Lava Tube Exploration Vehicle

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Intro / Justification

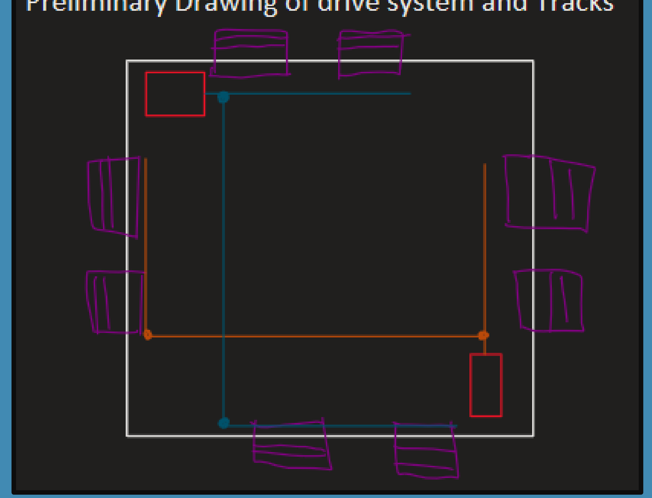
The Lava Tube Exploration Vehicle (LTEV) is a proof-of-concept project that aims to create a remote-controlled rover capable of exploring the dark lave tube formations. This project, under the advisement of Prof. Sean Sloan, was inspired by Project Artemis, a NASA mission to explore the lunar surface. Controlled remotely by the operator, the LTEV can easily maneuver and explore the narrow and low-light conditions of lava tube formations.

DEVELOPMENT AND CAD

Introduction

Our task was to design a rover that could explore small tunnels made by the past lava activity on the moon. Part of this specification was the rover must have treads on all sides and be able to articulate itself in 2 degrees of freedom.

Preliminary Drawing of drive system and Tracks



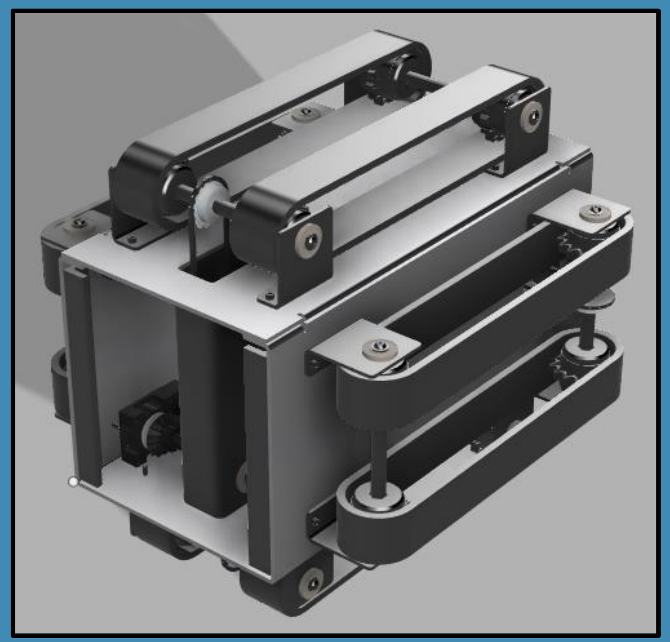
Preliminary Part Choices

Using the given specifications, we were able to estimate the part requirements and form a list of parts.

1	5052 Aluminum Alloy
2	6061 Aluminum Structural Angles
3	Universal Fastener Screws/Nuts
4	Sheet of Plexiglas 12"x24"
5	Cooling fans/filters
6	PG Series Gearboxes
7	Planetary 90° Drive Kit
8	Planetary Universal Female Output Shaft Kit
9	DC5-12V 0A-30A Dual Channel H Bridge
10	Shaft Add-On Kit
11	#25 Standard Roller Chain (10')
12	#25 Master Link (5 Pack)
13	16T Aluminum Hub Sprocket (#25 Chain, ½" Hex Bore)
14	½ inch flange hex Bearing 12 pack
15	Tank tread kit

CAD's Role

After and during the selection of our parts, we utilized CAD to make sure our parts would fit and get a better understanding of the rover.



CONSTRUCTION AND CHALLENGES

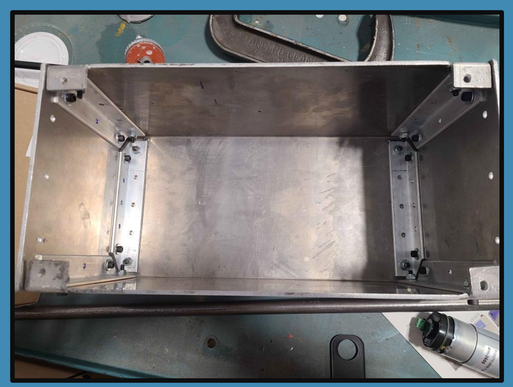
Method

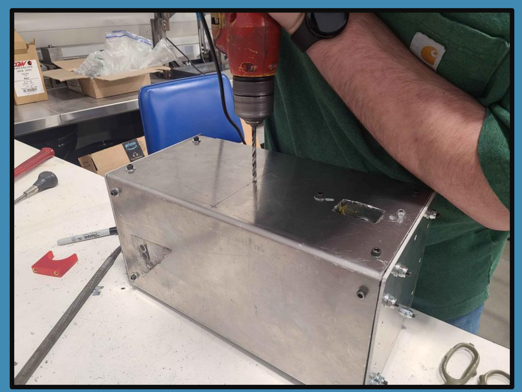
Once the parts were all delivered and the CAD model was completed, we were able to begin construction of the rover.

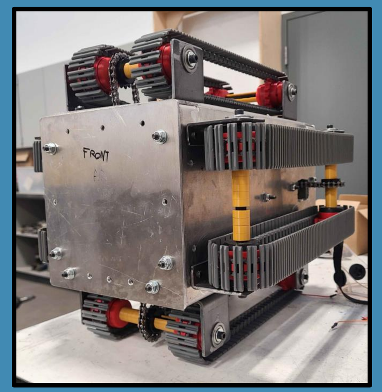
Cut the body of the Rover → Bend the body to shape → Install the Drive System → Install the Tracks → Install the Turning System → Install Electronics → Attach rover sections to each other → Upload Software

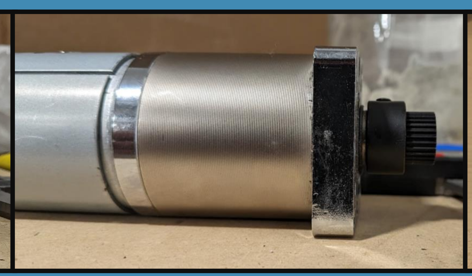
Integration of Parts

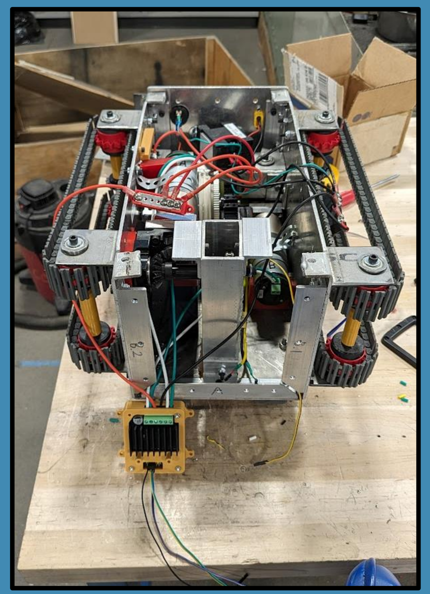
As we constructed the rover, we made sure to test as we implemented. As the driving system was installed, we would hook the motor up to the battery to make sure that the motor system was still functional. We also worked with the CSET team members to ensure that their code worked with the hardware throughout the process of construction.











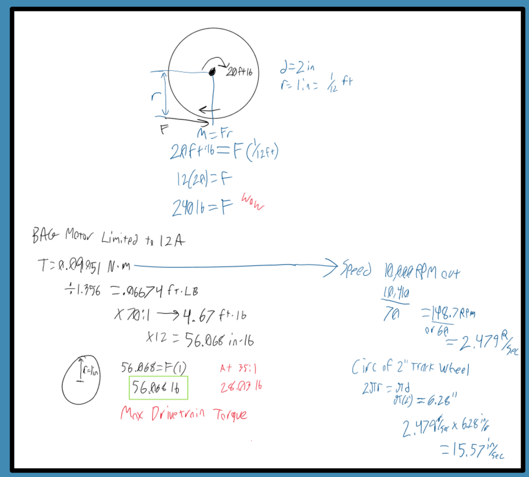
TECHNICAL CHOICES

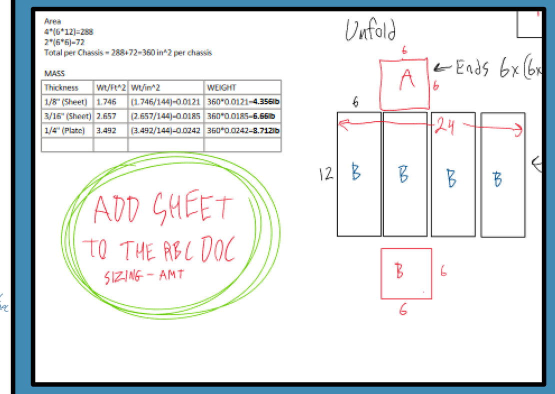
Math of the Rover

For the choices of the material and motor, we:

- Estimated weight and size.
- Utilized Statics and Machine Design knowledge to estimate required torque.

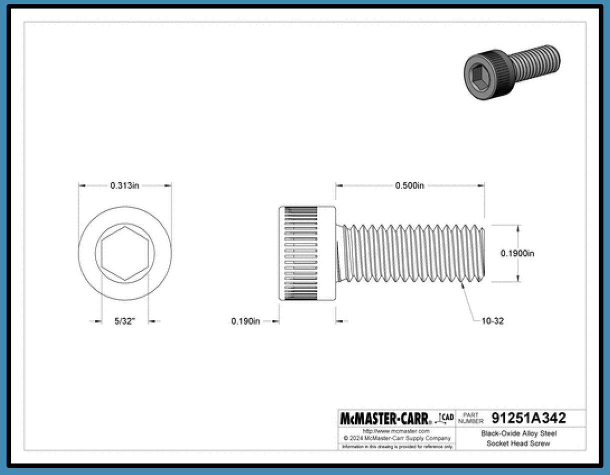
We determined that a 70:1 gear ratio motor will be ideal for our project, providing enough torque with a low power requirement.





Choices of Material and Fasteners

- 5052 Aluminum
  - Malleable and lightweight.
- ATSM A574 Head Cap screws
  - 180 ksi tensile strength.
  - 3 sizes of screws to simplify construction.



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