Kwadropus Mobility Arm

8Congratulations for being chosen to be a NASA HUNCH Finalist for Design and Prototyping. Know that there were a lot of very good teams with great ideas competing for these spaces. Being a Finalist means you are already a winner. There is not a 1^{st}, 2^{nd}, or 3^{rd} place—there are only Finalists. Although HUNCH would like to have all of these projects turned into flight hardware, most won't make it that far. However, some of these ideas may inspire other hardware and equipment. This is like real engineering where any of the projects or ideas in a project that are deemed valuable to NASA could be incorporated into another project. NASA has no intention of taking or stealing ideas. HUNCH has every intention to keep your names attached to those projects so that you and your team retain credit for your ideas and efforts. In general, NASA does not seek patents on space hardware unless there is a use for it on the ground that could be valuable.

Suggestions for the Final Design Review

Houston in the middle of April is warm and humid. The building is air conditioned but there will be lots of people. Rain is possible.

- Look professional.
- Everyone on the team should plan to talk.
- Update your brochure with you latest prototype and information.
- Make sure your QR code works for everyone.
- Update your tri-fold with your latest information—less about early concepts, more about features.
- The better your model looks, the less you have to say.
- Take a video of everything working well so if it fails when you arrive, you can still show functionality.
- You will be sharing a table with another team. Make sure your display will not take up more than half of a 6 ft x 2ft table. There will be some tables with power and some without. We will try to give priority to those who need it for the presentation—video.

Suggestion for Kwadropus Mobilty Arm

- Demonstrate grabbing a simulated handrail.
- Durability--Provide data on running the arm many times.
- How did you decide on the outer covering that maximizes grip but minimizes damage? Testing data?
- How do you plan to reduce the size of your mobility arm to fit on a smaller Kwadropus?
- How and where would you incorporate at least two suction cups?

Kwadropus Mobility Arm

Ossining High School

Mr. Albrecht

Shane Avenius, and Luke Zebelman

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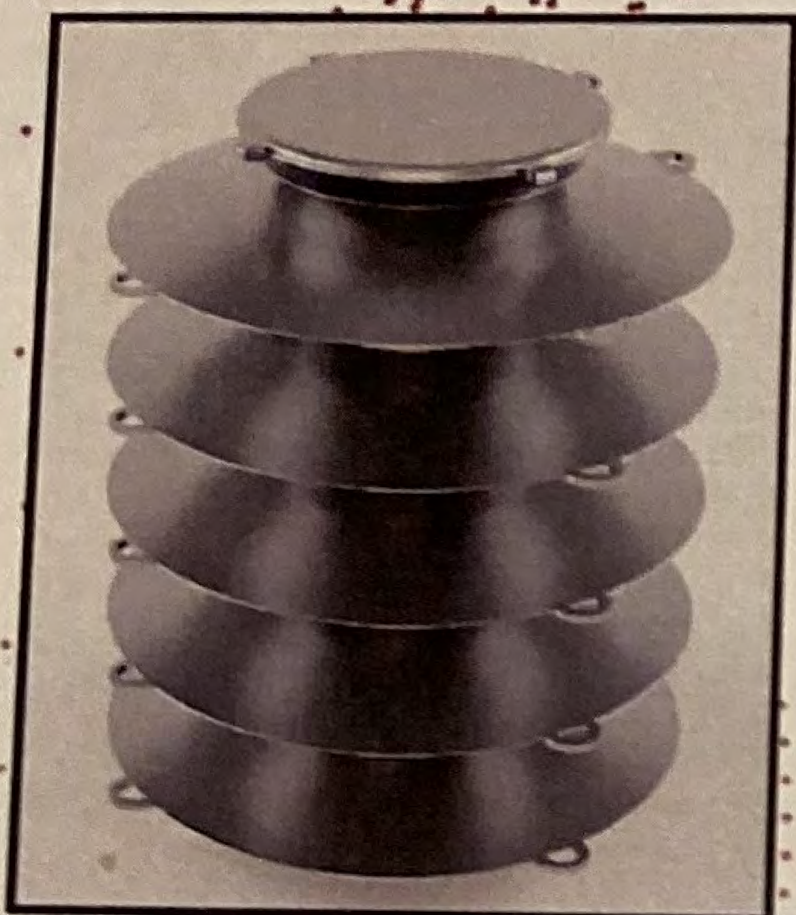
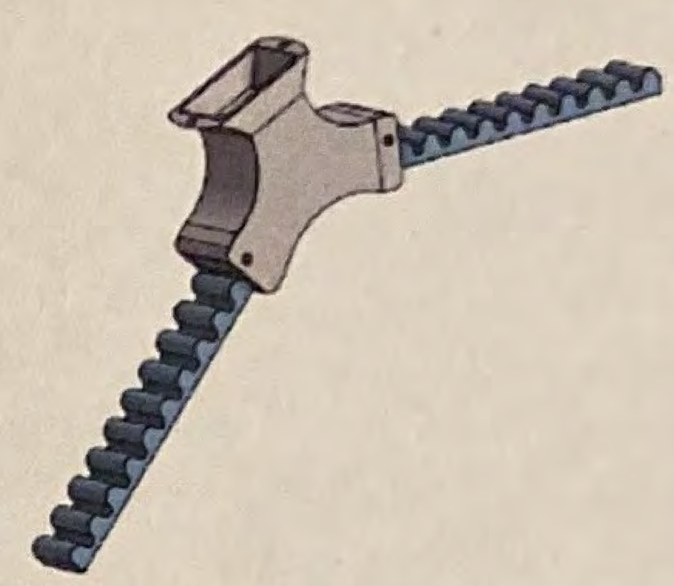
Segmented Soft-Robotic Arm



This fully 3D-printed robotic arm uses continuous servos and cables to control movement around a fixed point.

Pneumatically Actuated Gripper

This fully 3D-printed robotic gripper utilizes pneumatic power to grip objects in space.

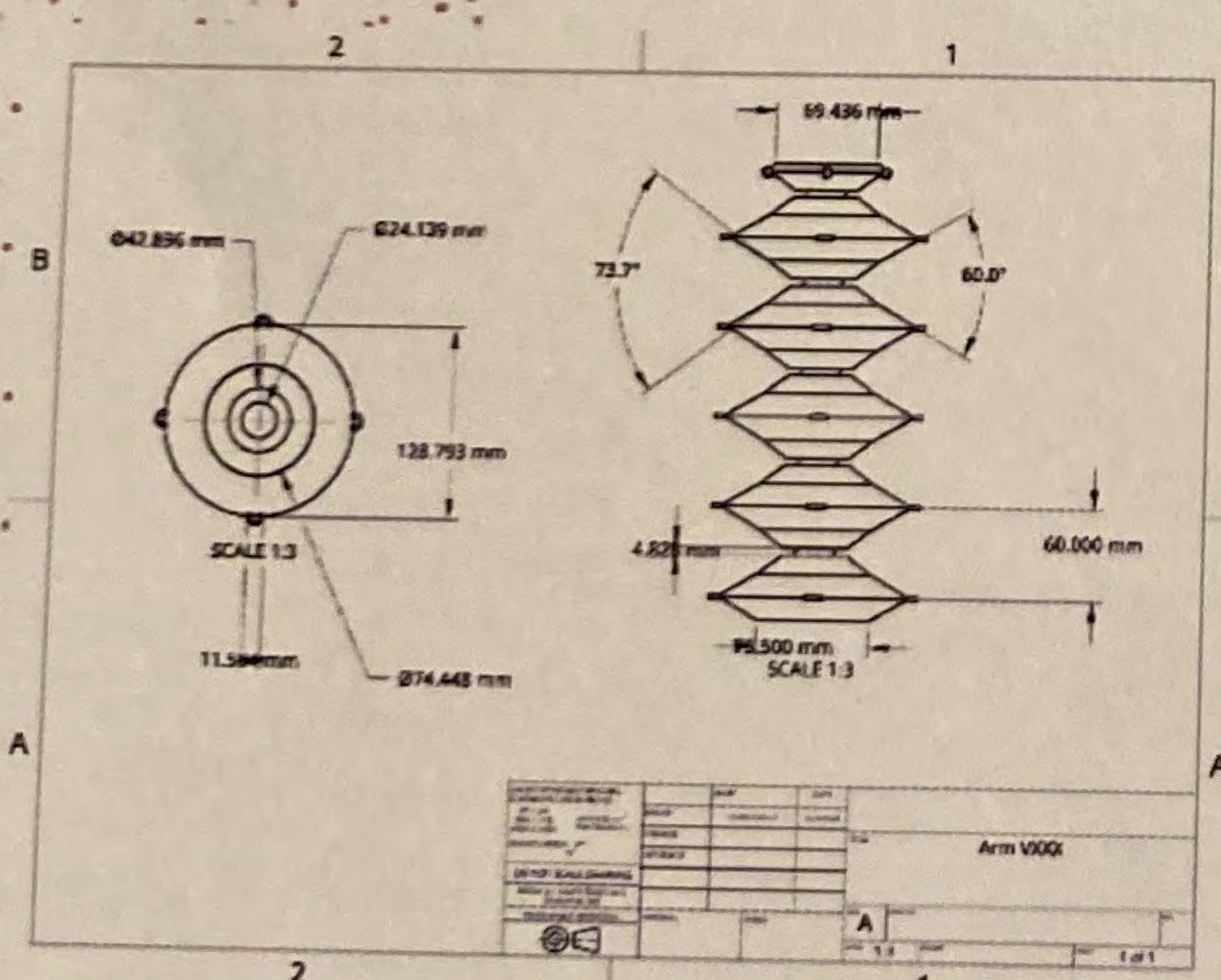


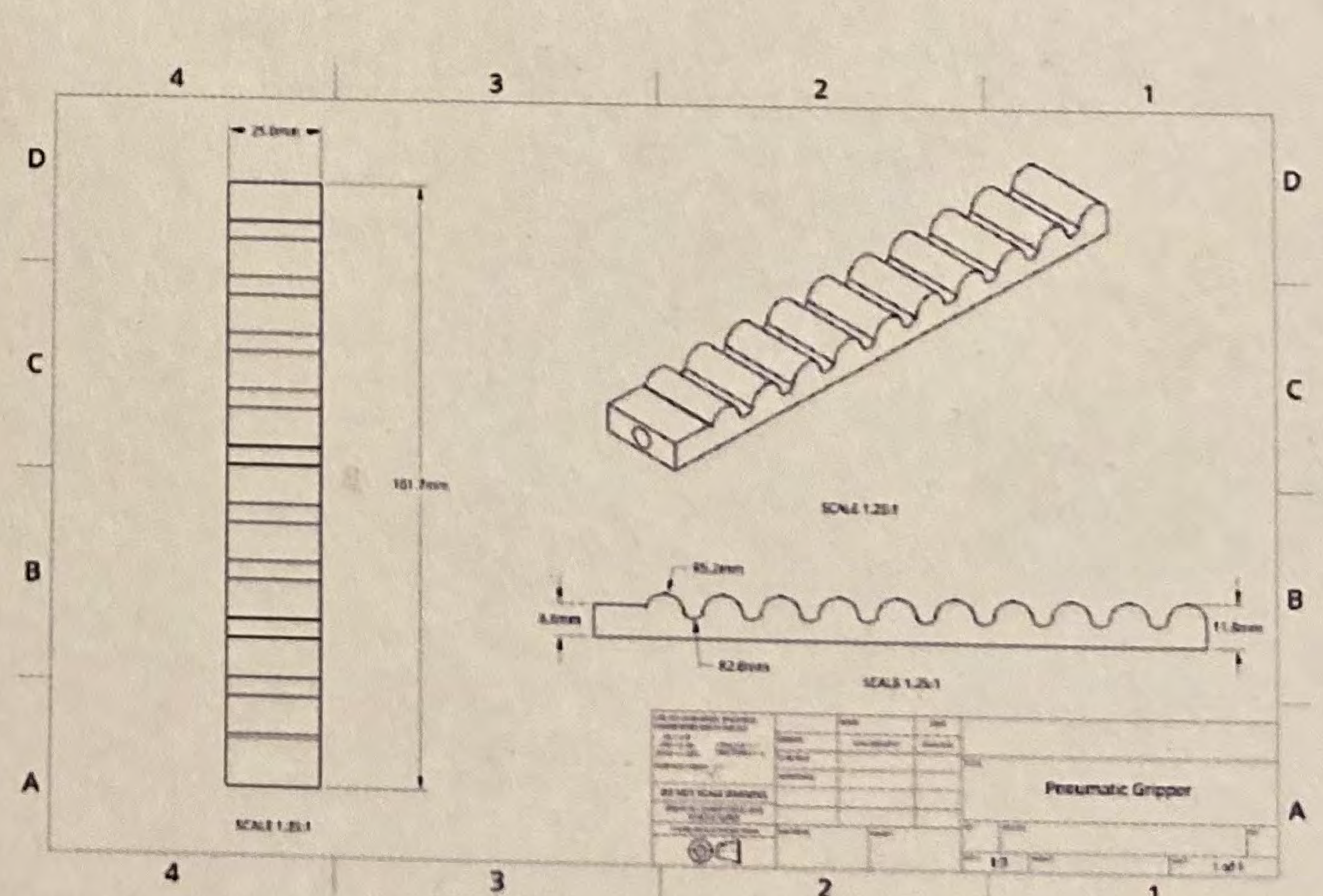
Features:

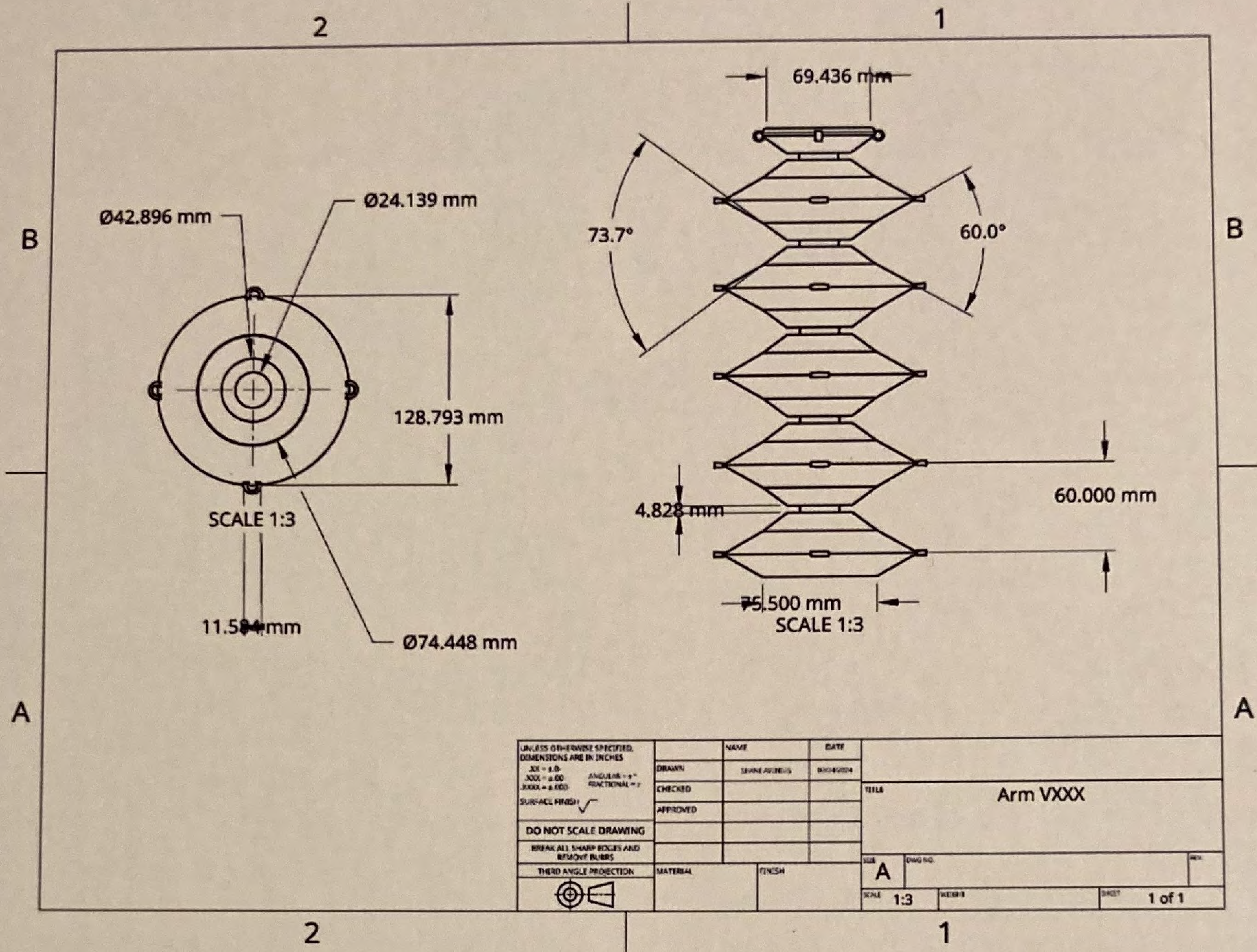
- collapsible
- lightweight
- mechanically simple

Features:

- Flexible
- Easy to manufacture
- mechanically simple







69.436 mm
Ø24.139 mm
Ø42.896 mm
73.7°
60.0°
128.793 mm
SCALE 1:3
4.828 mm
60.000 mm
75.500 mm
SCALE 1:3
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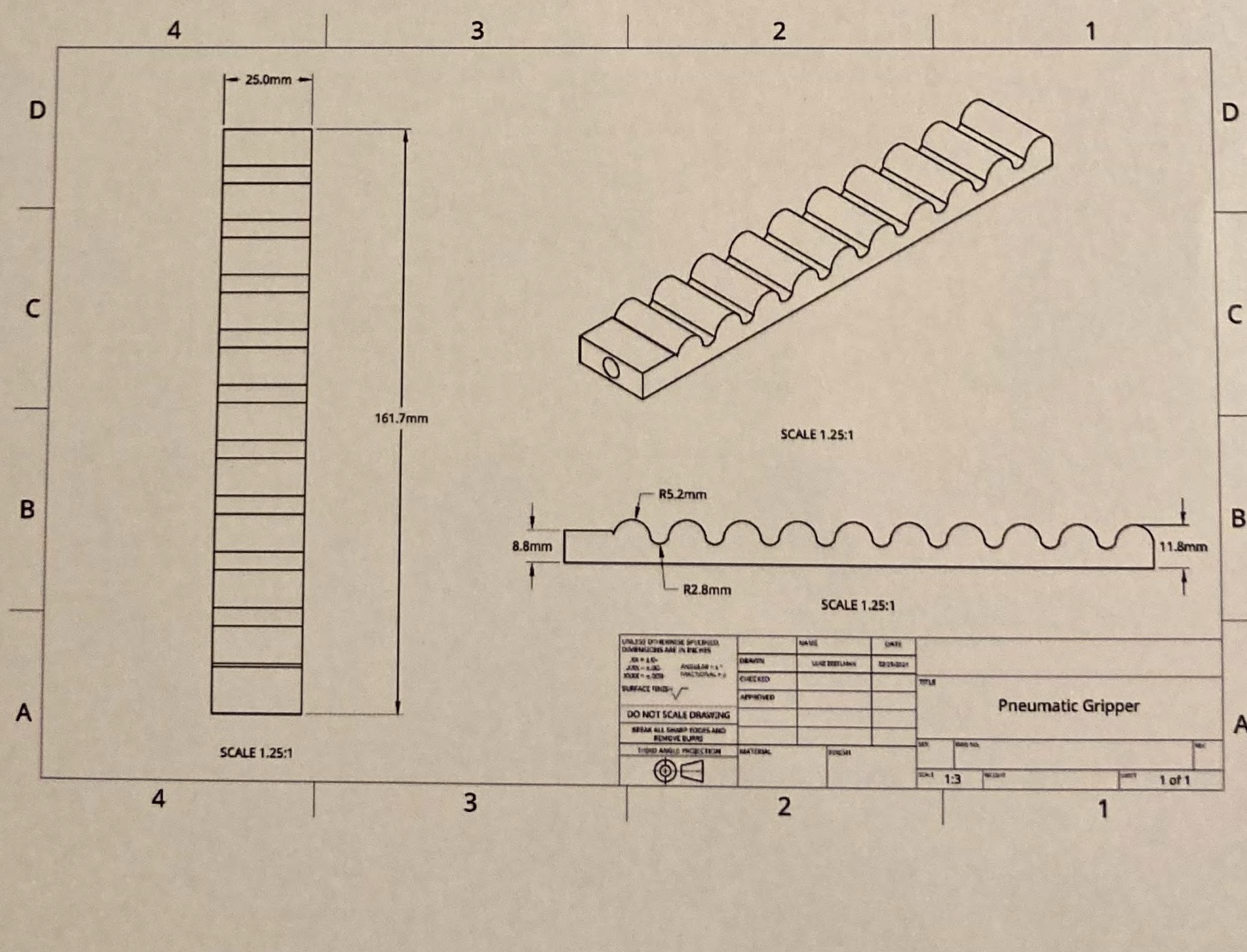
DO NOT SCALE DRAWING
THIRD ANGLE PROJECTION
TITLE
Arm VXXX
A
1:3
1 of 1



25.0mm
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SCALE 1.25:1
SCALE 1.25:1
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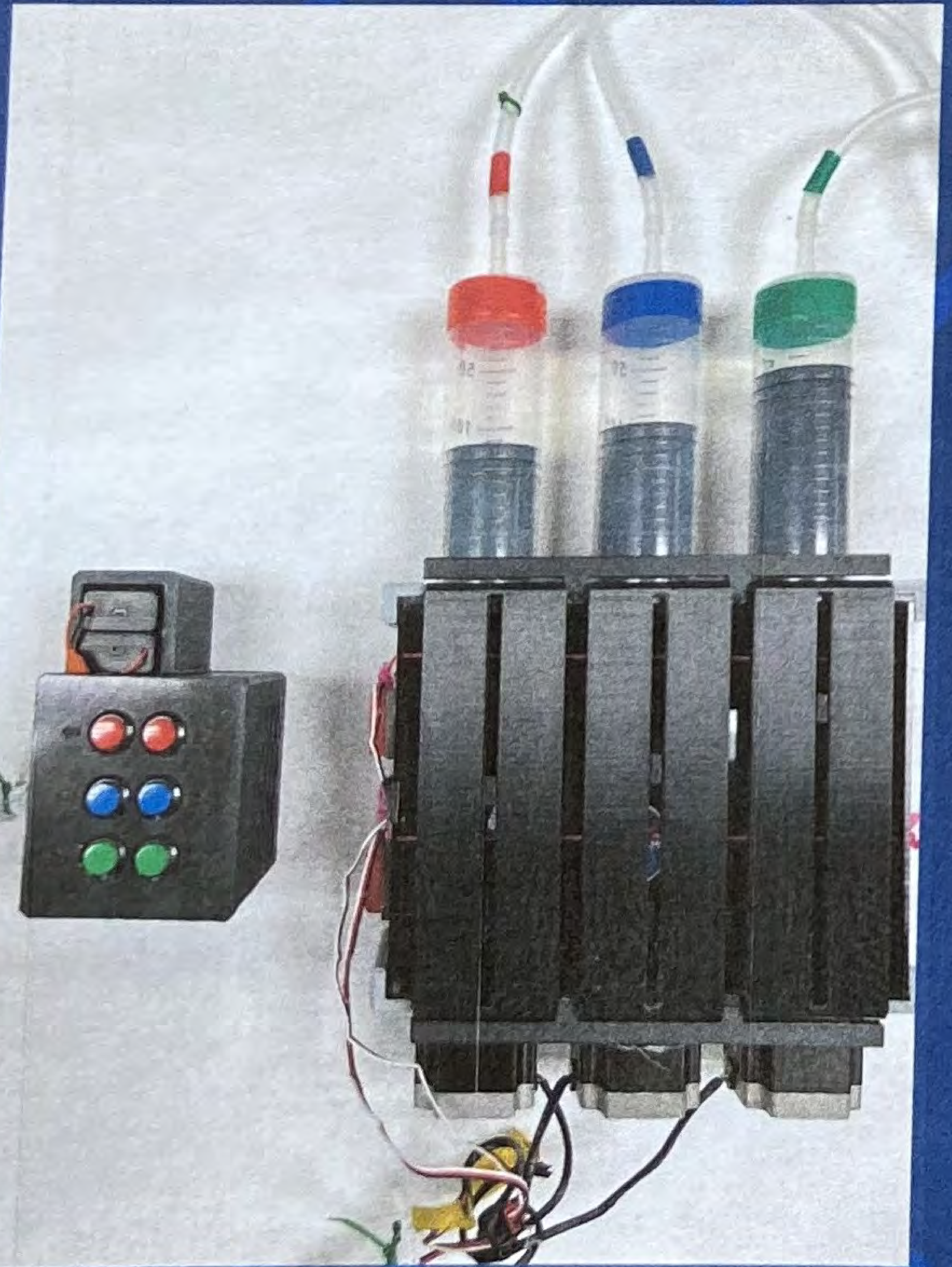
8.8mm
11.8mm
R2.8mm
SCALE 1.25:1
DO NOT SCALE DRAWING
Pneumatic Gripper
1:3
1 of 1

Control Box

We are utilizing a CNC shield and an Arduino to manage the movement of 3 stepper motors through a 6-button control panel. These stepper motors are connected to lead screws that actuate the plungers, functioning similarly to the z axis on a 3D printer. This enables us to precisely control the pressure in each segment of the main LSOVA. Our solution is robust, accurate, consistent, and can be easily scaled up or down.



Sensors

We incorporated a pressure sensor into one segment of the hand. Ideally, we would include a sensor in every individual LSOVA, but due to cost constraints, that was not possible for our prototype. We can detect when the arm or hand makes contact with an object when the pressure in a segment is higher than predicted.

About us

Juniors at Minnetonka High School

Marcus Silver
Software and electronics

Nate Kaufman
Research and presentation design

Nicholas Joseph
Hardware and design

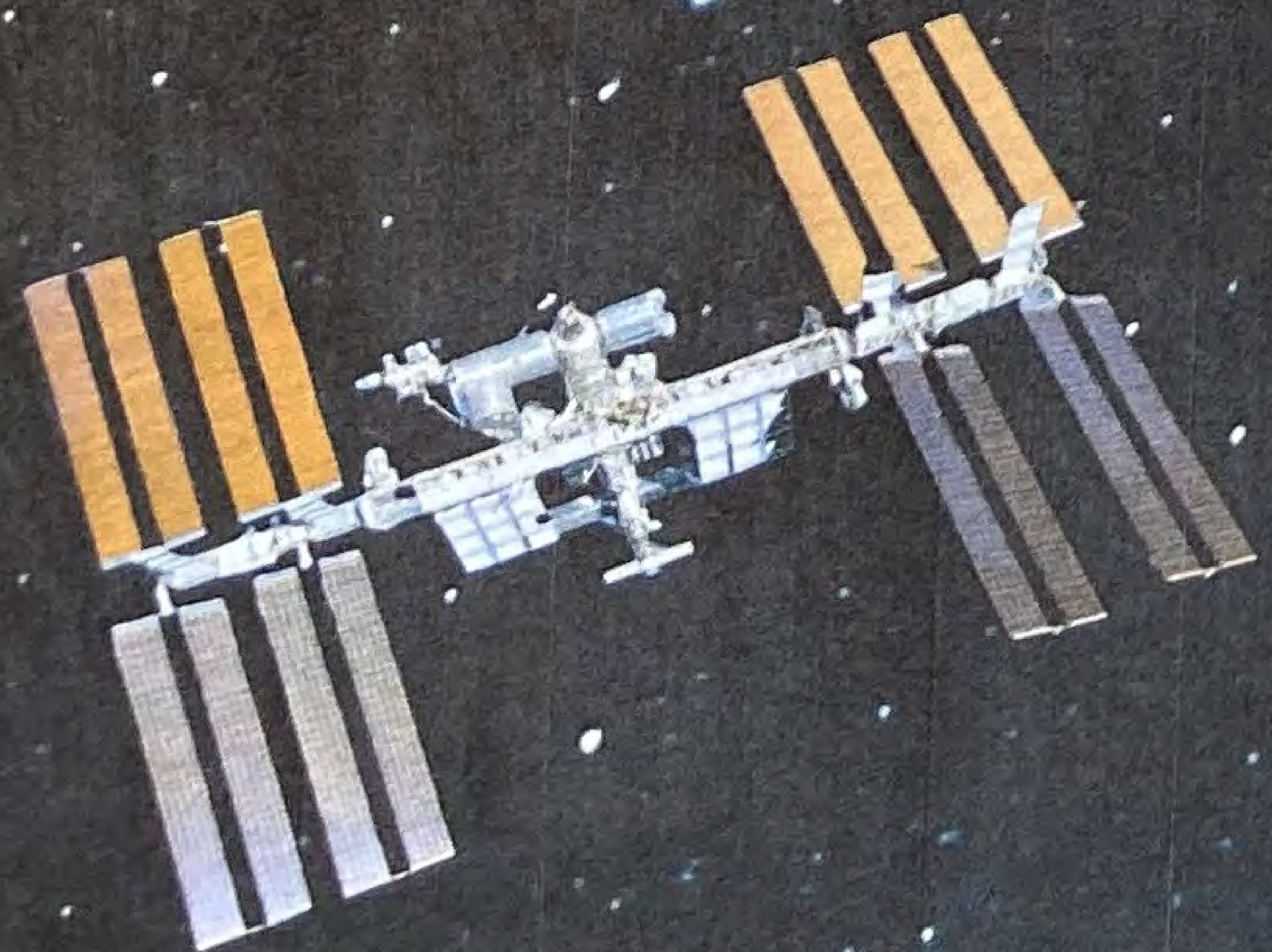
tonkahunch.team

MINNETONKA

Kwadropus Mobility Arm

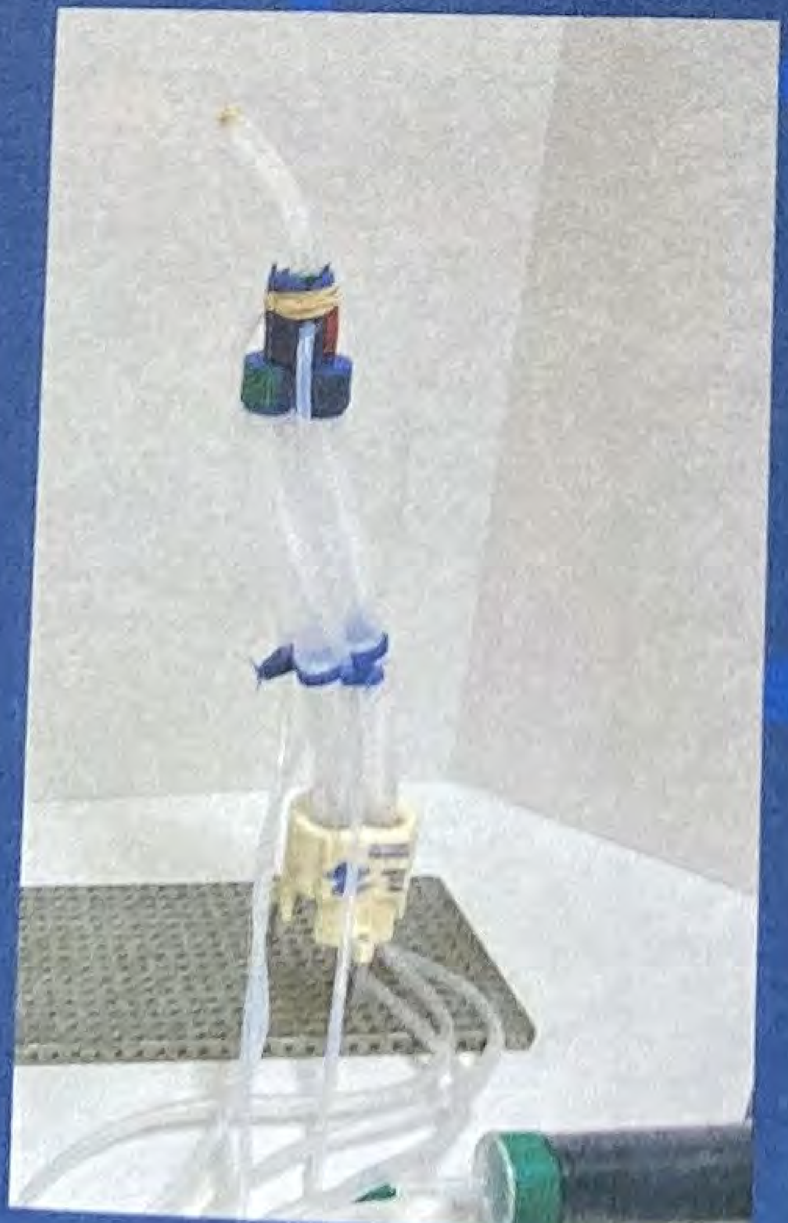
Problem and Requirements

Develop a robotic arm that has a minimal amount of rigid parts and can pull itself from one location to another using a handrail or other holds. It should be able to rotate to grasp in multiple directions. It must be able to expand and contract by at least 12 inches. It must include a location for a switch or sensor on the arm that detects when it grabs onto a handrail. It must Include locations for at least 2 suction cups.



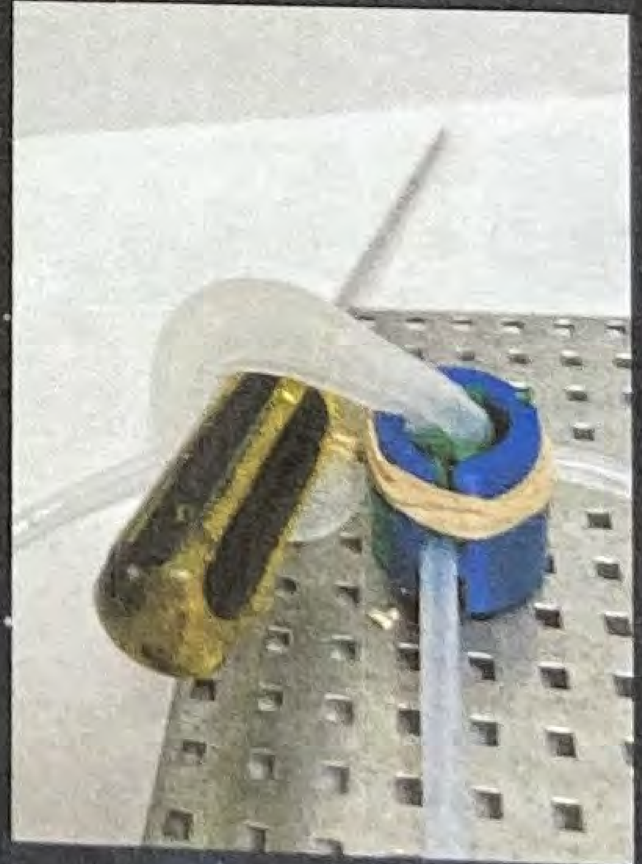
Arm

We are using three corrugated plastic tubes to create a large Liner Soft Vacuum Actuator (LSOVA). This gives us a strong, durable arm with good reach while remaining semi-flexible. Suction cups can be mounted on any part of the arm with a simple 3D-printed part, but right now we have only included them on the midpoint of the arm. The arm alone can extend by 8 inches, and with the hand, it can reach up to 12 inches.



Hand

For the hand, we created a smaller and more flexible LSOVA made of silicone. It is attached magnetically to the end of the main arm and can be controlled with smaller syringes by hand. This allows the hand to move independently and with greater flexibility than the main arm. Ideally, it would be longer but we were limited by our mold size.



Pictures

Contact Us!

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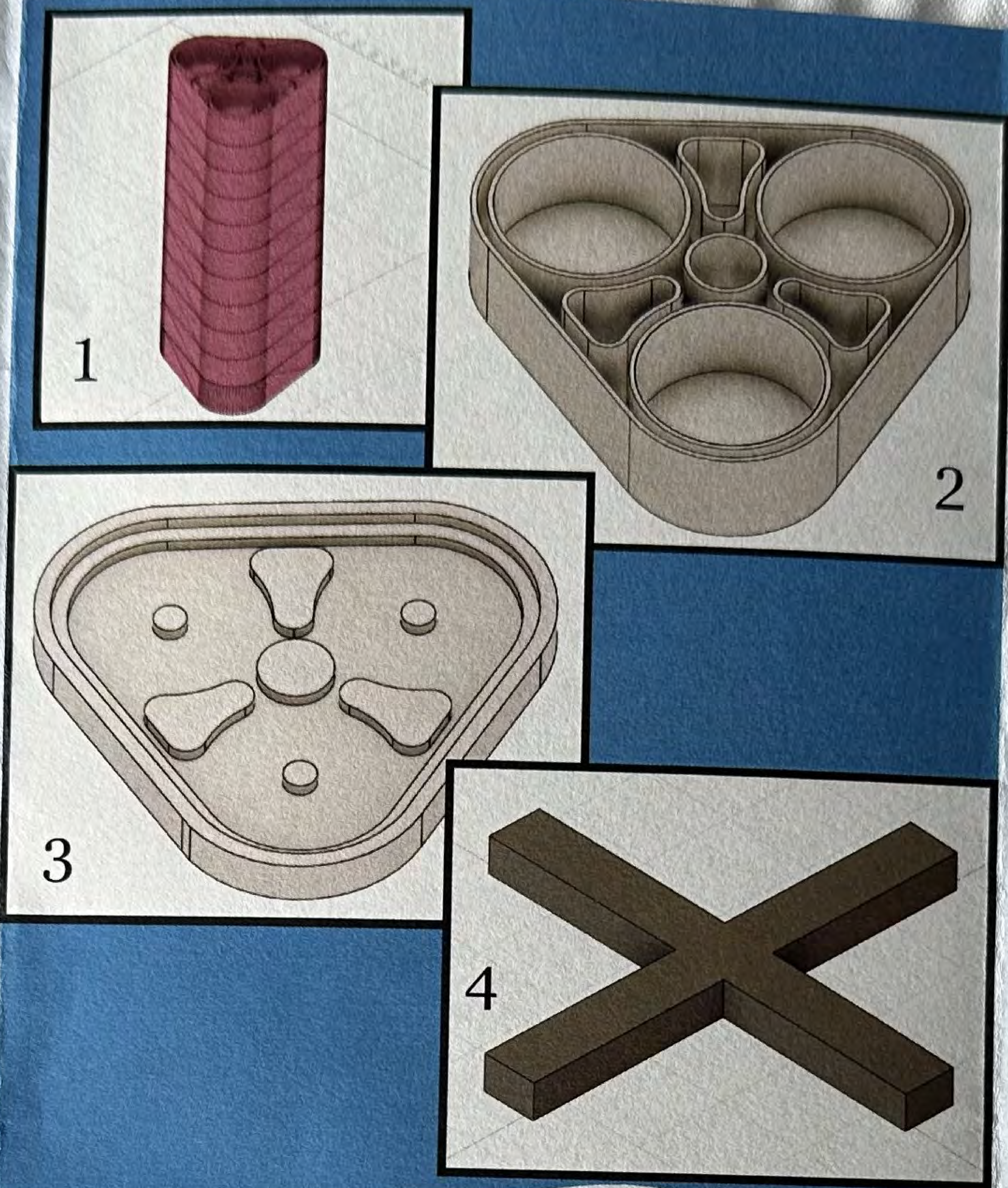
Mobility Arm

Ala Alawadi
Ana Rivera
Miles Johnson
Ibrahim Seshan

Tuscarora Highschool
Mr. Craig

Main Features

The main feature of our Mobility Arm is its rubber composition and ability to expand via air. This combination allows for increased flexibility to be able to effectively carry out its task and decreased risk of damage to the the arm.



CAD Drawings

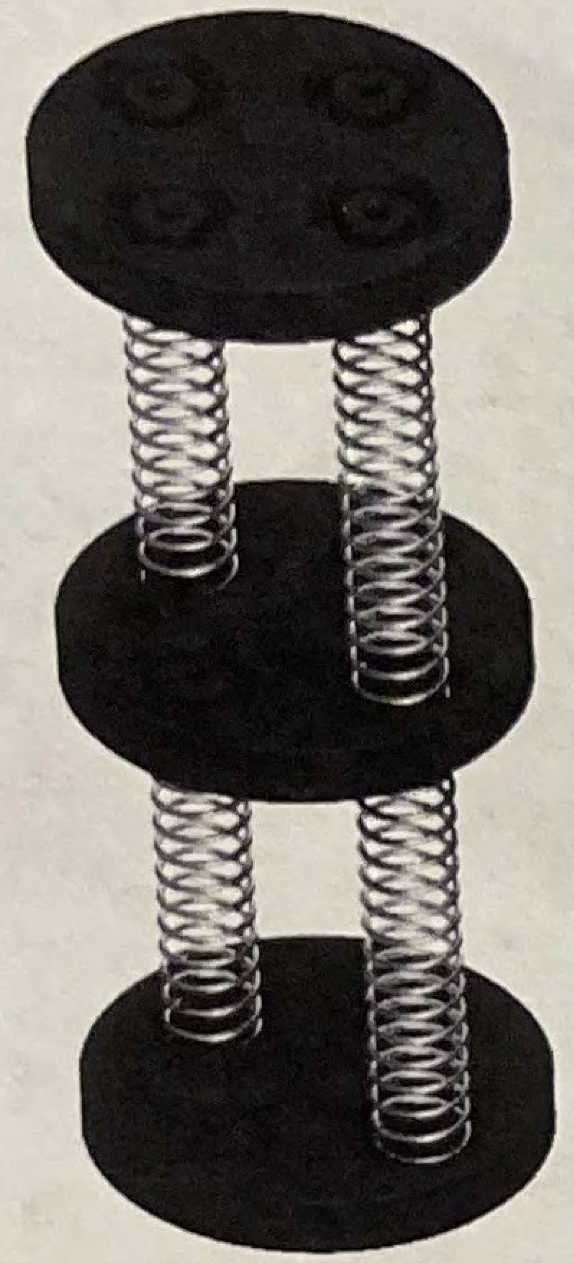
Pictured above are the CAD drawings of different elements of our mobility arm.
1. The design of the air chamber, or the arm portion.
2. The mold used to create the sides of each section of the arm, the product of this mold was then put into the mold shown in picture #3 to create the bottom.
3. The mold used to create the bottom part of each section of the arm
4. The design of the claw portion of the arm, which is the element that will be used to grab onto the ISS handrails.

Testing

-Best able to grip things that have ridges and/or bottoms
-Can carry at least 10 lbs
-Carries flat objects easiest
-Can extend 8 inches maximum

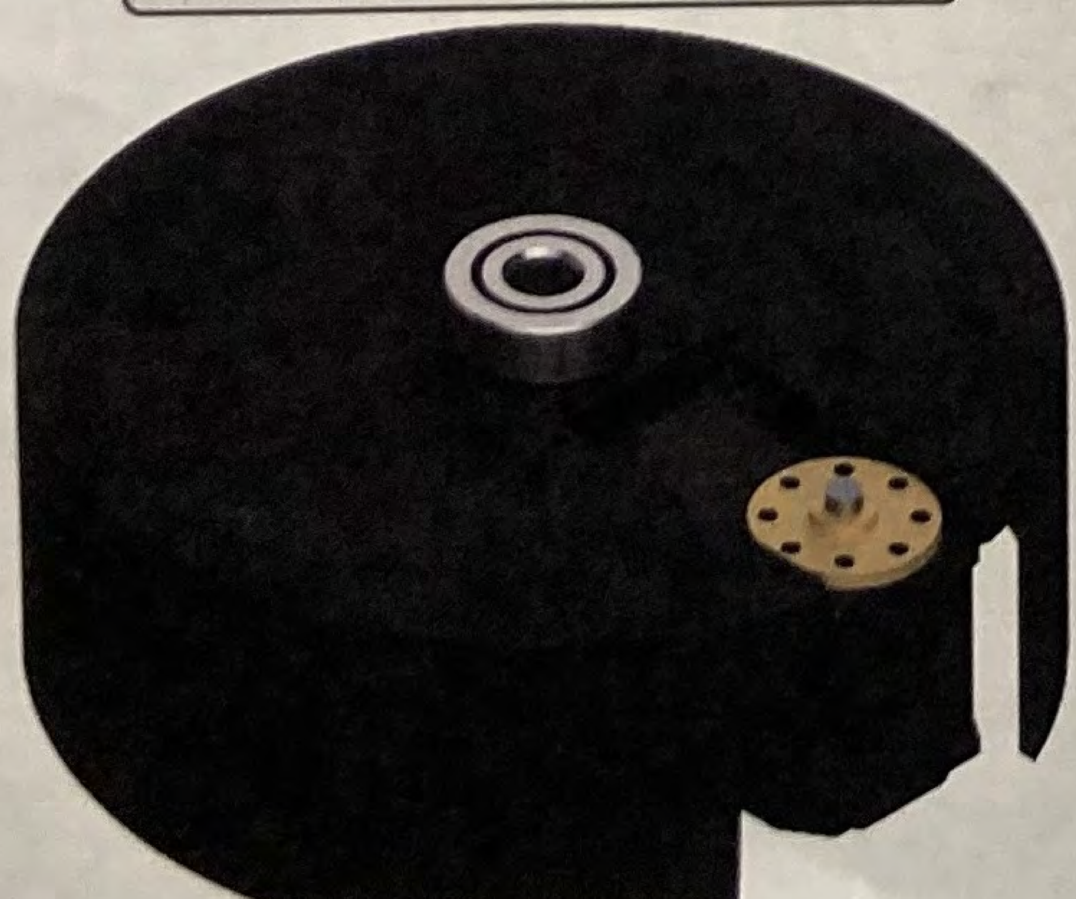
Link to Testing

Vertebrae



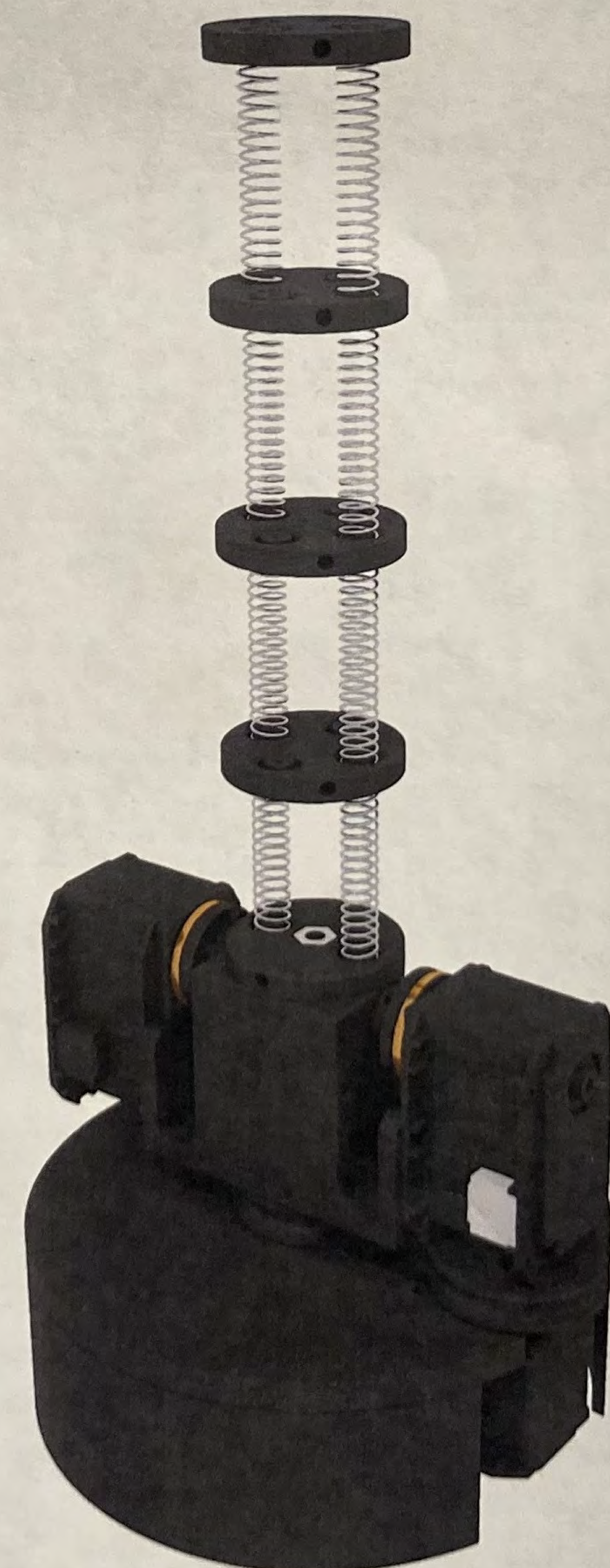
Servo Base

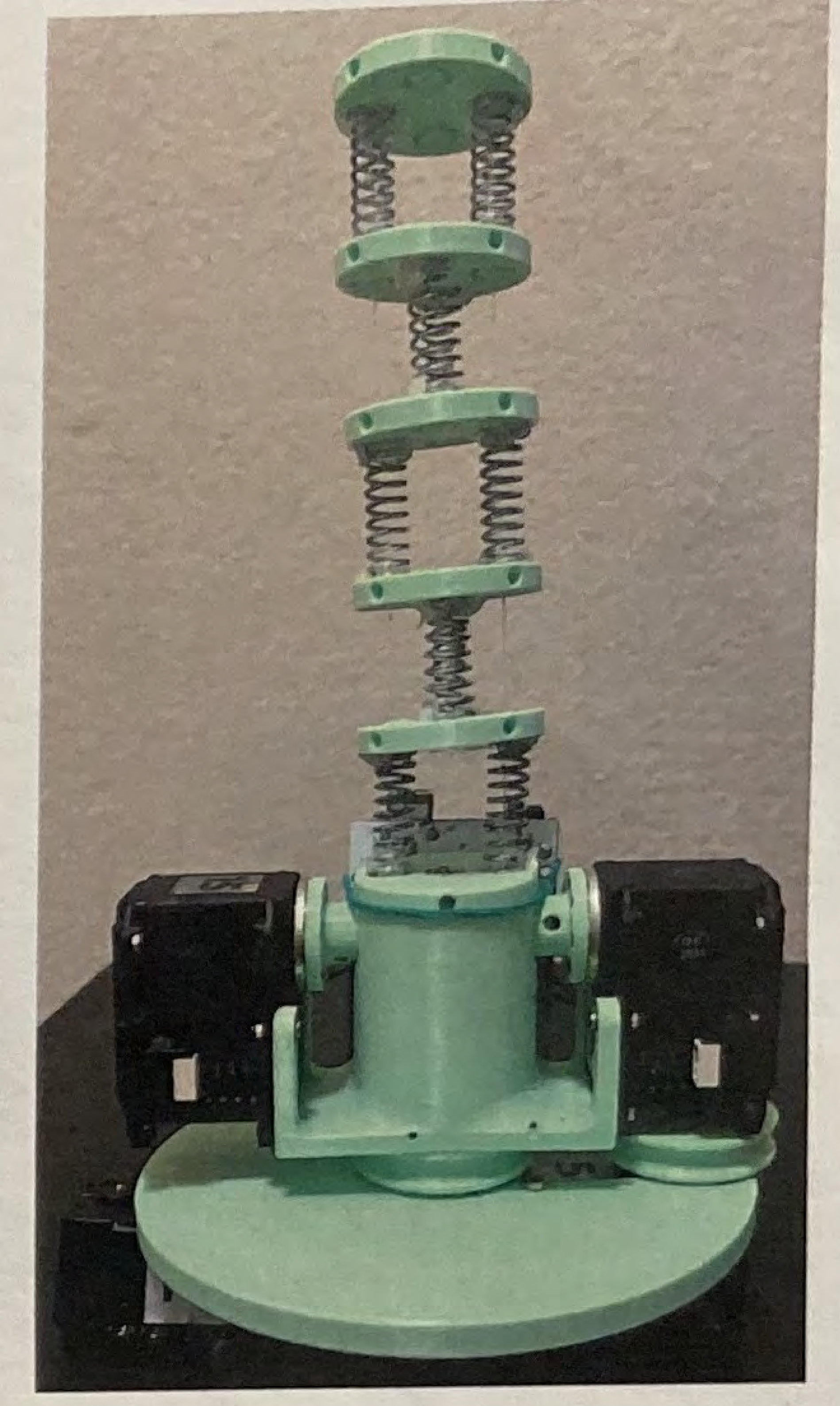
Turntable



Kwadropus Robot Mobility Arm

Plano ISD Academy High School
Mrs. Gunnels
Cyrus Lauderdale, Imanol Gomez, Natalie Daleo

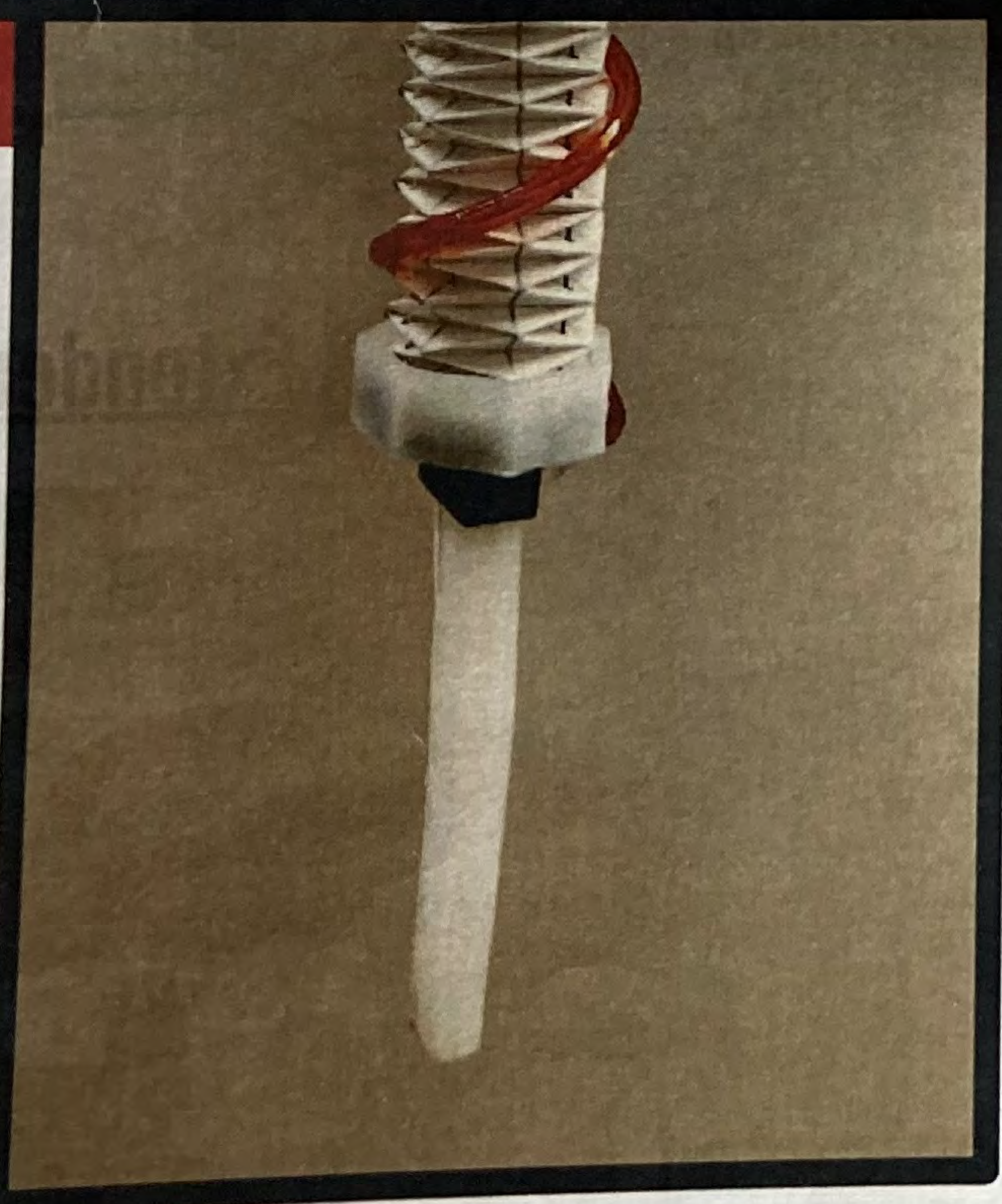




The project involves developing a versatile robotic arm for dynamic environments, with features including compression for grabbing, rotation for maneuverability, contortion, and bendable joints for navigating tight spaces, and overall flexibility for various tasks. Primarily the arm will be capable of self-movement, pulling itself from one location to another, and will have the ability to rotate in multiple directions for effective grasping and manipulation.

Kwadropus Mobility Arm

The Jubbers



Meet the Team

Wylie Mugaas
Finn Berg
Jasper Jacobsen

Contact Us!

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jasper.jacobsen@bsd7students.org

Bozeman High School
Bozeman Montana
Teacher: **Carl Poeschl**

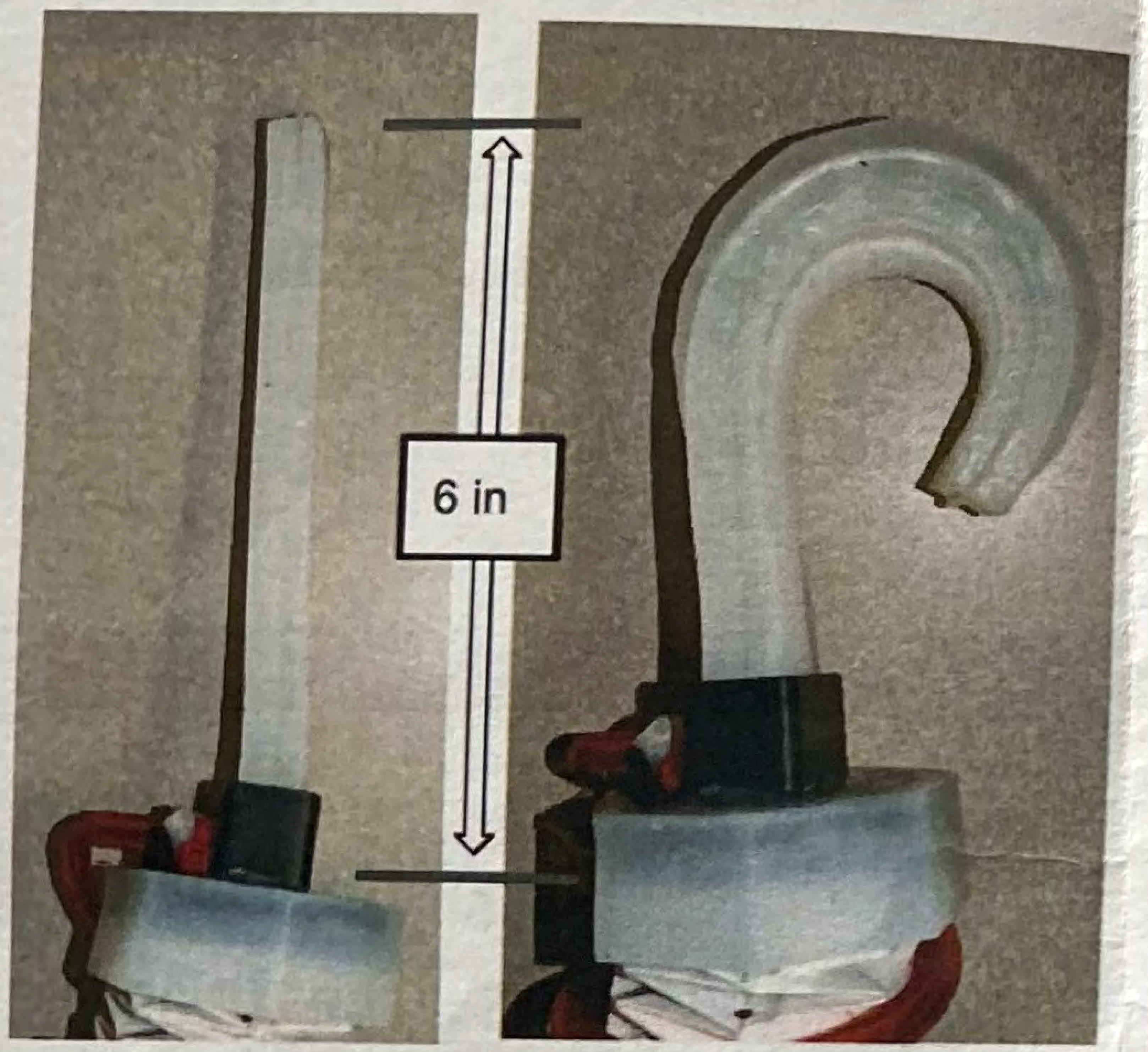
Requirements:

- ✓ Soft
- ✓ Extendable
- ✓ Can hold on to handrails
- ✓ 360 degree mobility

Link to VIdeo!

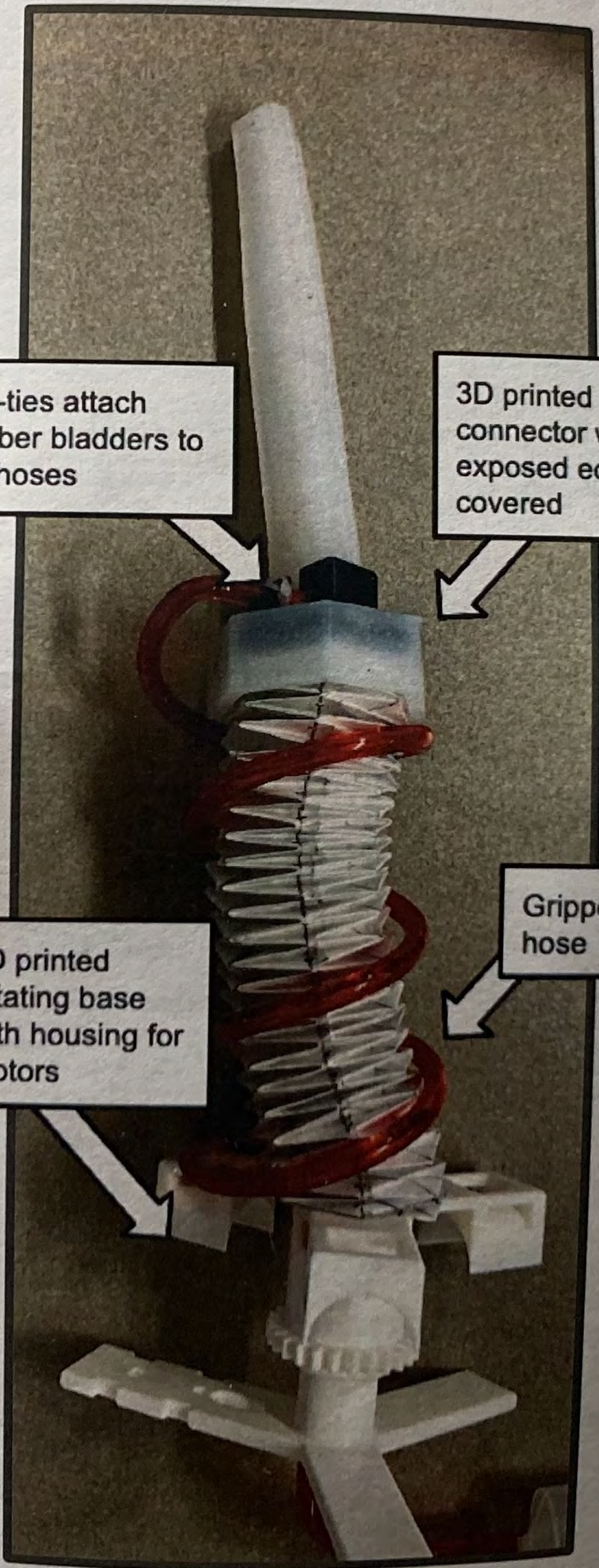
Our design integrates paper origami, using its strength and flexibility while keeping with a semi-soft material. Complementing this, the majority of exposed components are made out of or covered in a soft, flexible silicone material, ensuring no damage to spacecraft. The use of silicone air bladders in our design also allows for an entirely soft grabber tip which provides lots of grip and no hard edges.

The Gripper



At the tip of the arm is a soft, rubber hook. When inflated, air chambers along the back expand while an embedded strip of light-weight nylon fabric keeps the opposite side from stretching. The result is a strong, curved tentacle perfect for curling around space station handrails and moving the robot around

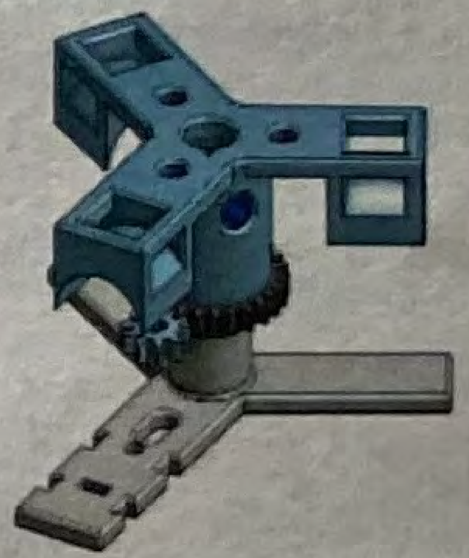
Our design uses a two part system, with an extendable base and rubber gripper.

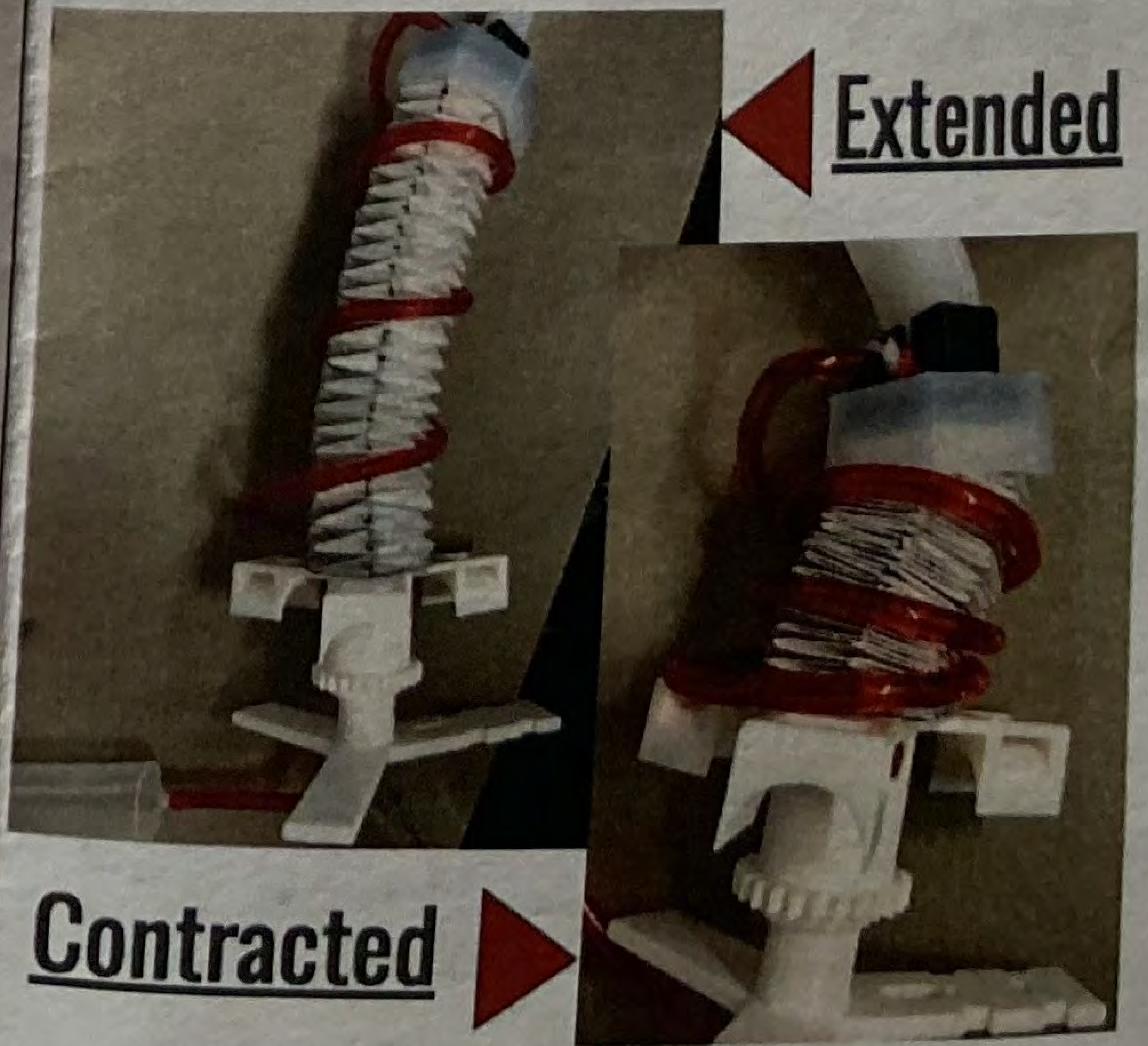


Extending-Base

The base piece enables the arm to extend and contract using air to fill and expand a rubber tube on the inside of an origami shell. THis piece also has three strings running through the outer, rigid shell to provide added mobility. It has the ability to rotate 360 degrees using a motor connected to a gear.

3D Printed Base Part



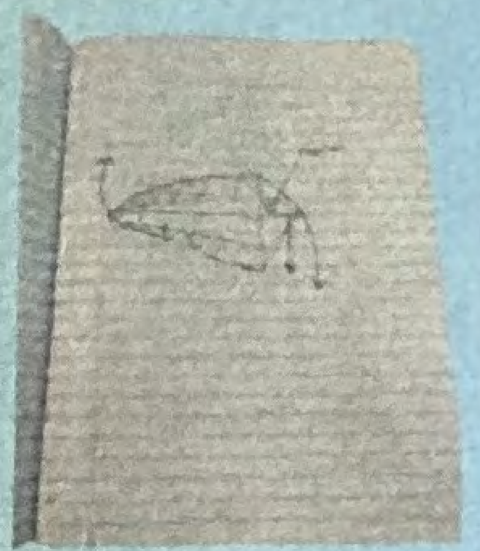


Extended

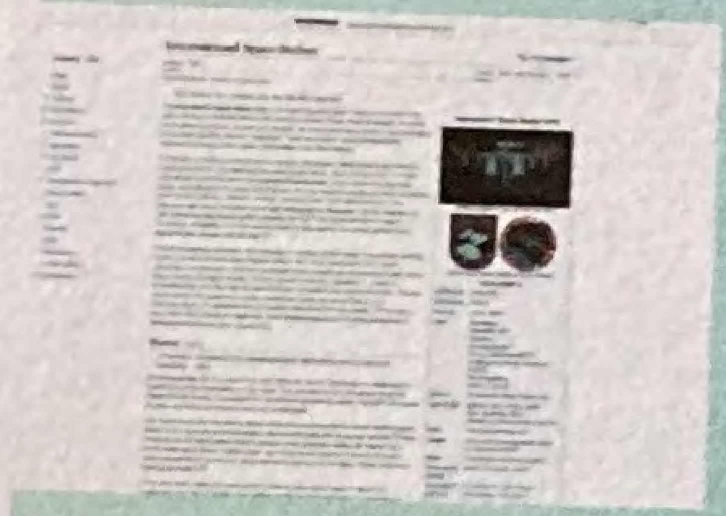
Contracted

Design Timeline

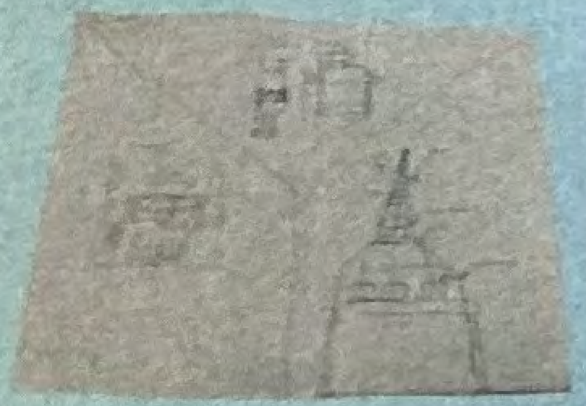
Brainstorming



Researching



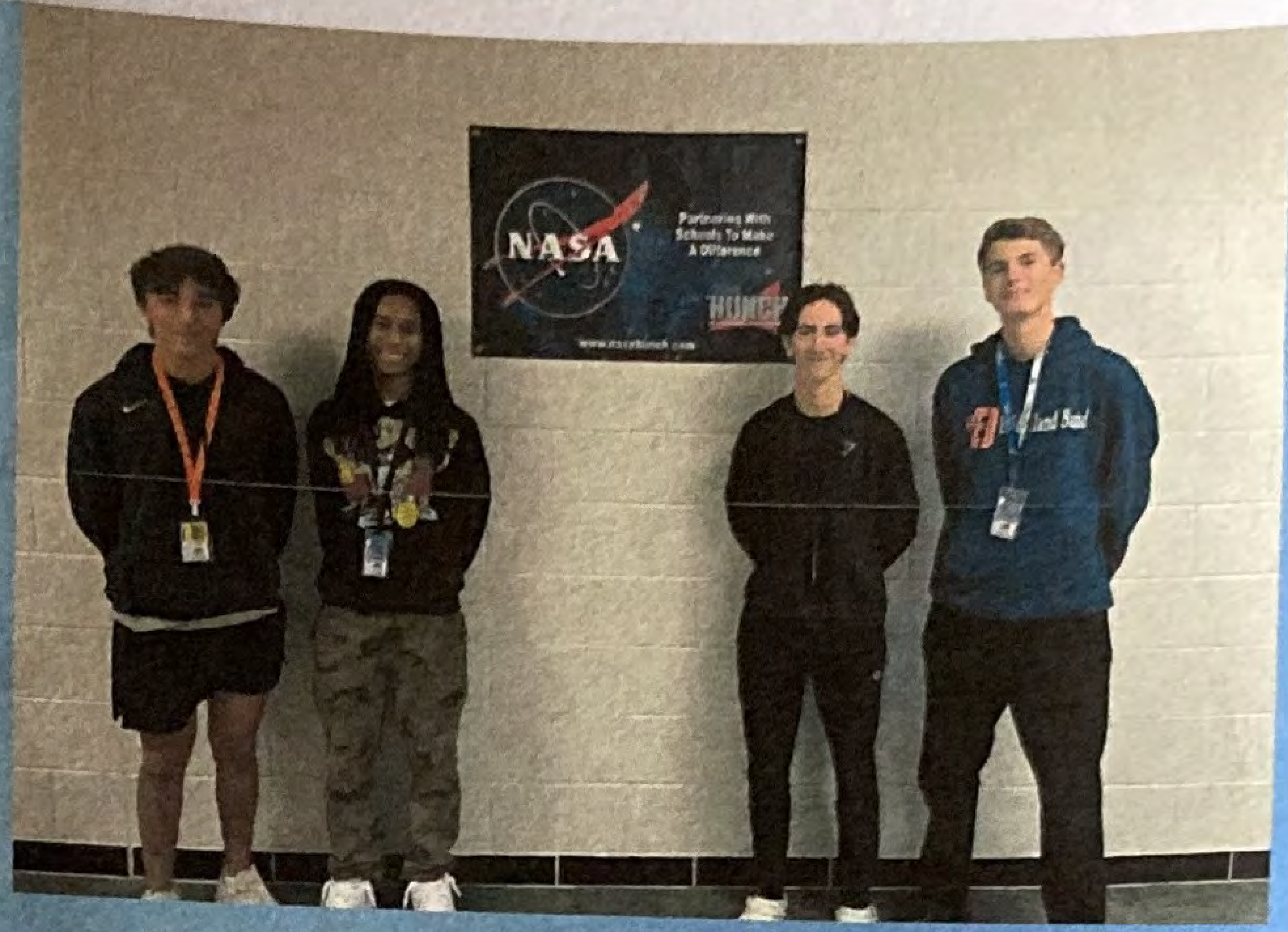
C-Sketching



Inventor Design

Putting Parts Together

Final Product



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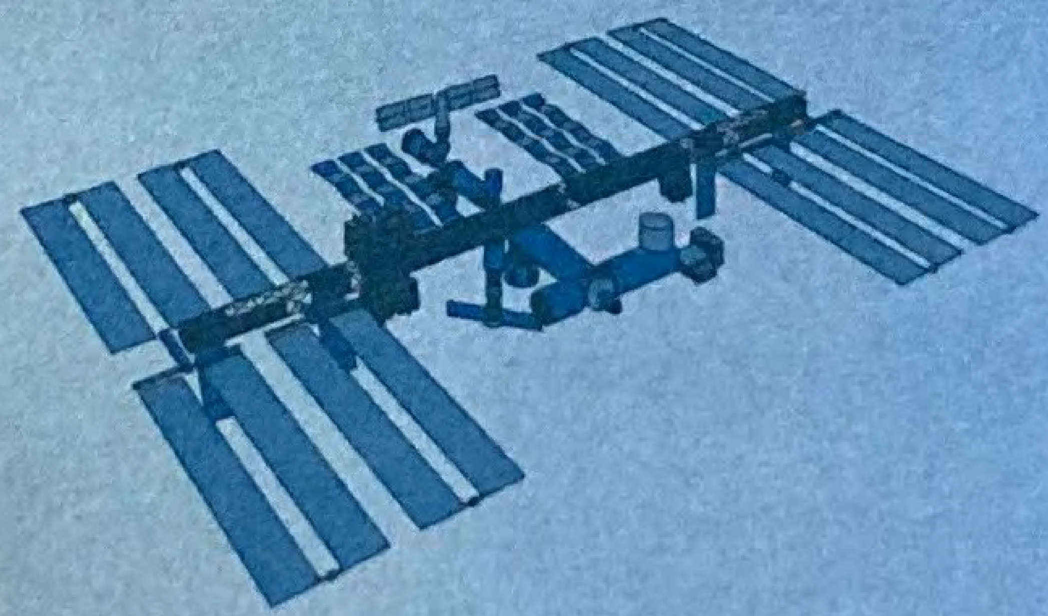
HOME OF THE BEARS BRIDGELAND HIGH SCHOOL

NASA HUNCH

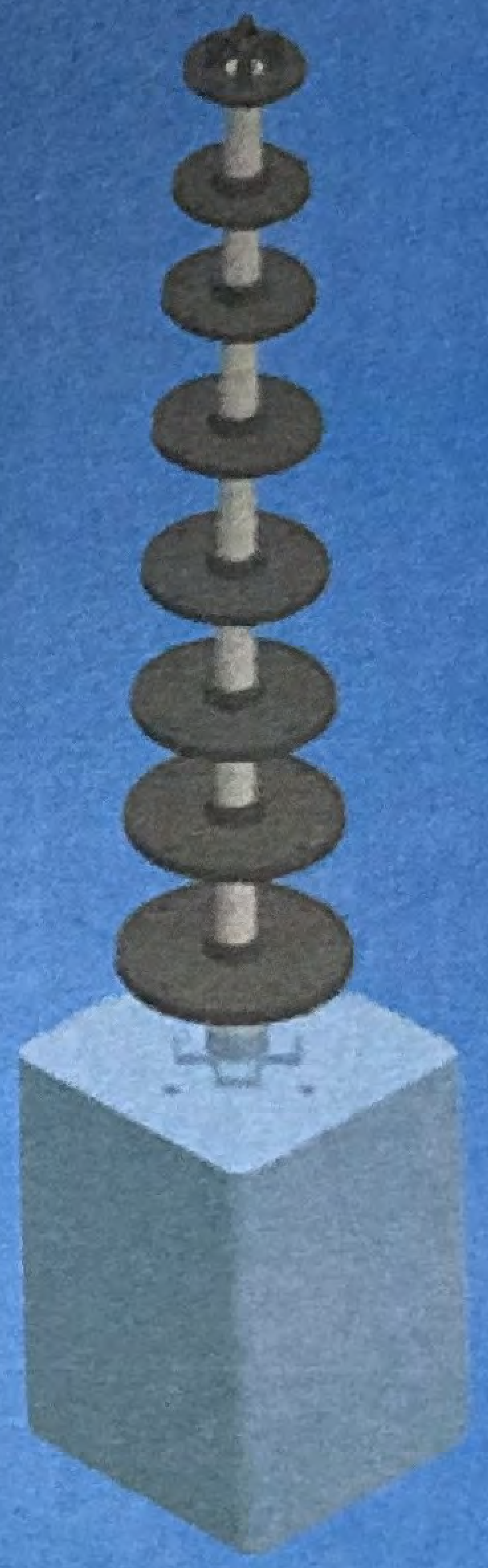


MORE ON ROBOTIC ARM

RUBRIC

Mobility Arm

Nasa Hunch 23-24



Reaching to the Future of Space Tech

About the Mobility Arm:

The Problem

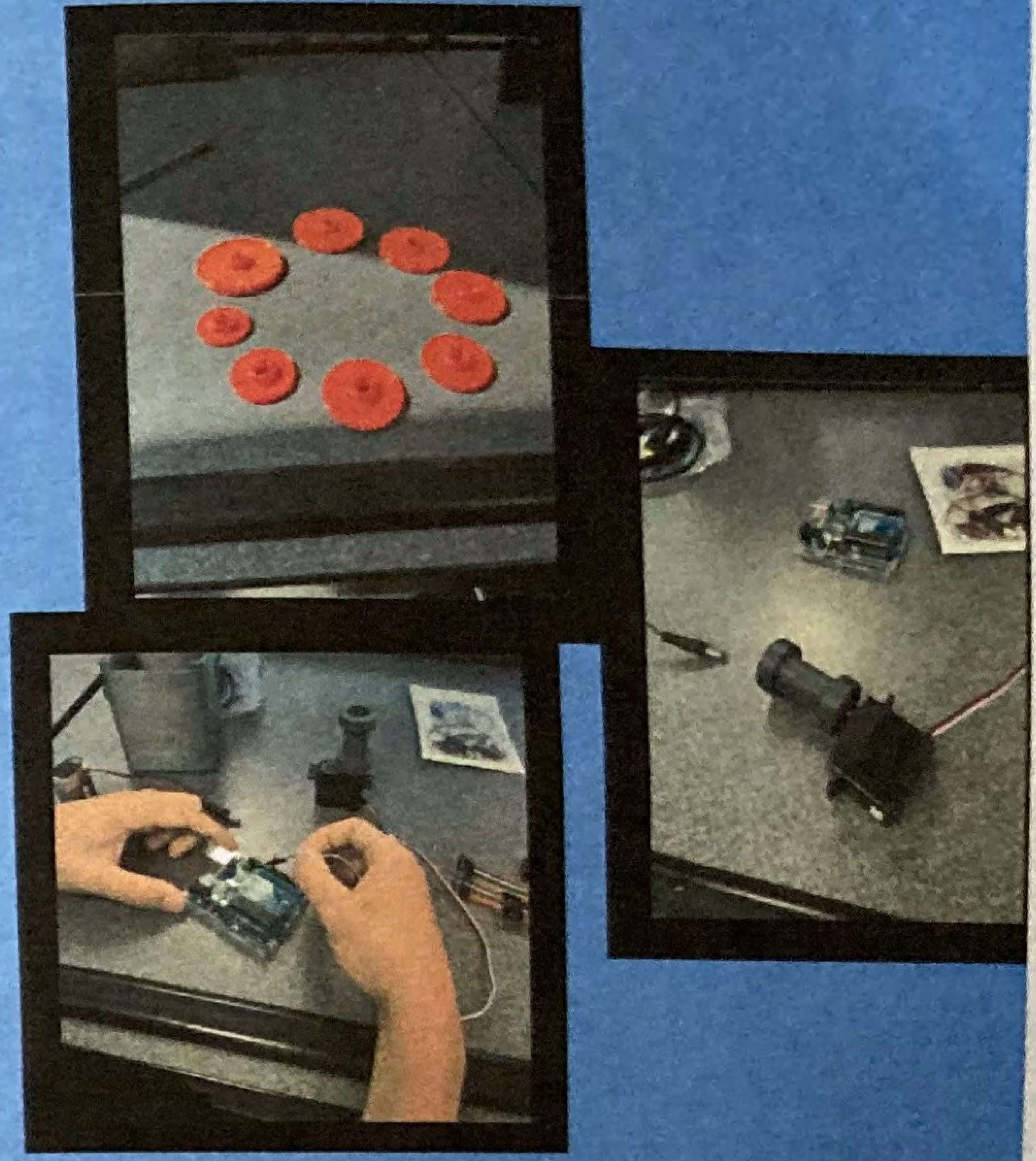
The problem we had to solve for this project was to make an arm capable of grabbing, holding, and pulling towards a handrail. To do this we decided to make individual discs pulled fishing line so it is able to move in every direction.

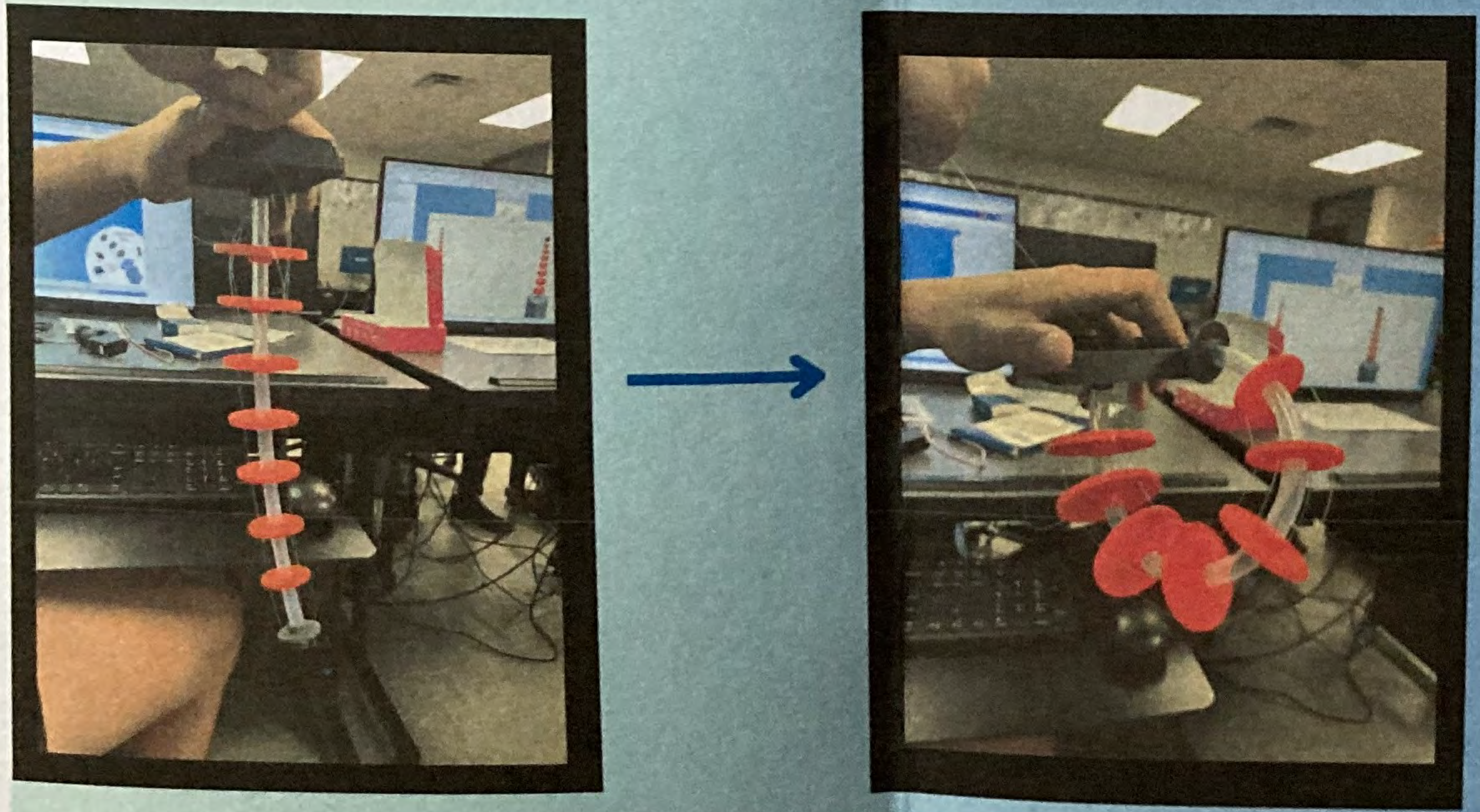
Our Solution

Our prototype is made of varying sizes of 3D printed discs connected by a flexible silicone tube in the middle. The arm itself is moved by four fishing lines that are thread through the discs to pull it in each direction. one of which is connected to a Servo motor which is coded and coded by an Arduino in order to demonstrate the full automated capabilities of the Mobility Arm.

Testing

Assembling Parts





Motion of Arm

Mobility Arm Parts