Hamza Arshad

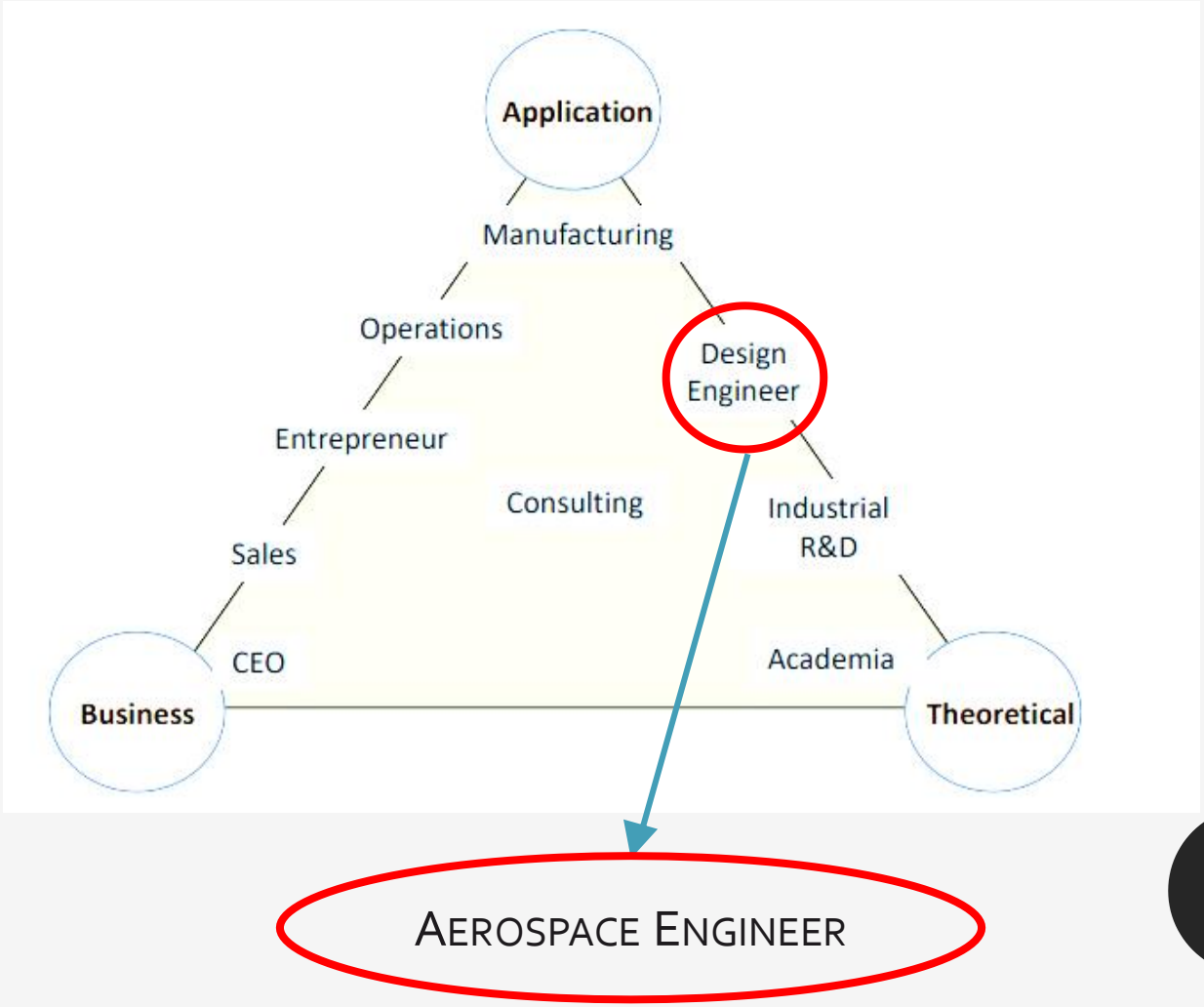
Portfolio

The purpose of my portfolio is to demonstrate my engineering experience and competency to potential employers by highlighting these experiences and connecting them to engineering-related skills, specifically to skills needed for design engineers.

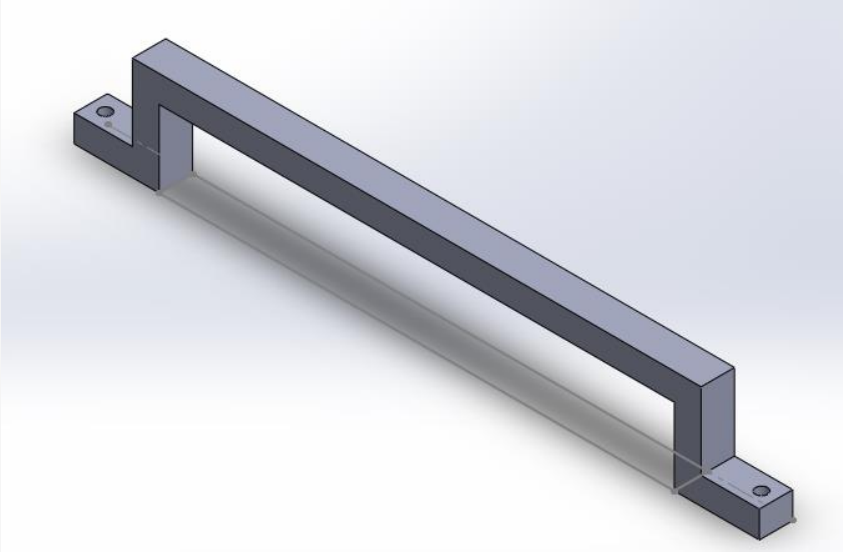
The intended audience of my portfolio are mechanical engineering employers hiring design engineers, specifically for the aerospace industry.

INTRODUCTION

- See myself in a "design engineering" role
  - Considers both theory and application
  - Personally, I value a career of applying theoretical knowledge into new, improved products
- Specifically, interested in aerospace engineering and designing new mechanical structures for space systems

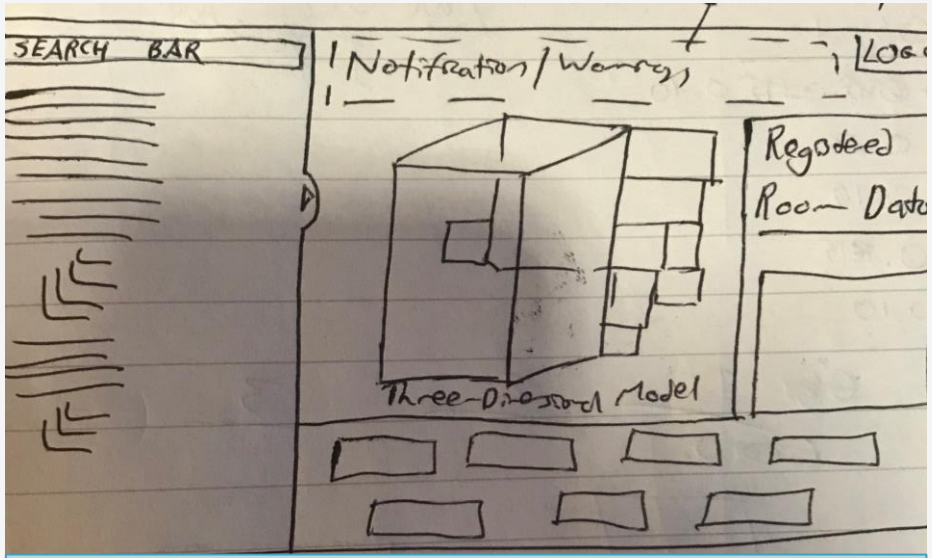


I'll highlight three skills that showcase my competency for aerospace engineering:



USE OF ENGINEERING TOOLS

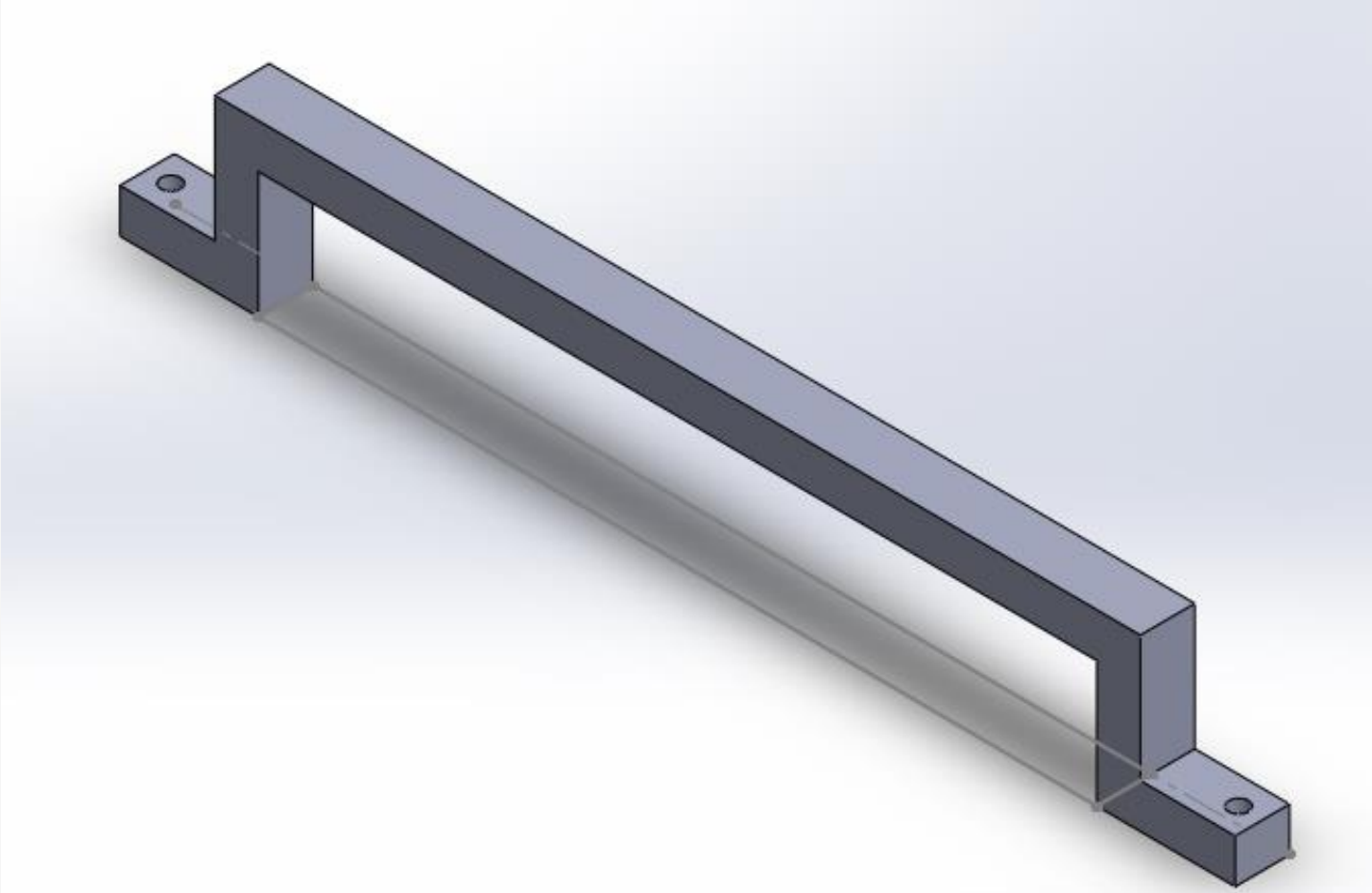
TEAMWORK



DESIGN

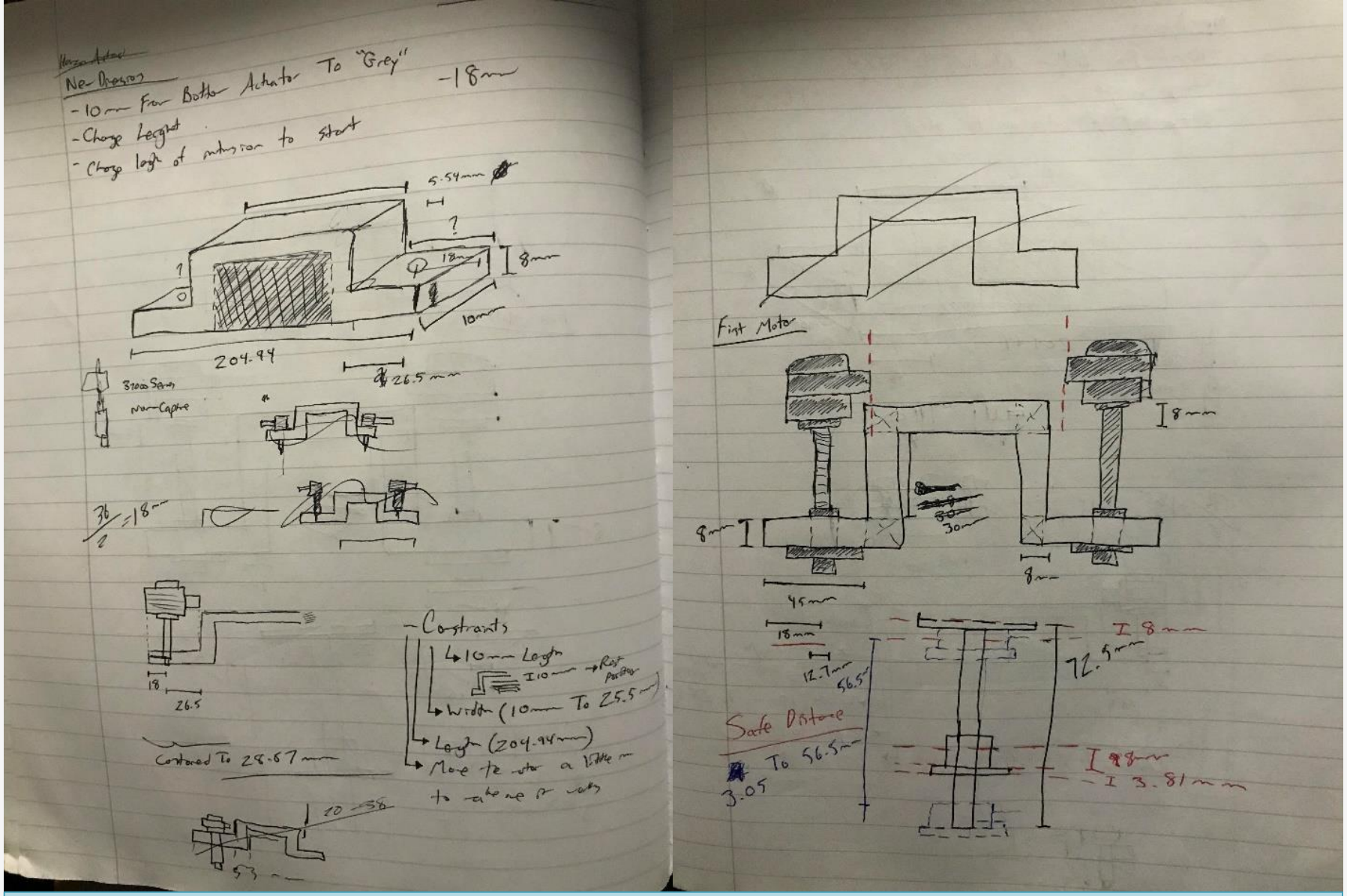
Use Of Engineering Tools

- Use of 'SolidWorks' to CAD various components of a satellite for the 'University Of Toronto Aerospace Team' (UTAT), including:
  - New actuation board for popping microfluidic blisters
  - 2700 batteries
- Use of 'SolidWorks' to CAD the gearbox of a mechanical rover for the MIE243 design project
- Used the 'CES' software to benchmark the prices of custom made axles on the mechanical rover for the MIE243 design project



CAD OF A NEW ACTUATION PLATFORM

- Designed and dimensionally constrained a new, potential actuation board for popping microfluidic blisters in the satellite
- Needed to pop blisters, in order to allow the fluid inside to flow towards another area of the satellite to start a microbiology experiment
- Showcases the use of CAD software, a vital engineering tool



USED PREVIOUS CADS TO CONSTRAIN THE DIMENSIONS

- Used previous and current satellite CADs to determine the right dimensions
- Showcases a critical use of available engineering tools

2700 BATTERY CADS; COMPLETED FOR THERMAL TESTING

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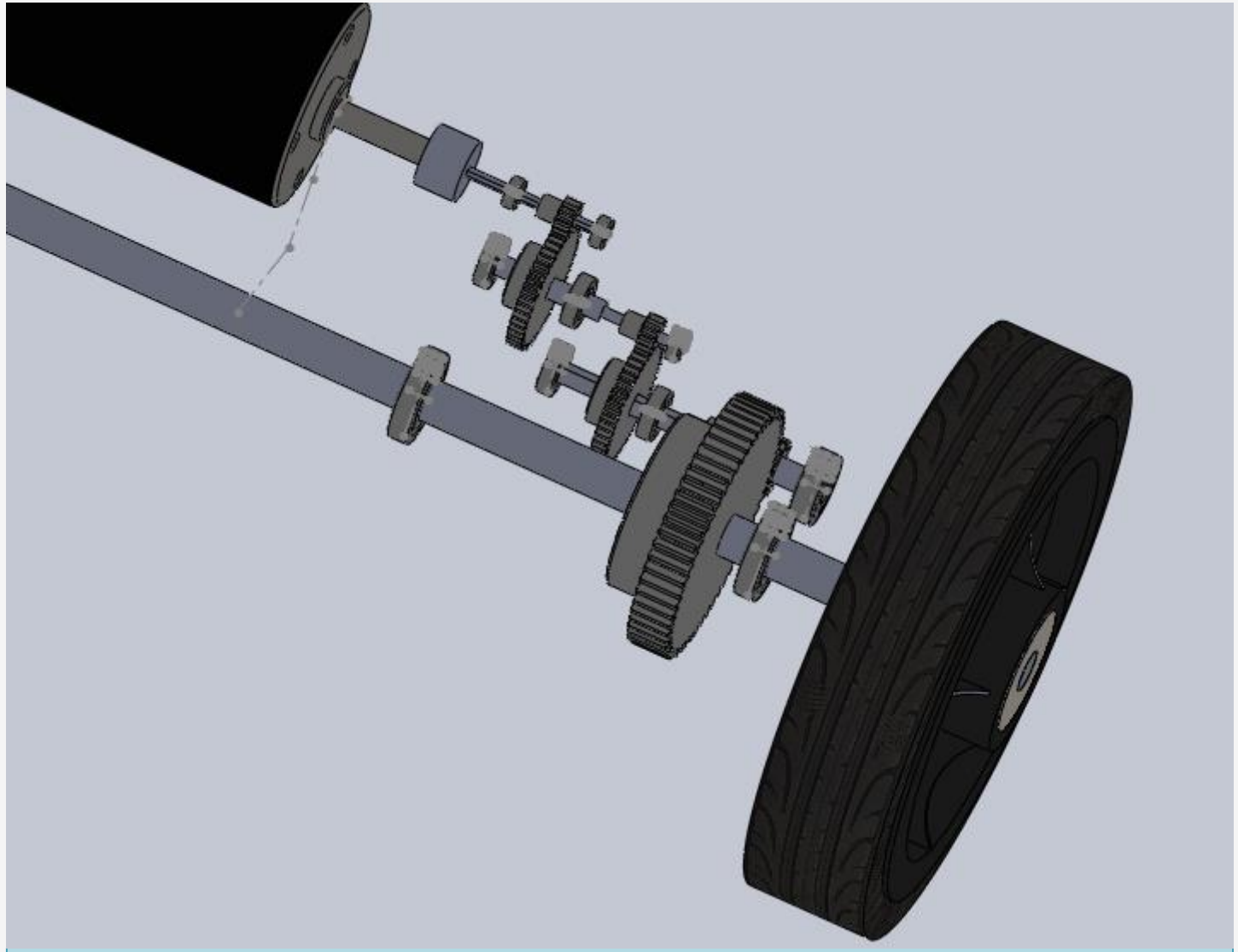

CAD OF THE BACK-POWER MECHANISM FOR THE ROVER

- The rover requires a large torque at its back-wheels to move, so it was necessary to create a gearbox for increasing torque
- Used ‘SolidWorks’ to create gears and mates to simulate the torque conversion
- Showcases my knowledge of mechanical and basic mates in the software

Use Of Engineering Tools

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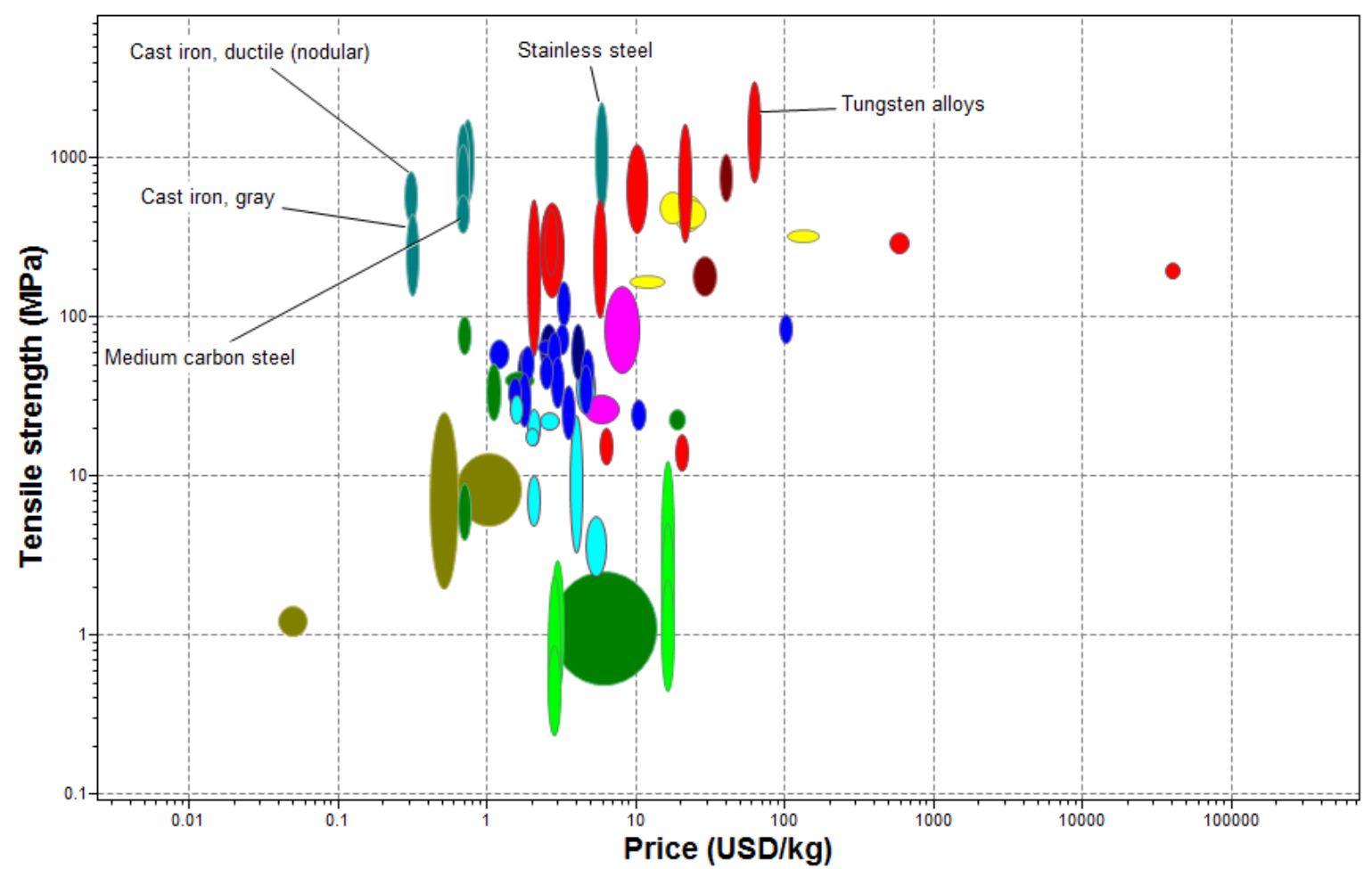

USED THE 'CES' SOFTWARE TO DETERMINE IDEAL MATERIALS

- Used the 'CES' software to find a material for the axles of the rover, with low price and high strength as factors
- Determined "cast iron" to be the ideal choice
- Showcases both a use of an engineering material selection software and engineering design principles by prioritizing certain material factors

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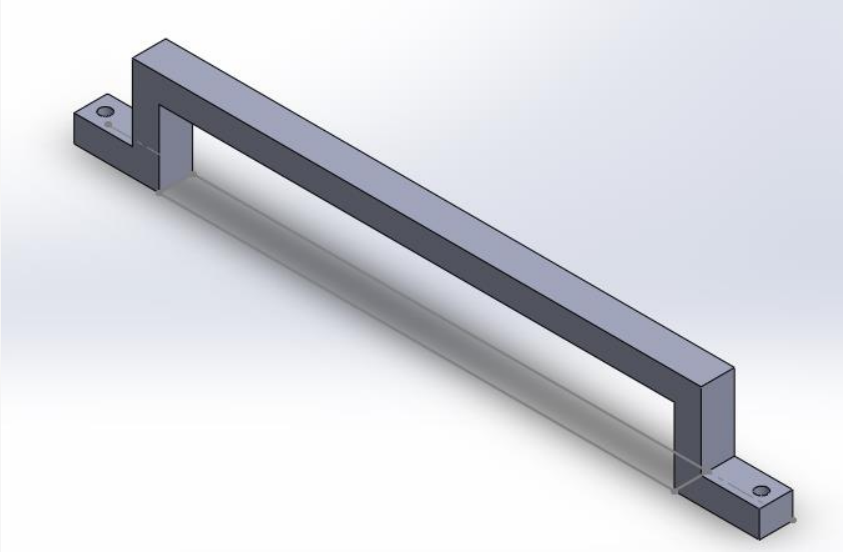

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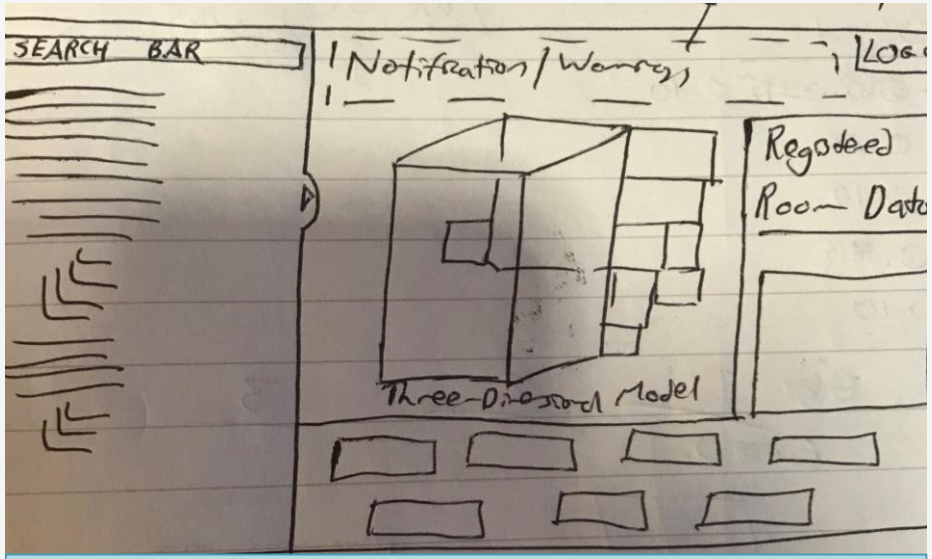
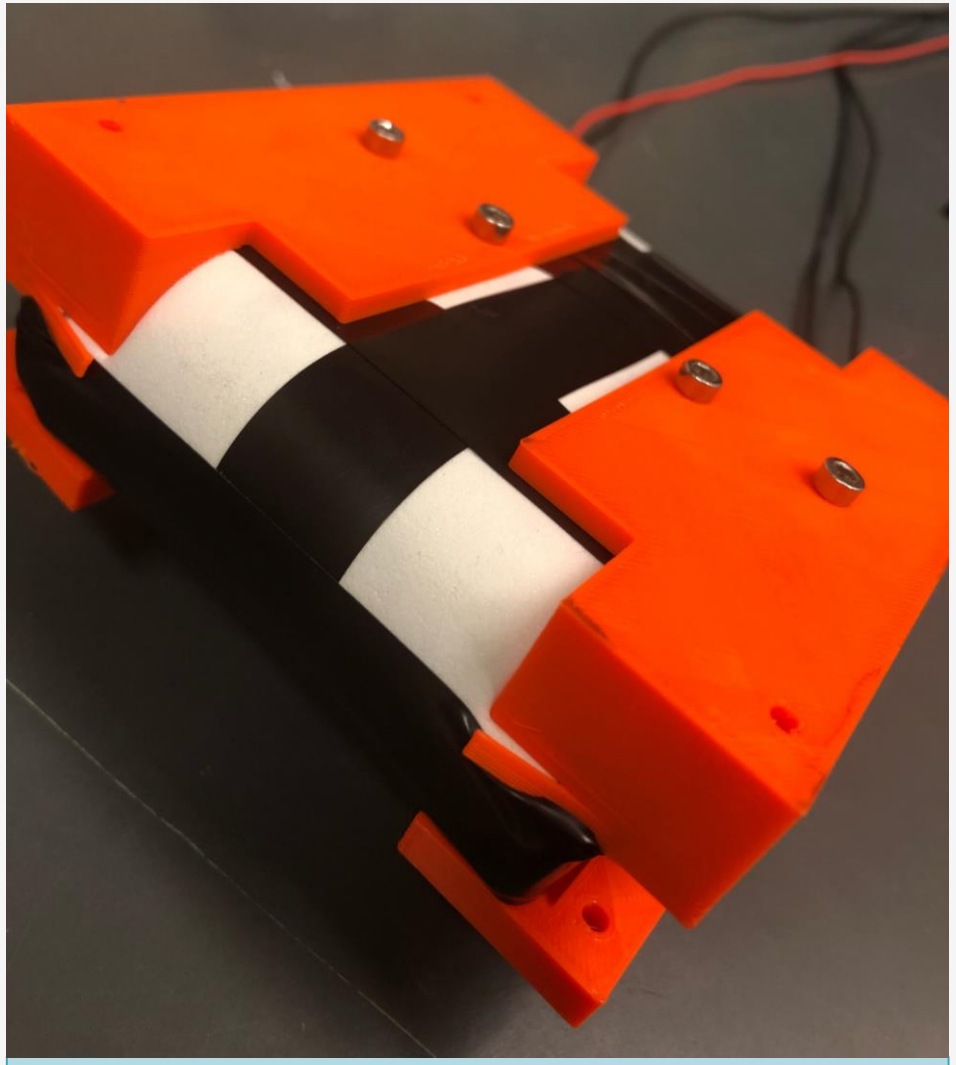


DESIGN

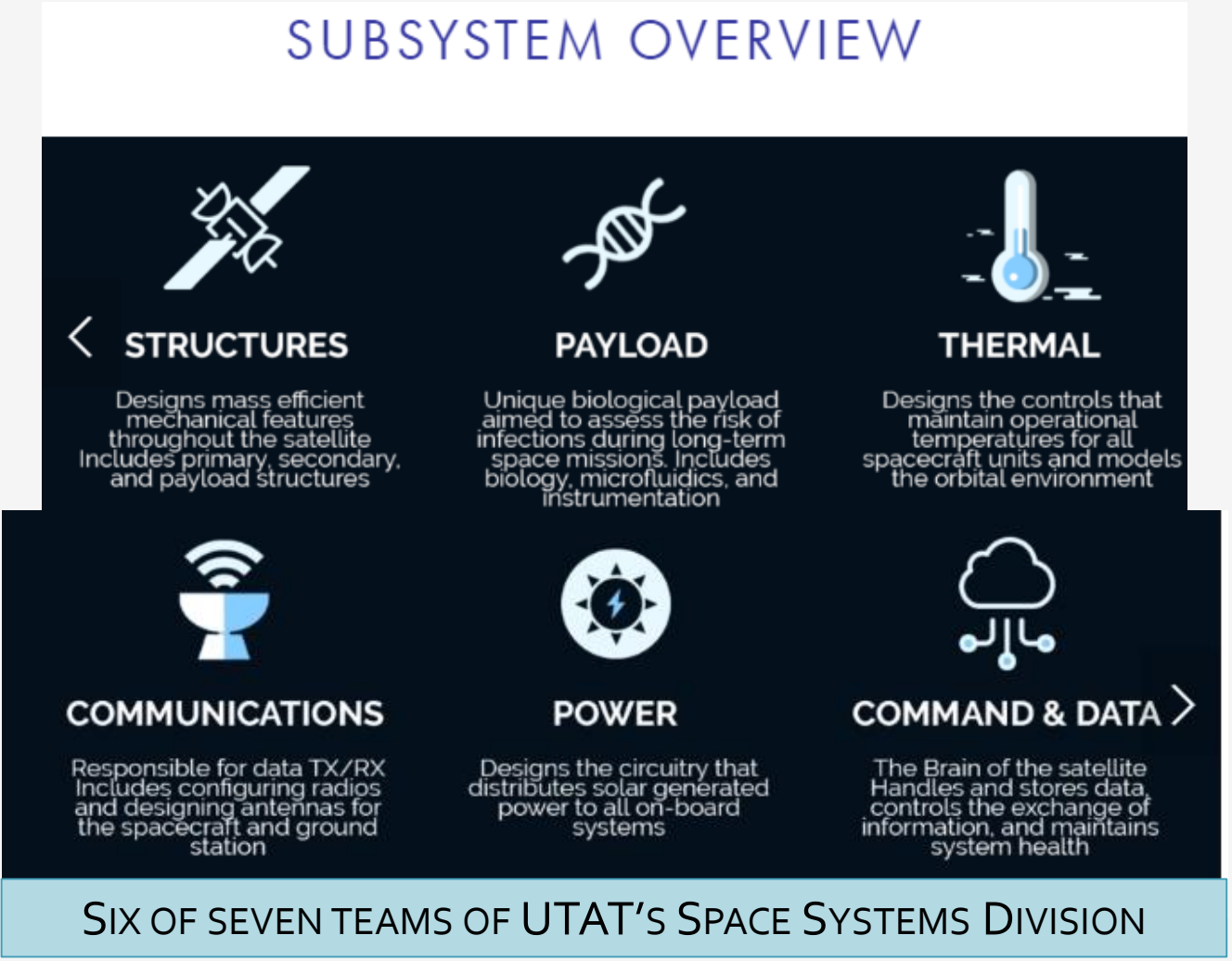
TEAMWORK

- UTAT
  - Have to work with a multi-disciplinary team, consisting of people with different backgrounds, such as biology and computer science
  - Example: 2700 Batteries – Designed for a thermal team to do insulation testing on them
  - Mainly, I work closely with the mechanical/structures team
- Student Council
  - Worked with a team of six to implement events and assemblies at Jarvis Collegiate Institute
  - Helped to bring on “grade representatives”



THERMAL INSULATION TESTING WAS DONE ON THE 2700 BATTERIES

- In order for the 2700 batteries used by 'UTAT' to function in space, they have to be insulated; hence, the need for insulation testing
- Showcases the multi-disciplinary work at 'UTAT' and how I worked with two different teams on a single project



SIX OF SEVEN TEAMS OF UTAT'S SPACE SYSTEMS DIVISION

- Taken from https://www.utat.ca/space-systems/
- Showcases the number of teams at the "space systems" division of UTAT, where I work

Teamwork

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POSTER FOR THE "HALLOWEEN DANCE"

- One of the events planned by the student council that I was a part of; My contributions consisted of making the tickets and a "masters list" of ticket purchasers
- Important, as it shows how I've worked with a non-technical team, developing strong communication skills with people not from engineering; Shows that I can work with a wide range of people

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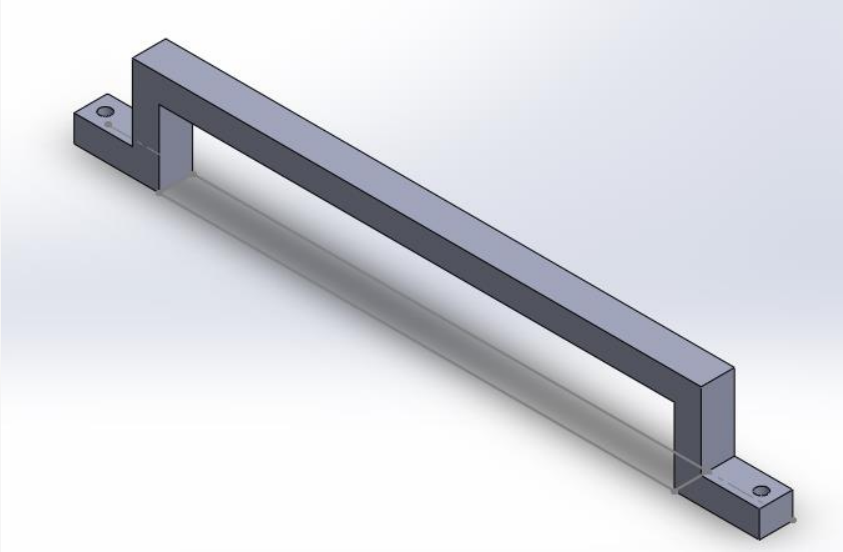

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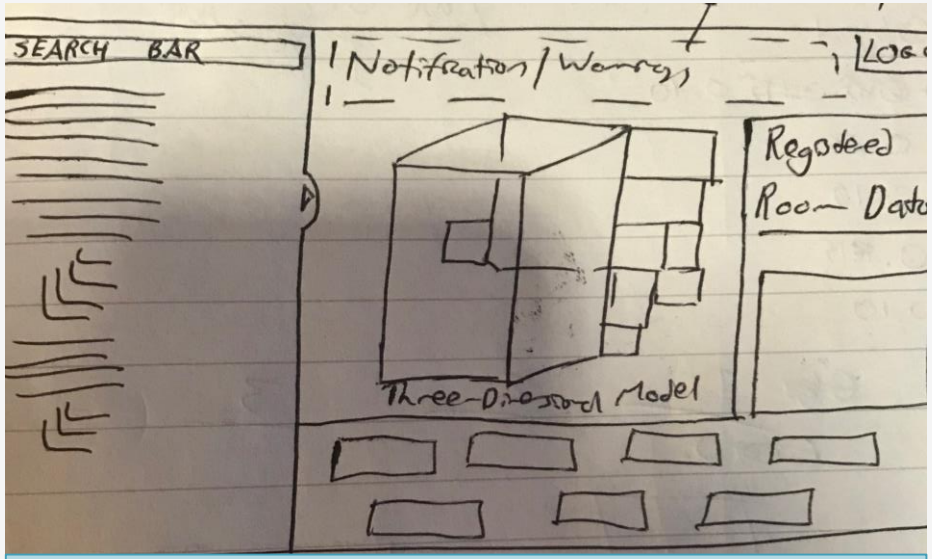
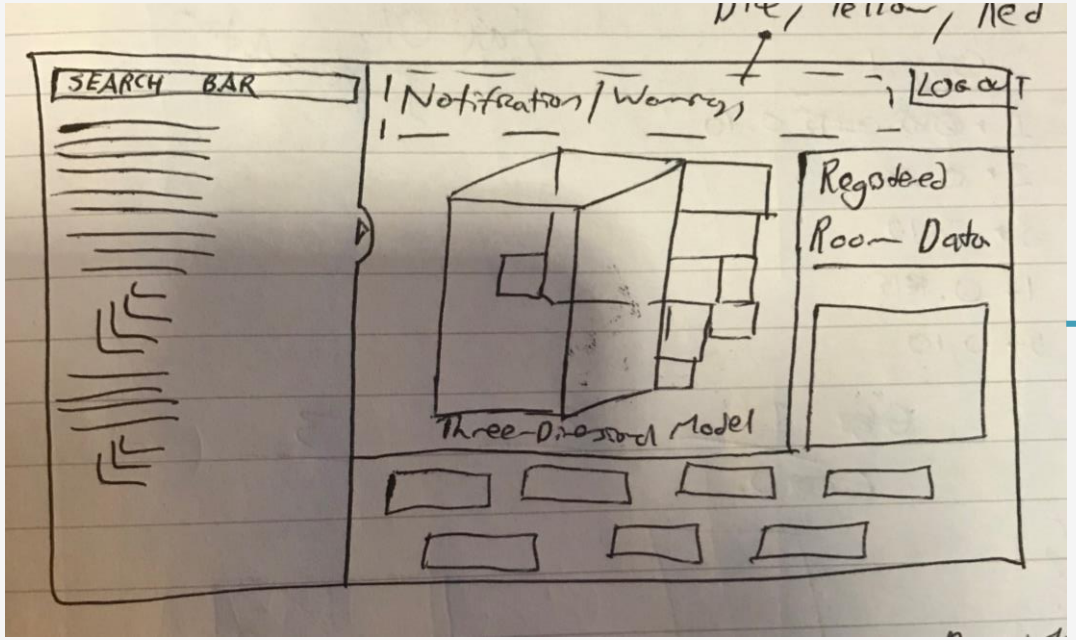
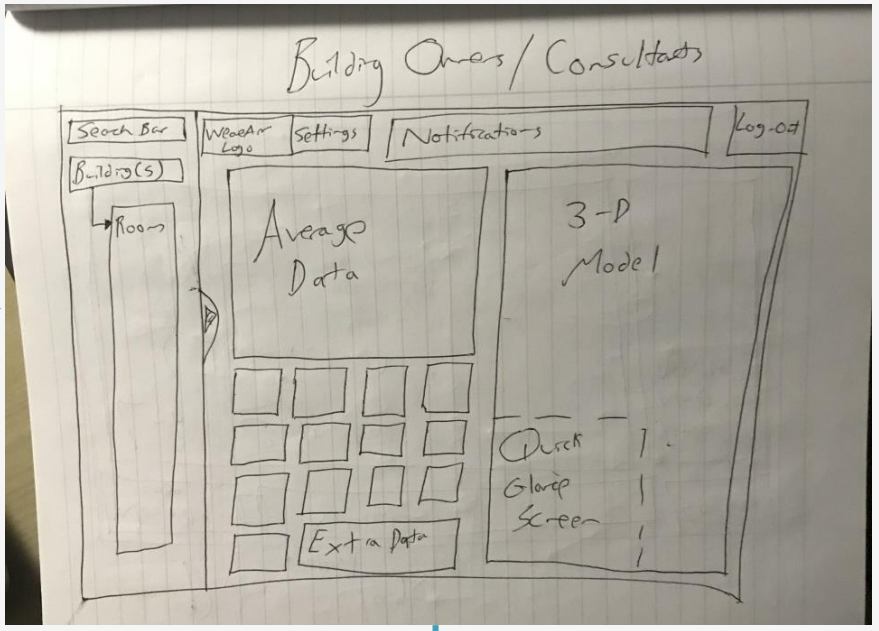


DESIGN

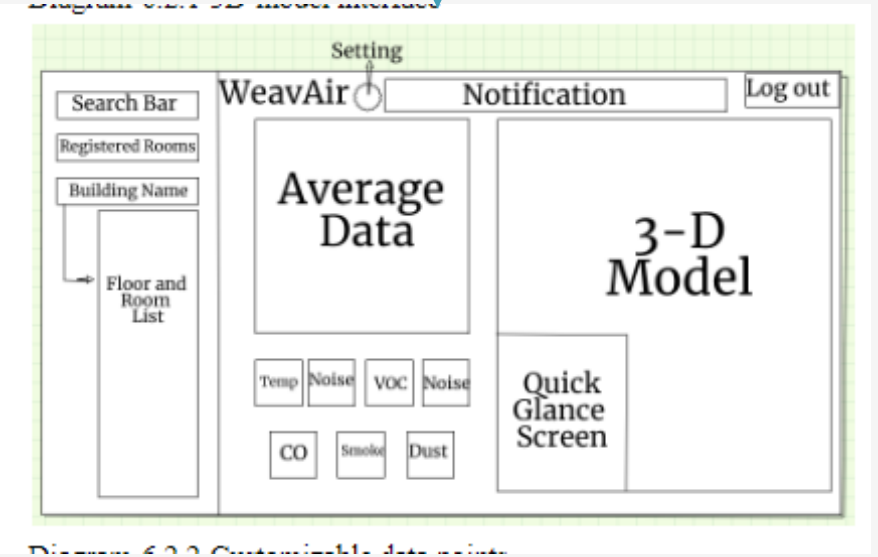
Design

- WeavAir
  - Part of 'Engineering Strategies And Practice II' design course
  - Created a solution space of up to fifty solutions for a new 'HVAC' interface system and went through major design iterations
- UTAT
  - Solve an actuation engineering problem
  - Came up with a solution space to define this design problem
- MIE243 Design Project
  - Used a weighted decision matrix and graphical matrix to determine the "best" engineering solution to a mechanical rover design problem





- In order to prioritize my team's objectives of "quick access to data" and "simple to use and navigate", three major design iterations were performed on one design
- Showcases the use of engineering criteria of functions, objectives, and constraints to define and improve potential designs



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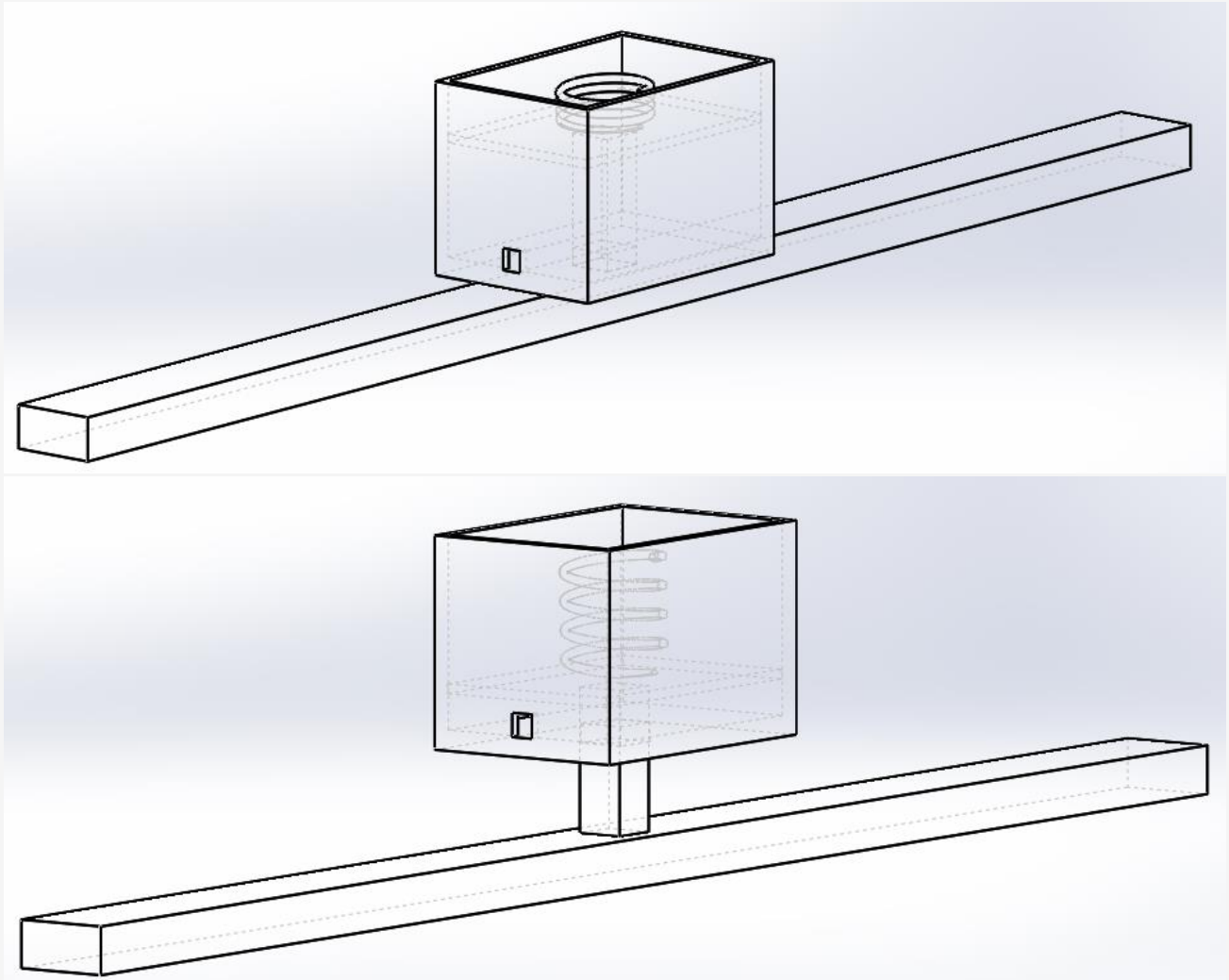

CAD OF A POTENTIAL "PRESSURE SYSTEM" SOLUTION TO THE DESIGN PROBLEM

- An engineering problem with the actuation board was the synchronization of motors (two motors were being used at either end of the board)
- Alongside a team member, we drafted a document with potential solutions, such as:
  - Pressure system board (figure on the left)
  - Replace one motor with a spring
- Showcases how I defined a design problem and used engineering tools (Ex: SolidWorks) to improve a previous design

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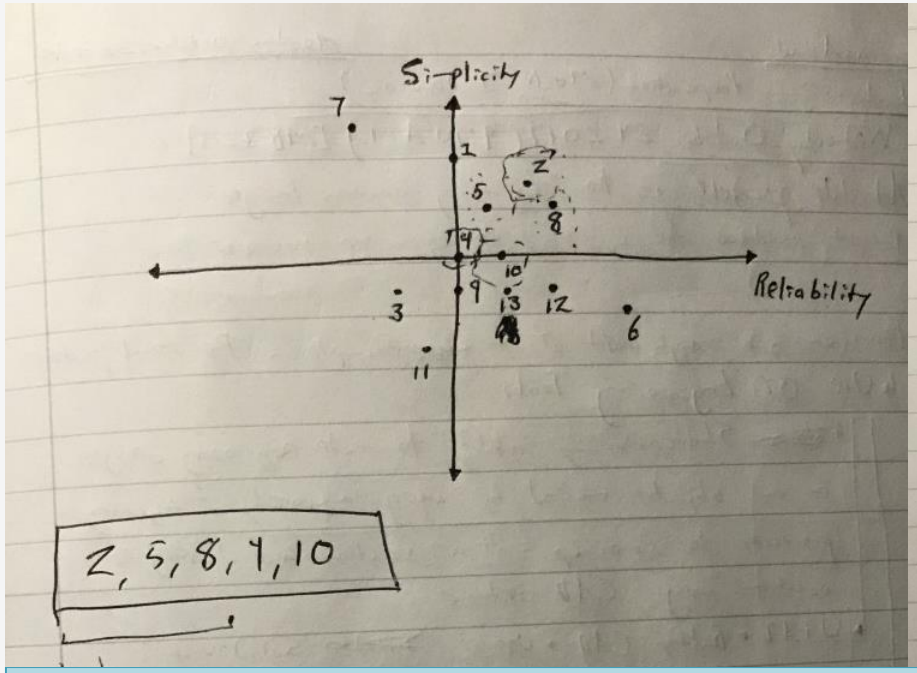

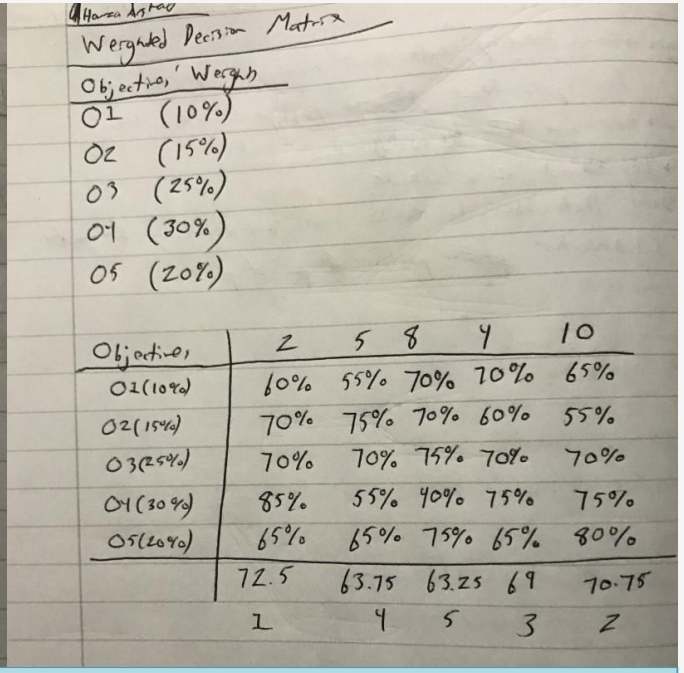

Weighted Decision Matrix

Objective, Weight	2	5	8	4	10
O1 (10%)	60%	55%	70%	70%	65%
O2 (15%)	70%	75%	70%	60%	55%
O3 (25%)	70%	70%	75%	70%	70%
O4 (30%)	85%	55%	40%	75%	75%
O5 (20%)	65%	65%	75%	65%	80%
	72.5	63.75	63.25	69	70.75
	1	4	5	3	2

"GRAPHICAL MATRIX" AND "WEIGHTED DECISION MATRIX" FOR THE ROVER DESIGN

- Used two important design criteria, simplicity and reliability, to narrow down potential rover designs
- Also, used a "weighted decision matrix" to further narrow down to three rover solutions
- Showcases the use of important factors, either requested by the client or found through research, to define narrow engineering design choices