DATA + RESEARCH

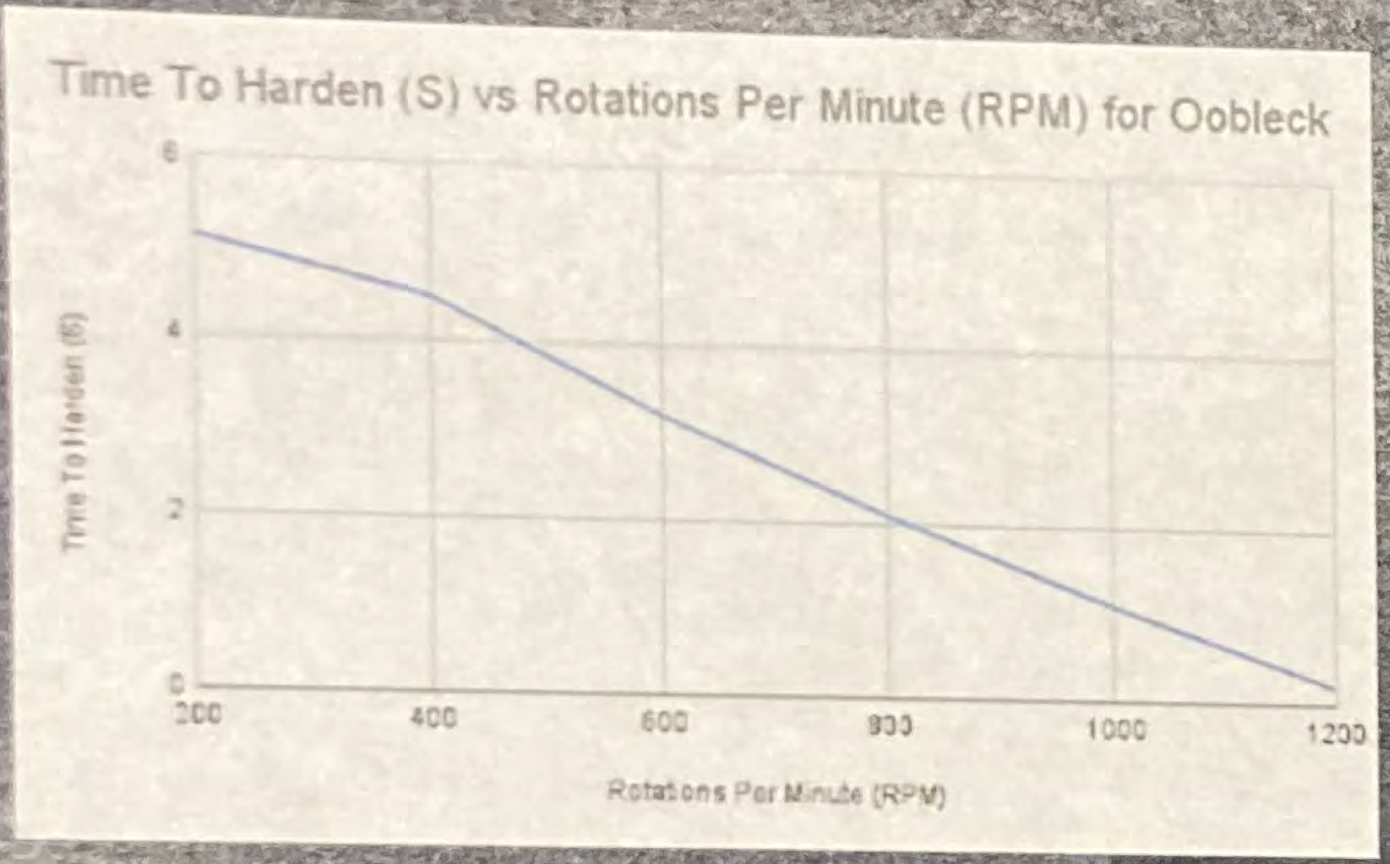


Figure 1: Oobleck Hardening Rate Per RPM

Knowing the RPM for the obleck to harden is important as we will need to control the release and stiffening of our arm.

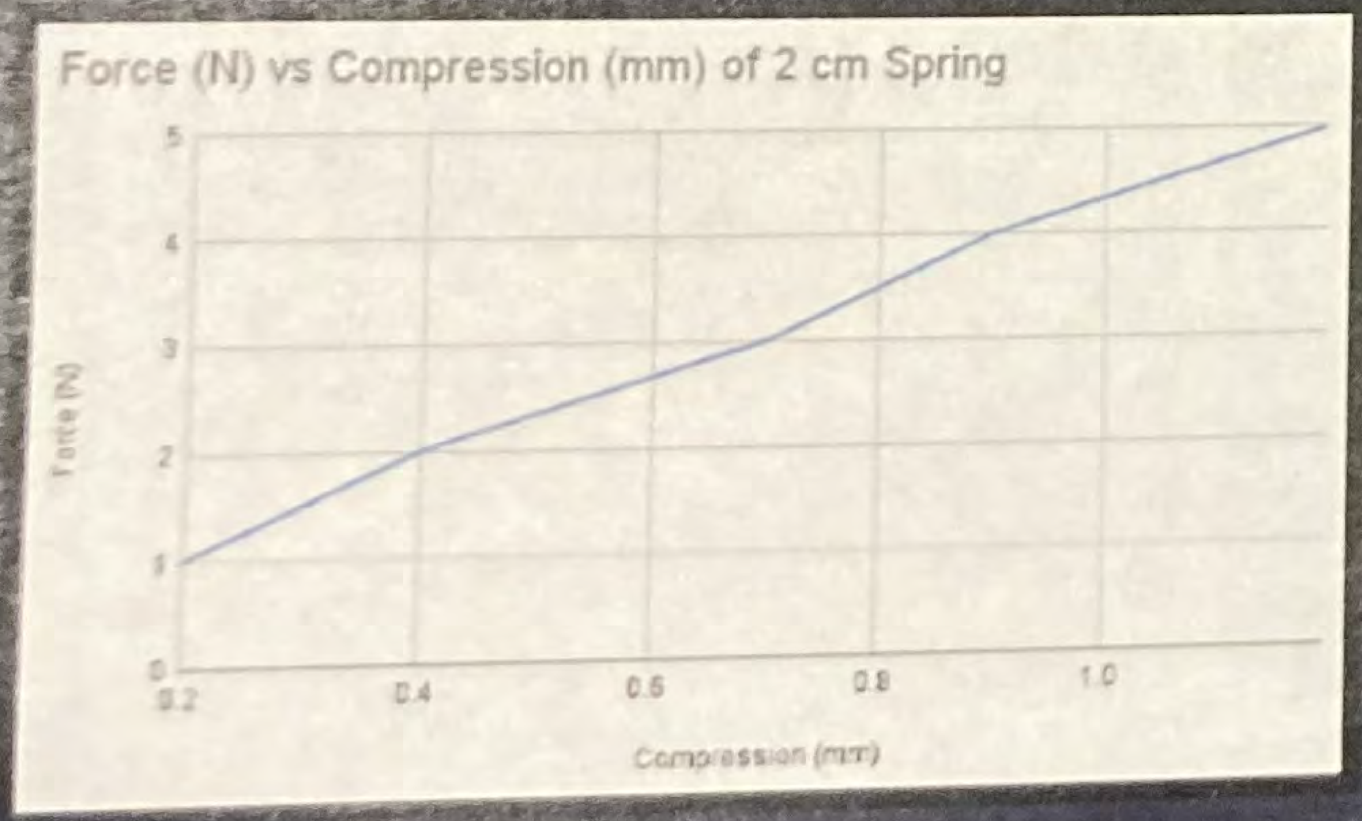


Figure 2: Force Compression Graph

Comparing the compression (mm) to force (n) will help us determine the ideal spring to use for our project.

MEET THE TEAM!

Zahra Hassanali

Alyssa Lee

Zayaan Bhanwadia

Quinn Wang

Sujay Golla

Mohammad Shikho

Teachers: Helen Strelkovska and Shalini Arjomand

QUESTIONS?

nasahunchvpci@gmail.com

SPONSORS

Thank you to our sponsors!

NAV CANADA

REACH FOR THE TOP

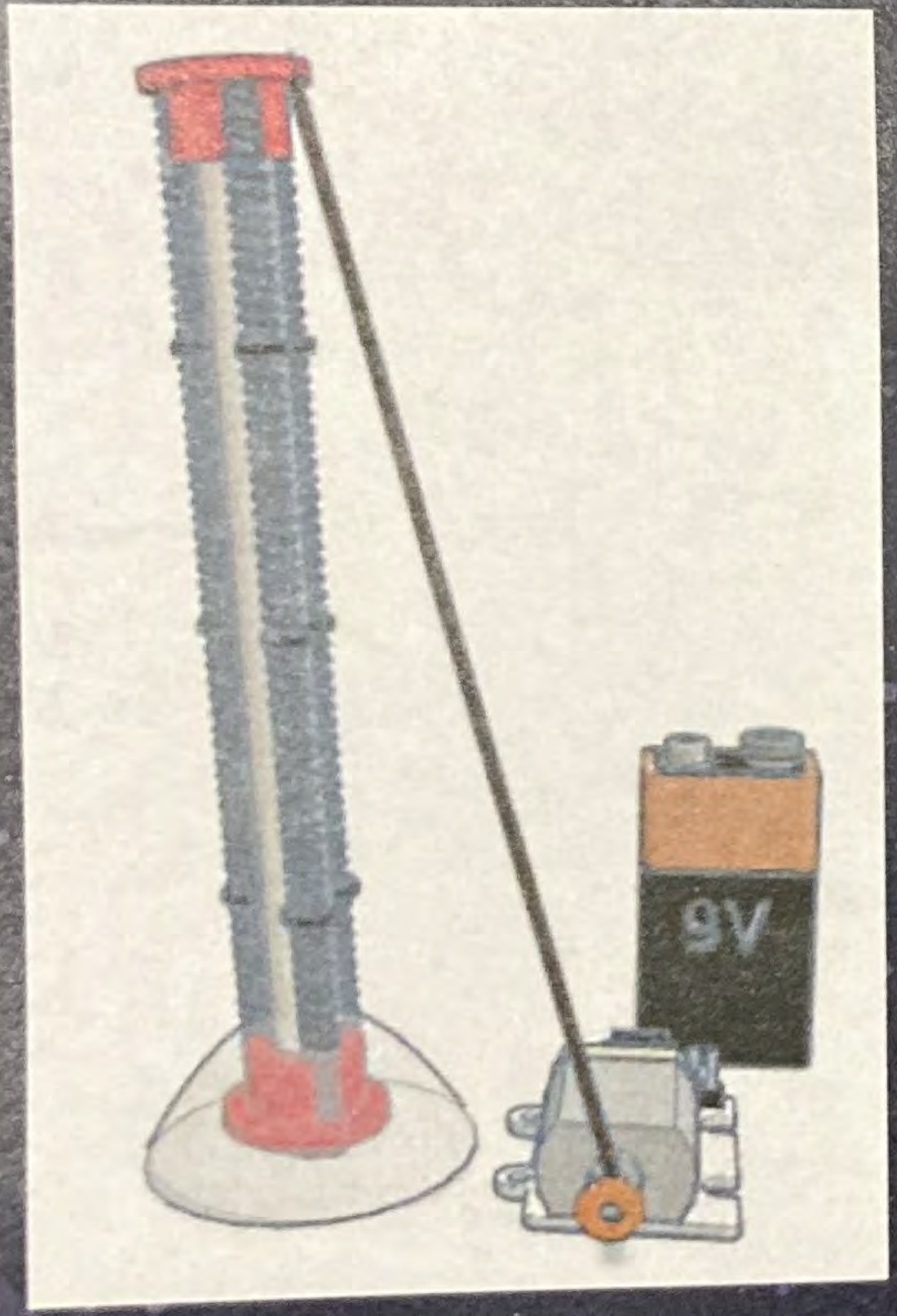
THE MAG-NNIFC (Non-Newtonian Fluid Incorporated) ARM

NASA HUNCH @
VICTORIA PARK CI
15 WALLINGFORD RD, ON, CAN
M3A 2V1

Scan to see our prototype!

OUR IDEA

The NNFIC arm uses springs to control the bending of a tube filled with a non-Newtonian fluid and a chemical agitator which would harden once the arm is positioned properly around a handrail, and liquify when it's ready to let go.



CAD model of our idea

Once the arm detects a handrail, a string will be spun around a shaft, bending the arm. Then the chemical agitator would activate, solidifying the oobleck resulting in a better grip. The chemical agitator will turn off and cause the oobleck to liquify, allowing the arm to unwrap when desired.

PROTOTYPES

Testing Alien Tape | 2 | Linear Slides

1 | Alien Tape + Intro to Springs | 3

Our Current Prototype

Dimensions: 8" x 6" x 12"

OUR NEXT STEPS:

- Implement a greater range of motion
- Prevent the oobleck from drying out
- Make the arm more compact
- Provide greater control over the arm

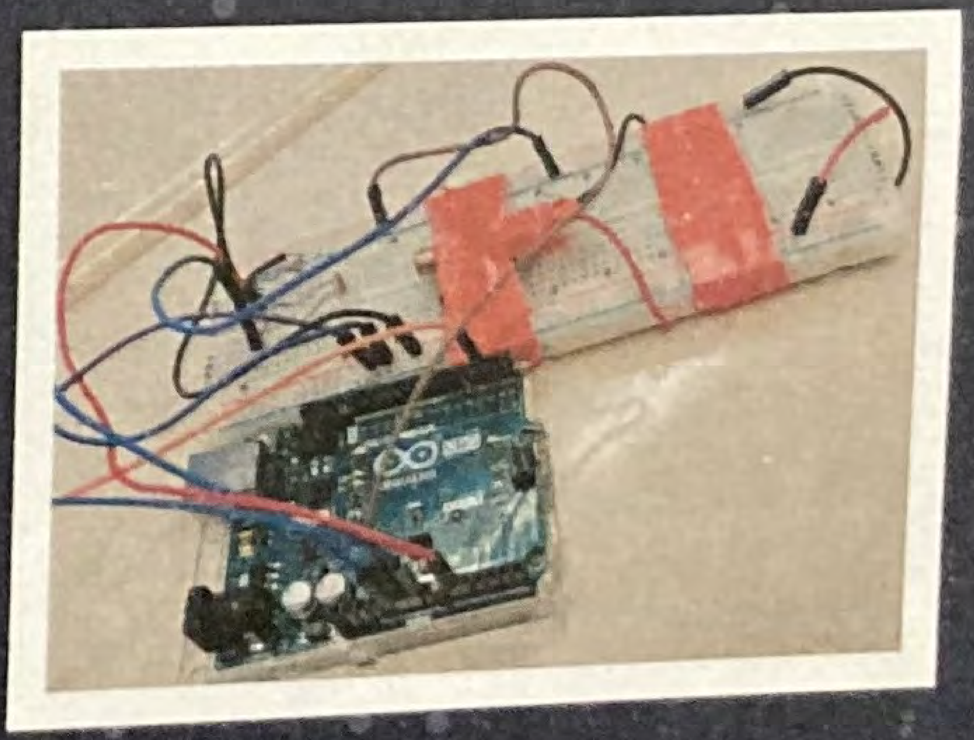
CONT.

Why Oobleck?

- Ensures that most of our prototype is soft & and does not damage any handrails on the ISS
- The hardening using a chemical agitator allows us to include as few rigid parts as possible!

Sensors

With the help of an LDR (light-dependent resistor) and a laser, we coded only a few lines using our basic knowledge of Arduino and electrical components to make the arm wrap and unwrap automatically.



Sensor setup

Criteria Met

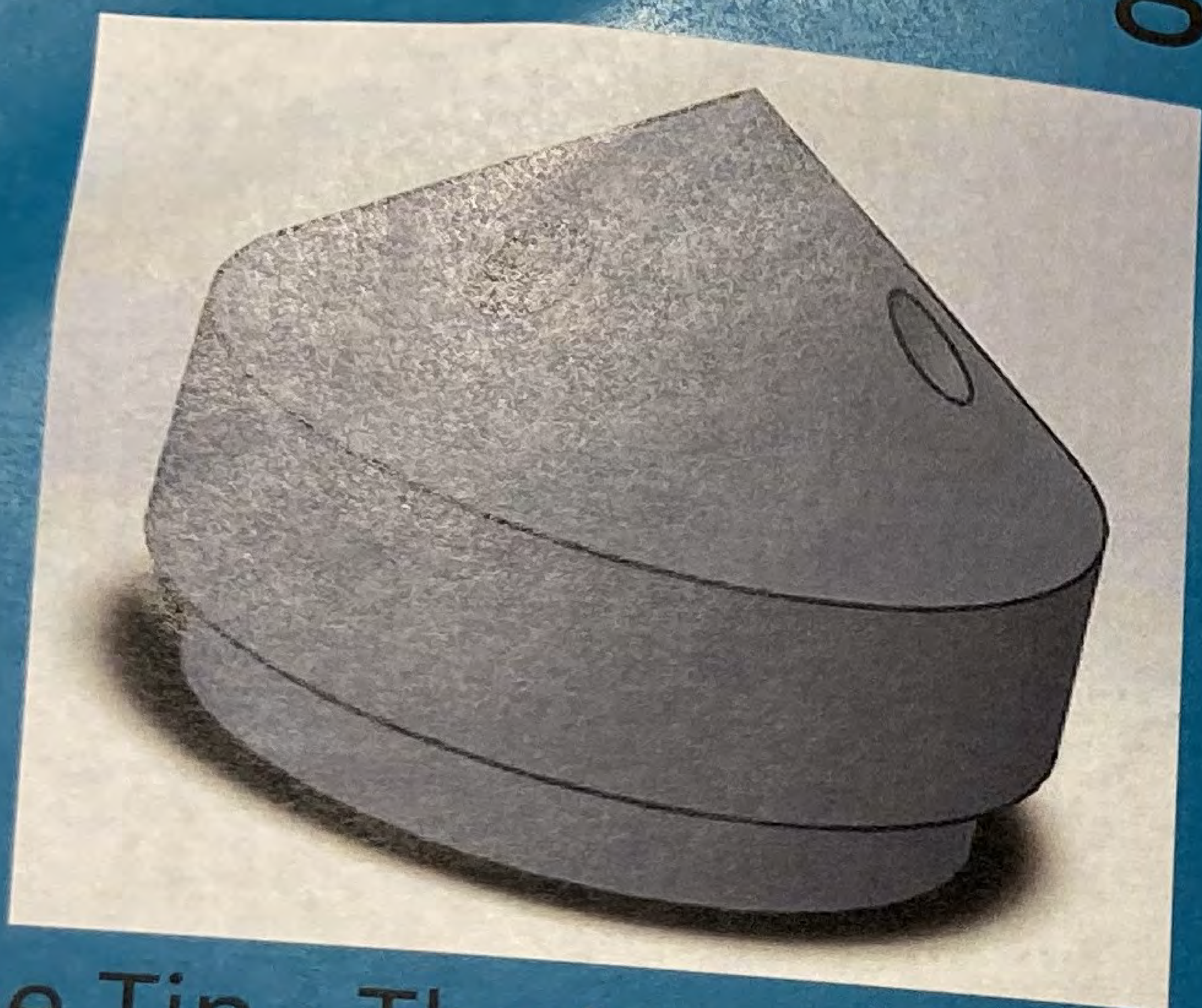
Simple: Cheap and accessible materials, easy to build

Range of Motion: Wraps and unwraps around the handrail

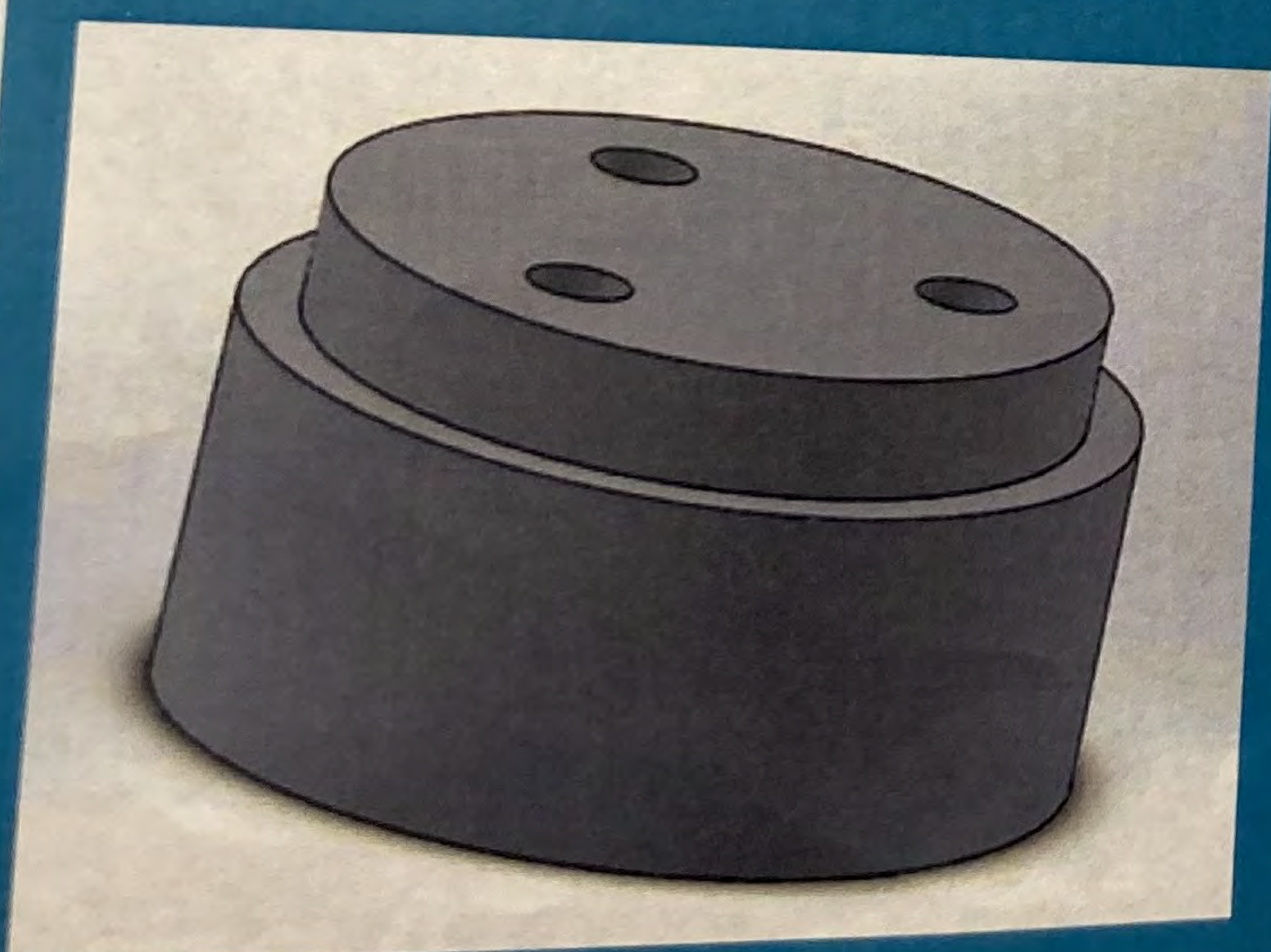
Can be automated: Only a few lines of code

Innovative: Non-Newtonian fluids and springs are used to effectively address the challenge

Cad Drawings



The Tip - The top of the arm. Provides a way to connect the strings to the arm



The Base - The bottom of he arm. Provides a base as well as a way to keep the strings in line.

The Arm - The main part of the mobility arm. Made of flexible resin to allow movement.

Testing Results

Flexible Resin Return Time:

Total Time Compressed	Return Time
5745 min (95.75 hr)	2.1705 min
2899 min (48.32 hr)	2.0505 min
12947 min (215.78 hr)	2.003 min

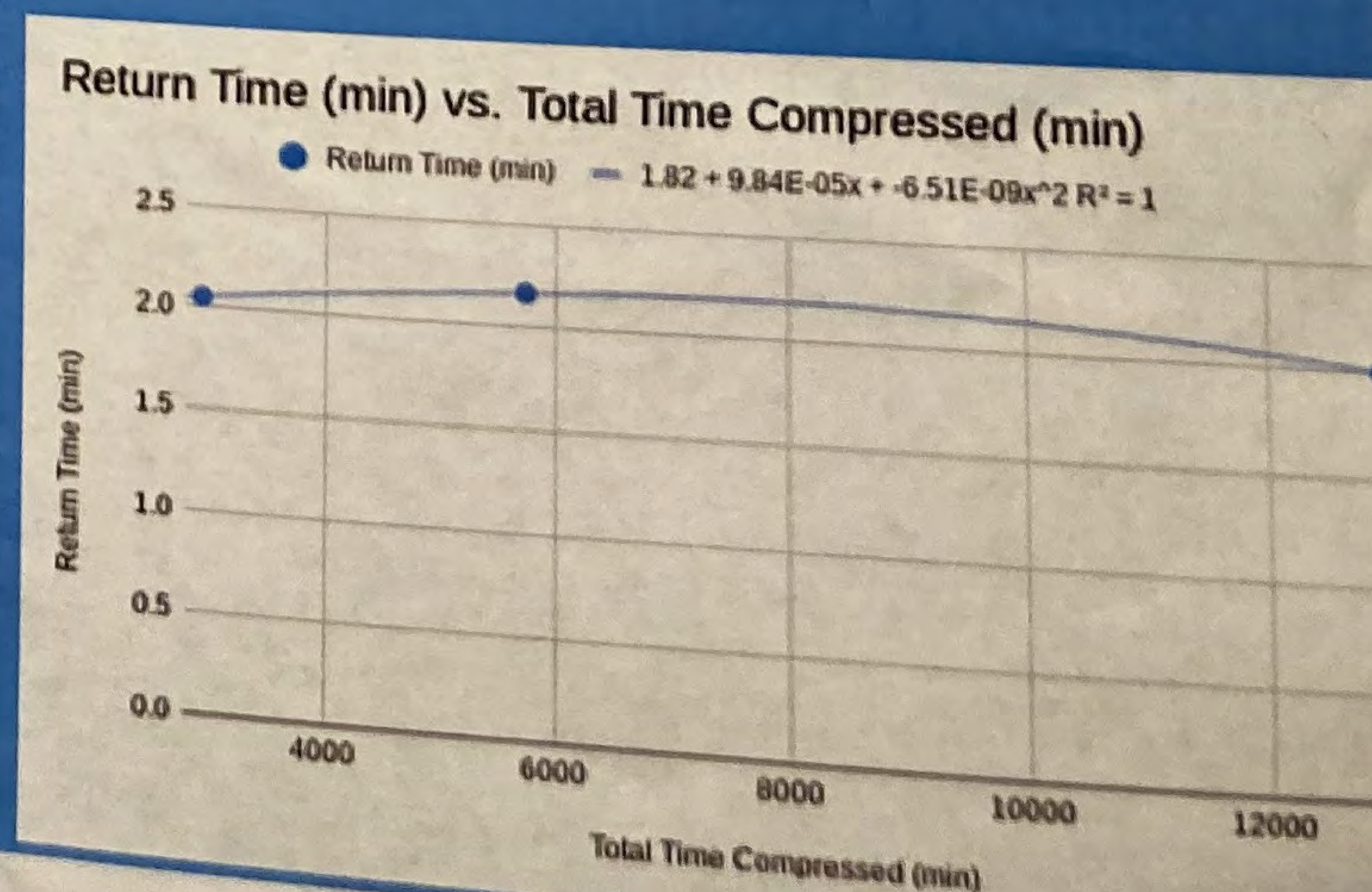
Testing Result

The arm can contract 14.4 cm

It can bend more than 180 degrees.

Once fully bent, the shortes distance from the base to the tip is 4.5 cm.

If scaled down, the arm could grab and release a handrail.



Cost and Materials

Flexible Resin from formlabs	$10
PLA filament	$16.17
Fishing Wire (3ft)	$.05

Total Cost per Unit: $26.22

Final Solution Statement

The Mobility Arm will help the robotic duster stay in one spot while it is cleaning by having strings pulled, resulting in the arm bending in that direction, creating a firm grasp on any handles.

Contact Me

Jaya Desai:
2251718@jeffcoschools.us

Mobility Arm

Jaya Desai

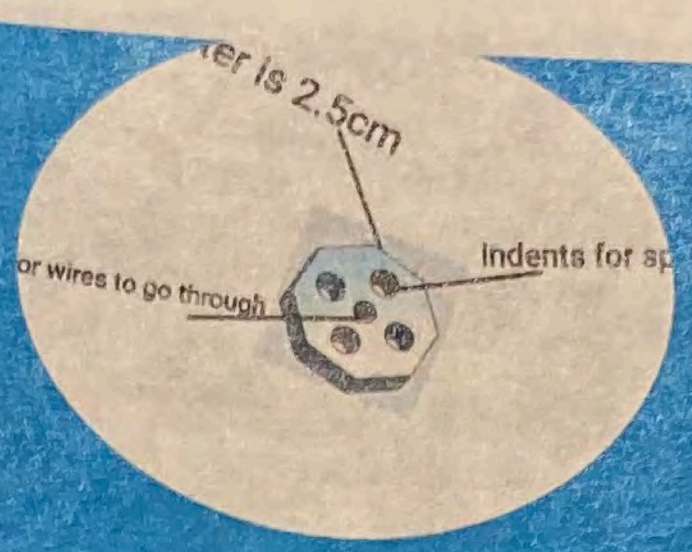
Lakewood High School

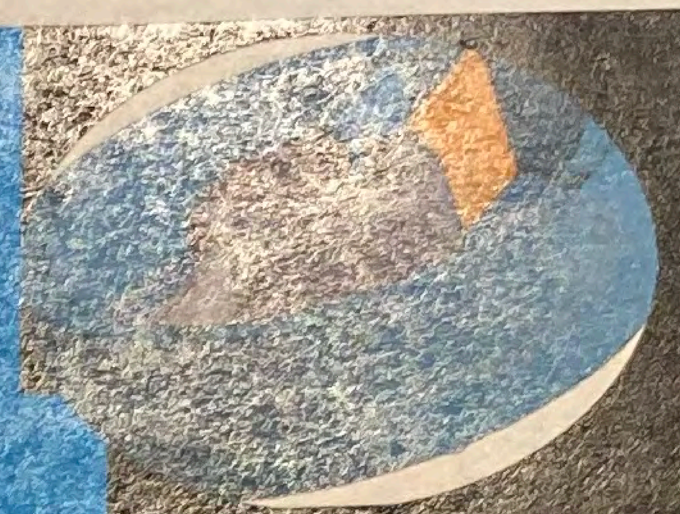
Ashley Pederson

Mobility Arm
Jaya Desai

Testing Data

- Wire snaps too easily, Fishing line is much stronger
- The original joint shape moved every 75°, new design is every 45° for more control
- Circular disks had low grip, changed to octagonal disks for flat grip
- Motors are weak and hard to use, switch to stronger and Programmable motors
- The weight of the arm is 190g and the base is 900g
- Blue arm curve radius: 11.5cm, Yellow Arm: 3cm

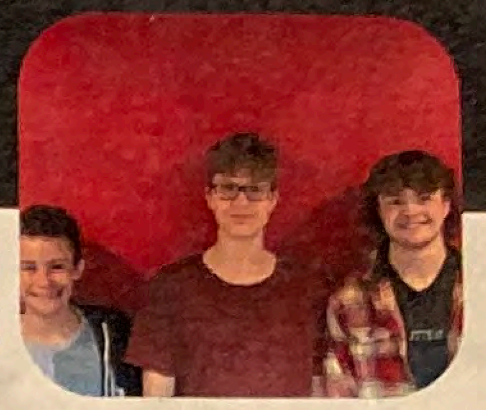




RESEARCH

- The specific design we have chosen to turn into a functioning robotic arm seems to be related to many commercial products
- No products seem to be a fully omnidirectional appendage.
- Even those that are relatively similar instead are mainly just multiple one directional arms with mechanics akin to that of our design.
- A Youtuber by the name of Barb Makes Things designed a rough but working prototype that we have decided to base our design off of.
- The reason for picking this as a base for our design is that these arms are not only omnidirectional but can also be further modified using designs given by NASA.

O. MNIDIRECTIONAL K. INEMATIC T. RAVERSAL A. RM



By: Bradley Bohl, Carter Mac
and Isaac Thompson
School: Manning Middle scho
Teacher: Sarah Maud

WHAT IS IT?

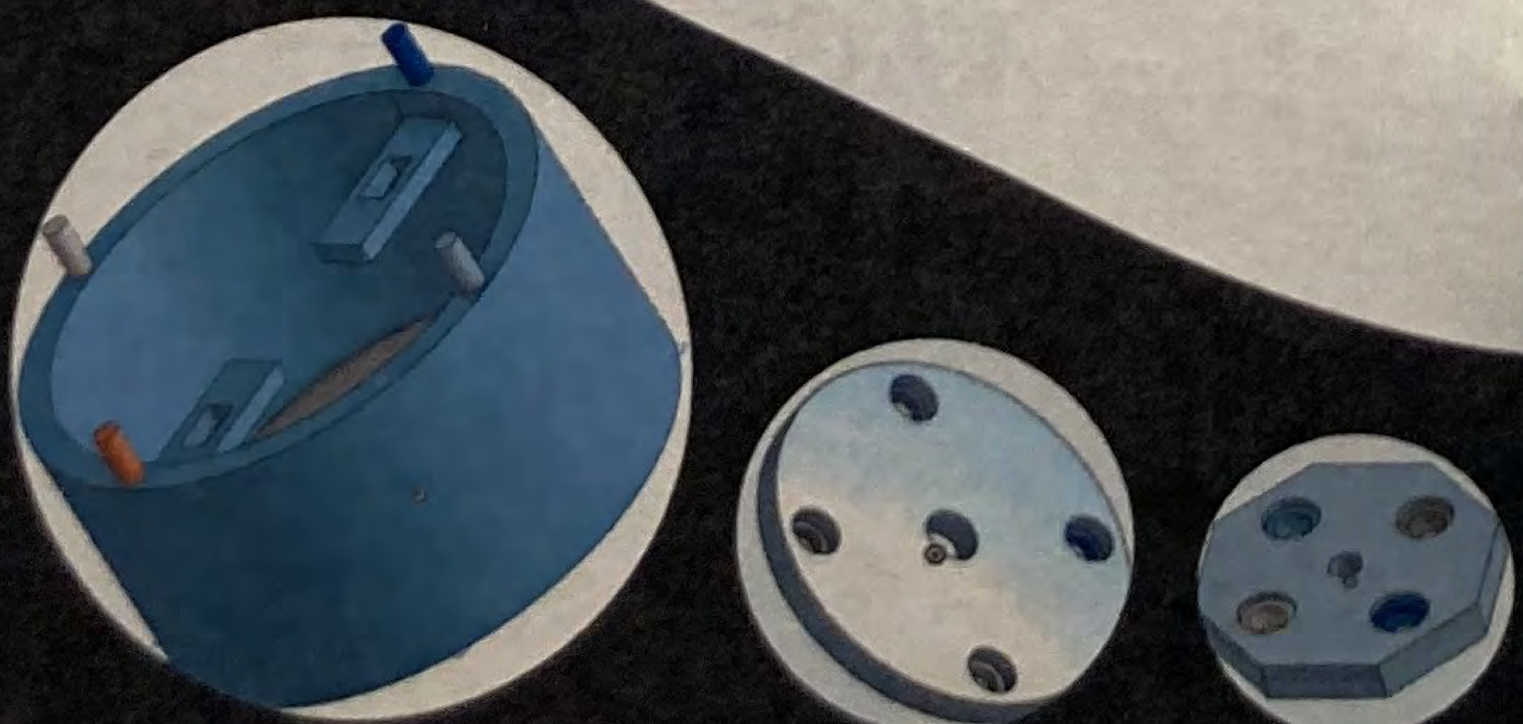
The O.K.T.A. is a semi-soft robotic arm designed for helping the Quadropus Duster Robot move and hold onto spacecraft

OUR GOAL

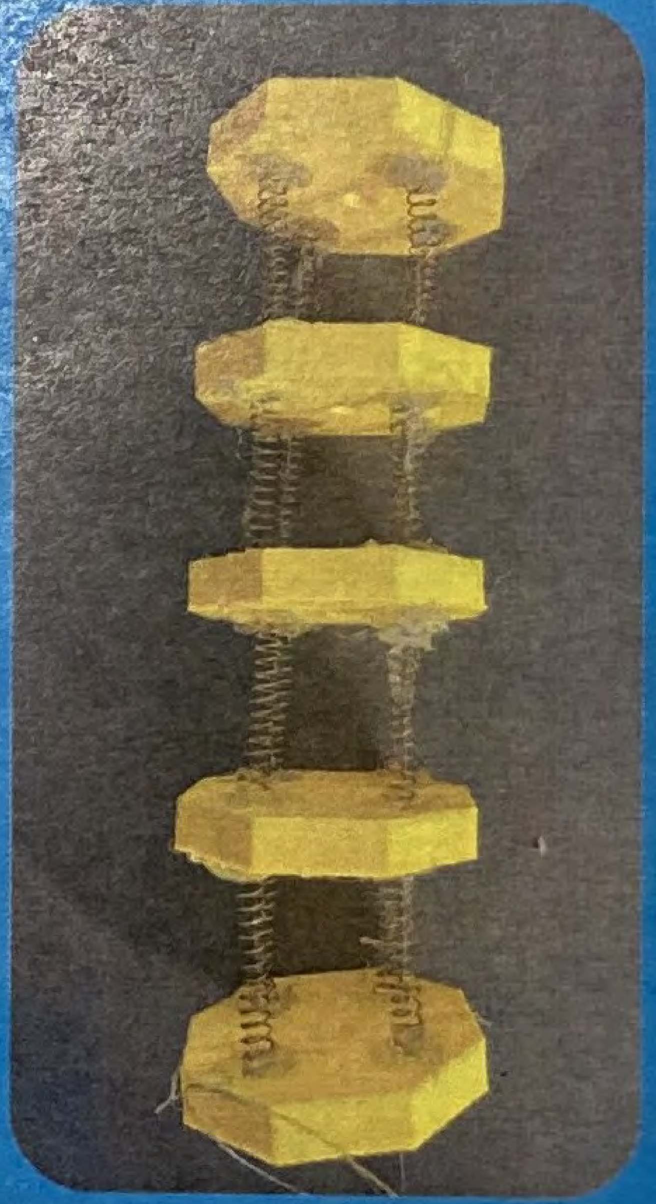
Create a compact design to allow the Quadropus duster robot to easily and autonomously move around spacecraft

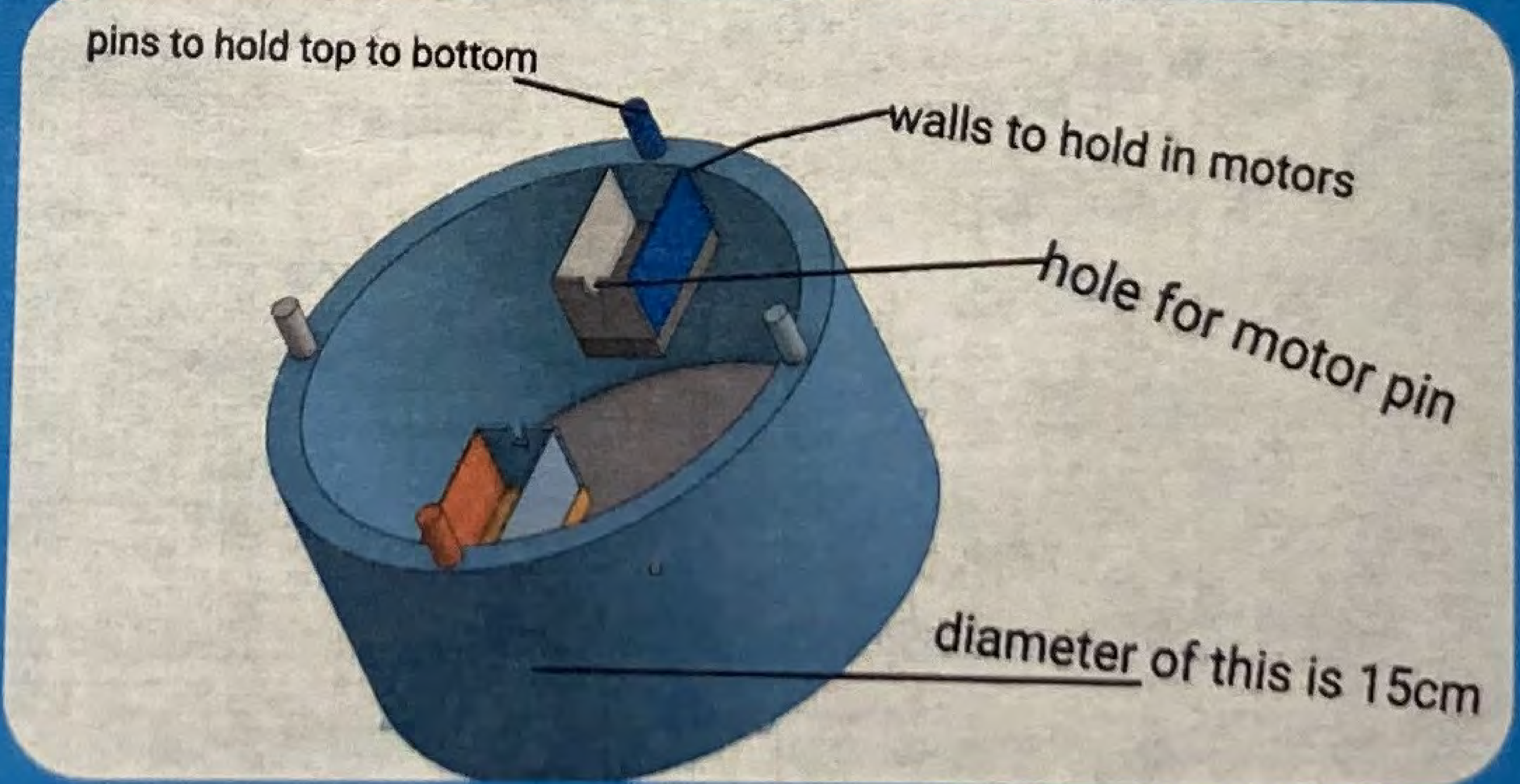
SEMI-SOFT DESIGN

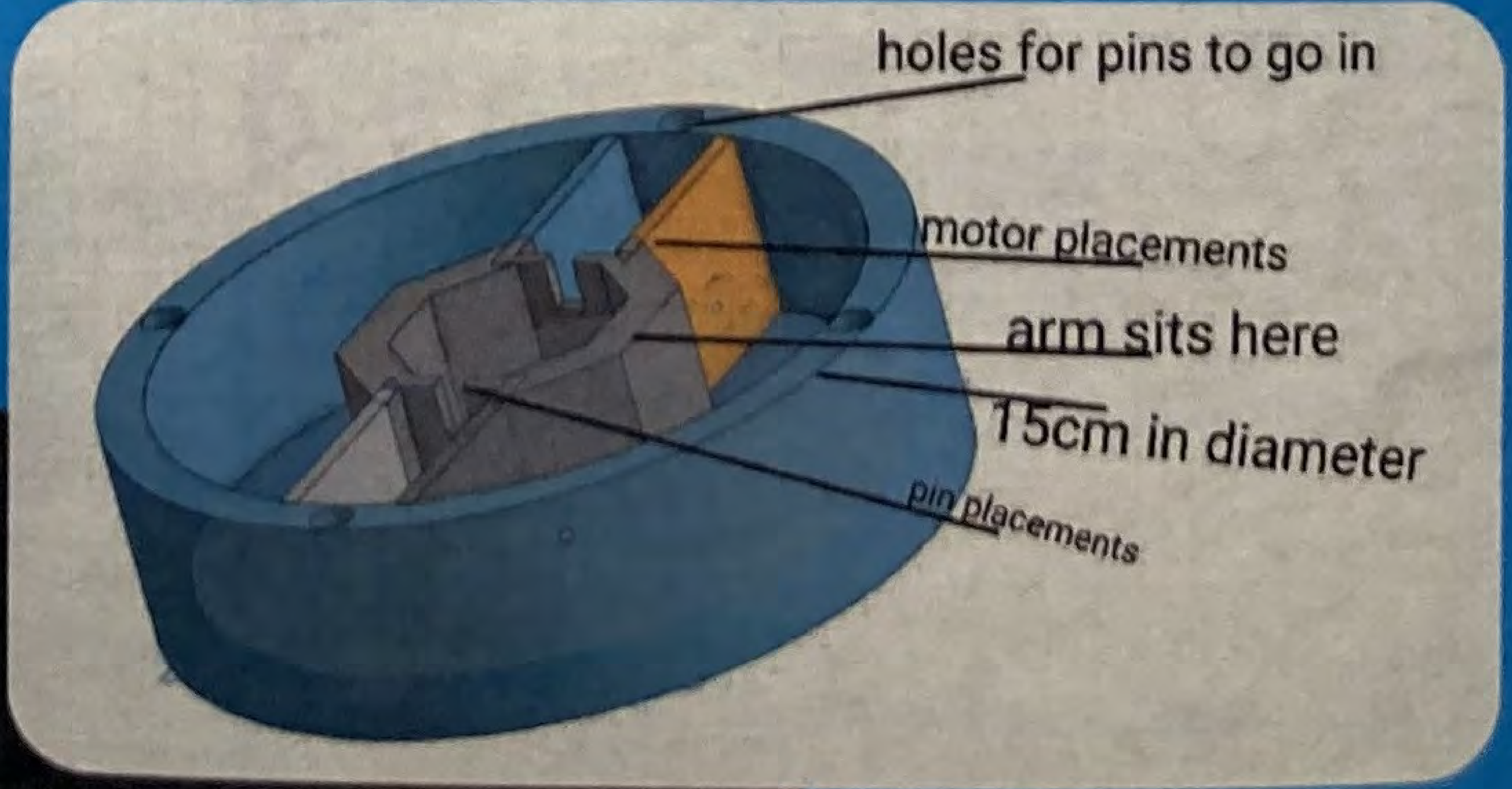
Mix of stiff and flexible parts to allow for stable and fluid movement



PROTOTYPE







PROS

- Multi-axis movement
- 8 degrees of motion
- Hexagonal disk design
- Simple tension based design
- Simple and compact gearbox
- Based on real octopus tentacles

BIO-MIMETIC DESIGN

Tentacle prototype based on real octopi movement and muscles placement

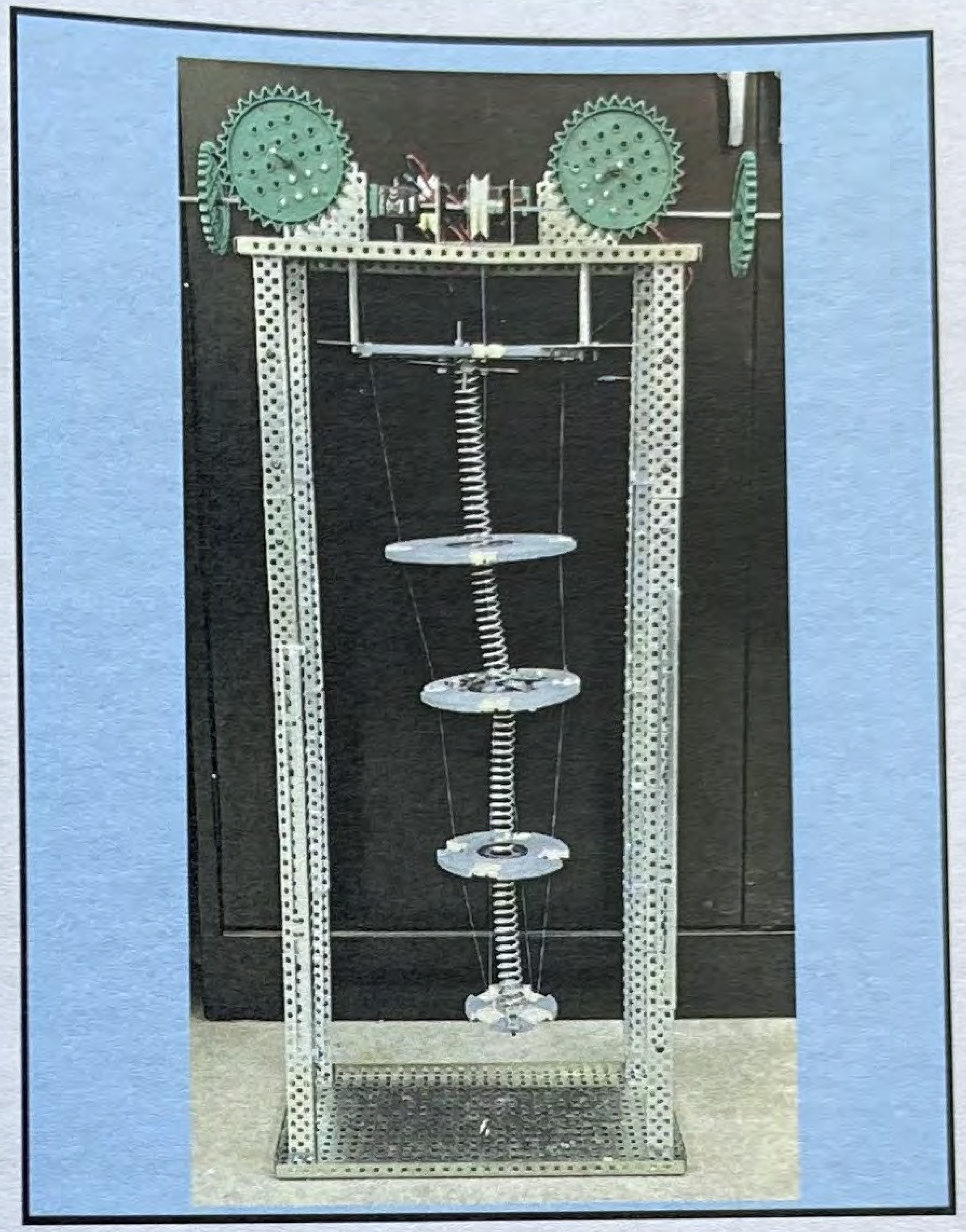
QR Code links

Our attempt at relaxing a spring:

The arm moving:

The arm cover prototype & gripper prototype:

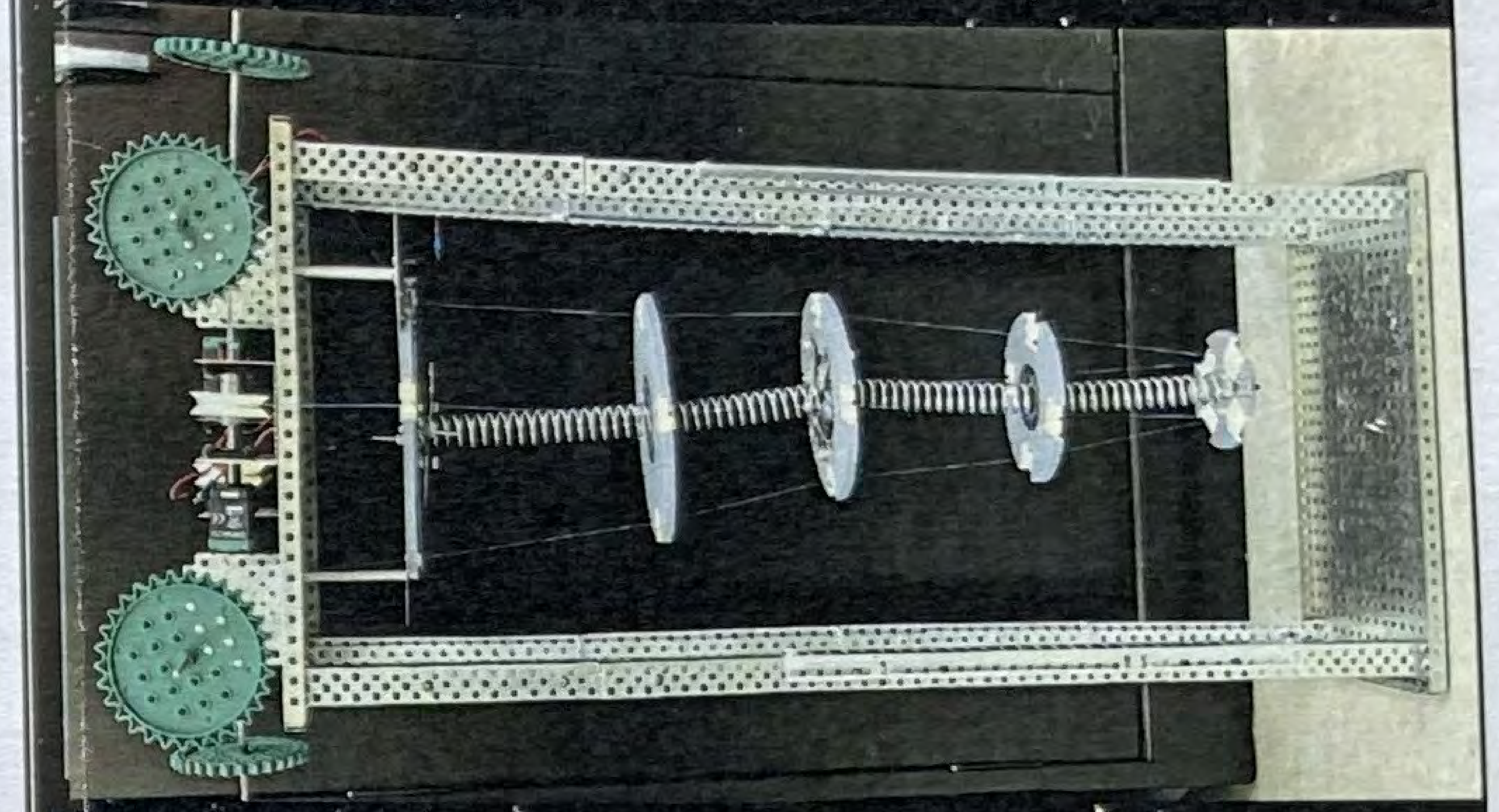
CDR Design



We discarded the SMA idea, so instead of using the SMA, the cords going through the segments are each wrapped around their own spool-like part which spins to wind up like a yo-yo. A spring goes through the middle to return the arm back to "normal" state after bending. A "gripper" is attached to the end in order to grab railings, etc that might be harder for the arm itself to get to. Arm is covered with an SMA mold for low rigidity.

- Motor turns on —> "yo-yo" spins —> string winds up —> segments are pulled —> arm bends in direction of spinning "yo-yo".

Kwadropus Mobility Arms



School: Wadena-Deer Creek
Advisors: Mike Shrode & Dawn Hamelau
Team: Cadie, Chloe, & Blade

NASA HUNCH

What is It?

The Kwadropus is an idea proposed by NASA HUNCH for a 4-armed, soft robotics, octopus-like robot. It would move along the inside walls and railings of the Starlab and/or Axiom Space Stations to remove dust in a zero-g environment. Our team's project is to design the mobility arms for this robot.

Criteria/Constraints

Criteria:

1. Spots for 2 suction cups
2. Minimal amount of rigid parts
3. Rotate to grasp in multiple directions
4. Soft so it doesn't damage hardware

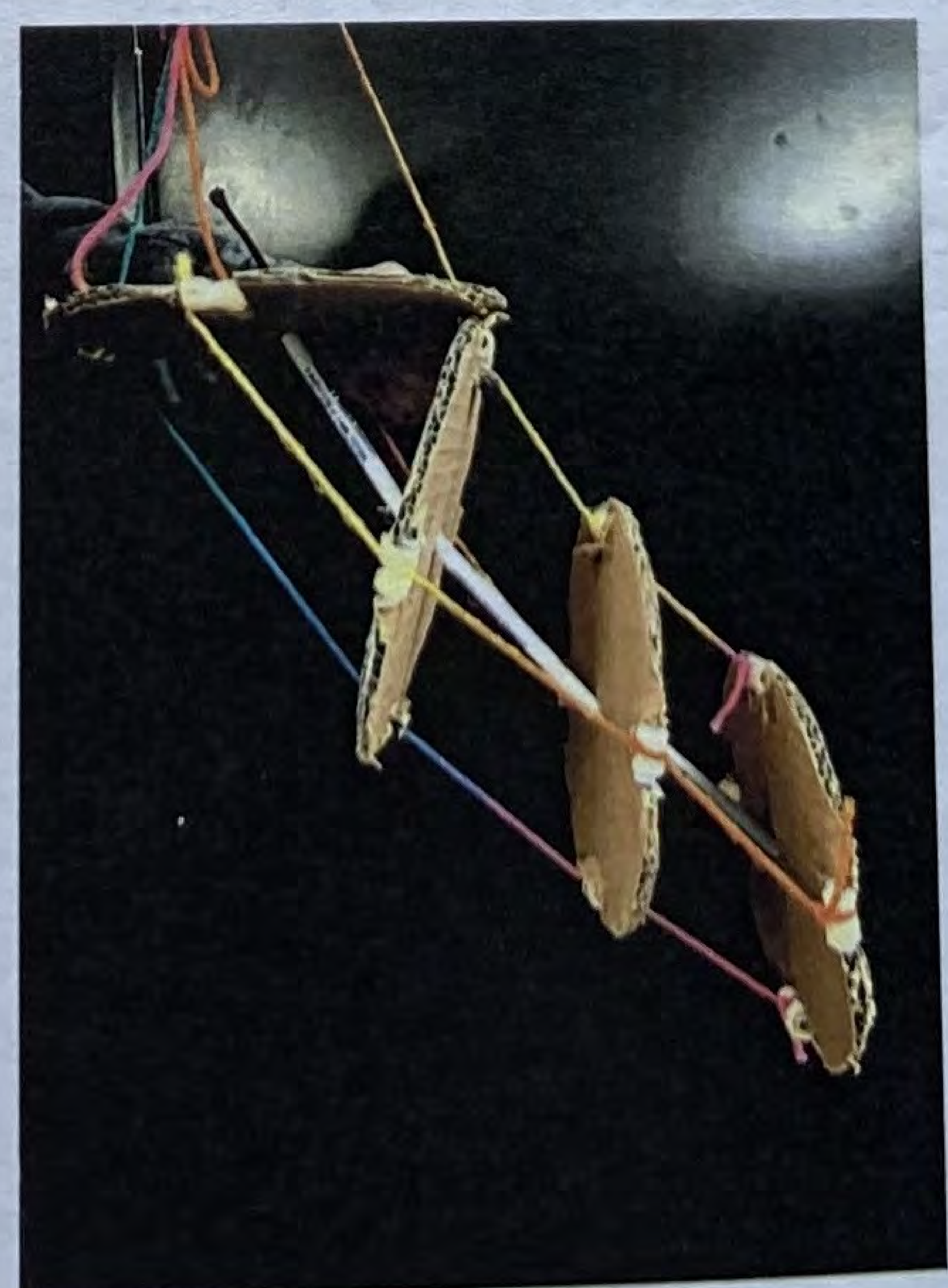
Constraints:

1. Interface to control arm
2. Durability
3. Avoid overheating
4. Avoid deterioration
5. 2-2.5 in. diameter, 1 ft tall
6. Can withstand room temperature

Prototype Development Process (Pre-PDR)

1. Made a list of criteria and constraints to follow.
2. Brainstormed ideas and came up with a list of things to research.
3. Came up with a preliminary design for the prototype, and put it together.
4. **Preliminary prototype:**

- **Individual segments connected with braided fishing line.**
- **The end of each line has a spring made of Shape Memory Alloy that will pull the line when heated, bending the arm.**



Prototype Development Process (Post-PDR)

1. We analyzed our feedback (suggestions and things to look at/think about).
2. We discussed how we would go about applying these suggestions.
3. We went over the ideas and settled on developing programming for motors to move the arm, and building a stand from VEX robotics parts.

VEX ROBOTICS

4. We put it all together and ended up with our final design.*

*See "CDR Design"

Description

The device is a soft body arm that was designed around a tentacle. The arm has a claw on the tip of the structure that is capable of deforming around the object it's attempting to grasp, and the claw can return to its original form after releasing the object. The arm is powered by three motors at the base of the arm, and they transfer power through an internal pulley system.

Gladys Porter High School

3500 International Blvd.
Brownsville, TX 78521
Phone: 956-548-7800
Website:
porterechs.bisd.us

LINK TO PORTFOLIO

LONDON PYLE, JOSHUA RAMIREZ, EDWIN LOPEZ

ROBOTIC MOBILITY ARM

GLADYS PORTER EARLY COLLEGE HIGH SCHOOL

MS. C. CORTEZ

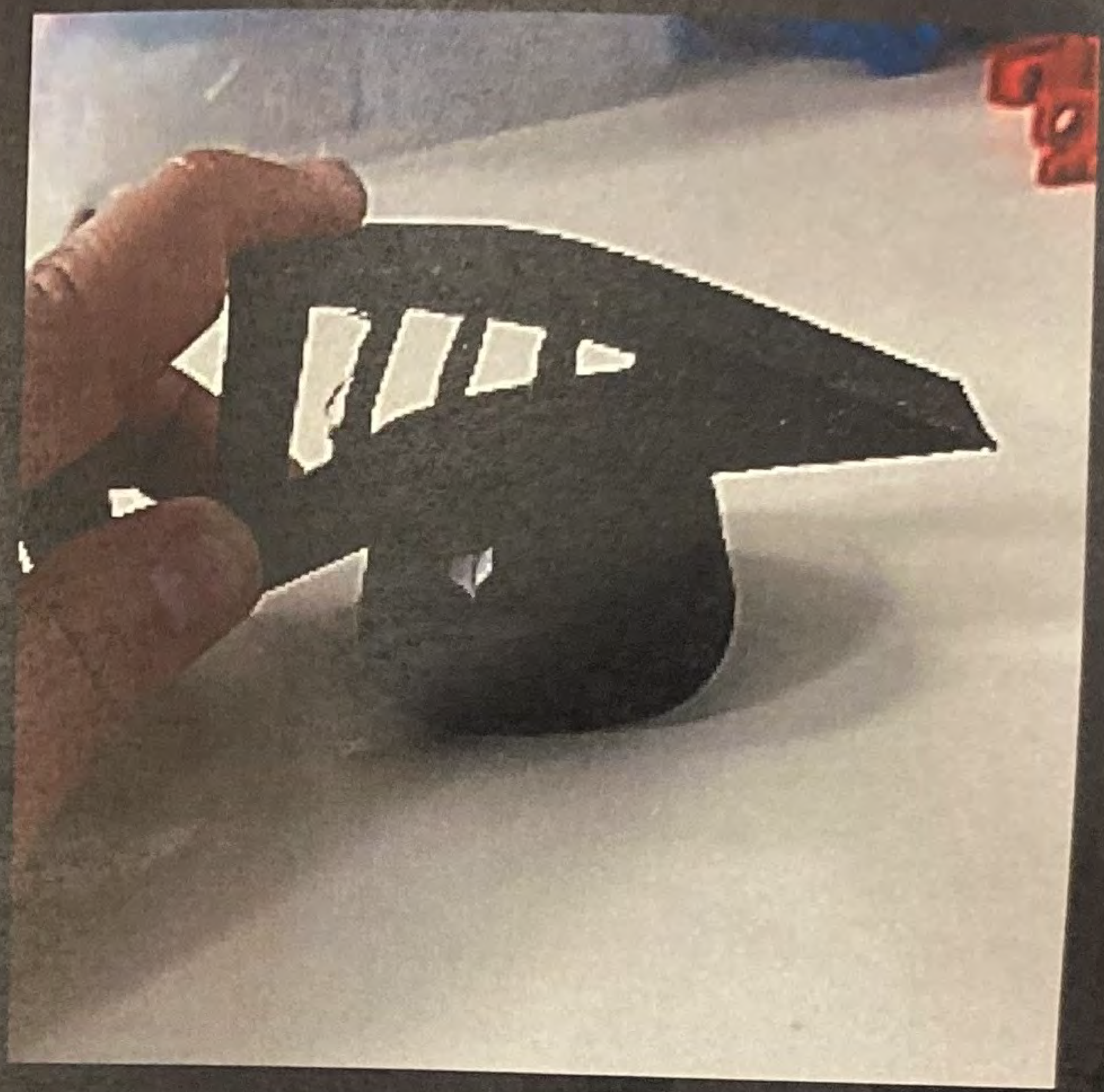
London Pyle, Joshua Ramirez, Edwin Lopez

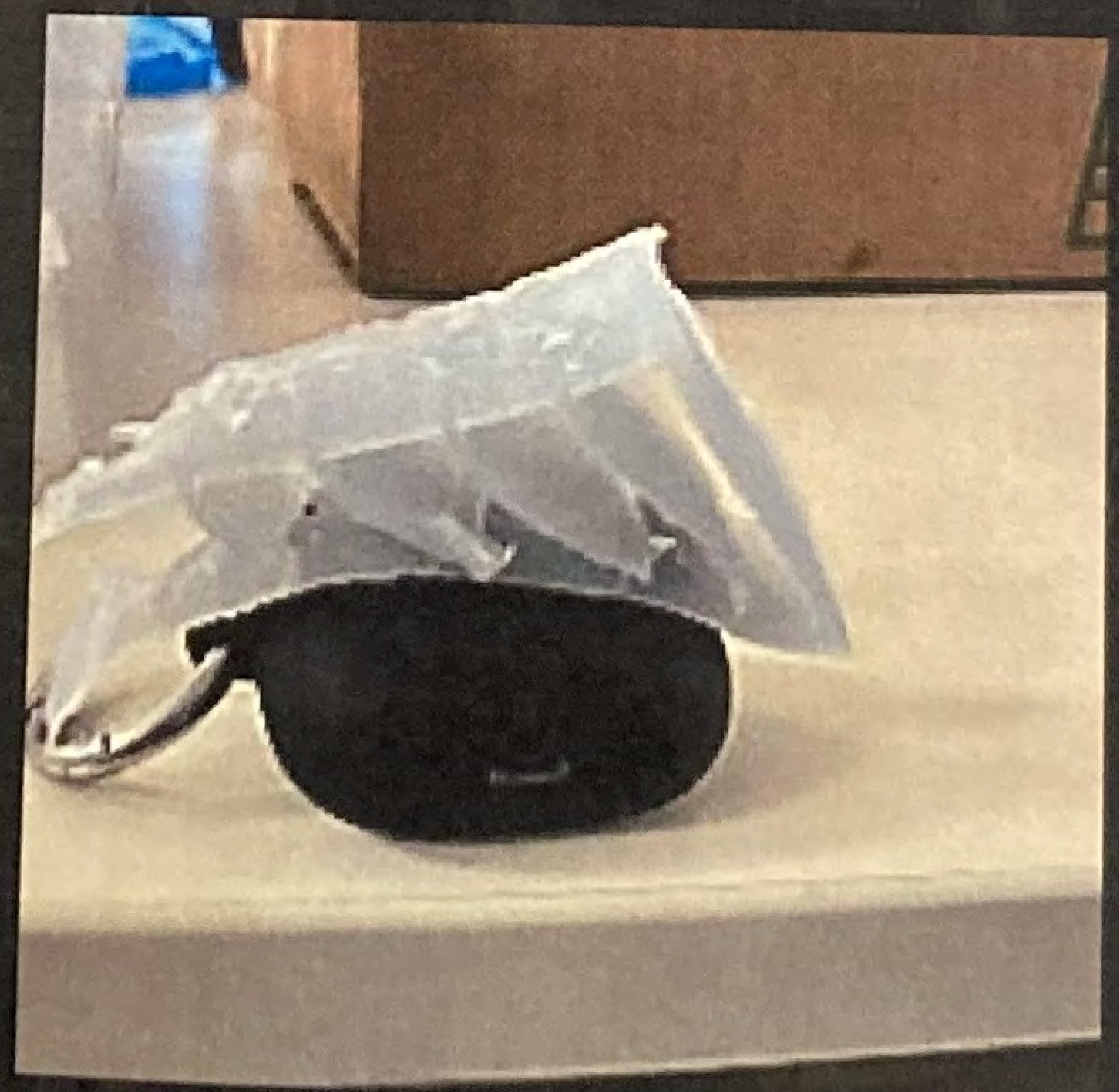
Overview

It is designed to be strong and durable, yet flexible. It can alter its claw to grasp around any object no matter the shape.

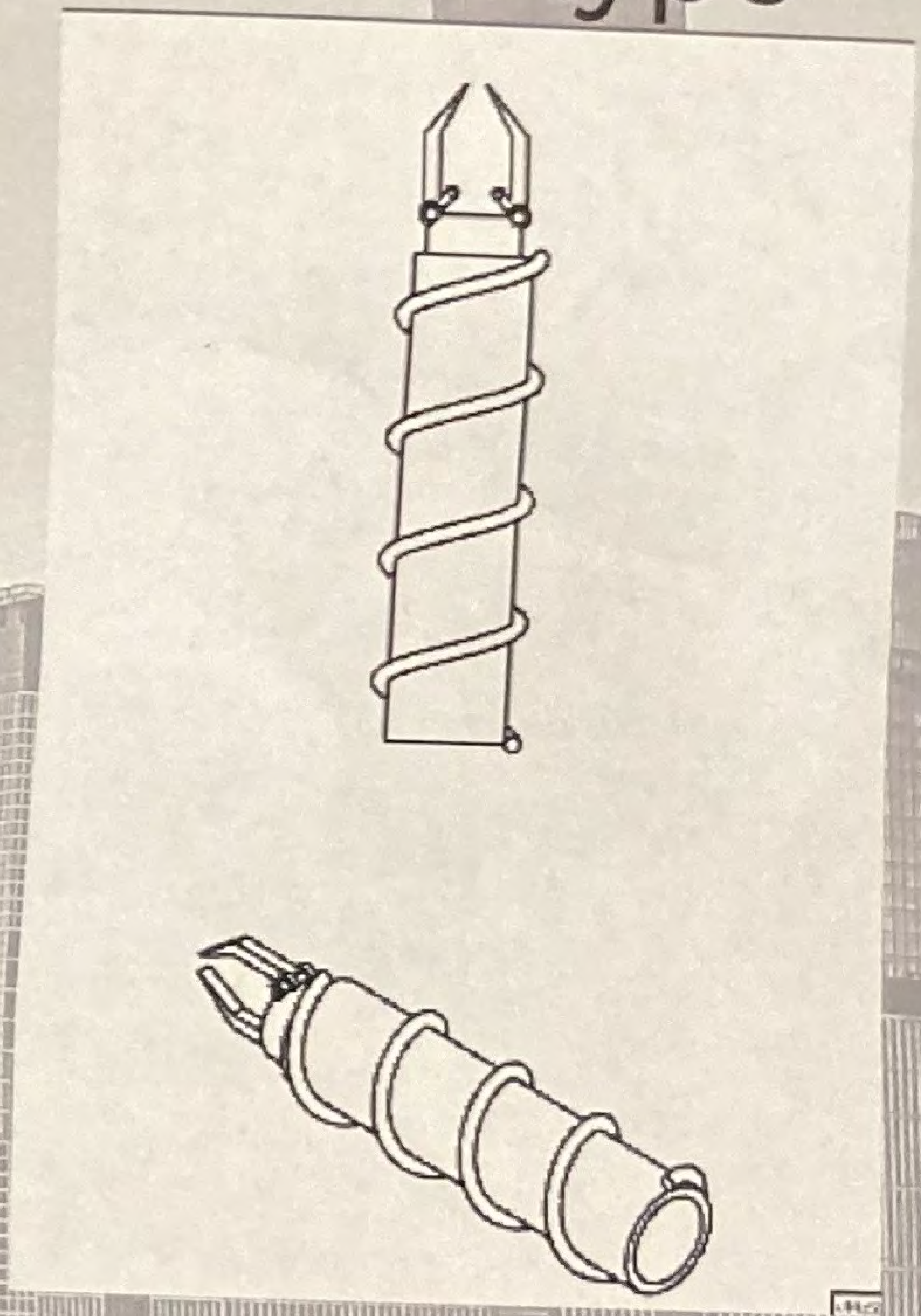
First Prototype

Prototype Pictures





CAD Image and Prototype



Soft Robot Arm

C.R.O.E.M.
Prof. Cordero
Ethan Cubero,
Derek Gonzales,
Hedielberto Barreto

The utilization of a soft robot arm constructed from silicone with elbow actuators and an air pump system presents a transformative solution for space exploration endeavors. Its inherent flexibility and adaptability enable seamless navigation through confined spaces and complex environments, crucial for the unpredictable conditions encountered in space missions. Moreover, its lightweight design contributes to overall spacecraft weight savings, a critical factor in space exploration where payload efficiency is paramount. The compliance and lack of rigid components enhance safety during operation, particularly in collaborative tasks involving human astronauts or ground crew. With the capability for a wide range of manipulation tasks and increased fault tolerance, this soft robot arm offers versatility and reliability in handling various objects, even in dynamic space environments. Furthermore, its energy-efficient air pump system and simplified maintenance requirements make it a practical and efficient choice for space missions, promising to revolutionize exploration beyond Earth's boundaries.

Our mission is to develop one robotic arm with minimal amount of rigid parts that can pull itself from one location to another using a handrail or other. It is made by materials like silicone because of their grip and weight. The main feature would be the elbows actuators in conjunction with the air pump system to manipulate and have better movement of the arm.