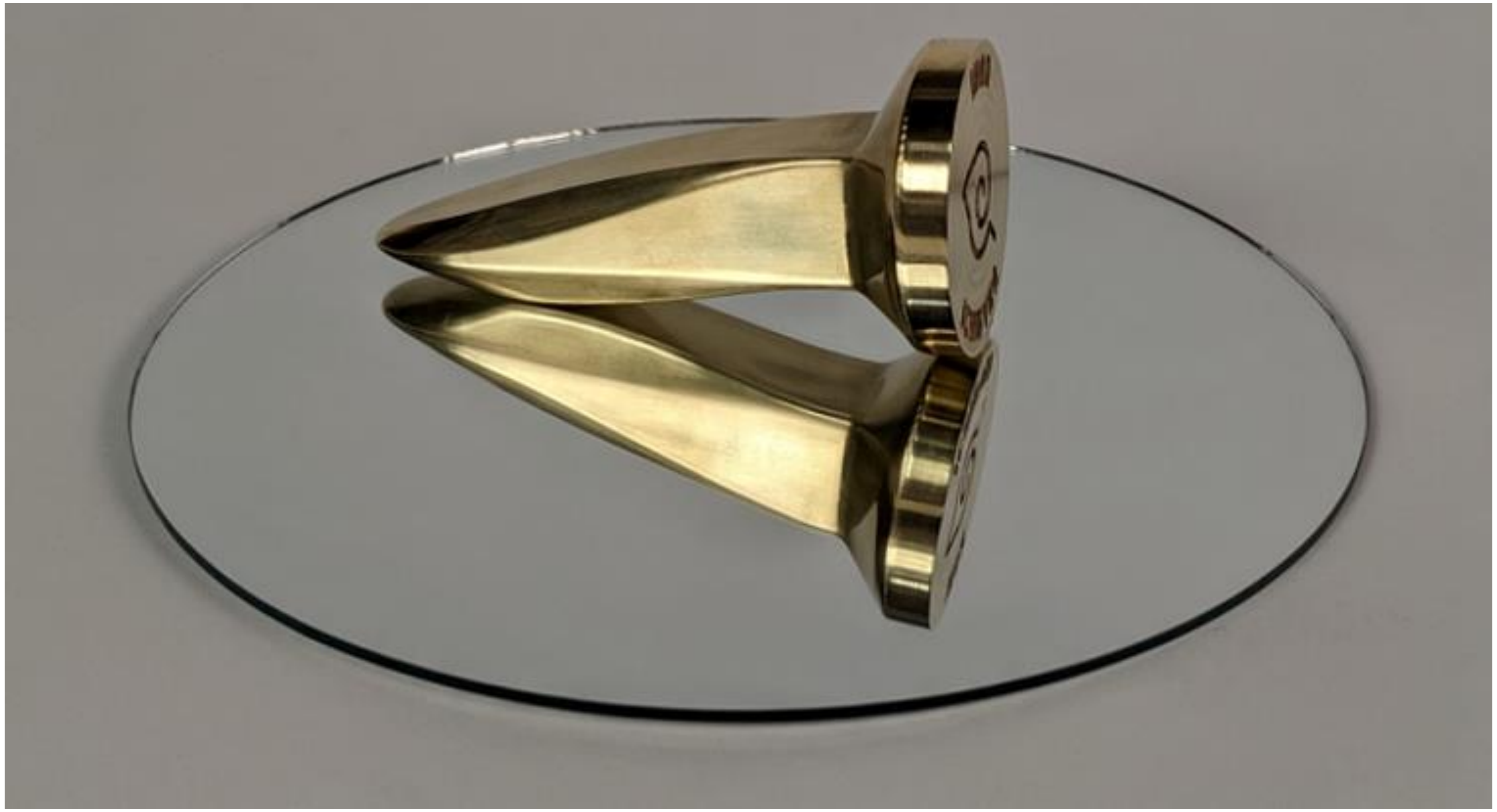
Gave an overview of what we do and how we design, workspace tour to all new team members; familiarize them with the vehicle and different subsystems.

Spearheaded the efforts to organize an intro-meet with a goal to attract diverse people. Over 100 people expressed intent to join the team in the next year.



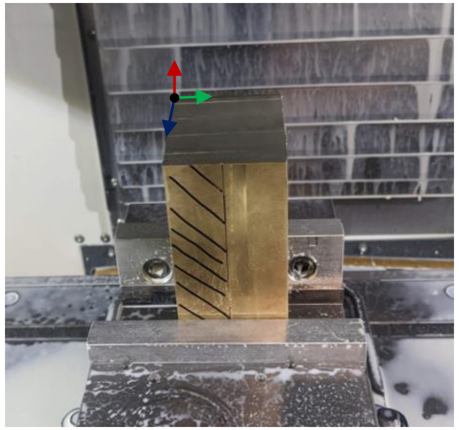
Convinced few teammates to come together and teardown an old engine instead of enjoying a day off

FW31

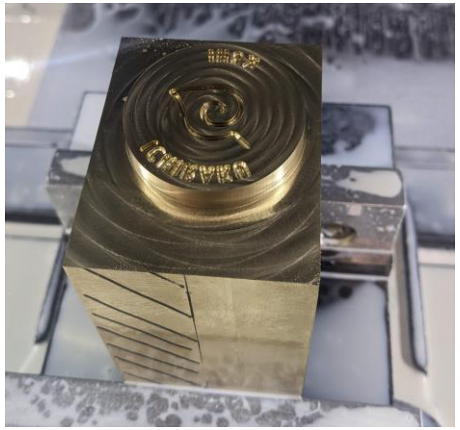


Formula One Inspired Espresso Tamper

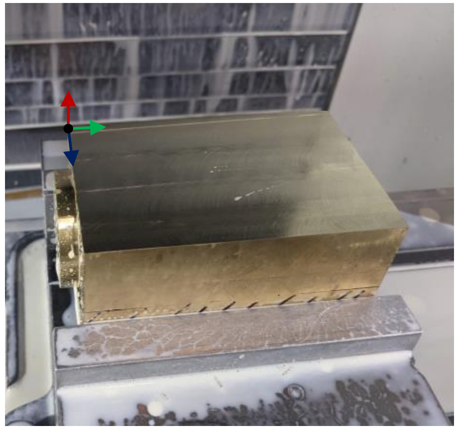
FW31



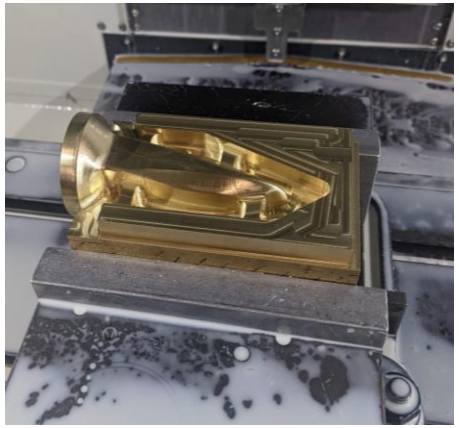
Initial Setup



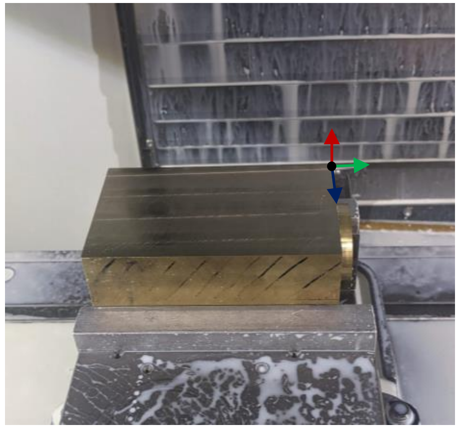
Result: First Operation



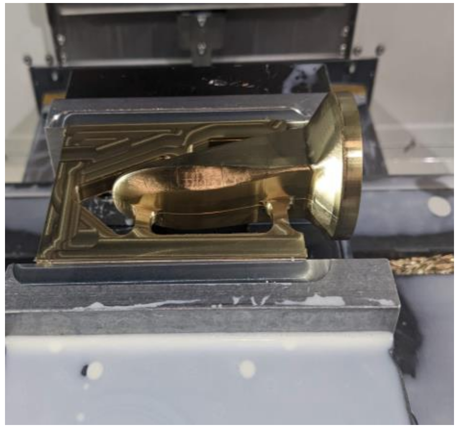
First Part Flip



Result: Second Operation



Second Part Flip



Result: Third Operation

FW31 was machined on a Haas VF2 CNC mill and then finished by hand. The part is made from free machining brass(C360) and work holding was accomplished using tabs.

The main design is inspired by the nose of the Formula One car FW31. The bottom has engravings that convey my love and passion for coffee.

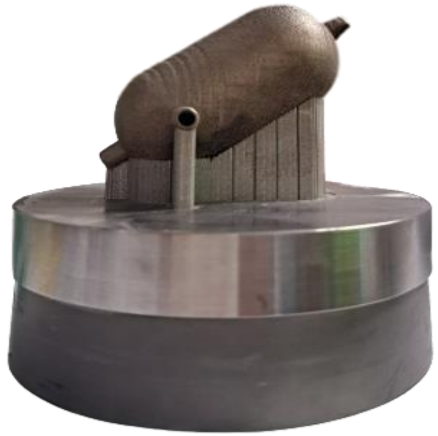
HooXi

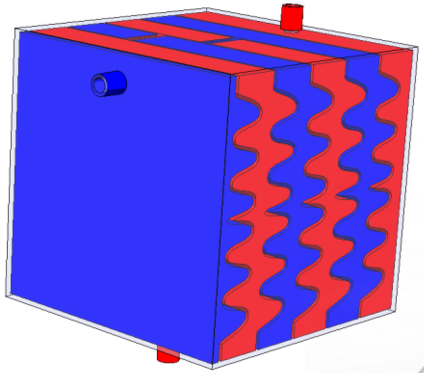
HooXi is a topologically optimized bottle opener made for my class ME 349.

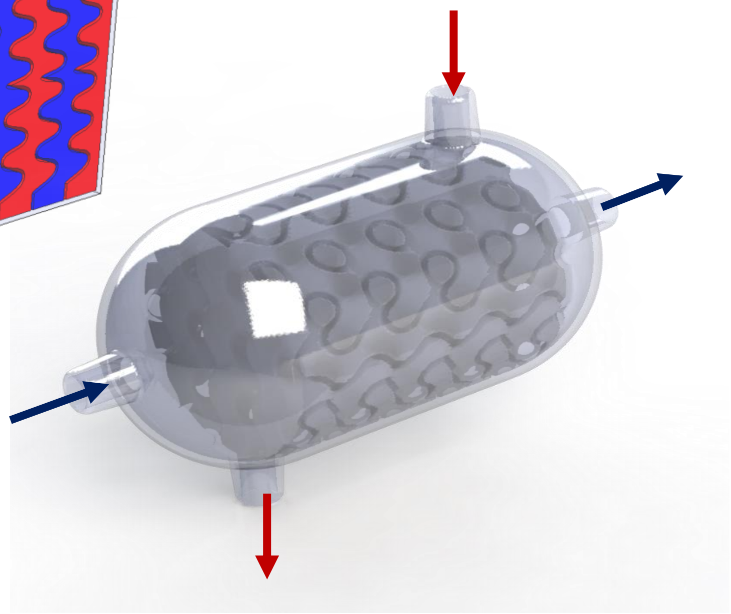
The design was optimized using Fusion 360, the results were further verified using Ansys by creating a FEA study in addition to hand calculations. The opener was realized using SLA and tested successfully on multiple bottles and demonstrated to the whole class.

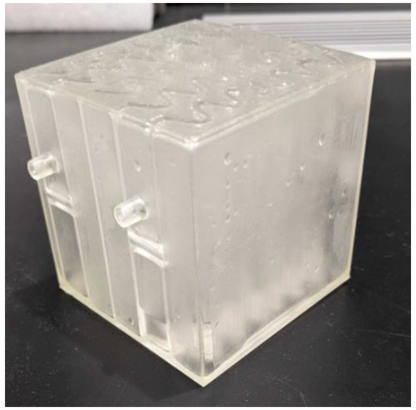
It was judged as the best opener in the class by the teaching team.

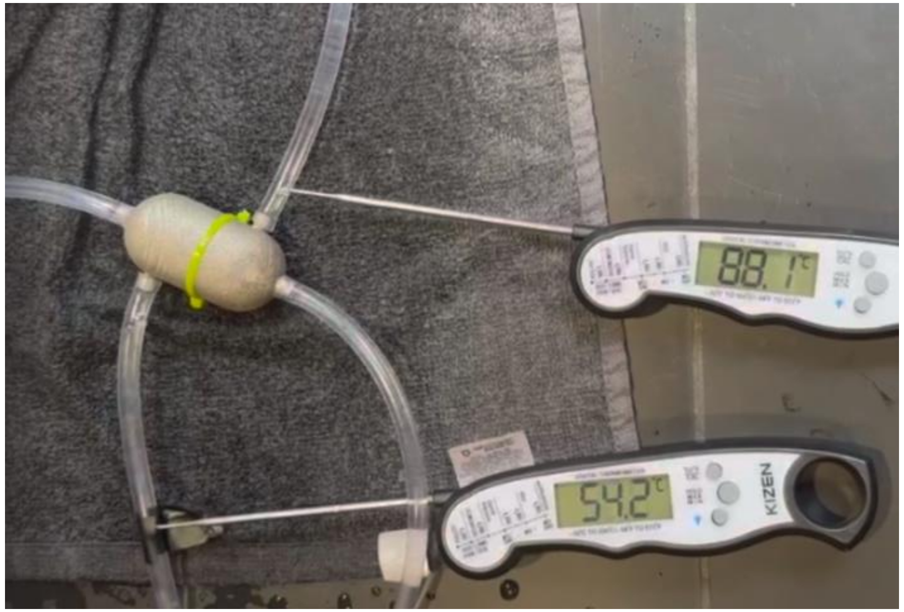
Metal Additive Heat Exchanger



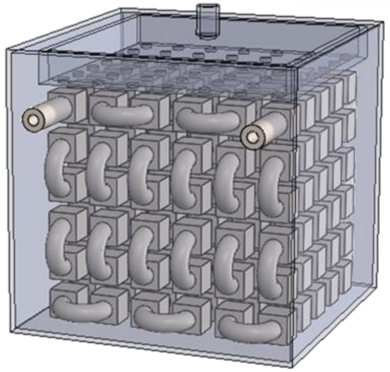








Length Scale ~60 mm



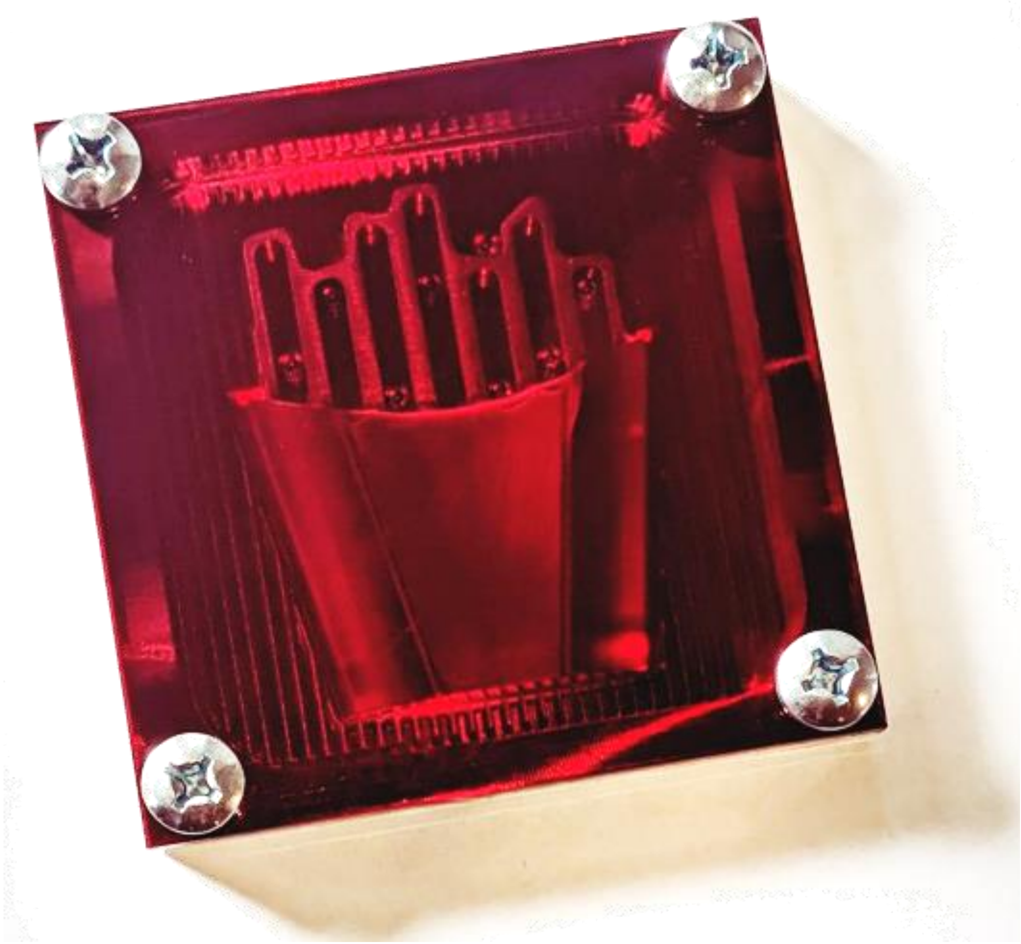
The goal was to design a compact heat exchanger that could achieve a temperature drop of 20 deg-C without leaking. Created a TPMS based gyroid lattice design which provided additional surface area along with maximizing the AM advantage.

PROCESS: LPBF (Laser Powder Bed Fusion) **MATERIAL:** SS316L

Frites Rouges

MATERIALS: Aluminum 6061 , Acrylic

PROCESSES: CNC Machining, Laser Cutting, 3D Printing (FFF), Assembly



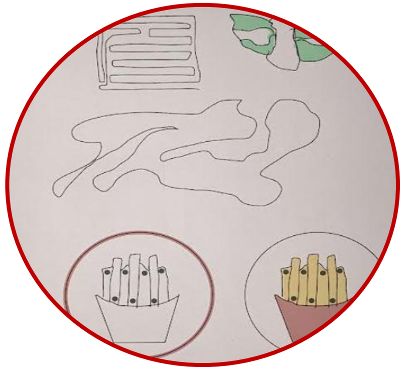
Frites Rouges is my manifestation of a surrealistic maze. The maze is a box of french fries inside with several marbles embedded throughout. This design breaks the notion of "what's a maze" in different ways. The steel marbles inside the slots of the fries are "trapped" as there is no way to get them out and it's not possible to get the satisfaction of completing a maze. The steel marble on the outside periphery can be moved around but there is no well-defined start or end point in the maze which again peals away the satisfaction of successfully finishing something like a maze. However, it makes for an interesting desk toy.

The design process involved leaning heavily on lateral thinking for ideation, Fusion for CAM to generate toolpaths for adaptive clearing, pocketing, tapping, scalloping, and finishing operations before machining the part on a Haas VF2. Hand sanding was done to accentuate some surfaces before assembling the maze with steel marbles what are held in place by a red acrylic lid which was laser cut from an acrylic sheet. The assembly is held together by ¼-20 UNC screws.

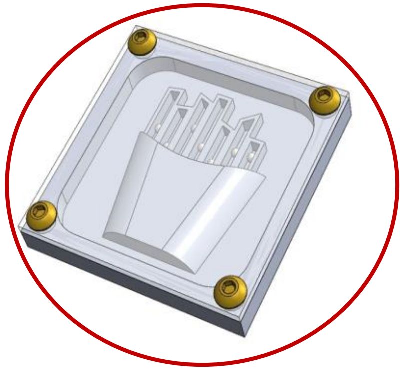
Frites Rouges

MATERIALS: Aluminum 6061 , Acrylic

PROCESSES: CNC Machining, Laser Cutting, 3D Printing (FFF), Assembly

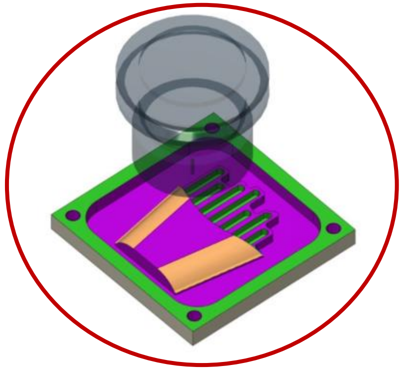


Ideation



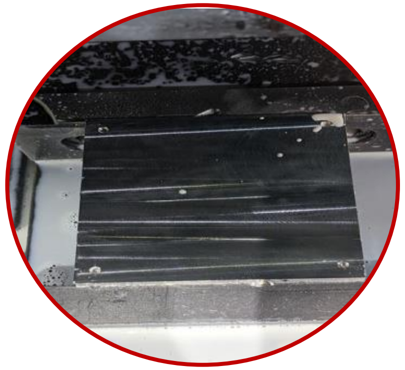
CAD

Prototyping



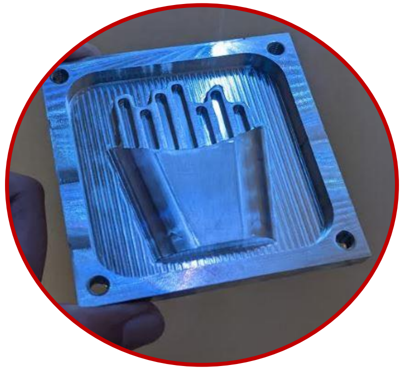
CAM

Tooling

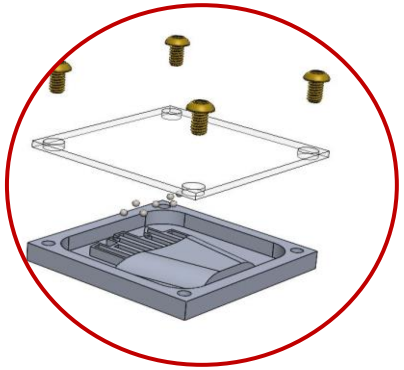


Work holding

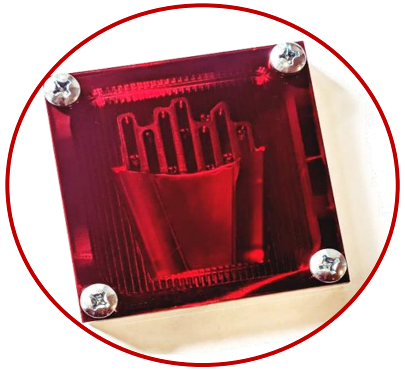
Machining



Finishing



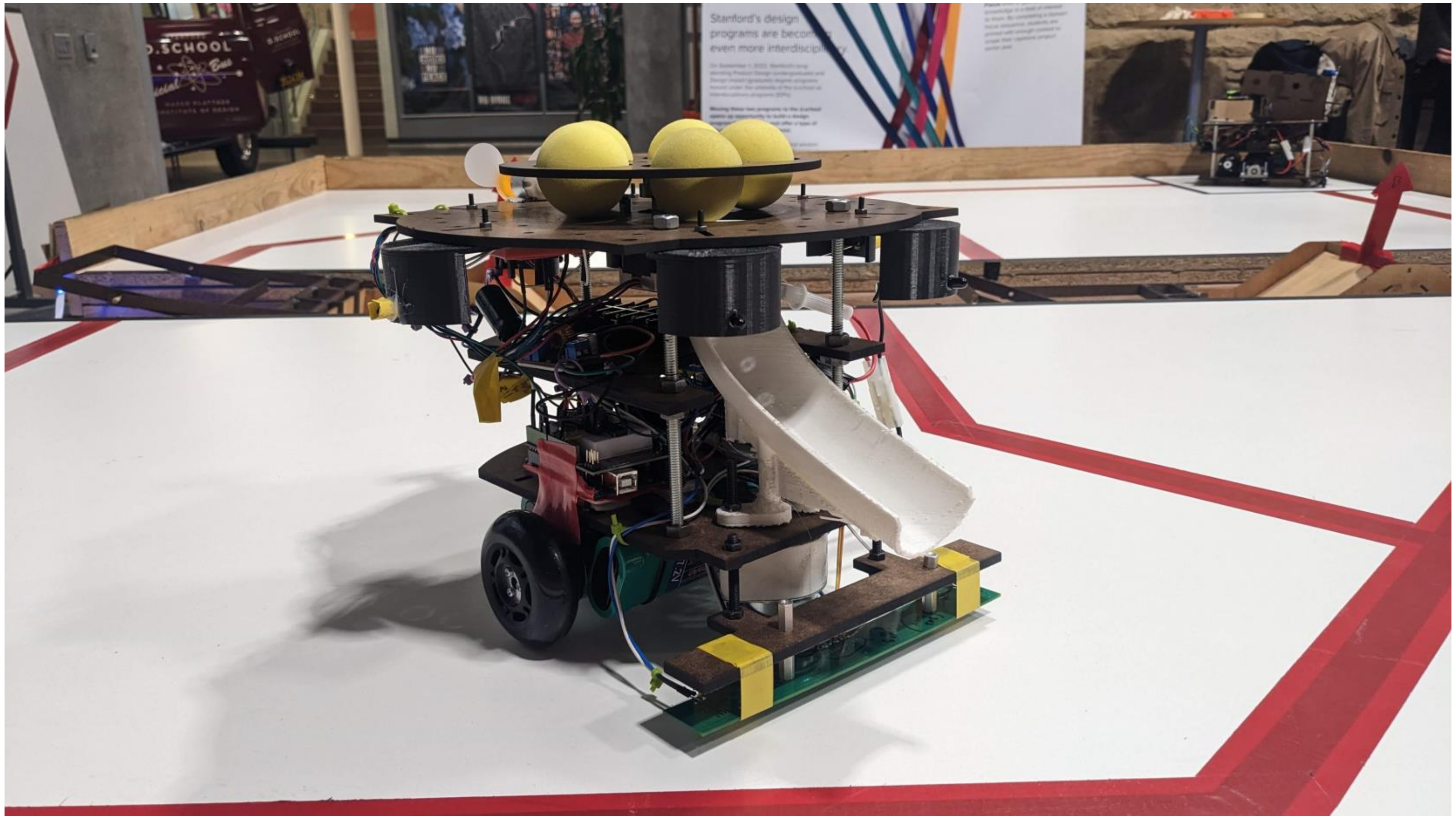
Assembly

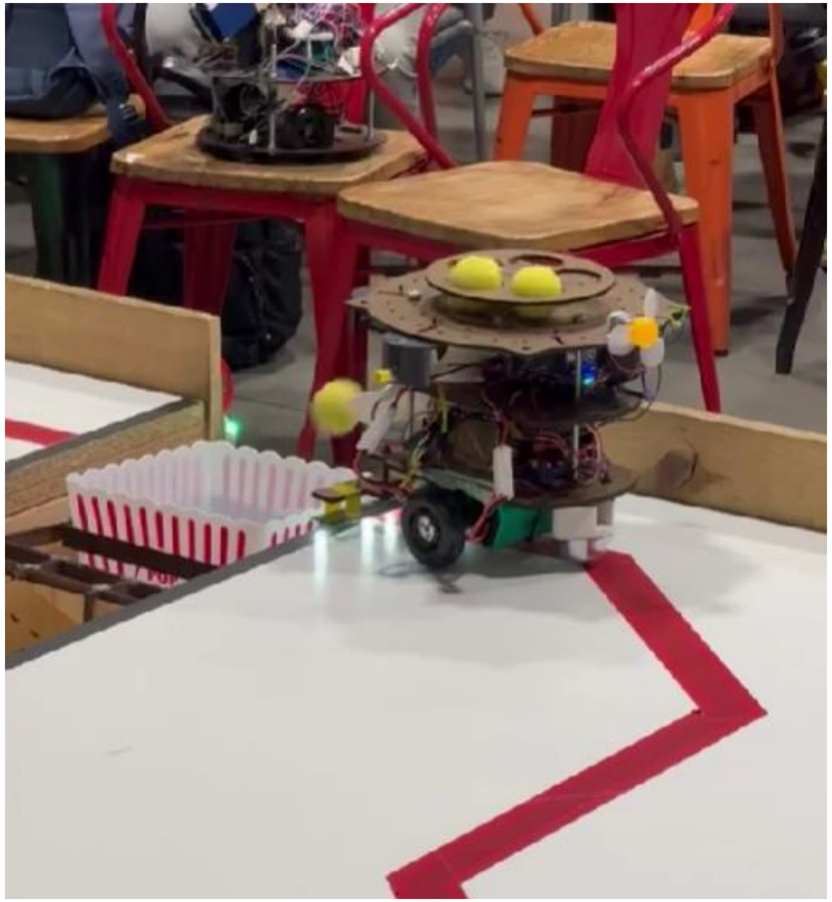


Result

Woodpecker

My team of 4 created an autonomous robot to compete in the annual me210 mechatronics competition at Stanford, our goal was to navigate a simulated high profile Oscars red carpet event and deliver press (balls) for our film to the attendees (bins) in order to win an award.

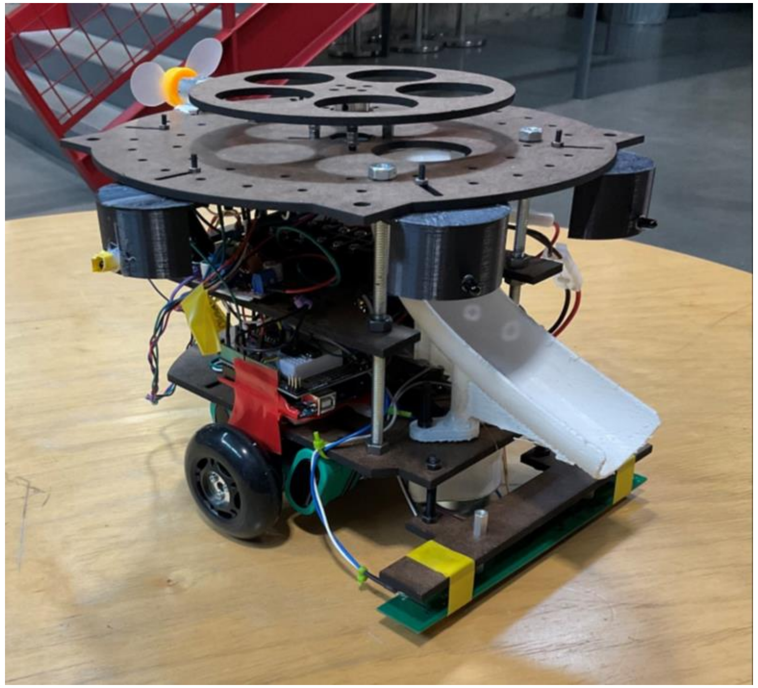


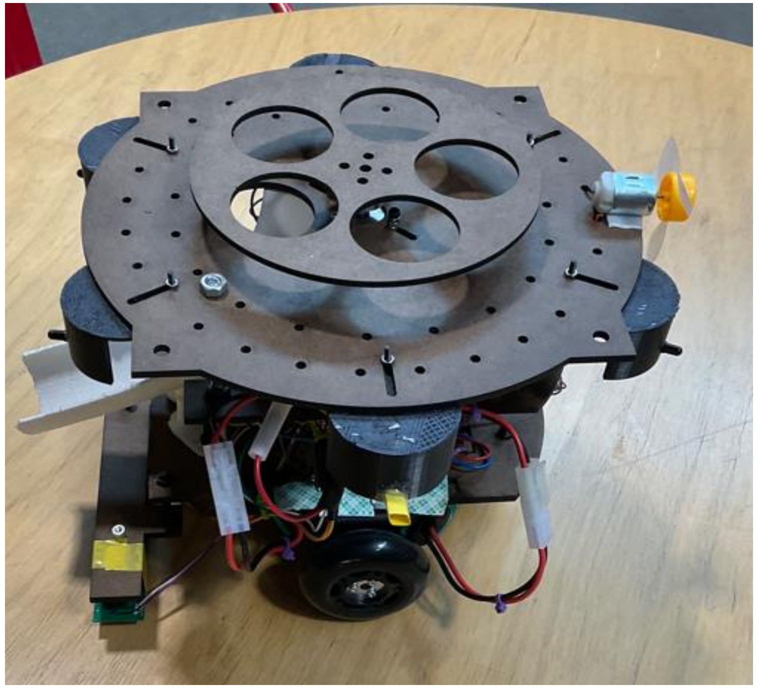


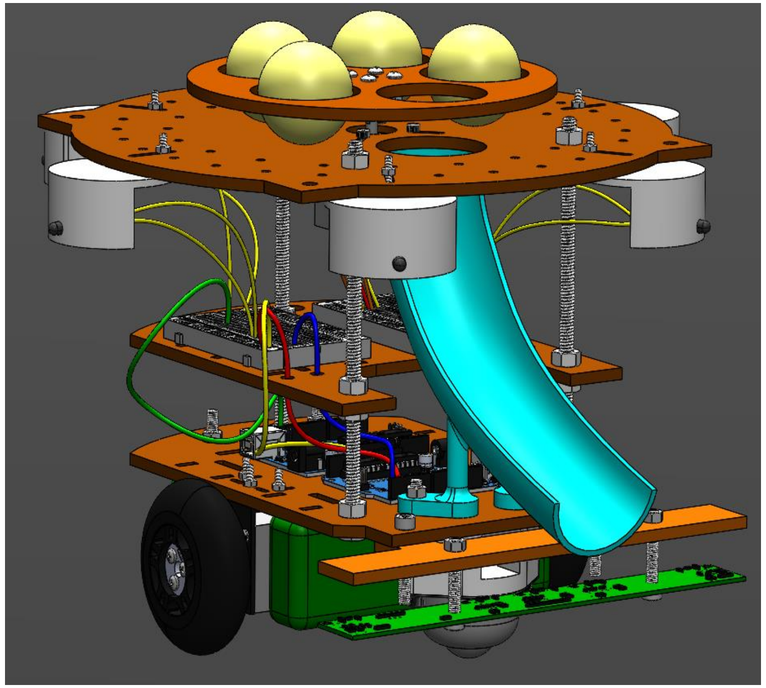
Woodpecker

I designed and realized a revolver style PRESS delivery mechanism including its full electro-mechanical design using a stepper motor, was responsible for integration of all other electrical and mechanical sub systems into the robot which included designing the robot chassis, adjustable sensor mounts including one for PCB assembly. I created the complete CAD model (pictured below) of our bot and made sure that all the integration happens without any hiatus. I fabricated all the mechanical parts, procured COTS parts before assembling.

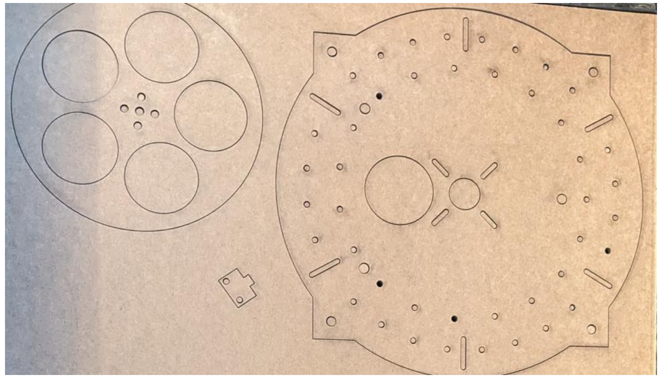
PROCESSES: Electro-mechanical Design, Motor Control, Soldering, 3D Printing, Laser Cutting

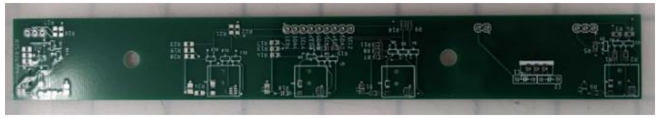


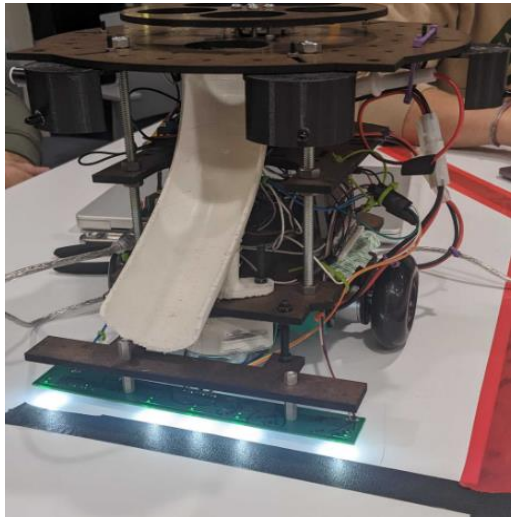


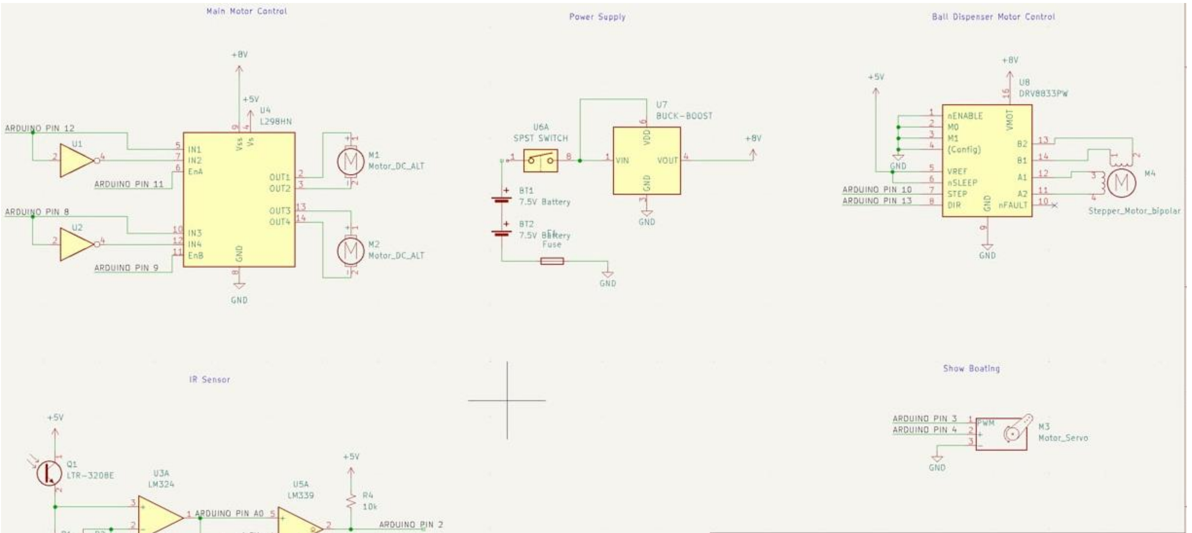


Woodpecker

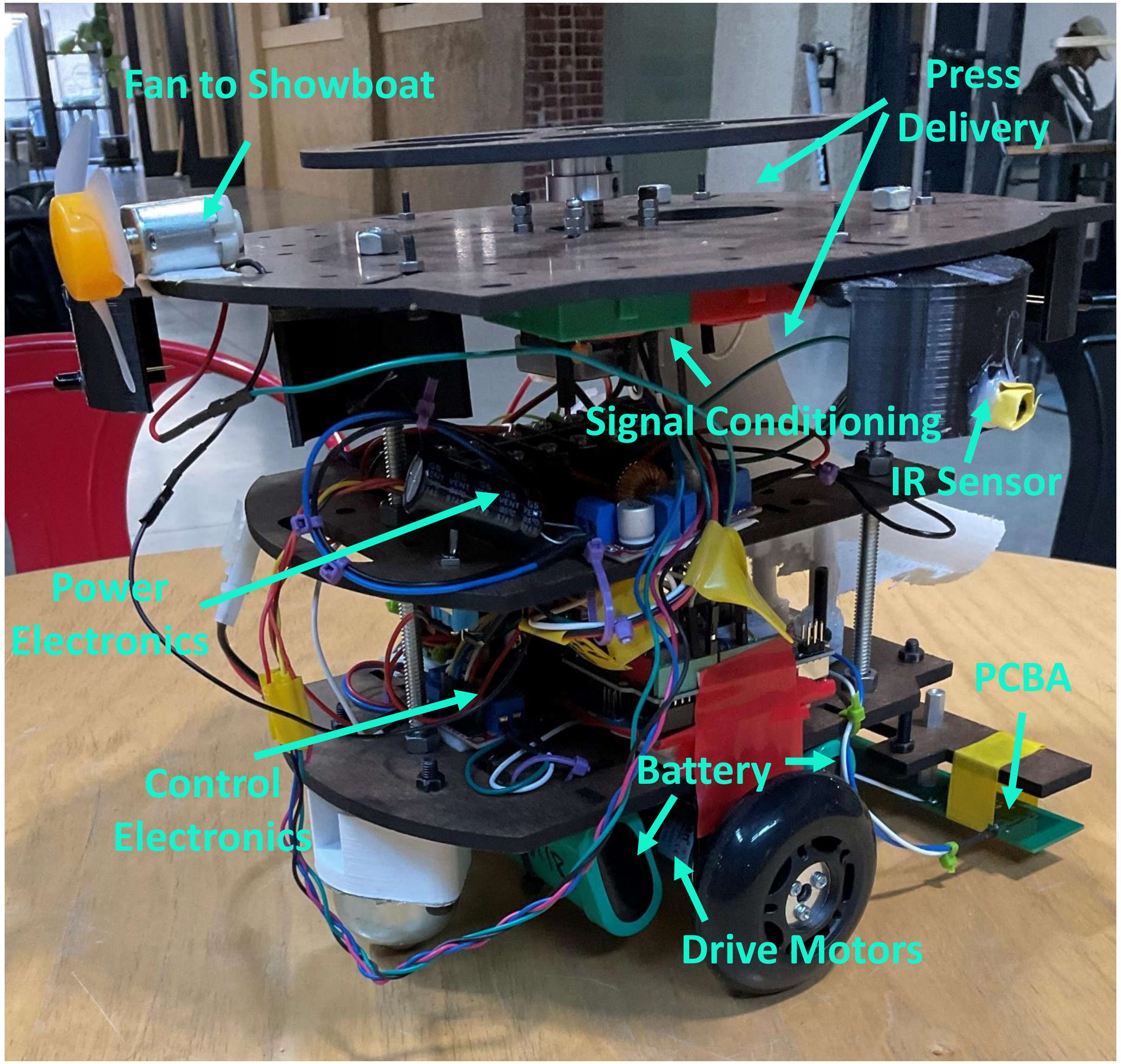








Electrical Schematics



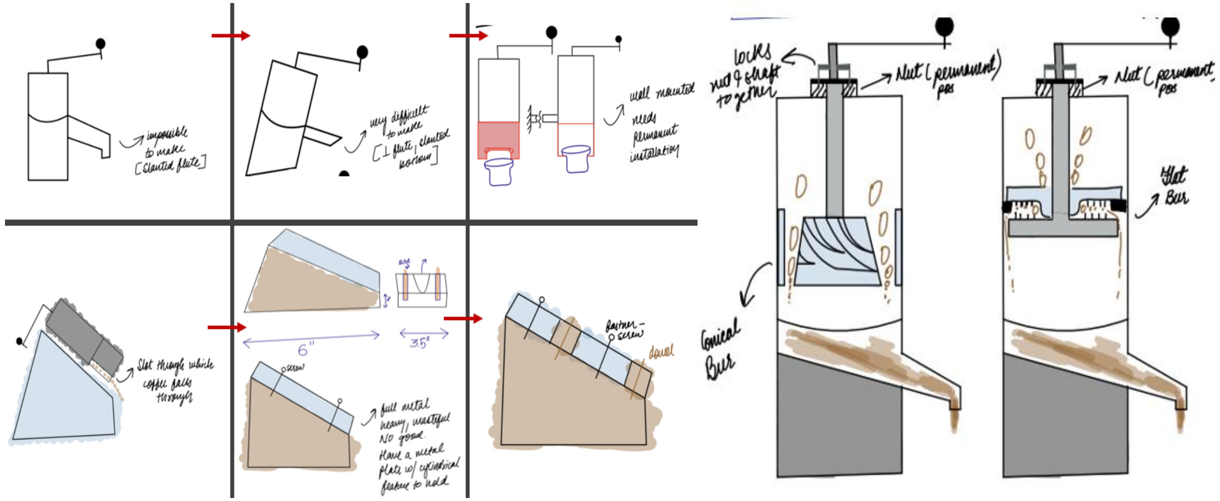
Woodpecker

All of design, fabrication and debugging for this project took place in less than 3 weeks which was a tight timeline to realize a bot that is autonomous, had multiple subsystems that needed to work together in addition to designing, fabricating, and assembling lot of parts including a custom PCB assembly. This naturally created a lot of stress in team, and I assumed the role of Yoda where I maintained morale, mediated team conflicts and supported different subsystems as needed. I did project management for the team, created, tracked and updated timelines.

Milaana

Milaana is the coffee bean grinder I created during my course on design and manufacturing. Motivated by my never dying thirst for coffee, this project took lot of machining and some woodworking to realize it.

The design process started with napkin sketches, experience & functional prototypes, to shape design directions and evaluate function. Involved revising the design numerous times as I iterated before finally spending time to machine and assemble it.



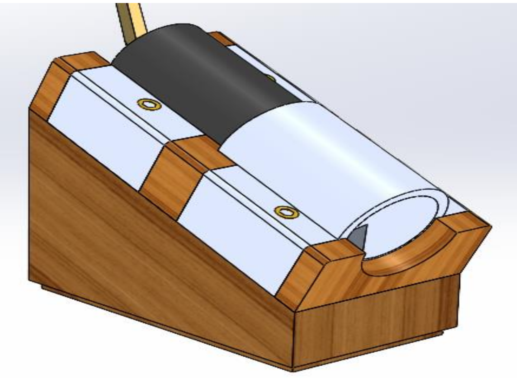
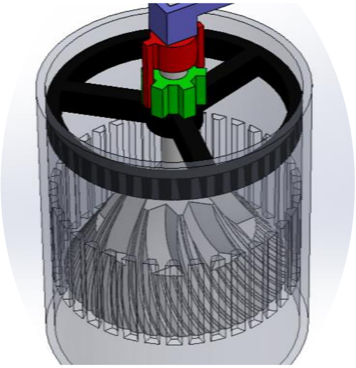
Milaana



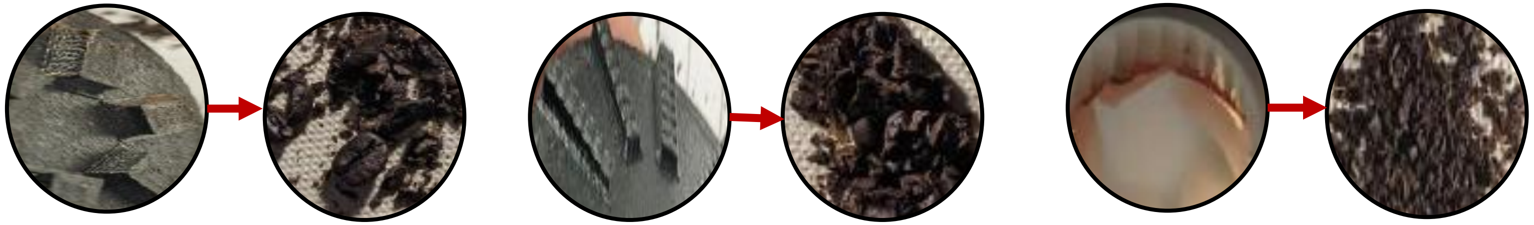







Prototyped Burr Geometries:



Future Talents

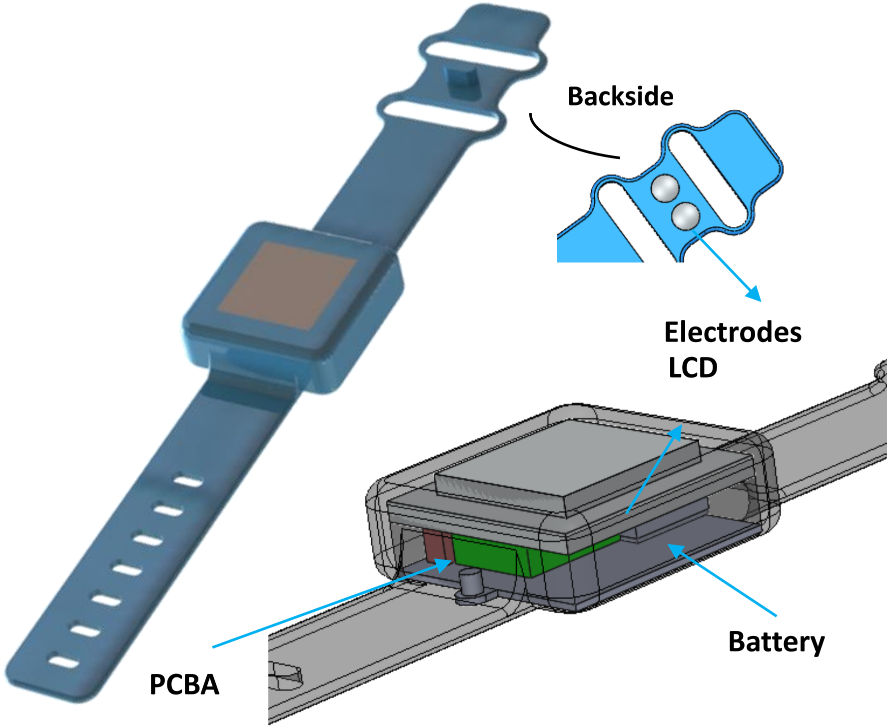
Spread across 5 time zones, Future Talents was a Stanford ME310 global design innovation project between 5 universities and corporate partners. As a part of this project, our team developed and prototyped a solution to support employee wellness in the tech. industry. This included developing a wearable device that tracks stress levels in employees through their skin response and developing intervention tools and mechanisms for both the employee and the employer. We ran multiple user experience and testing studies and carried out ethnographic need finding to understand the problem space.

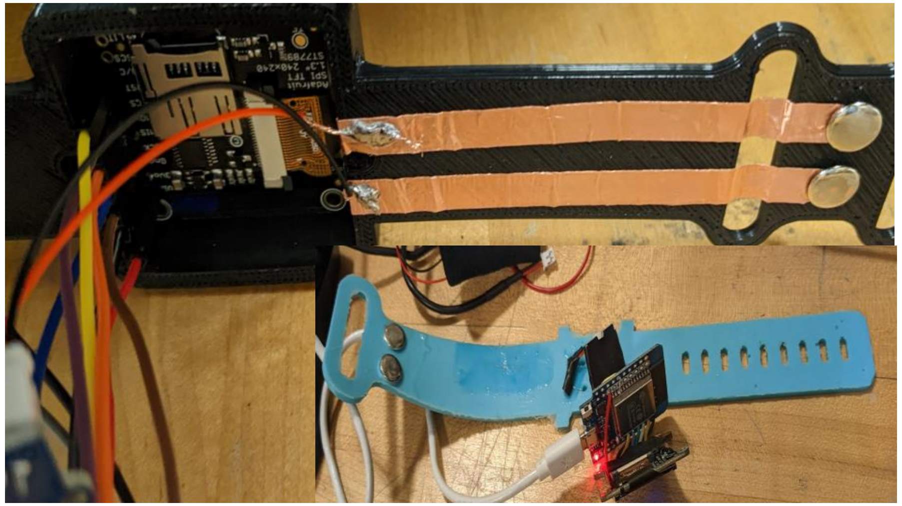
Future Talents

I designed and manufactured the wearable device for the team.

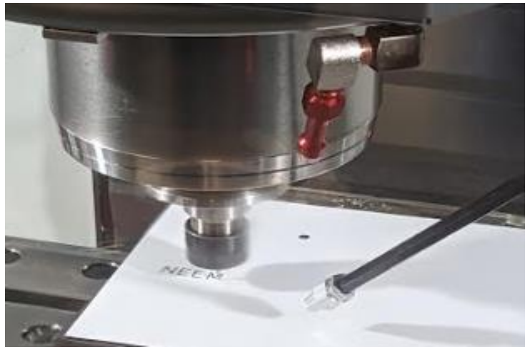
In the final product the wearable had skin response electrodes embedded in its strap which was electrically connected to the main housing without being visible from the outside.

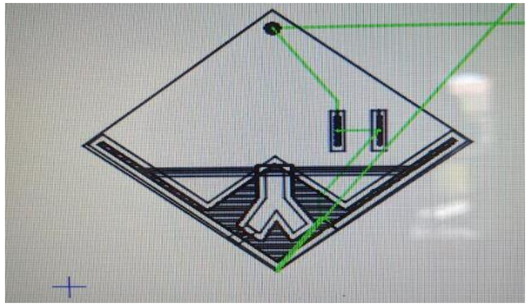
PROCESS: Silicone Molding, Electronics Soldering

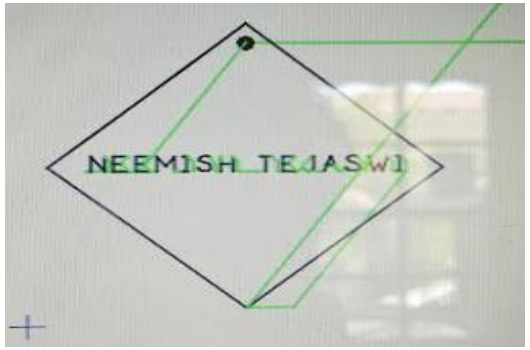


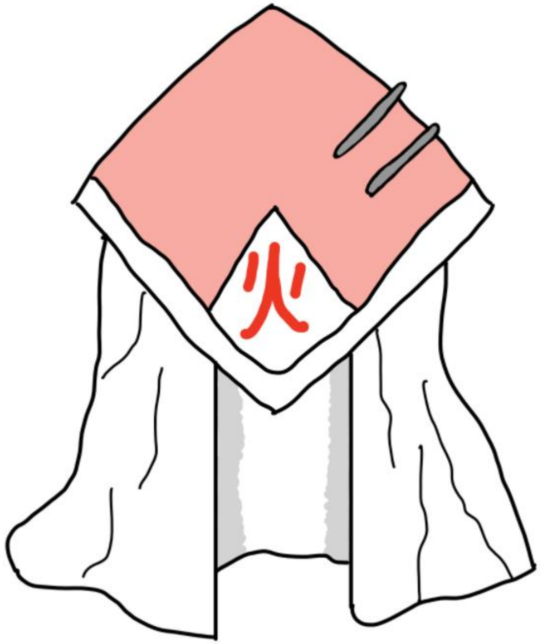


火影 Will of Fire







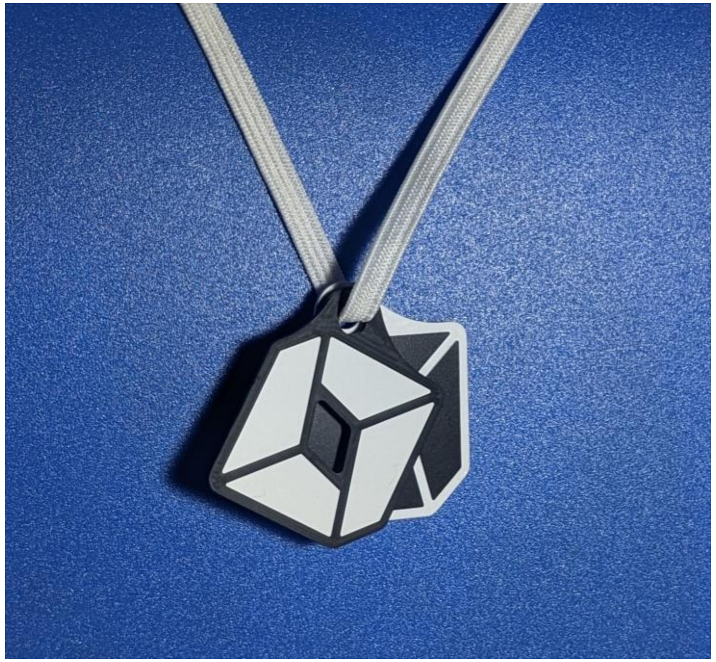


I designed and machined a two-sided luggage tag for my bag pack. The tag is the Hokage hat from my favorite anime Naruto.

I programed the part by hand without relying on a CAM system and used a 1/32nd inch end mill for the job. The stock was secured using VHB tape to a HDPE fixture plate.

MACHINE SHOP EXPLORATIONS

Pendant



MATERIAL: Sign Stock

PROCESS: 1/16th inch end mill on a CNC mill; Used VHB tape to secure the sign stock on to a HDPE block

Magnifying Glass

MATERIALS: Brass, Delrin, Acrylic

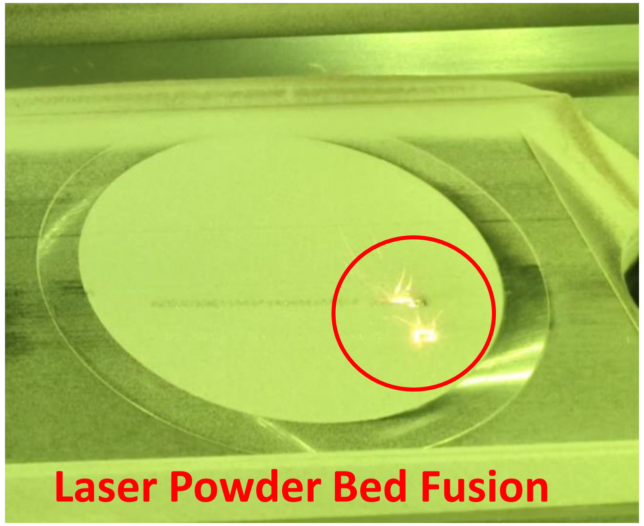
PROCESSES: Milling, Silver Brazing, Turning, Spherical Turning, Facing, Threading

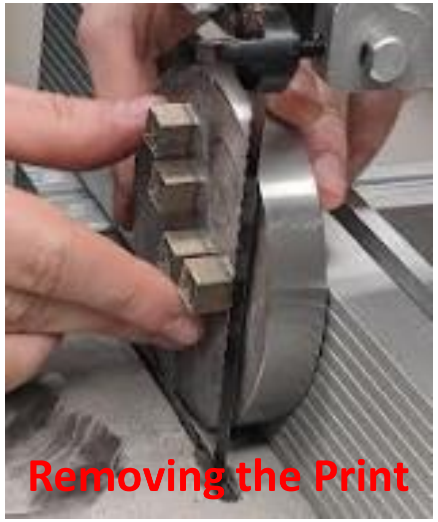
Plaque

MATERIALS: Bronze, Sheet Metal

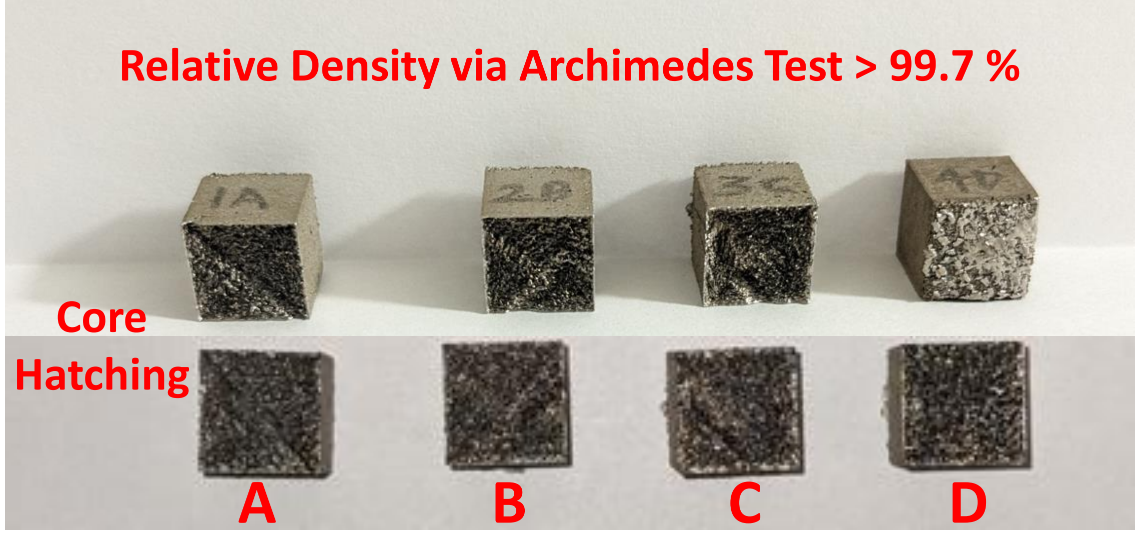
PROCESSES: Sand Casting, Sheet Metal Forming, Gas Welding, Bead Blasting

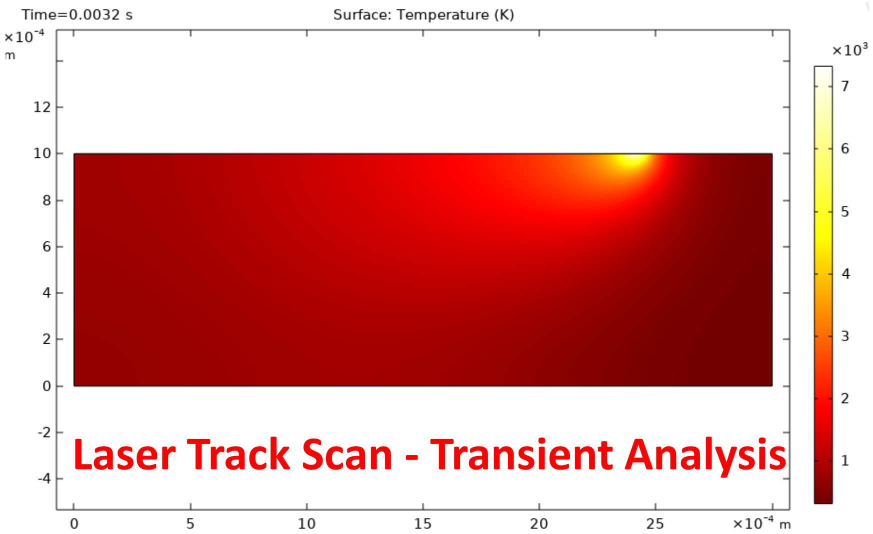
METAL 3D PRINTING

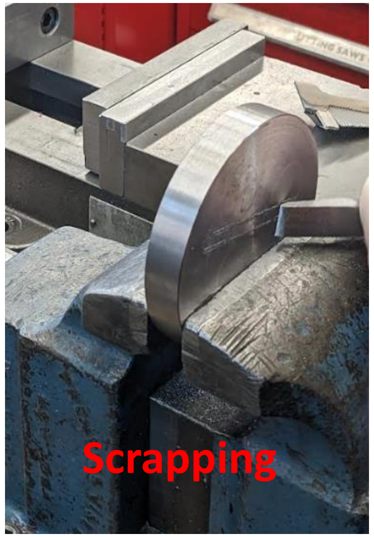




Material: SS-316L
Particle Size: 15-45 micron
Shielding Gas: Argon
Laser Size: 30 micron
Laser Type: Fiber Laser
Layer Thickness: 30 micron
Typical Process Parameters: Oxygen Concentration, Laser Power and Scanning Speed, Re-coater Velocity, Shielding Gas







High Heat Flux Cooling

I studied high heat flux cooling for computer chips as a part of a research project during my undergrad. where I carried out CFD analysis by developing a conjugate heat transfer model for 50W computer chip being cooled by a micro-direct jet impingement cooler.

Inlet Temperature	10-degree C
Chip Power	50 W
Flow Rate	600 ml/min
Jet Configuration	4x4
Jet Diameter	0.6 mm
Fluid	Water

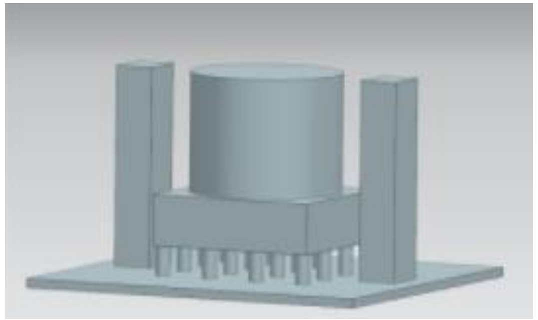
Modeled the cooler using Siemens NX, carried out CFD analysis using ANSYS Fluent

Developed a conjugate heat transfer model and simulated a direct jet impingement cooler.

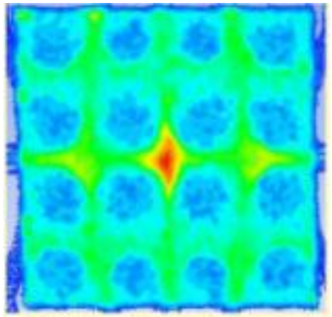
Used two equation standard k-ε model to solve additional transport equations to model turbulence

Predicted a temperature rise of 10-degree Celsius for a 50W Chip.

Results were verified with available experimental data, in house testing was not conducted.

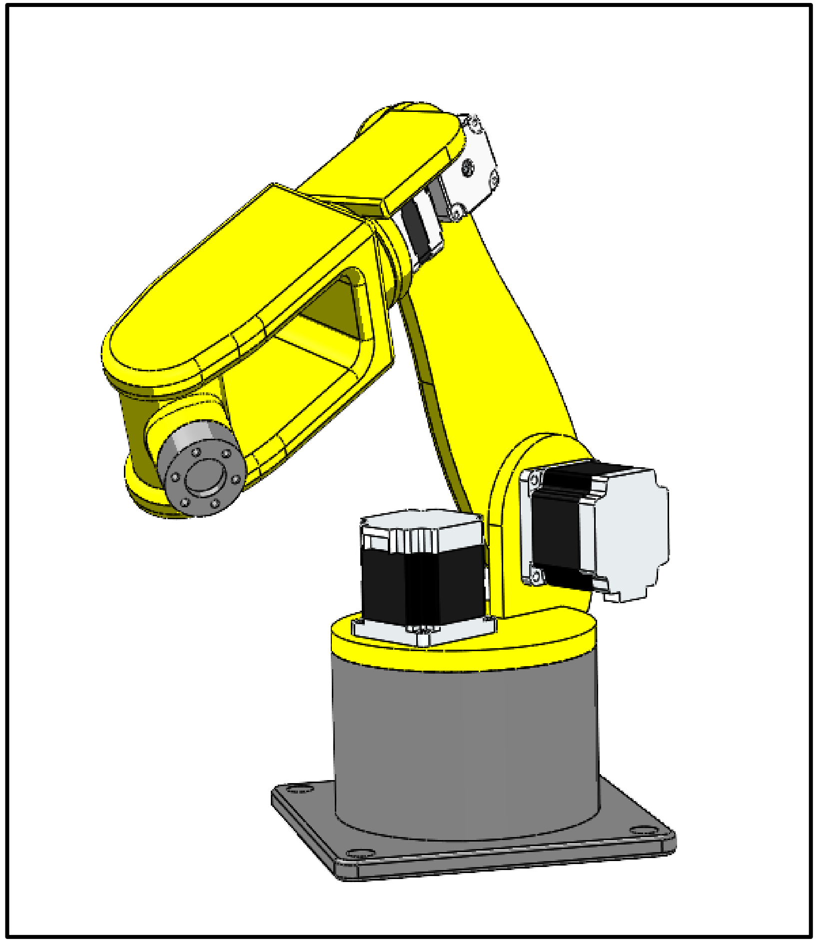


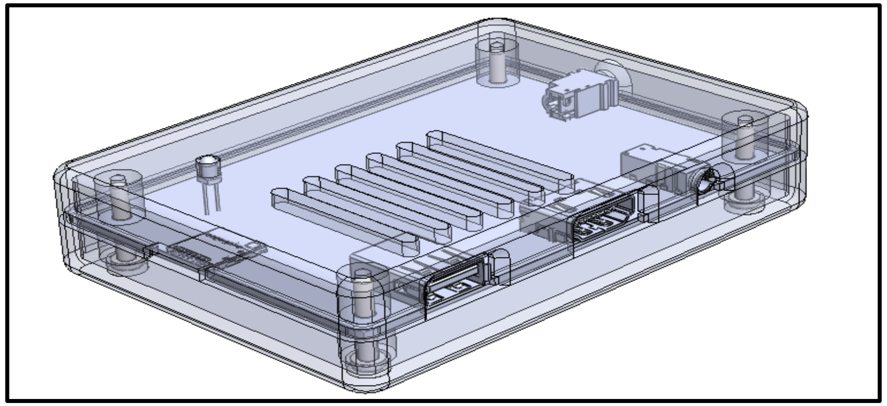
Extracted Flow Domain

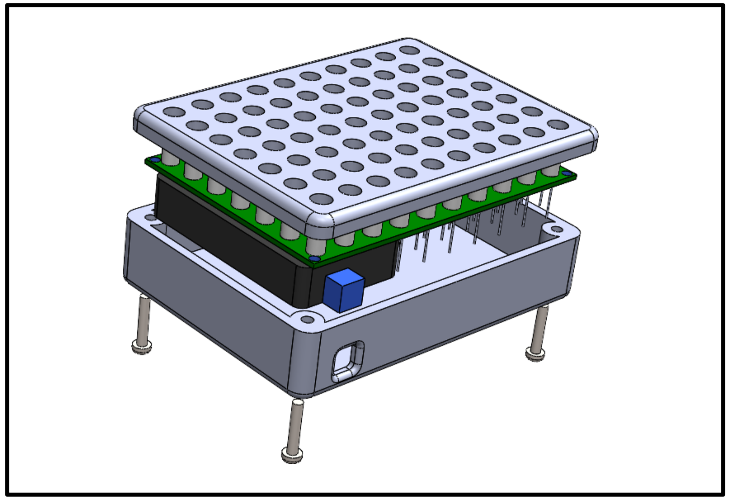


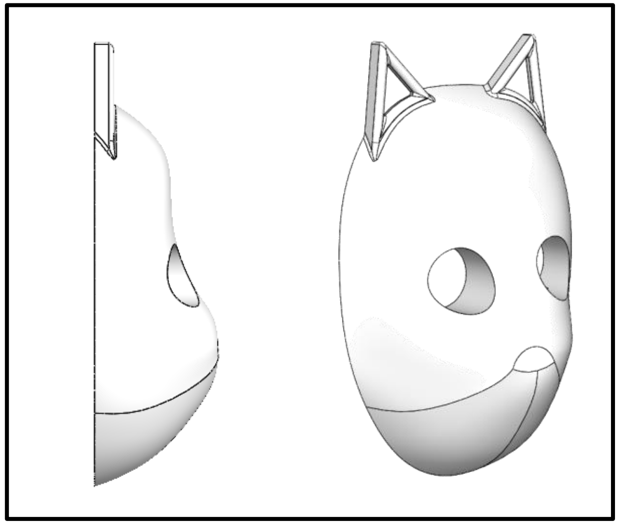
Temperature Profile at Chip Interface

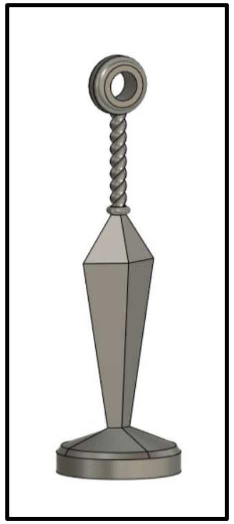
CAD Work

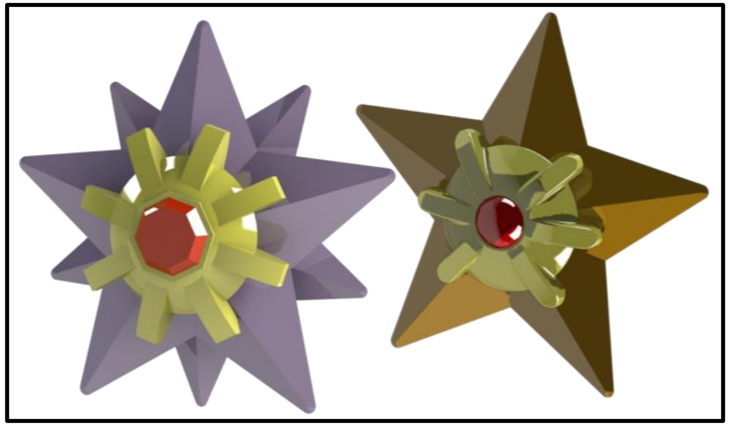




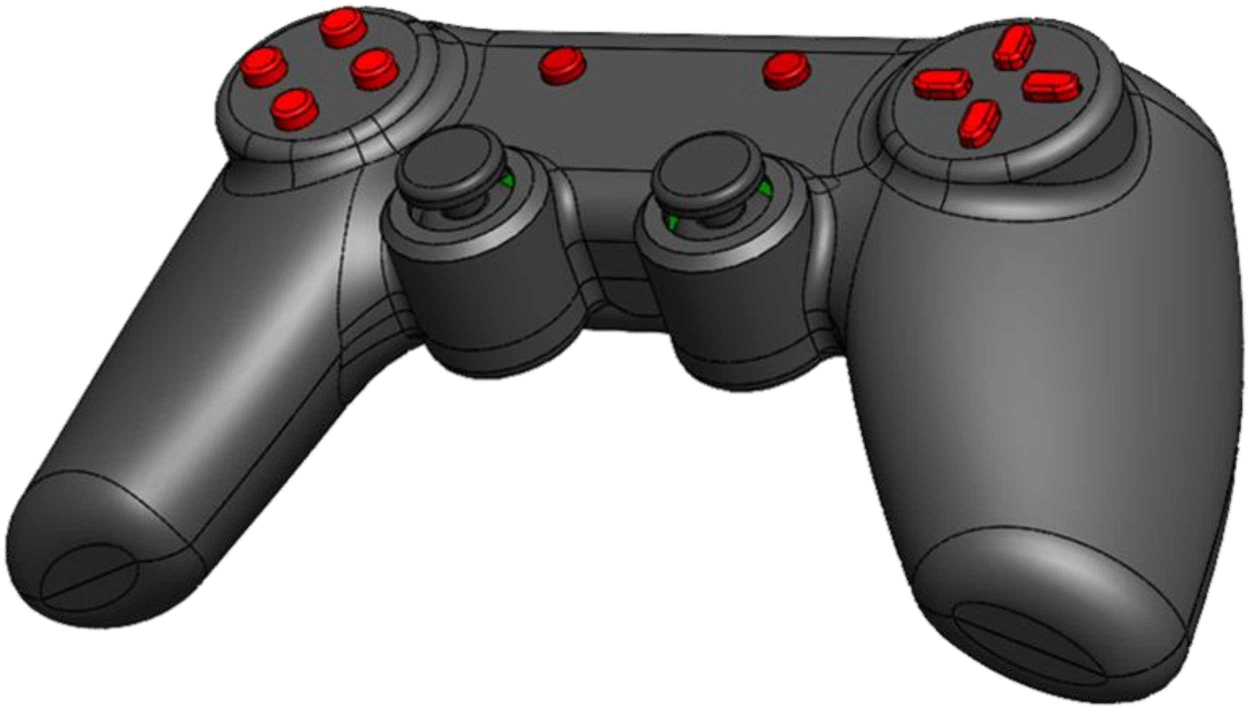




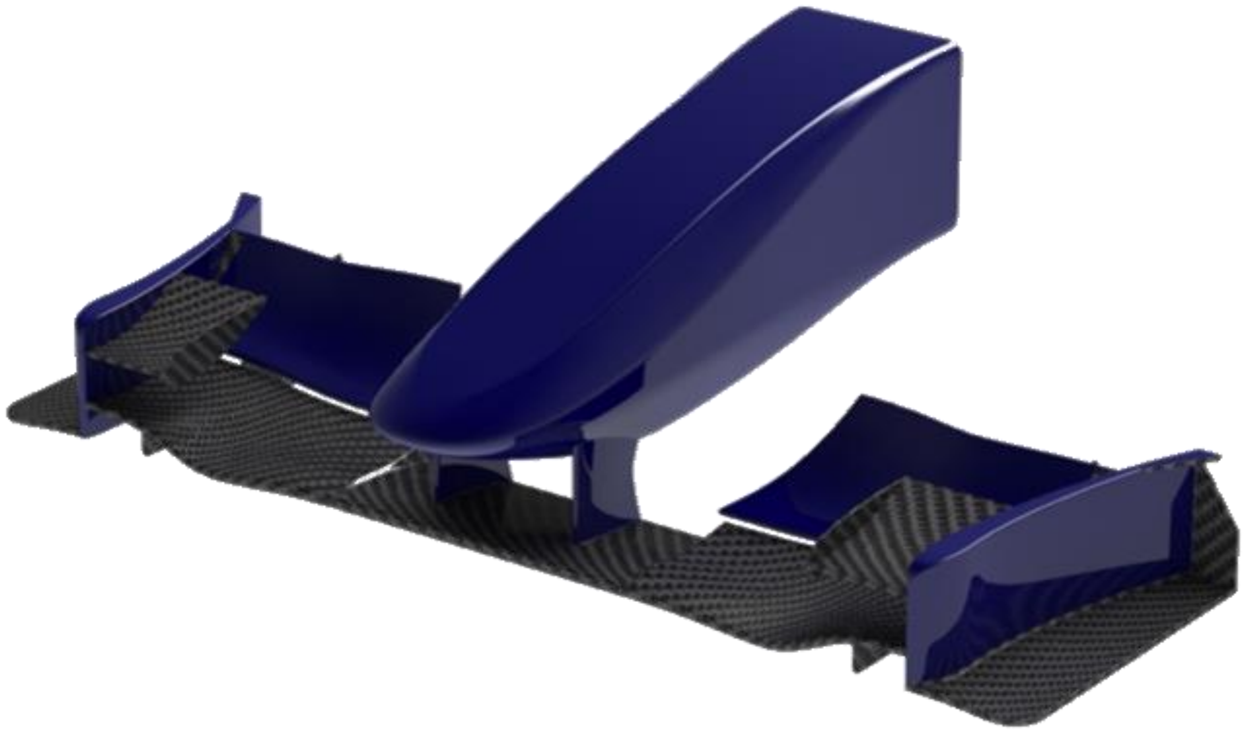


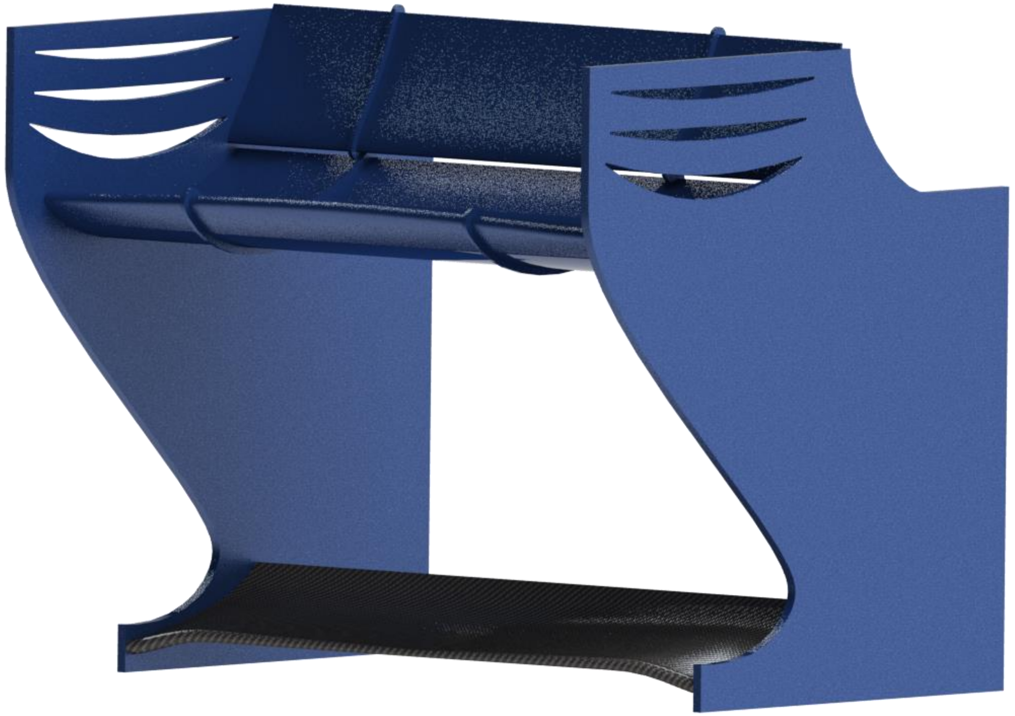


CAD Work



CAD Work





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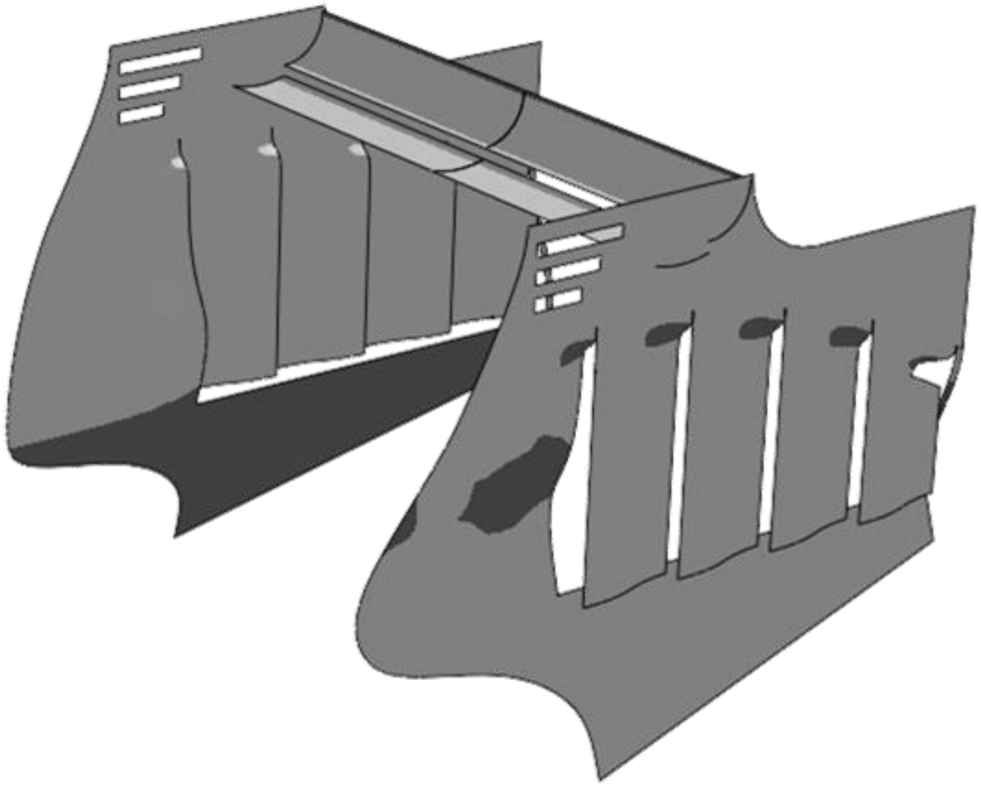

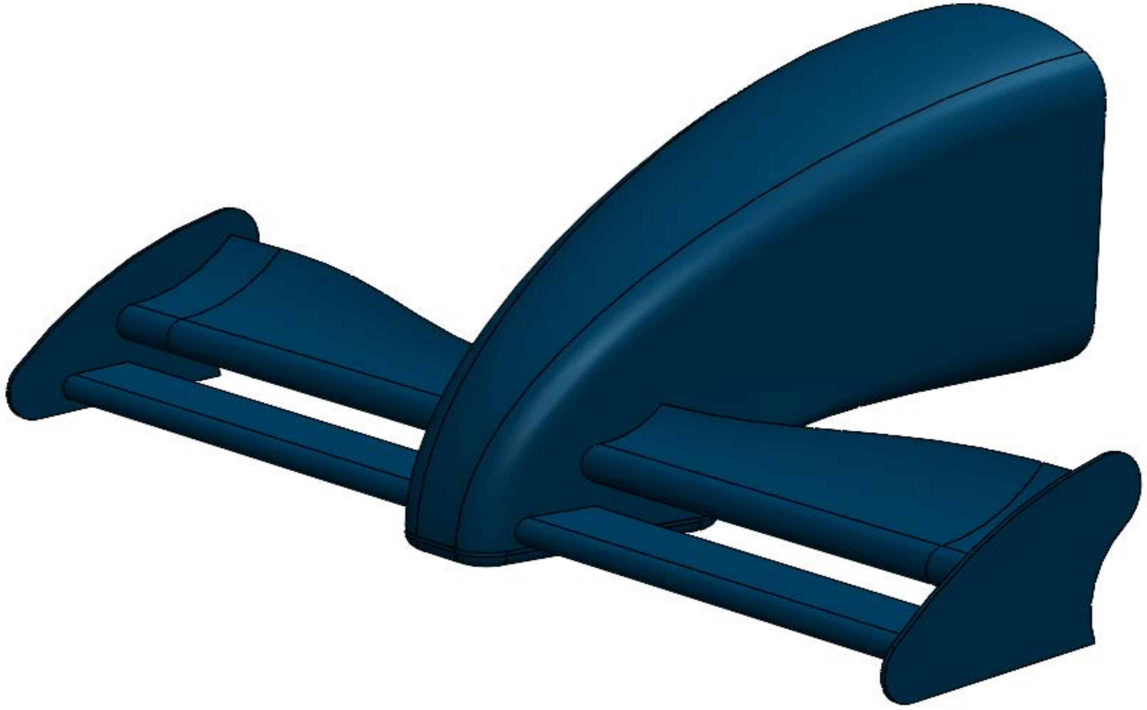

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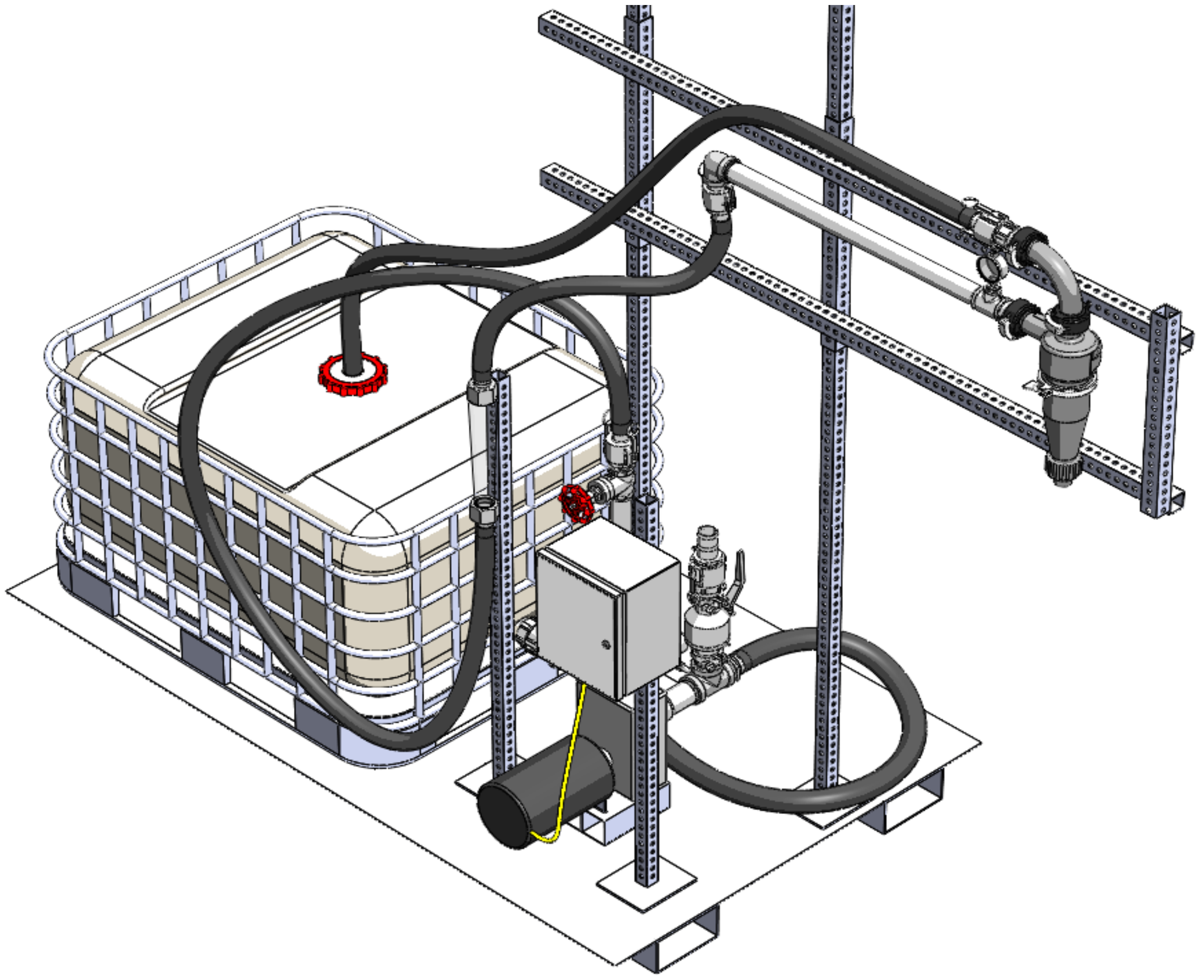
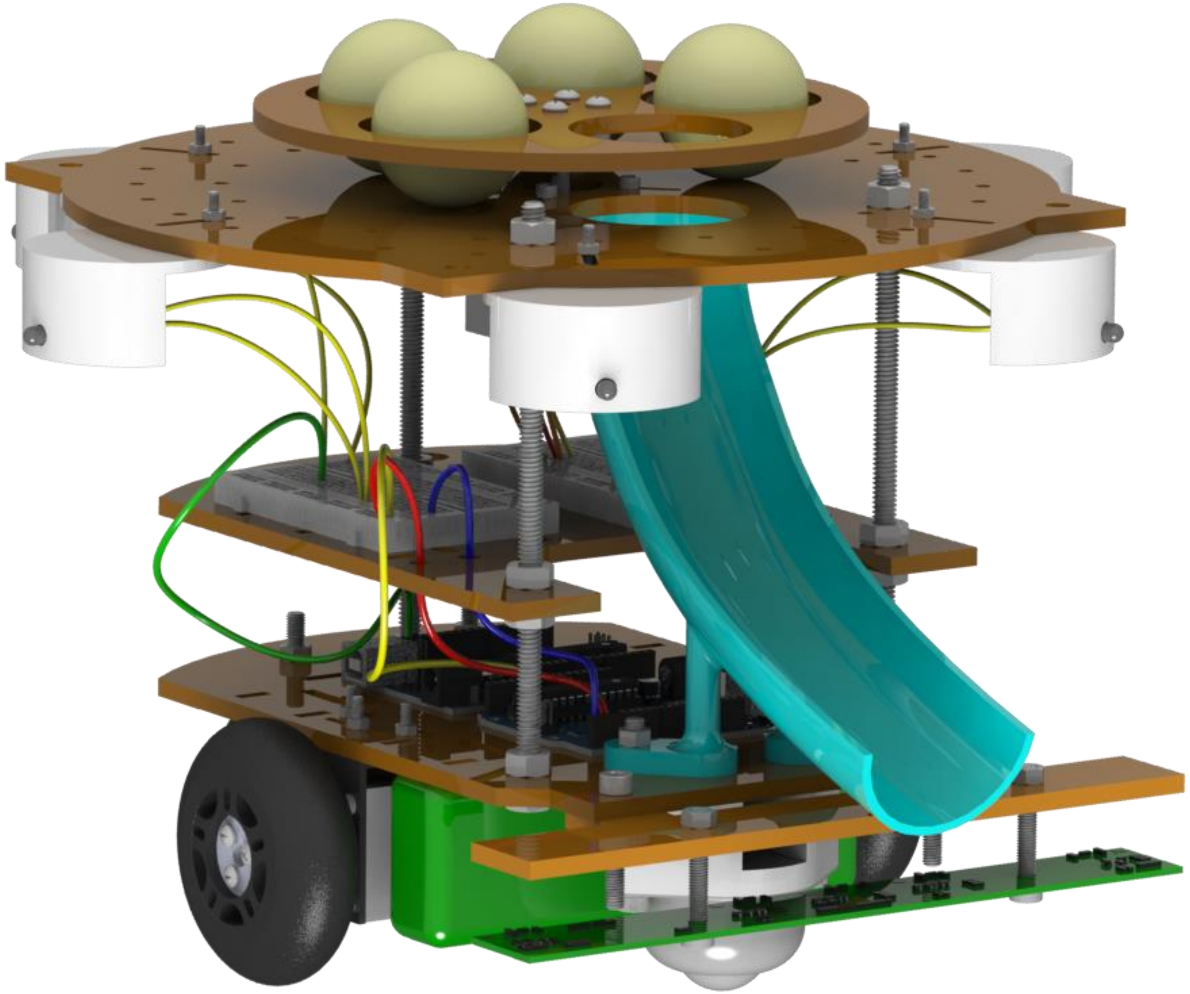
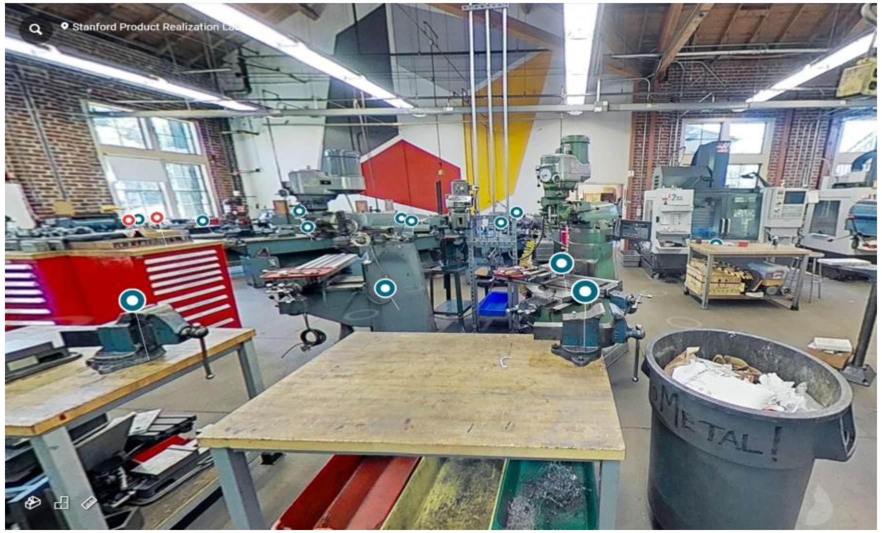




Virtual Field Trips



Product Realization Lab @ Stanford
https://ixd.su.domains/vft/

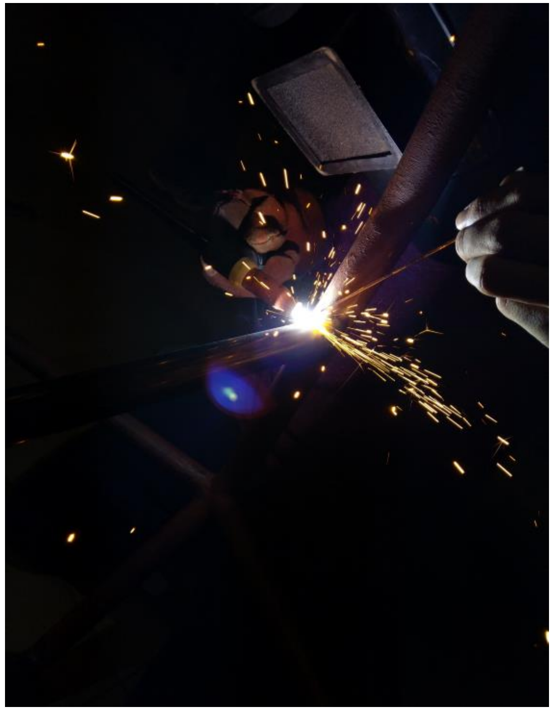
Roble Arts Gym @ Stanford:
https://my.matterport.com/show/?m=77rKLLUk1j1

Mechanical Engineering

Virtual Personal Visits to Stanford Maker Spaces

Stanford provides a variety of well-equipped maker spaces and a world-class program in how to use them, yet students with no prior experience in making can be intimidated by the machinery or the complexity of skill involved in learning to use it. We are creating a virtual experience of Stanford's maker spaces that will invite students to explore, learn about equipment and activities, and hear from fellow students who have developed making skills using these spaces and the resources they offer. Our project aims to encourage many more students to feel welcome and confident in their ability to learn to use these spaces.

Rebecca Currano, Veronika Domova, David Sirkin, Mark Cutkosky



THANK YOU