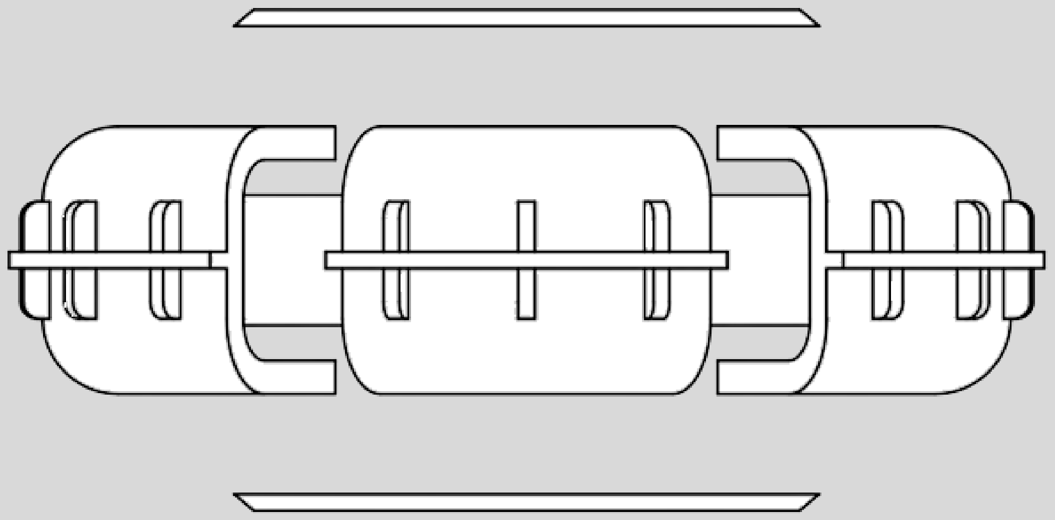
THE MTS LUNAR WHEEL

Fully Modular - Durable - Lightweight



In order to better show the way our wheel functions, we relied on a real simulation test, using a modified scooter with our custom-made wheels. Unfortunately, the 3D print was not durable, as seen in the video. However, the simulation was able to hold a load weight of 195 pounds (per Luke's body), and the vast majority of the damage came from the concrete ripping the wheel, not the weight of the person, demonstrating the wheels themselves to be quite strong design wise.

View a video of our simulation using 3D-printed parts here:

Material Specifications:

Our design will use two different materials:
1. A strong and highly durable material for the central hub, that will serve as a more permanent feature intended for incredibly rare replacement.
2. A still durable, but more easily replaceable material for the modular treads. These treads could be made through a molding process, or simply transported as pieces, ready to be easily replaced when damage occurs.

To achieve this, we have a few general ideas:
For 1, we are still trialing items like carbon fiber, professional-grade thermoplastics, and advanced composites. We hope to specify this more in the future.
For 2, we currently are toying around with the idea of aluminum treads, but are open to new ideas, including certain advanced composites.

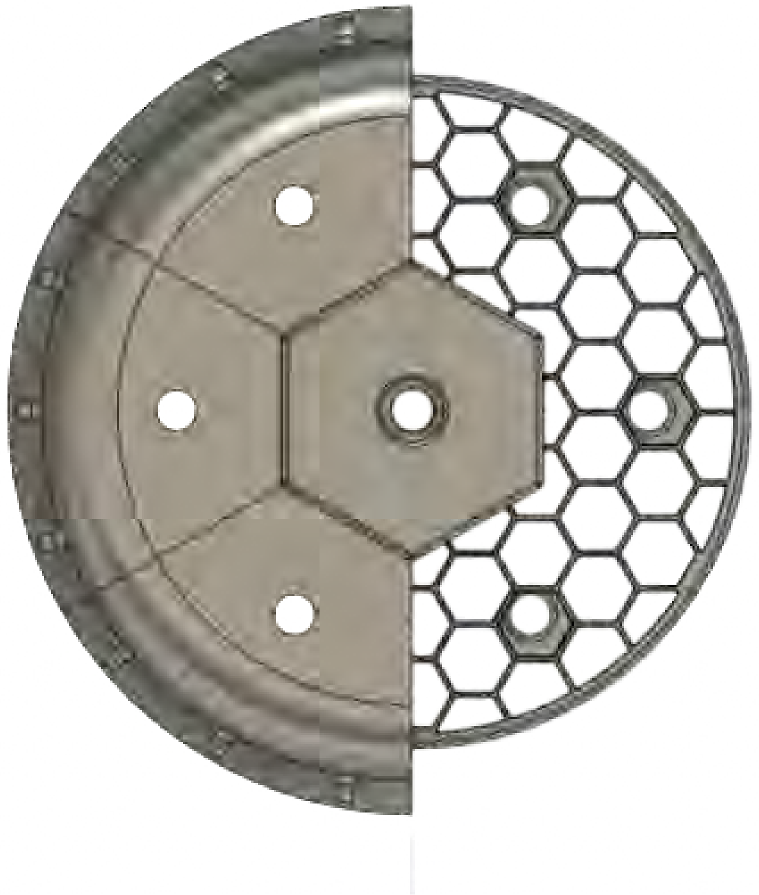
THE MTS LUNAR WHEEL

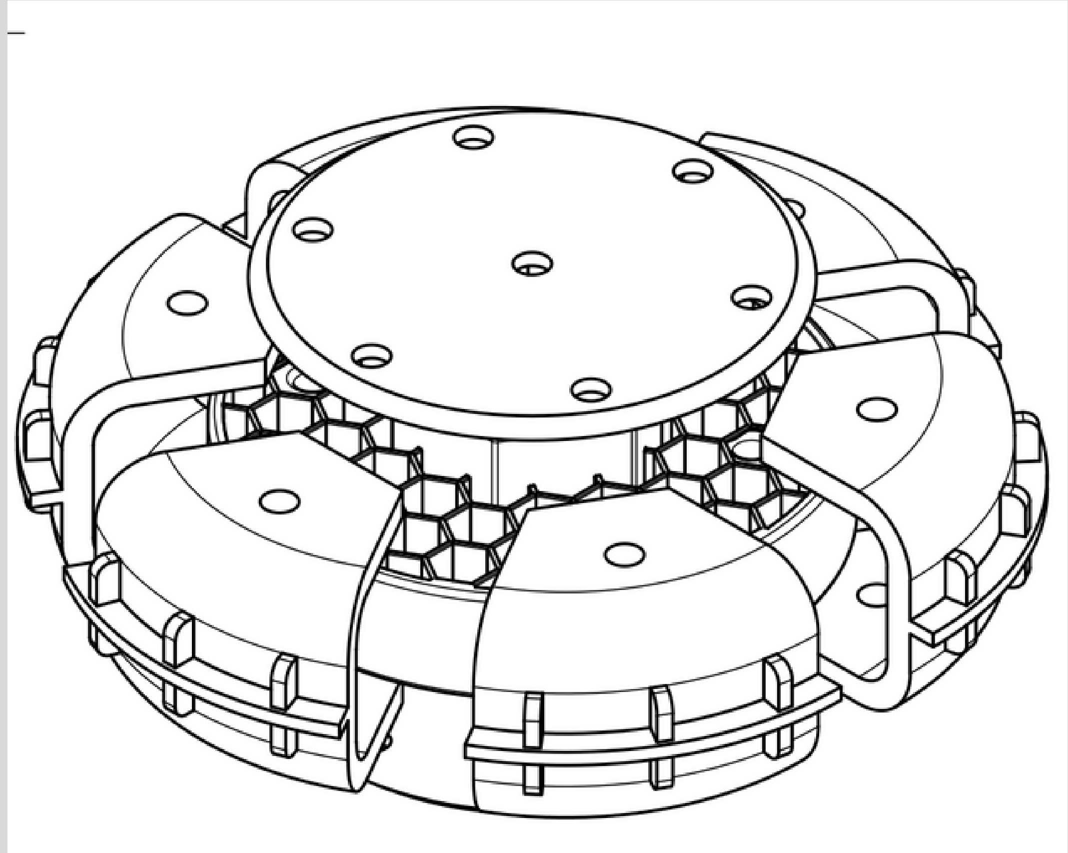
Fully Modular - Durable - Lightweight

Modeling:
We have created a variety of models that have culminated in our current design. We began with large scoops, due to a severe overestimation of the amount of dust on the moon. After correction, we severely shrunk the paddles, leaving them for cases of higher dust areas.

Modeling Specs:
Our current model's sizes and weights (though they will undoubtedly change) are as follow:
Mass - 653 Grams
Diameter - 120mm
Pin Diameter - 6mm
Height - 45mm
The total cost to bring 2 wheels to the moon would be approximately 3.45 million dollars.

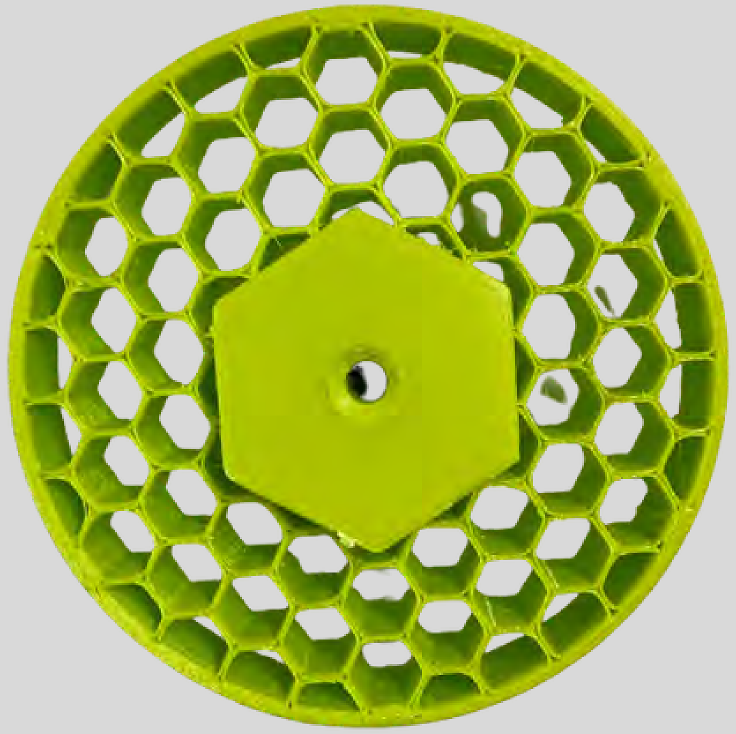
Paddles and Ridge:
The tread system itself uses a central ridge and paddle-based design to stabilize the wheel and bring more traction in dust-heavy areas. Inspired by the sand dune paddle wheels used on certain tires, this is sure to be a beneficial feature for moon travel.





Outer Treads:
Our modular tread system (MTS), brings a unique build to the ordinary wheel, saving astronauts time and money by allowing each damaged tread to be replaced individually, rather than the wheel as a whole.

Honeycomb Center:
Our innovative, hexagon-based design creates an incredibly stable core for the wheel, protecting the proposed internal motor, and providing flexible suspension without creating large, unstable holes that other internal suspensions rely on.




Testing
The Wheel

Innovative Design

The Lunar Wheel's advanced suspension system is one of its most innovative features. Designed to adapt to the constantly changing lunar terrain,

Tested in the Extremes

the Lunar Wheel underwent extensive testing in similar terrain to ensure its performance and reliability in the challenging lunar environment.

Built to the Millimeter

The Lunar Wheel was built with meticulous attention to detail

Contacts Us

It was popularised in the 1960s with the release of Letraset sheets containing recently with desktop

(406) 595-1140
(406) 548-1697

will_nash@icloud.com

205 N 11th Ave,
Bozeman, MT 59715

NASA HUNCH

William Nash Zac Serocki

NASA's New Lunar Wheel

Introducing the new Lunar Wheel, designed to meet the rigorous demands of NASA's lunar exploration missions. This innovative design features a durable aluminum alloy construction with specialized treads that provide superior traction on the moon's rocky and uneven terrain. The wheel's advanced suspension system can adjust to the constantly changing landscape, ensuring a smooth ride for astronauts and their equipment. This wheel is he ideal choice for NASA's upcoming lunar missions.

Our Design Process

01 We **Identified** what the problem was and our constraints.

02 We **Brainstormed** ideas about how to solve our problem with the required constraints.

03 We **Selected** which idea was best for the problem.

04 We **Built** our wheel using our engineering skills and principles.

05 We **Tested** our idea in carefully created testing facilities and used well crafted procedures

Our Lunar Wheel has a high efficiency ratio, maximizing traction while minimizing energy consumption. Its specialized tread pattern and reinforced construction allow it to withstand collisions with rocks and other obstacles, ensuring both the wheel and rover remain undamaged. This makes our Lunar Wheel an ideal choice for NASA's lunar missions where efficiency, durability, and adaptability are essential.

What Makes our Wheel Unique

Our Lunar Wheel features a carefully crafted design that is optimized for performance, durability, and adaptability in the challenging lunar environment.

High Quality Testing Facility

We have created a testing facility capable of closely representing a lunar environment.

Impact Resistant

Our wheel is Impact resistant to various lunar obstacles like rocks and potholes.

Leaf Spring Treads

The leaf spring treads will allow for contact on the ground at nearly all times.

Strong Internal Core

Our wheel is designed to have a strong internal core to keep a driver safe at all times.

About Our Wheel

Our Lunar Wheel is designed and tested at our facility to meet the rigorous demands of lunar exploration. It is carefully crafted with high-quality materials and advanced engineering, ensuring its durability and functionality in the harsh lunar environment. To test its performance, we use our specialized sand testing facility that simulates the challenging terrain of the moon. This facility allows us to evaluate the wheel's traction, suspension, and durability, and make any necessary adjustments to improve its performance. By subjecting our Lunar Wheel to rigorous testing at our facility, we can confidently provide NASA with the best possible equipment for their lunar missions.


Background
Reinventing the Wheel
Lunar Scooter Wheel
Zion C , Blake H, Alex H
Lakewood High School
Ms. Pederson
Testing
Criteria & Constraints
Prototyping
Iteration one
Iteration two
Research

Testing and Results

Rolling Test

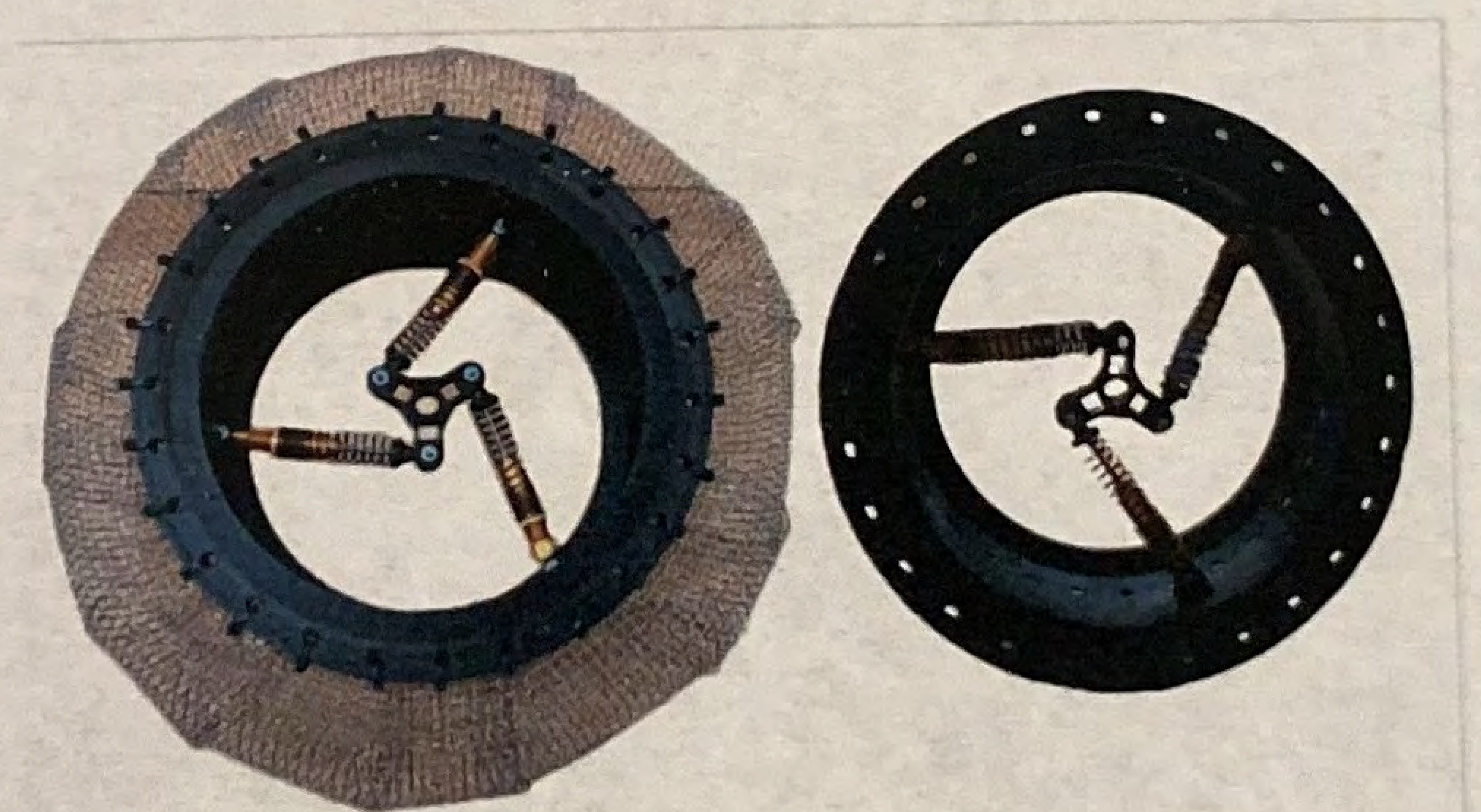
- Rolled wheel over 0.5 and 0.75 inch ledge at 5 mph.
- Shock absorption system performed well under ideal conditions.
    - Small impacts inline with the springs.
- Shock absorption did not perform well under high impacts or impacts not inline with the shocks.
- A six-pronged hub design and shocks with more travel would help to alleviate these issues.

Drop Test

- The Wheel was dropped from a height of three feet onto a rigid surface with spring shocks and stiff shocks
- The Graphs show the maximum acceleration applied to the axle of the wheel during each impact.
- The Spring suspension almost halved the forces applied on the axle during the impact.
    - Maximum Acceleration (Spring)
        - 86.847 m/s/s
    - Maximum Acceleration (Rigid)
        - 166 m/s/s

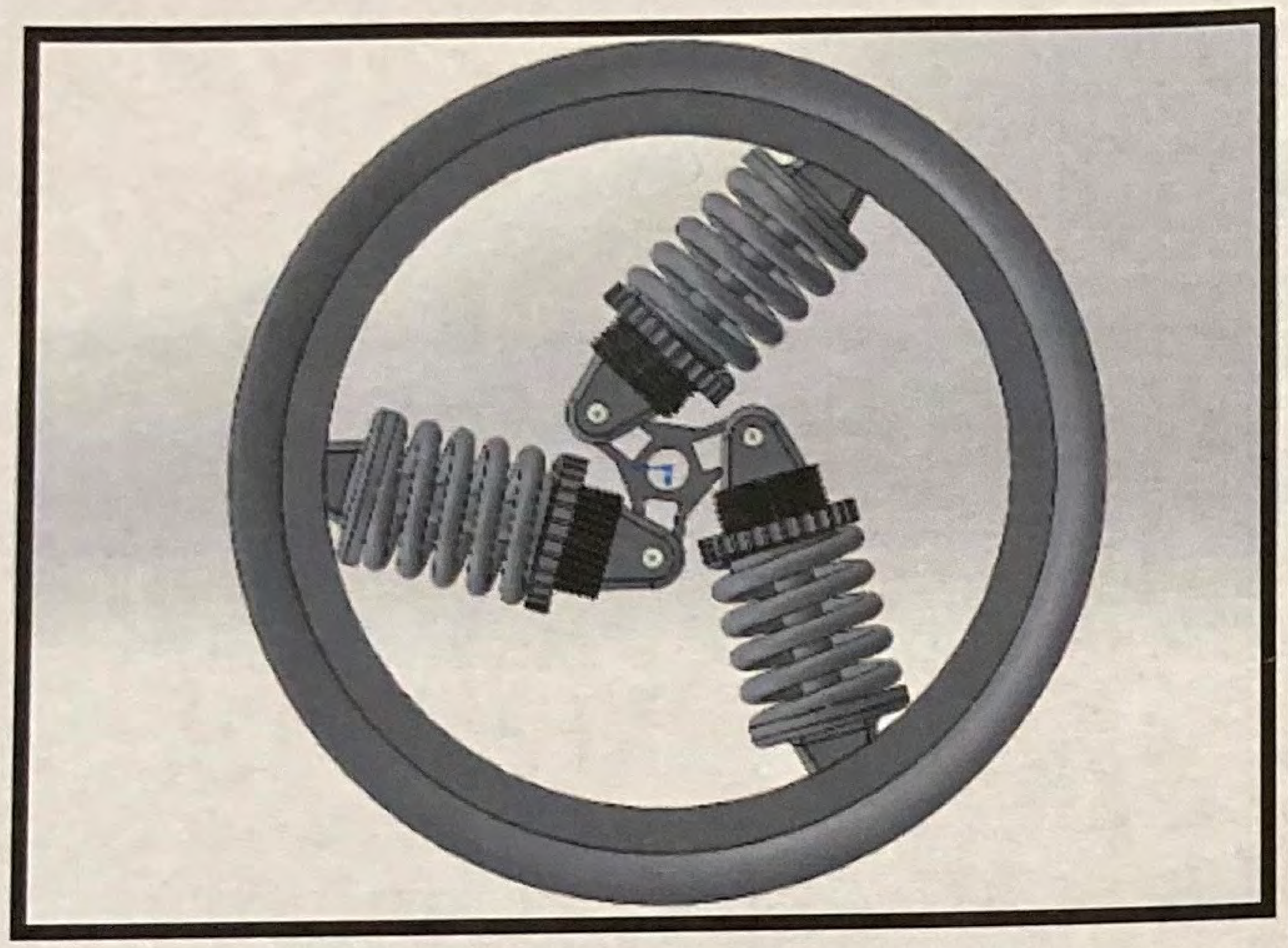
Final Solution Statement

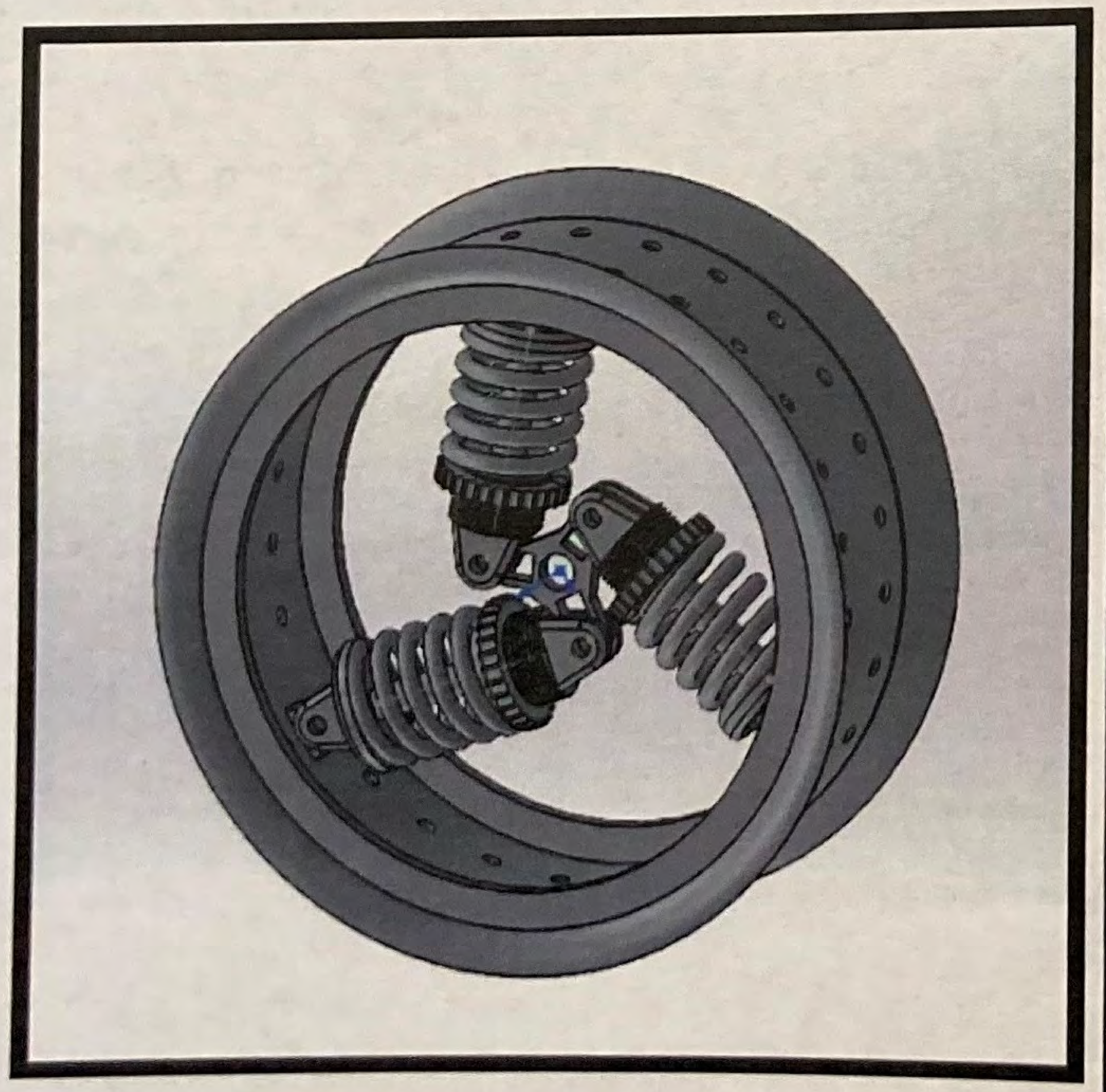
We designed a wheel that utilizes inner suspension components to dampen the impact of the harsh lunar surfaces on the scooter. The tire utilizes a wire mesh that provides extra traction and spring to the wheel. The wheel is also covered by a layer of fabric to mitigate lunar dust and soil. This will ensure the reliability of the moving components over long periods of use.



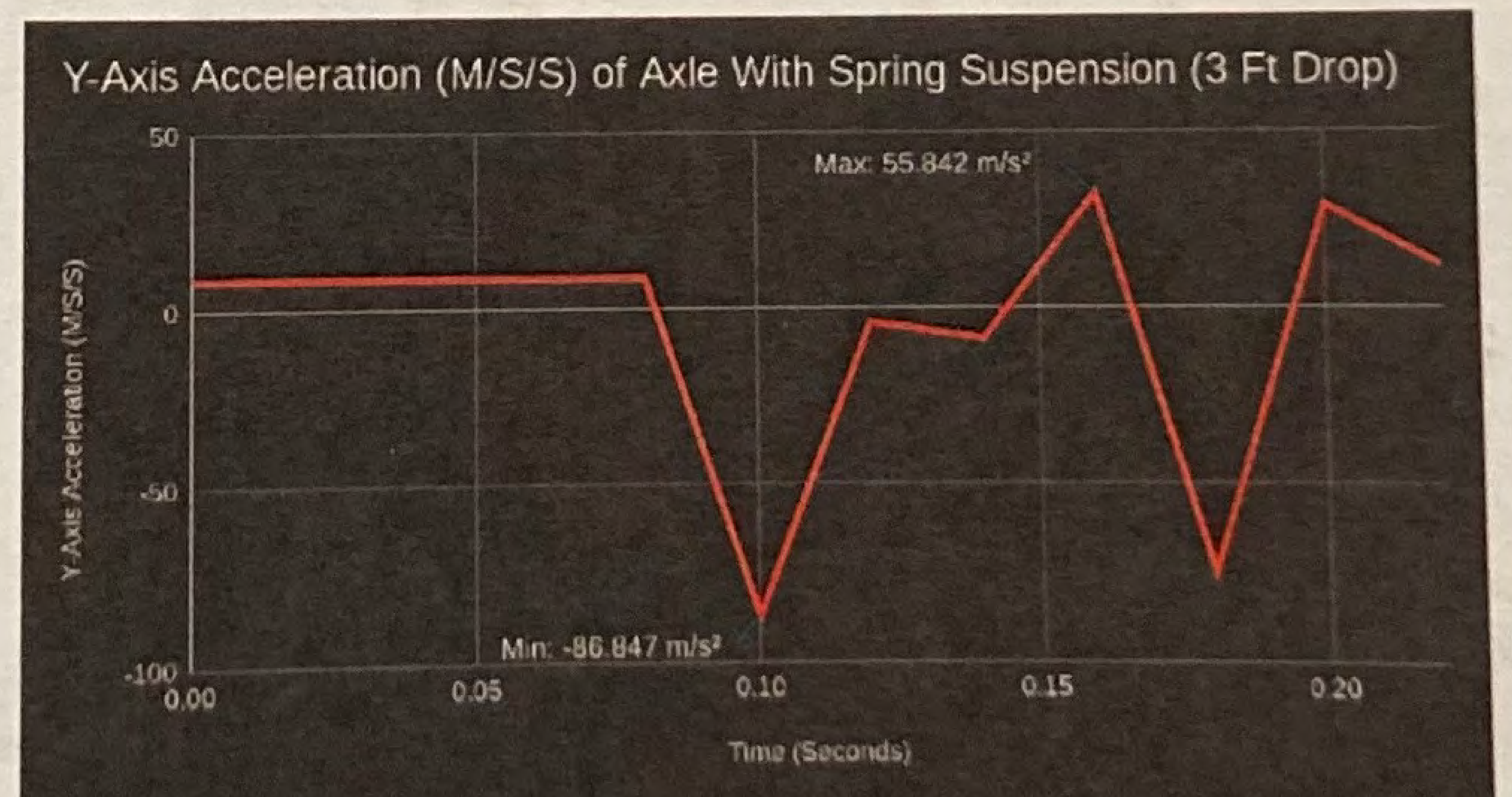
Materials list

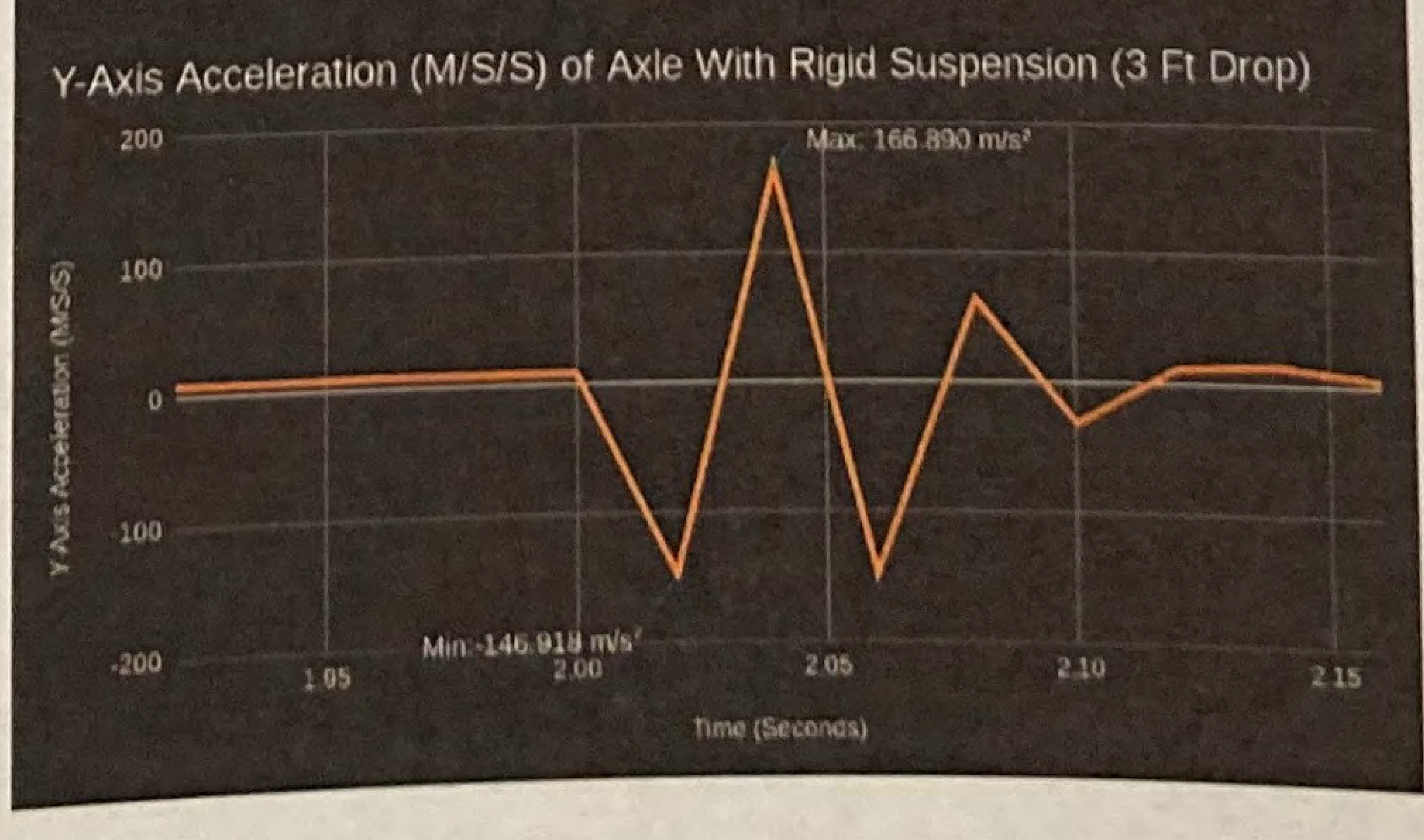
Wheel Part	Material
Center hub	Machined 6061 Aluminium
Outer Hub	Machined 6061 Aluminium
Mesh	Woven zinc coated spring steel wire
Suspension components	Aluminum 6061 or Hardened stainless steel
Dust prevention	Beta cloth





NASA HUNCH





HILL, HOFFER, CLARK

Lunar scooter wheel

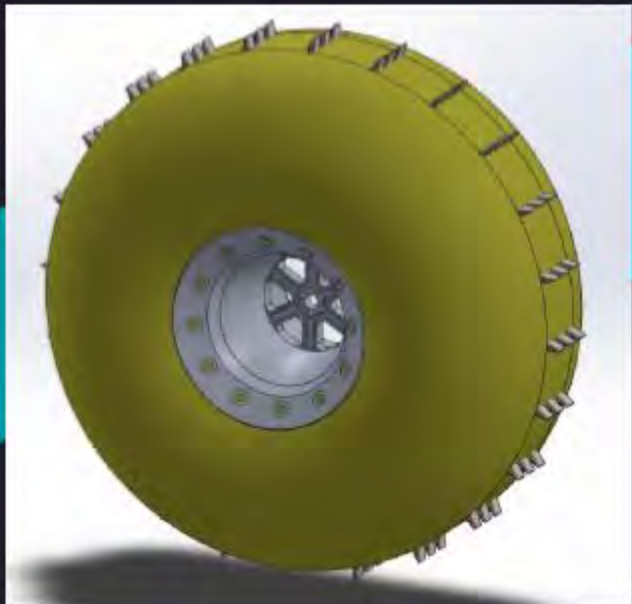
Lakewood High School

NASA HUNCH

Team Members: Zion Clark, Alex Hill, Blake Hoffer

Ms. Pederson

Format is not organized for digital viewing



Wheel Operation Video

Lunar Scooter Wheel

Andrew Wright

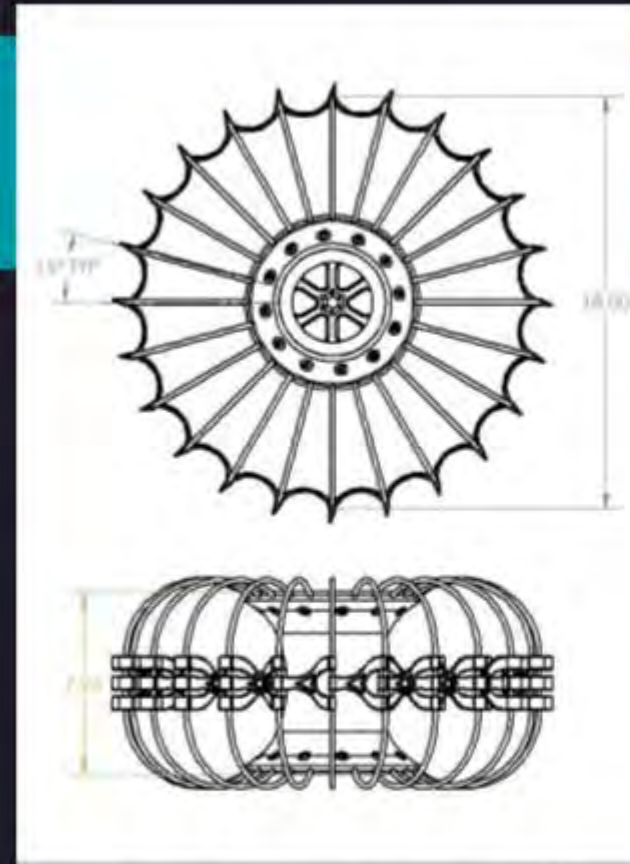
Kettering Fairmont High School

Teacher: Brett Jenkins

My Lunar Scooter wheel uses a cage-like design covered by a layer of kevlar. The 24 titanium wires are bent into shape and are set into grooves on the hub, then it is wrapped with kevlar that is held in place by rims that are bolted onto the hub. The wires also have arc shaped spacers with spikes on the end, which poke through the kevlar to provide traction.

To make my prototype, I 3D printed the hub and rims, as well as a guide to bend the wires into the right shape. To get the canvas cover I sewed to fit, I had to tweak the wire guide a few times to result in the proper dimensions

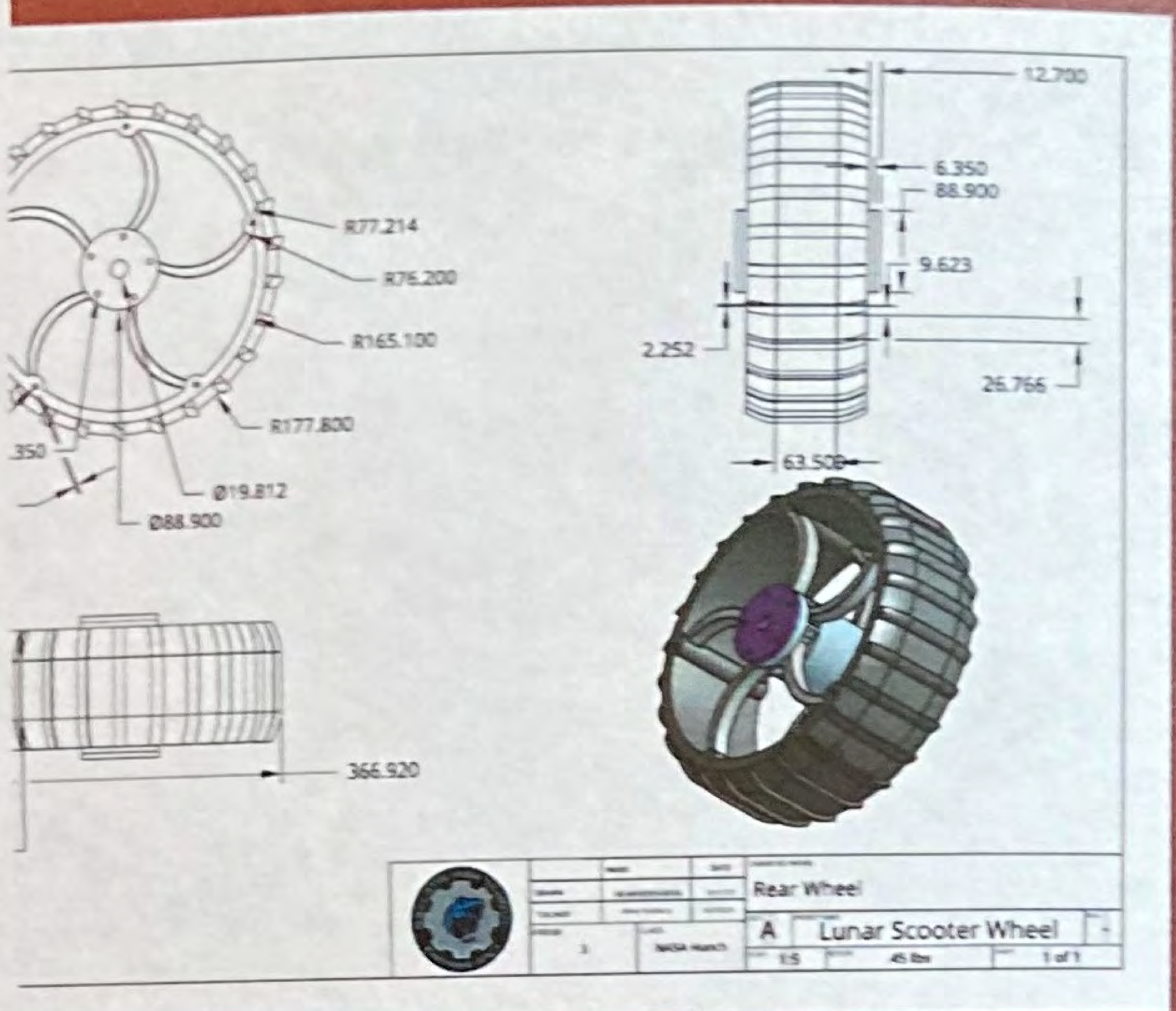
v1 v2 v3

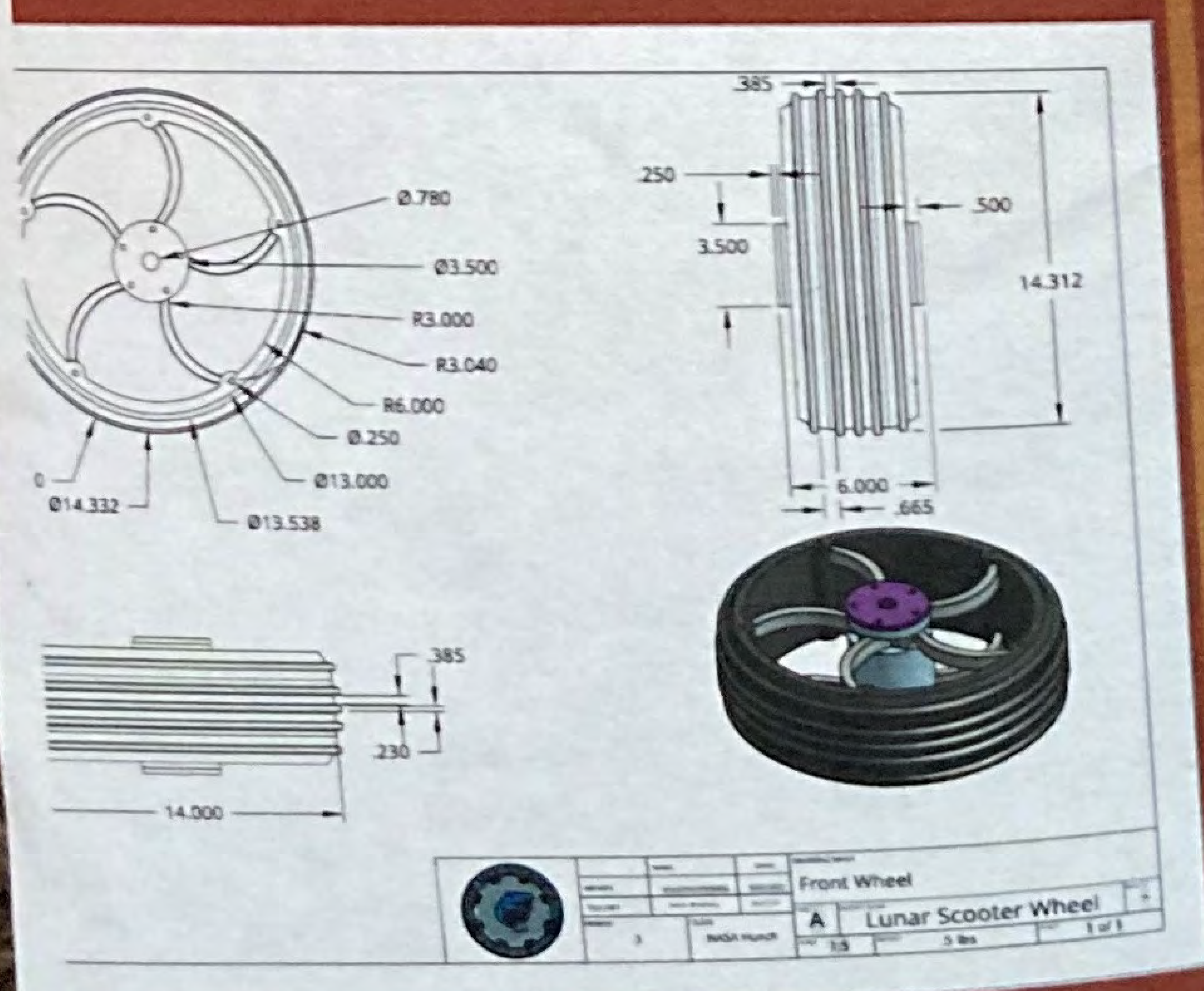


The wheel currently weighs about 10 pounds, and is 18 inches in diameter. The hub is about 8 inches wide, but the entire wheel is about 10 inches wide. The hub and rims are made out of aluminum, and the wires and tread are made of titanium.

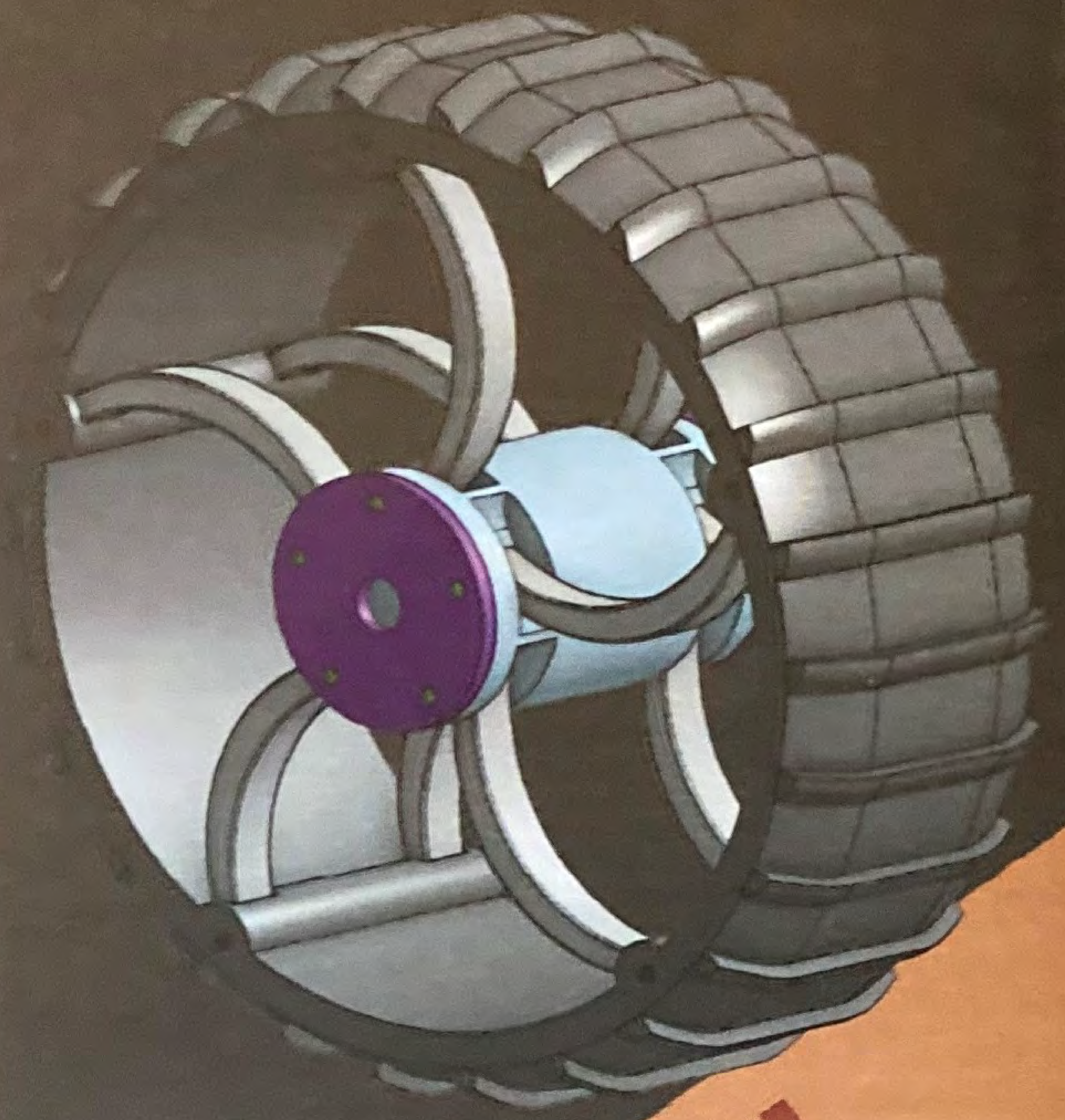

RAINSTORMING
The majority of these concepts are unfinished, but the main goal of this stage was to generate as many ideas as possible regardless of how impractical they are.
REVISING
NASA
HUNCH
LUNAR SCOOTER WHEEL
Andrew Wright
Defining The Problem
➤ Astronauts need a more efficient way to travel shorter distances
➤ A typical pneumatic car tire would not work on the moon due to the extreme temperatures and the abrasive regolith (fine moon dust)
➤ A scooter has more maneuverability than a car, and is more efficient in several scenarios
Criteria
➤ Maximum width and diameter of 10" x 18"
➤ 0.5" axle
➤ Last more than 300 miles in rough conditions
➤ Able to withstand the lunar environment
➤ Support about 100 pounds
➤ Travel up to 15 mph
FINAL DESIGN
This design consists of an
aluminum hub with titanium
PROTOTYPING
Constructing this prototype introduced a number of issues, but the biggest was bending the rods into the right shape. I made different guides to bend them, but I originally didn't account for the elasticity of the material. After a bit of trial and error adjusting the wire guide, the solution was to decrease the radius of the guide, which increased the intensity of the curve in the wire.
TESTING
Simulation Results
Direct Load
Centrifugal Force


Spokes
Lunar Scooter Wheels
The butterflies
Materials
Connection
Testing
Tread
Bearing Case





For the testing of our wheel we are figuring out how much the wheels will dig into the sand, this is going to let us now if our wheels will be able to float across the sand. Next the traction will be tested, this is to alow the scooter to stay afloat, but not be off ground. Lastly, the amount of sand that would be kicked up from the backtire, if too much sand is kicked up, then it is a hazard for the astronauts.



NASA HUNCH

LUNAR SCOOTER WHEEL

The Butterflies

Meet The Team

Kiedis MacFarlane
Ian Dyk
Samuel Stewart
Dylan Rosenzweig
Trey Kimm

Contact Us

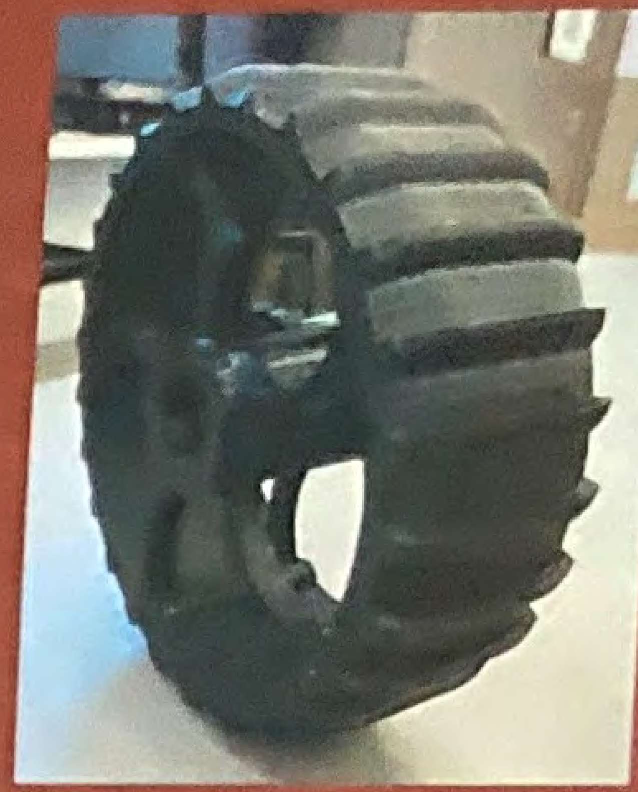
Email: kiedis.macfarlane@bsd7students.org
Trey.kimm@bsd7students.org
Dylan.rosenzweig@bsd7students.org
Sam.stewart@bsd7students.org
Ian.dyk@bsd7students.org

Phone: (406) 570-8056

Teacher: Glenn Bradbury
glenn. bradbury@bsd7.org

Our design

Goals:
we needed to make a light, durable, and most of all efficient wheel. Here is what we came up with



Materials

Tire:
PTFE or polytetrafluorethylene makes for a cheap, light and affordable outer wheel, on top of that it is 3D printable and can withstand great temperature variations

Spokes:
aluminium/titanium alloy is very light, formable, resists weathering, and is strong with a little give making it a great choice for our spokes

Testing:
PetG was the best material we had access to for our testing as it is strong, 3D printable, and cheap