Kwadropus Propulsion

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 1st, 2nd, or 3rd 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.

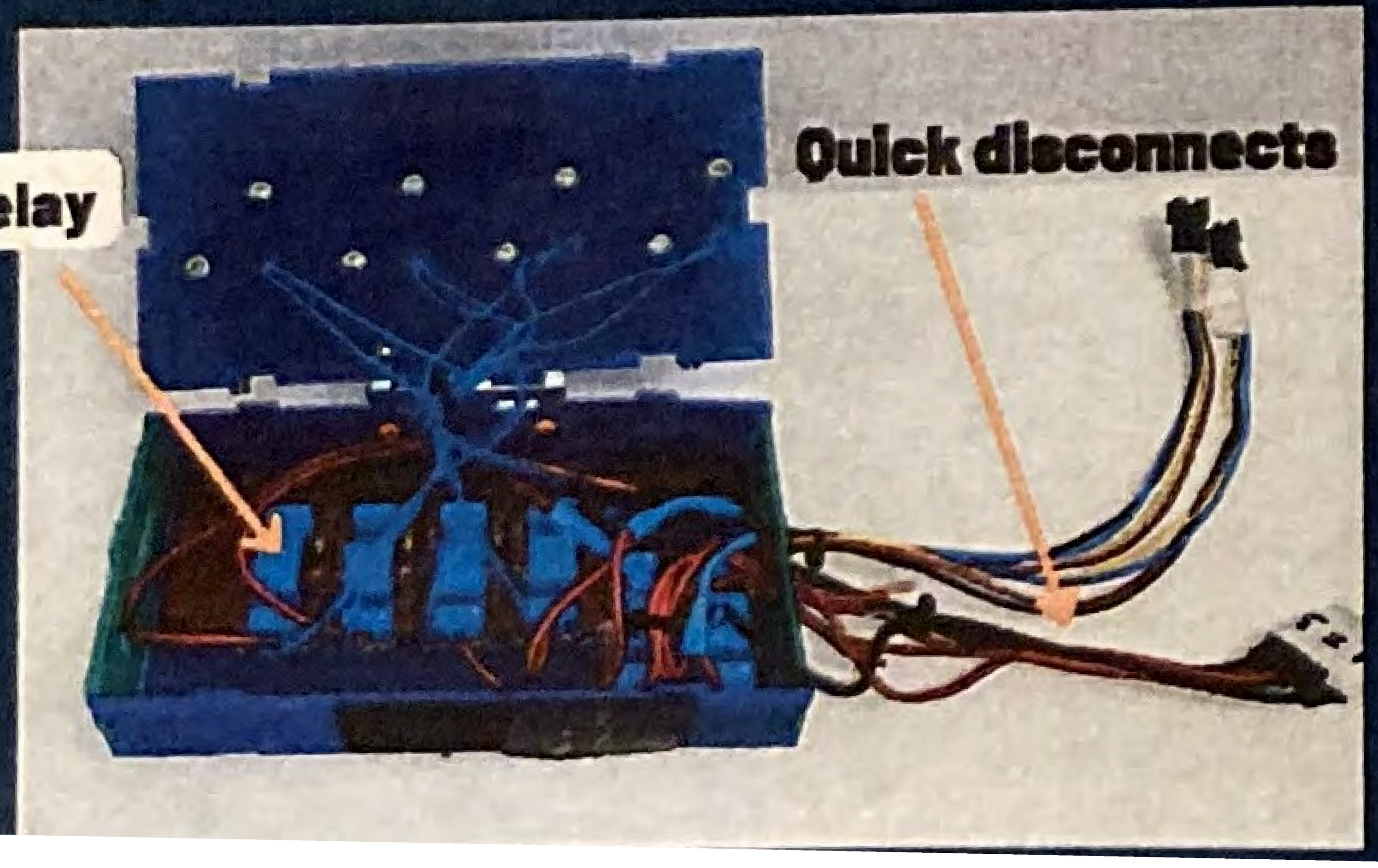
Suggestions for Kwadropus Propulsion

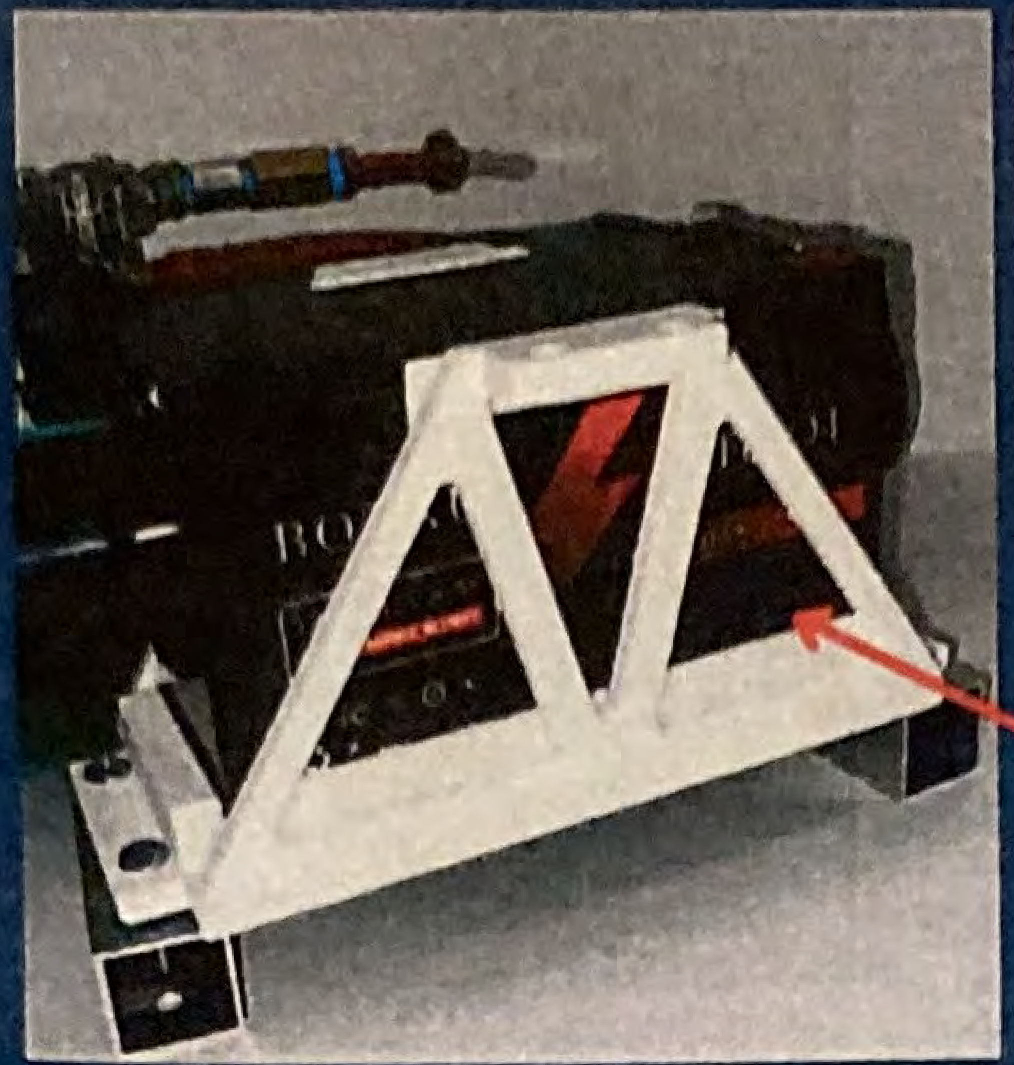
- Plan to explain the time the propulsion is needed and how often it would be used.
- What does your propulsion method do that is better than the others.
- Be ready to discuss the positive and negative attributes of your propulsion.
- How do you plan to shrink it down when the Kwadropus is only 12" across to fit into nooks and crannies?
- Will your propulsion method stir up the dust you are trying to clean up? Why or why not is this a concern?

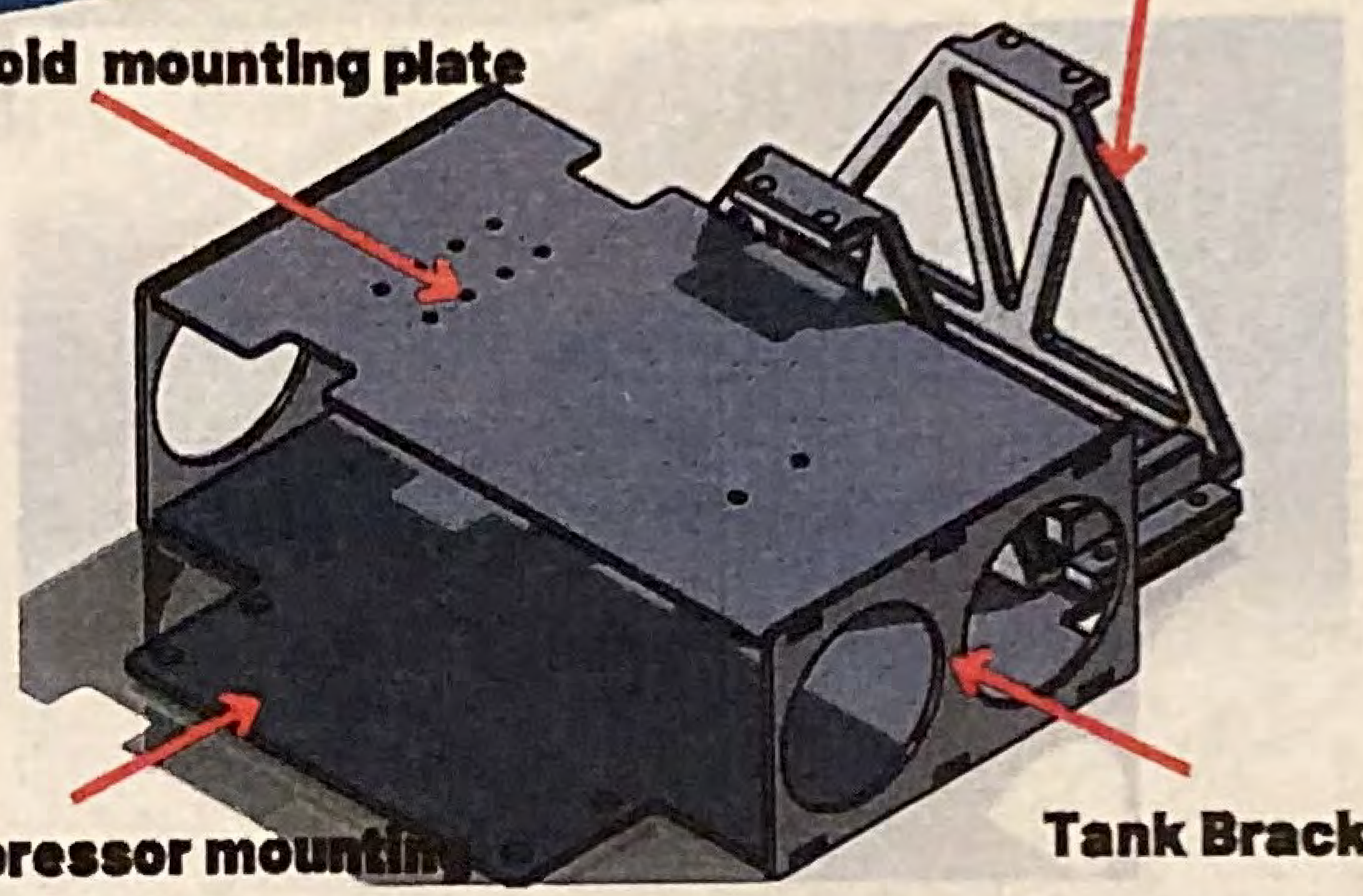
- Our components are mounted on custom laser cut acrylic brackets.
- The brackets are held together using a interlocking system like a puzzle

WIRING

- The wiring is most complex component of our project. A problem we ran into was switching 12 volt valves with an Arduino, which only supplies 3-5v.







ABOUT US:

Tri-County RVTHS
Franklin Mass
Engineering Tech Shop

CONTACT US:

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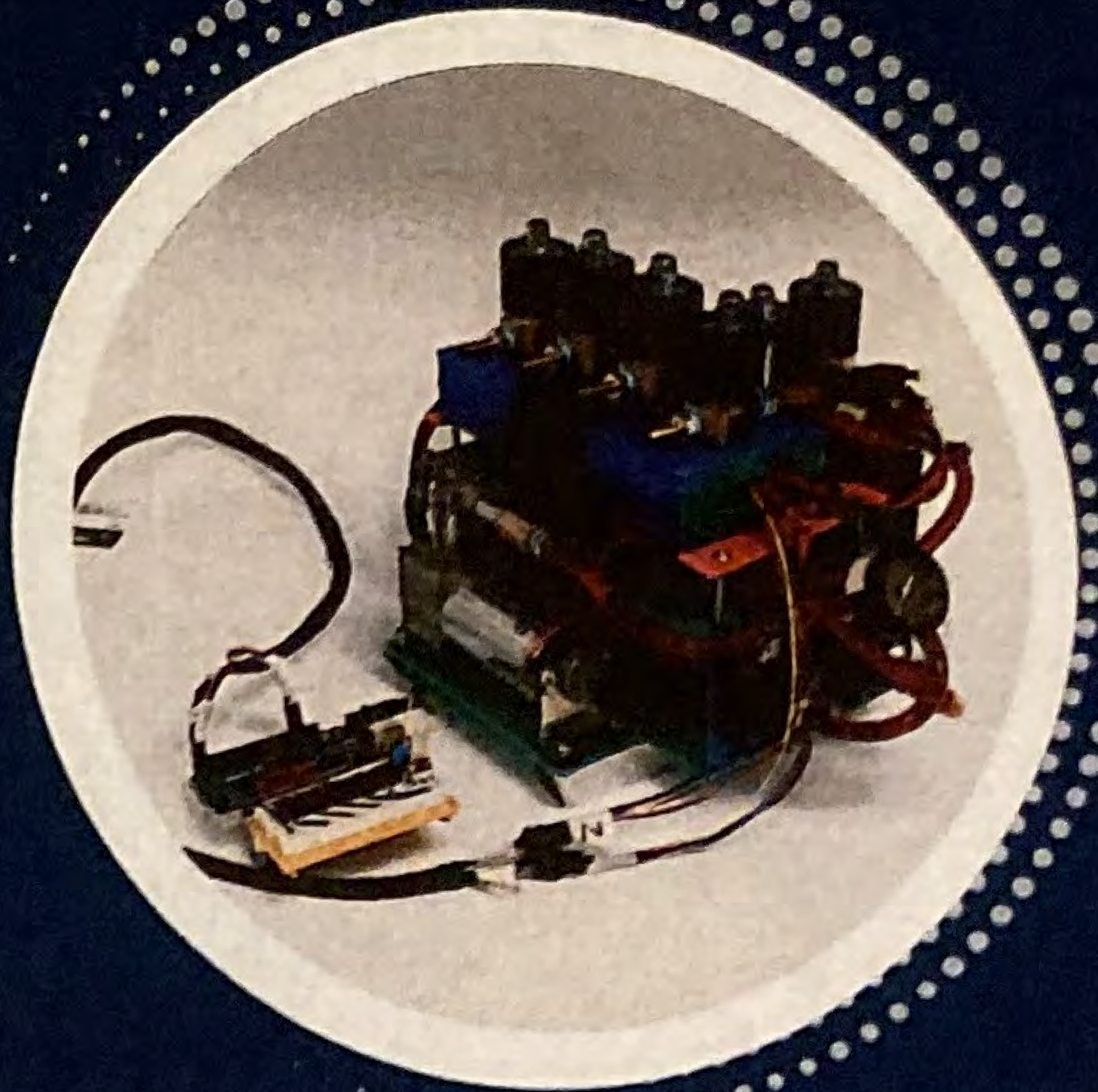


SPACE ROOMBA PROPULSION

MEET THE TEAM

Nicholas Harootunian, Nicholas Daday, Ephraim Aday

DESIGN RESTRICTIONS:

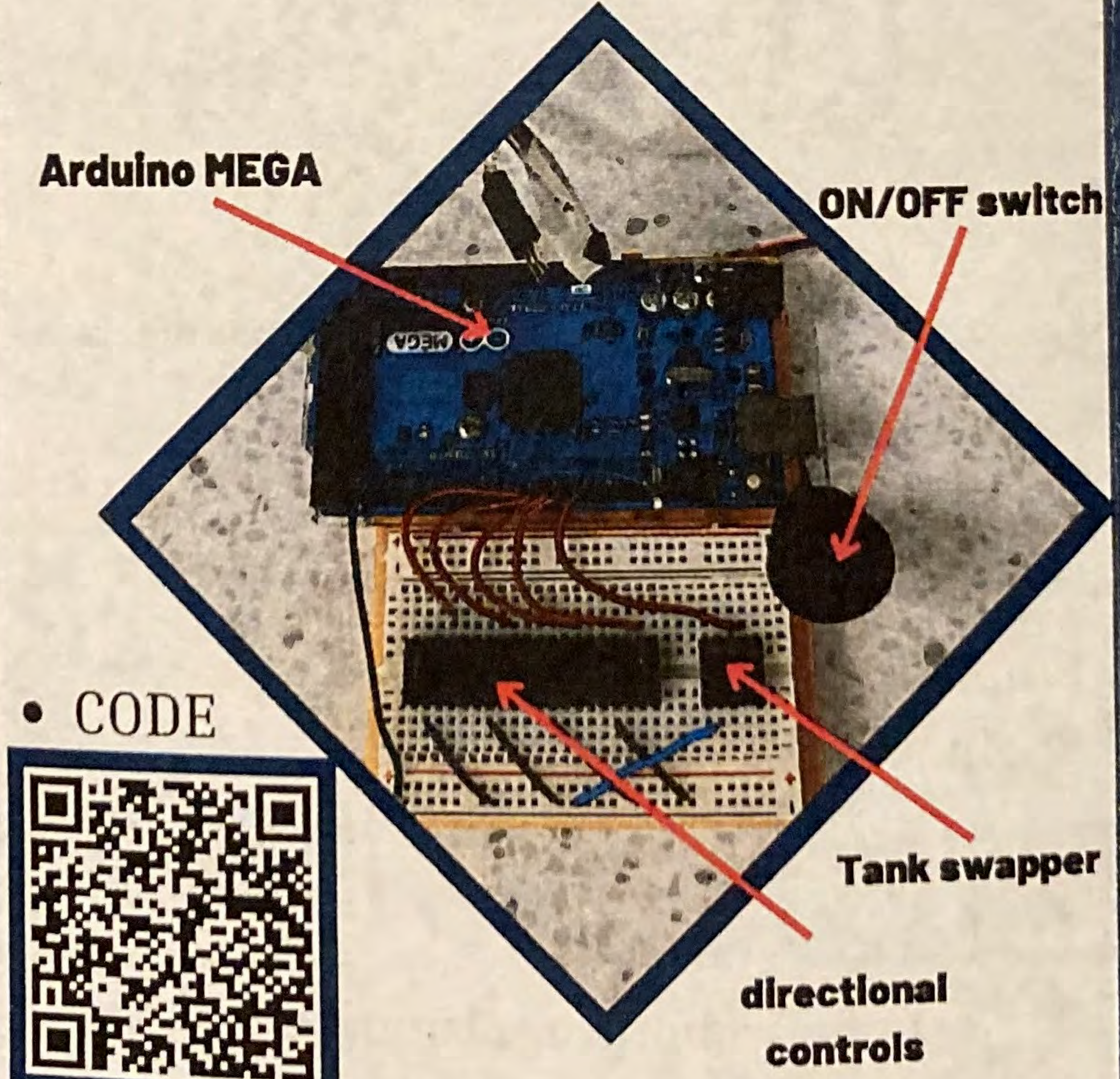
- Return the robot to the wall of the space station
- Can't require Astronaut interaction
- Responsive and controllable
- Not unnecessarily complicated

OUR PRODUCT:

- Compact concept for a propulsion device
- Uses all off the shelf products, other than custom laser cut acrylic brackets
- Dual tank system to ensure we always have active air flow

OPERATION:

- Robot is operated manually for now using an Arduino Mega (code framework is created for autonomous control)
- Air compressor is on a manual switch as well, but we plan on having pressure sensors that would turn it on and off, along with switching the tanks.



- CODE

OUR PRODUCTS EARLY STAGES:

- Our robot started out as two!
- In the beginning stages of prototyping, we were undecided between compressed air, and fan/impeller movement
- Complexity was a huge factor for us, we wanted this syststem to be easy to make
- Compressed air ended up being our final decision

Quadrapus Propulsion

Problem:

Create a way to control the Duster design of other teams while the design is midair so that if the duster ever gets off of a wall it can be moved back to a wall.

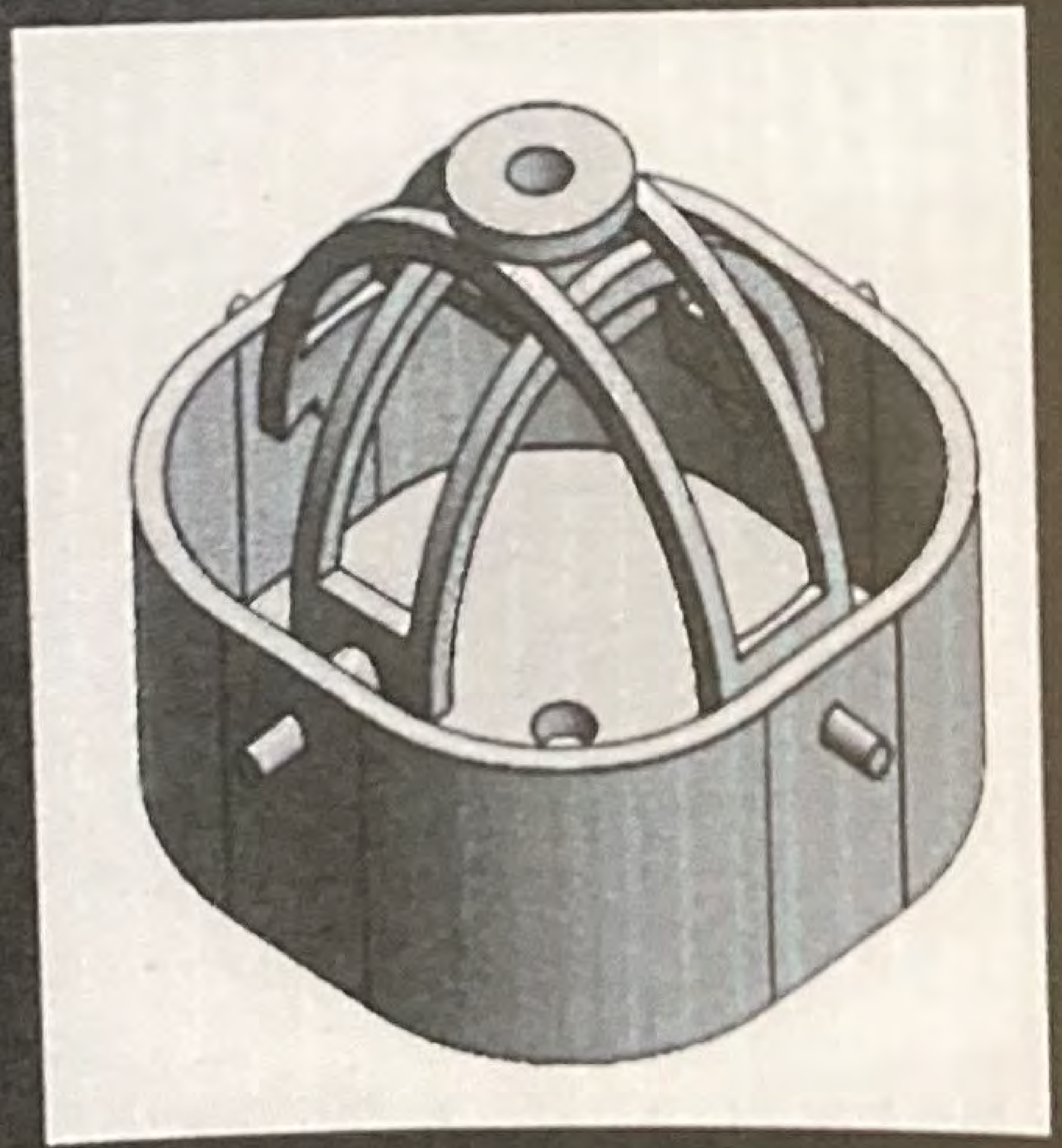
Our Solution:

Compressed air-

Our design controls a stream of compressed air to control the movement of the Quadrapus Duster despite being midair.

Servo Control (for Aiming)

We used arduino IDE and an arduino UNO to control the 2 servos and allow the range of motion that our design below requires.



(Link to design files)

https://drive.google.com/drive/folders/1tulXGH4b86aNrQRTkzjXLYp2hhMb0HjI?usp=drive_link

NASA HUNCH

Students:
Braden Vis and Max Weckman

Teacher:
Gary Shelton

Project Name:
Aimed Air Action

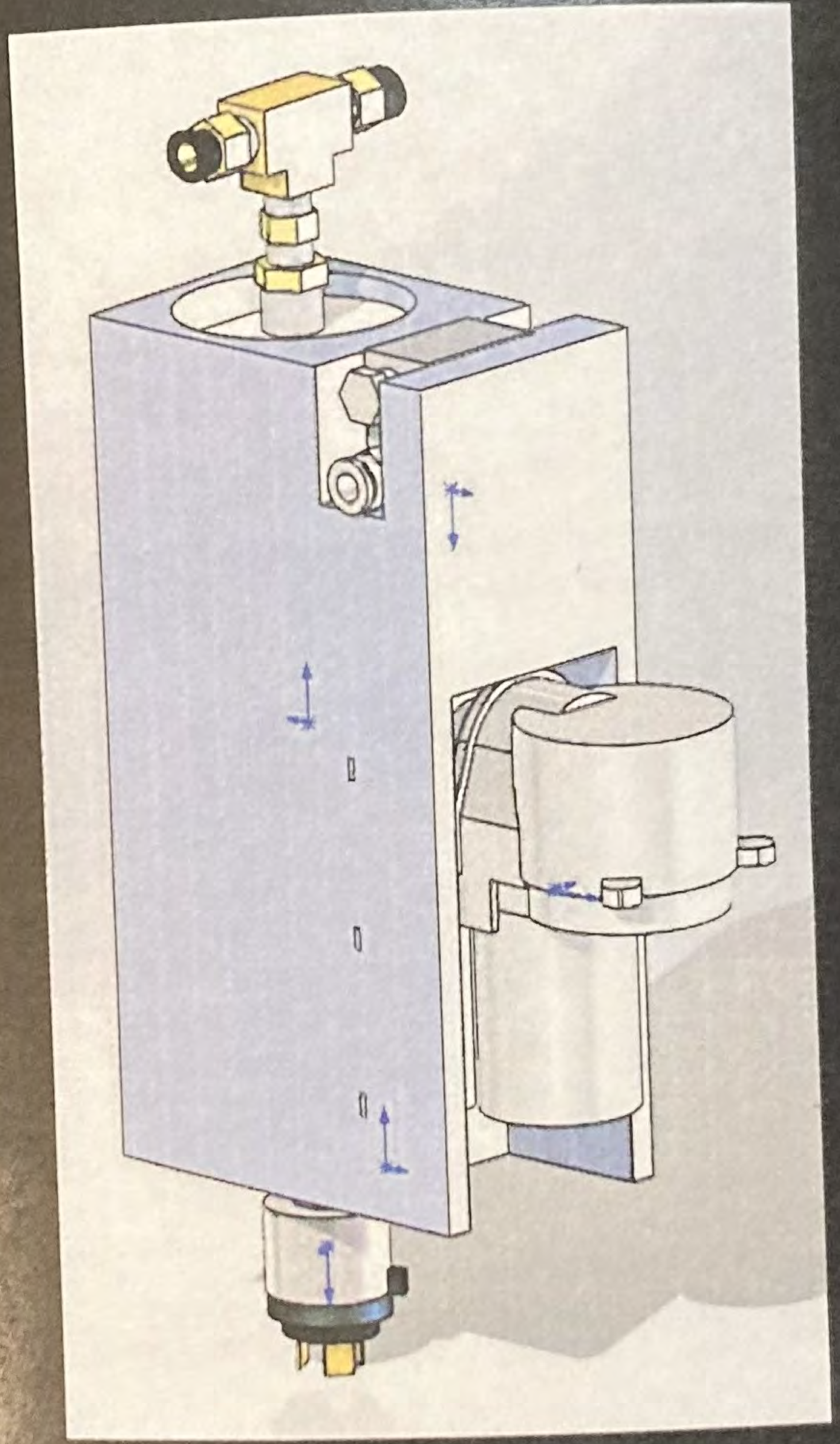
Design Description

Our design utilizes compressed air to propulse the quadrapus apparatus.

We plan to use around 15 PSI to allow for sufficient strength while also keeping the design safe and in control.

To direct the air we used 2 servo motors that we use to direct a point of propulsion.

Full CAD Model



Safety Features

In order to ensure safety our design includes:

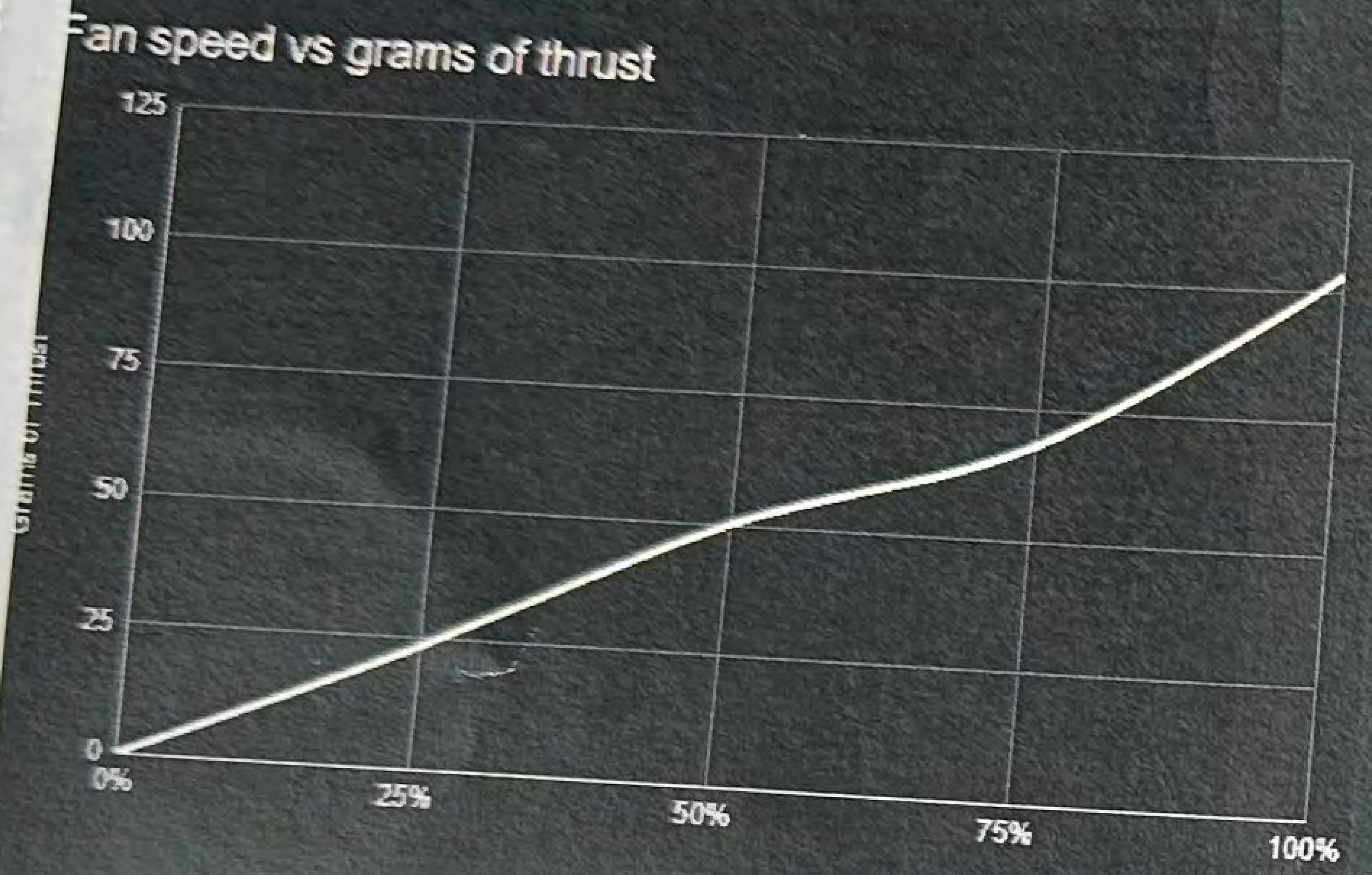
- Low PSI
- Suspension system

To ensure safety we will use a pressure switch that will release air if a component ever malfunctions and pressure begins to build.

Additionally, we have thought of using a suspension system using an elastic band or some sort of spring to take both internal and external shocks to reduce chances of the duster hitting people with damaging force.

Testing

One test we did was placing the system upright on a scale, and seeing how many grams it could lift off from the base.



From this, we could find out how many newtons of force the system can produce

Speed	25%	50%	75%	100%
Grams	23.5g	50.1g	68.4g	103.1g
Newtons	0.23N	0.49N	0.67N	1.011N

OUR TEAM

Demonstration

PROPULSION SYSTEM

INDEPENDENCE HIGH SCHOOL

MR. SAMUELS

ALEX KRYUKOV
TYLER STAELENS
SAMUEL MISSMER
KARIM SHUBAIR
LOGAN CANET

PROJECT BREAKDOWN

Nozzle

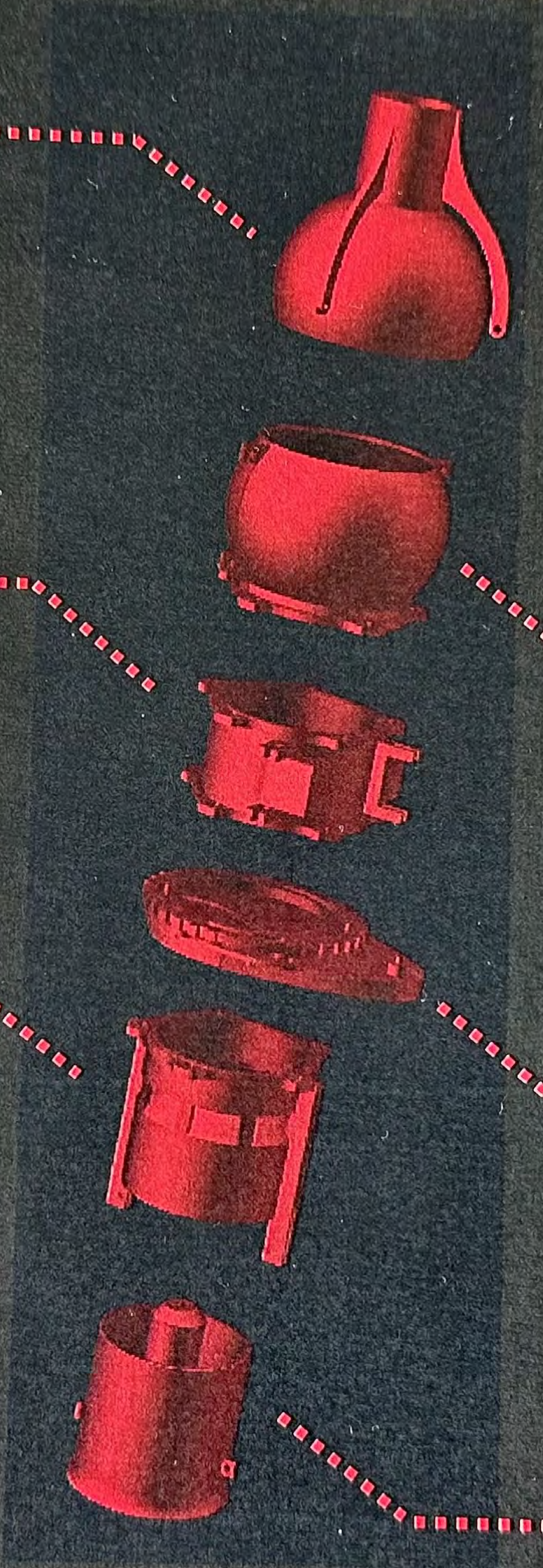
The nozzle is used in order for the robot to have control in which direction it needs to move. Rods on 2 axises connect to servos to allow for movement.

Servo Mount

The servo mount holds the servos that control the thrust vectoring gimbal.

Reverse Thrust Module

This module provides reverse thrust. When the revolving door is closed, it provides an exit for the air produced by the EDF fan, pushing the whole module backwards.



Mission

We sought out to figure out the best way that the duster can move. So, we based our design off of a jet engine and a rocket.

Gimbal Socket

The gimbal socket holds the nozzle piece in place while allowing it to rotate freely.

Iris Door

Similar to a camera lens, the iris door can be opened or closed in order to make the robot go forwards or backwards.

EDF Fan

The fan that provides the thrust to the rest of the system.

QR Codes

Pictures and testing videos

Past versions

Meet the Team

Noah Lorenz

- Junior
- Past Experience:
  - Code Quest 2023
  - 1st Place in Chatfield's Rocket-building competition
- Prospective Degree: Biophysics

Ryan Pan

- Junior
- Past Experience:
  - Biotechnical Engineering
- Prospective Degree: Aerospace Engineering

Kylie Bickford

- Junior
- Past Experience:
  - Biotechnical Engineering
  - 1st Place in Chatfield's Hot Air Balloon competition
- Prospective Degree: Mechanical Engineering

Reid Edler-Murphy

- Junior
- Past Experience:
  - First Place in Chatfield's Mechanical Airplane Competition
- Prospective Degree: Aviation Technology

Chatfield Propulsion Team

Research

Inspiration

- Octopus's jet propulsion
- Bird's one-way respiratory system

Design Principles

- Air moves through the system in one direction
- Impeller blade spins at a high velocity, doubling as a propeller when needed
- Gaskets hold air while not in use, creating the potential for strong bursts of air
- Chamber is elastic, allowing for higher volumes of air to be stored at lower pressures
- Thrust vectoring system is simple and effective, lowering the chances of malfunction

Pros

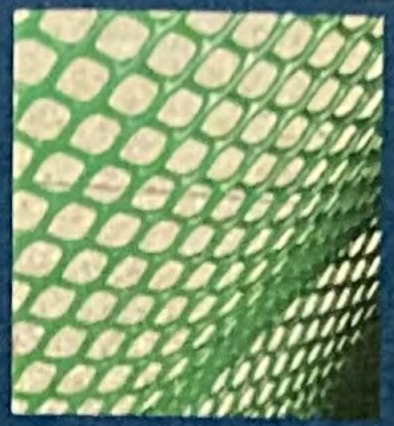
- Entire thrust vectoring system controlled by two servos
- Can store large quantities of air for long periods of time
- Powerful initial burst of air

Cons

- Requires a high efficiency motor
- Can only control two axes of motion at a time

Design

Air Filter



- Keeps small objects out of compressor
- Mesh fits between the two parts

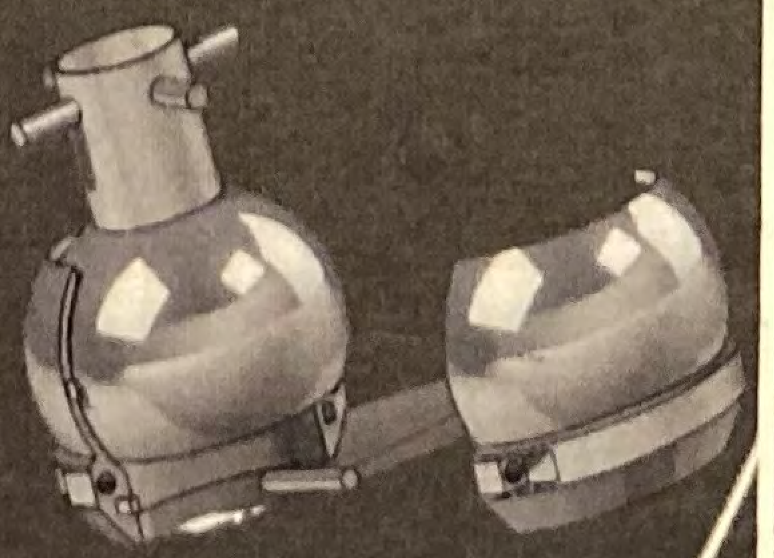
Compressor

- Compresses air into chamber while not in use
- Becomes a propeller after the initial burst of air

Chamber/Gaskets

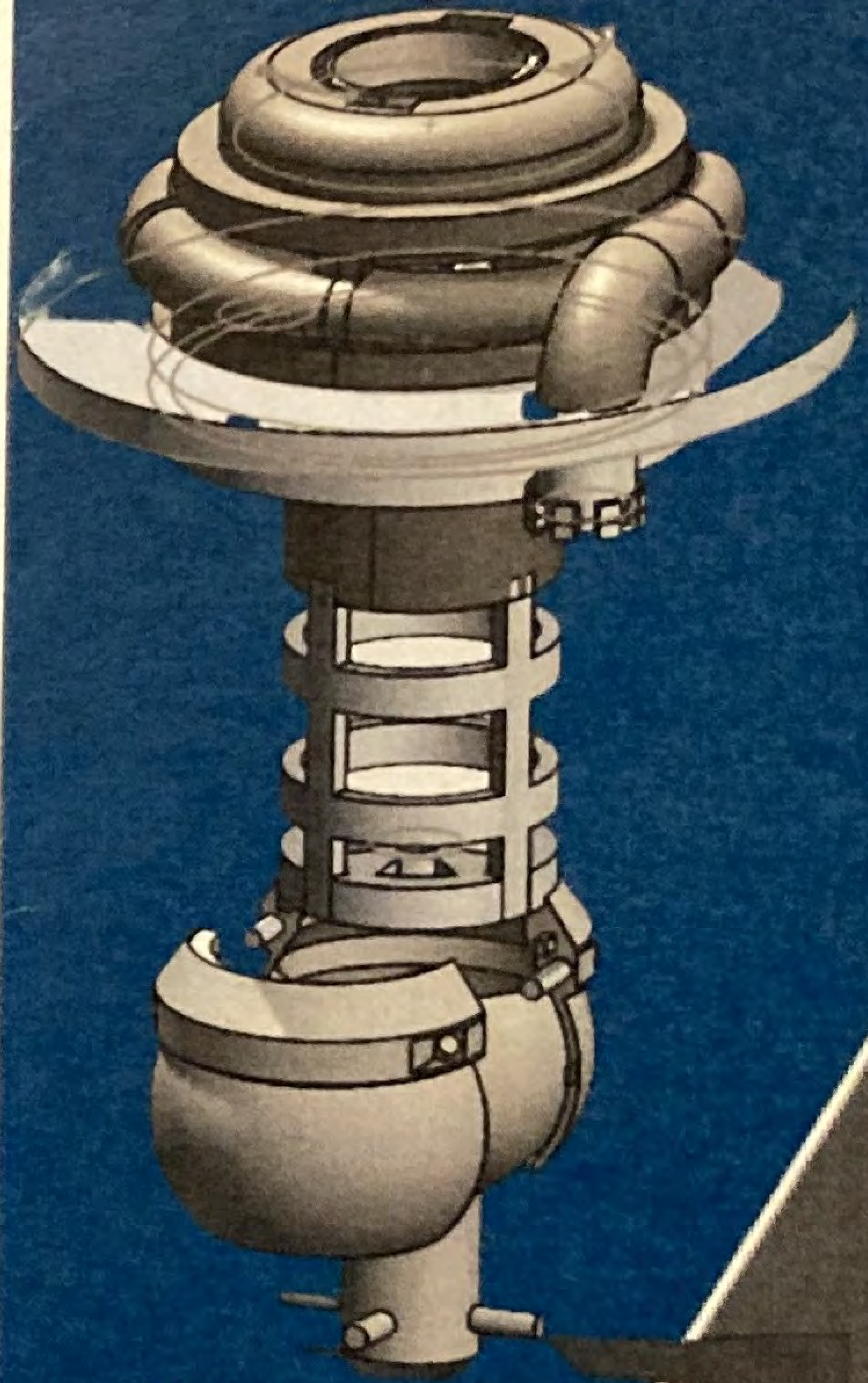
- Holds compressed air while the propulsion system is not in use.
- Controls the volume of air released
- Future designs would include iris gaskets

Thrust Vectoring



- Directs thrust in a controlled way
- Controlled by two servos

Prototyping/ Testing



- Rotational acceleration: $2\pi/9$ (~0.7) rad/s^2
- Time to turn on and off: 5 seconds
- Mass: 3.175 kg

SCAN FOR PROTOTYPE TESTING

SCAN FOR PRESENTATION ON INFORMATION FROM BRAINSTORMING TO PROTOTYPE TESTING

DUSTER ROBOT-PROPULSION

Grafton High School

Ms. Olympia Stein

By: Paul Sammet, Riley Amato, Reason Harris, Dylan Hoffman, Peter Saldeen

THE PROBLEM:

Astronauts on future space Stations, such as the Axiom and Starlab, will require a propulsion system for a cleaning robot. This robot will need to reattach itself to walls or handrails within the station so that it will not be stranded in zero gravity. Using this propulsion system, the robot will be able to propel itself to an attachment point where it will then use robotic arms to move.

OUR SOLUTION:

After focusing on selecting the ideal thruster type to meet our specific needs, factoring in efficiency, maintenance, and integration complexity; we chose the Ionic Thruster. This method is the best due to its higher efficiency compared to other options (such as compressed air).

PROTOTYPE DESIGN

THE IONIC THRUSTER USES ELECTRODYNAMIC THRUST (IONIC WIND) TO PROVIDE PROPULSION WITH NO MOVING PARTS. HERE ARE SOME OF THE CRITERIA WE USED TO BUILD THIS PROTOTYPE:

MODULAR DESIGN:

Enables easy assembly, testing, and replacement of individual components.

PROTECTIVE MESH:

Safeguards the thruster's inner workings while allowing ion flow.

COMPACT DIMENSIONS:

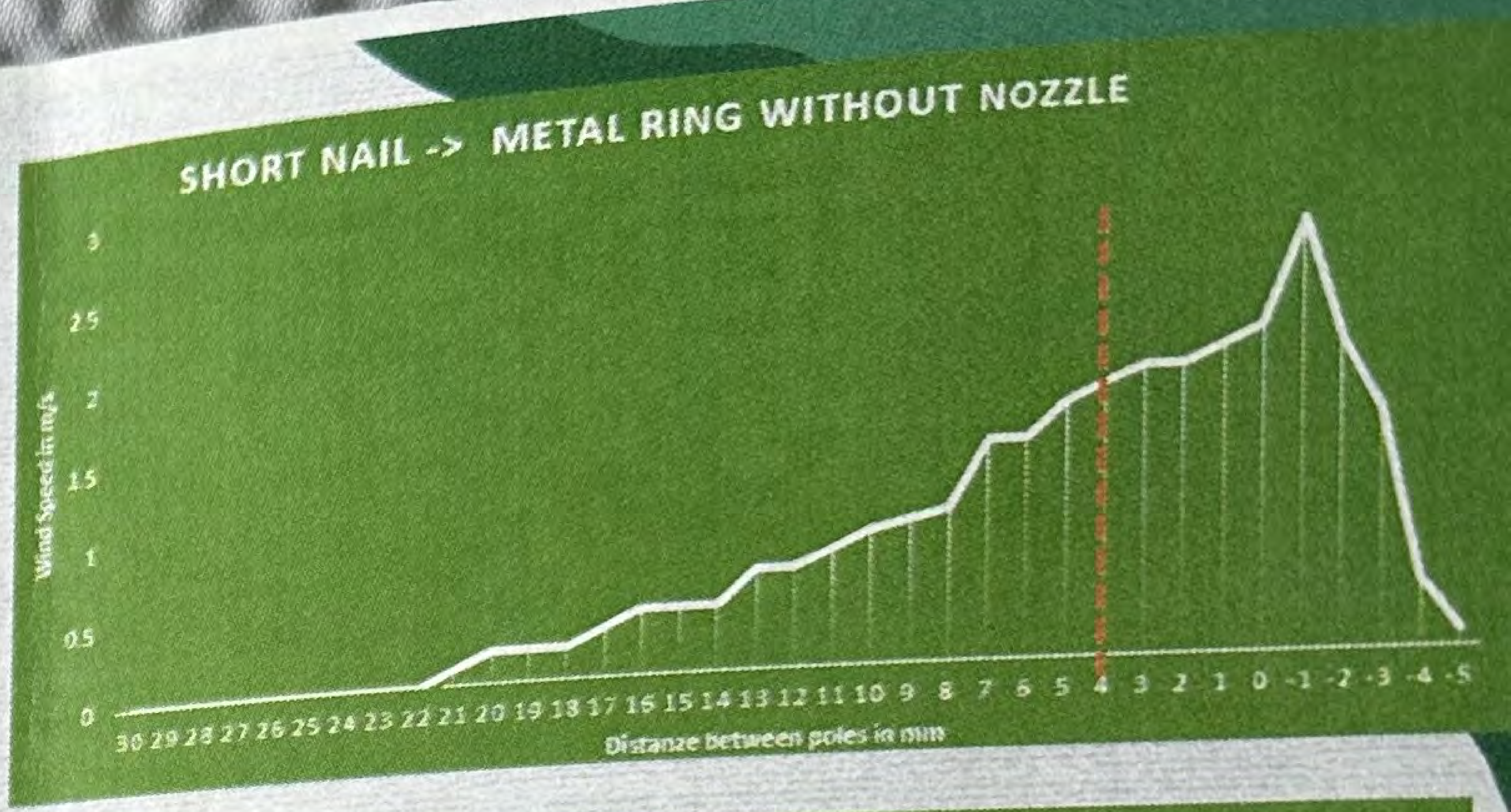
Main modules 55mm x 90mm x 90mm.

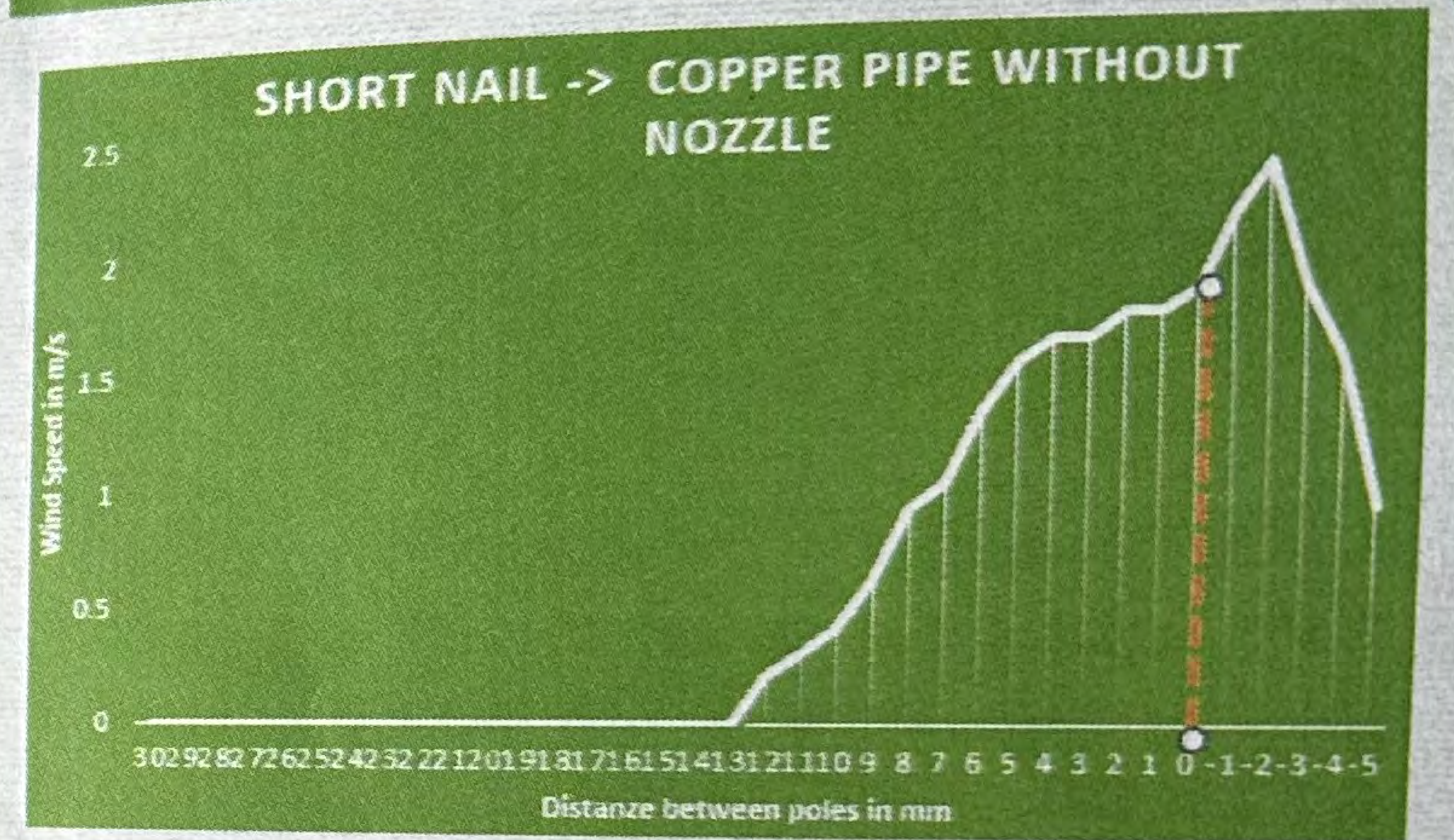
ELECTRICAL INTEGRATION:

Equipped with eight wires and four copper pipes ensuring full connectivity for power and control systems.

DEDICATED POWER SUPPLY:

Each thruster is powered independently, allowing for precise thrust control.

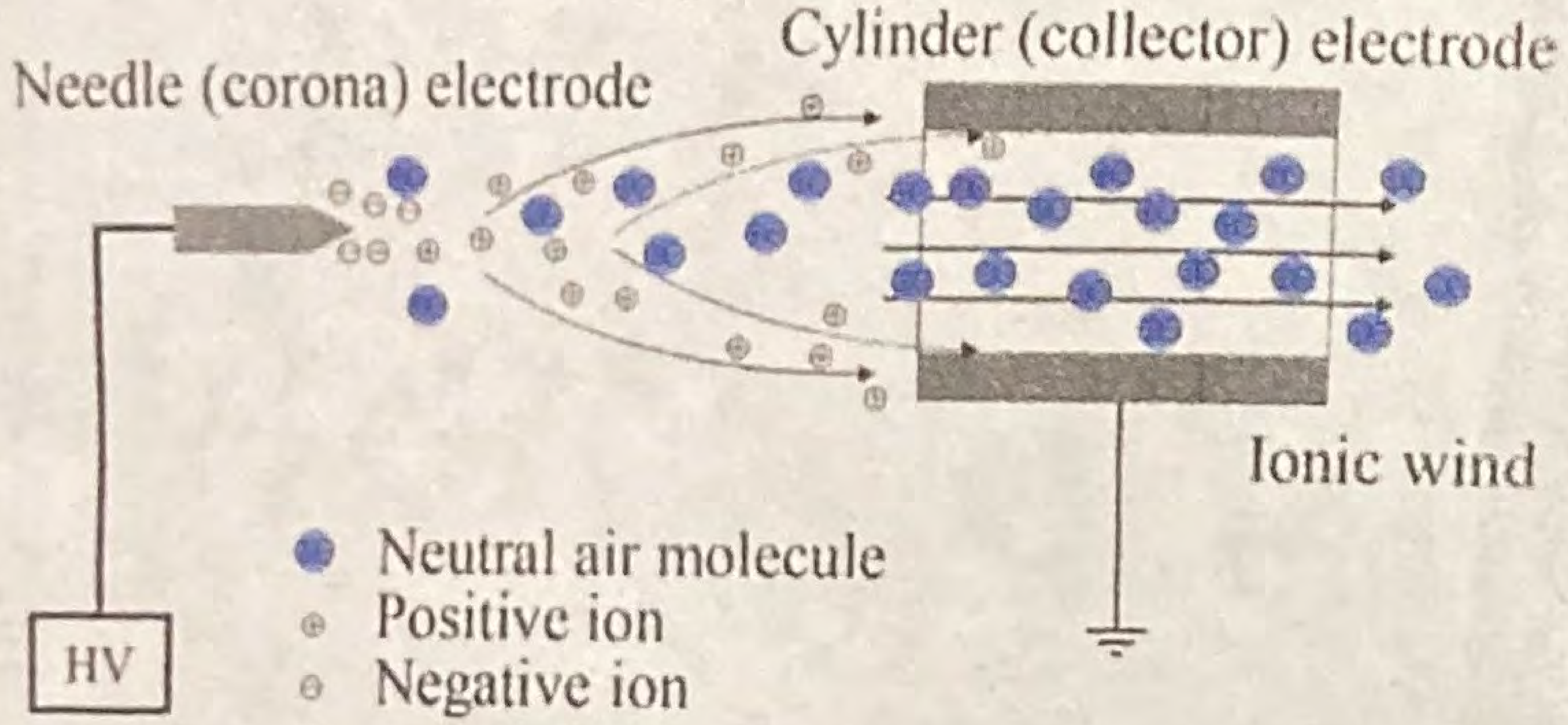




Improvements:

- Conductive Paint, Improved ring structure
- Power station to allow safer, more efficient testing
- Wiring
- Aluminum foil to copper
- Laser cut parts
- Multiple prototypes
- Testing methods

How it works



The sharp conductive end and the smooth ring produce a corona discharge, ionizing air which is then repelled from the sharp tip, producing air flow.

Flammability test

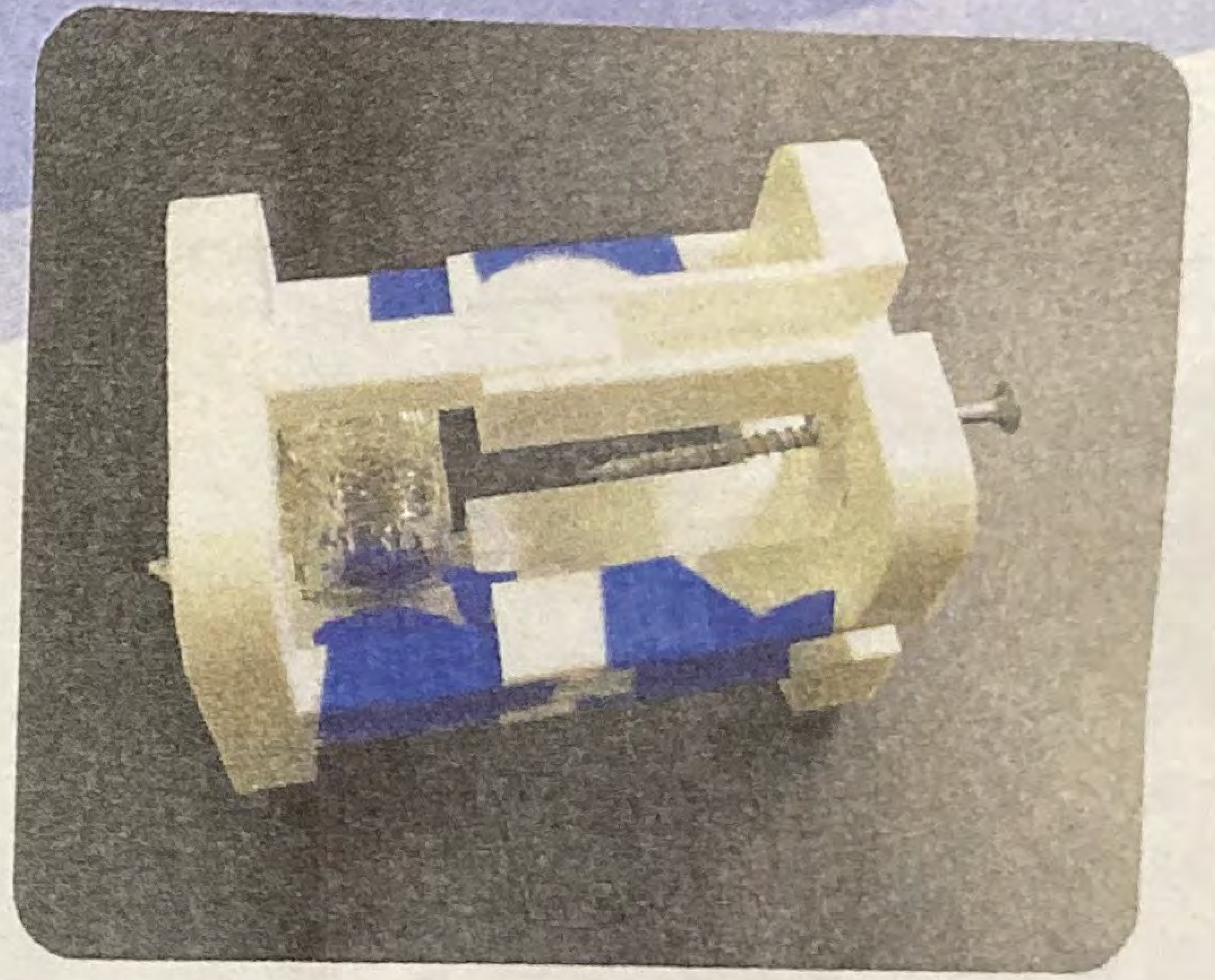
Safety

Is the Ionic Plasma Thruster safe?

Yes. We have conducted numerous flammability tests to ensure that dust and hair do not ignite if they pass through the plasma.

Additionally, our shell will keep astronauts and electronics far enough away to avoid shocking.

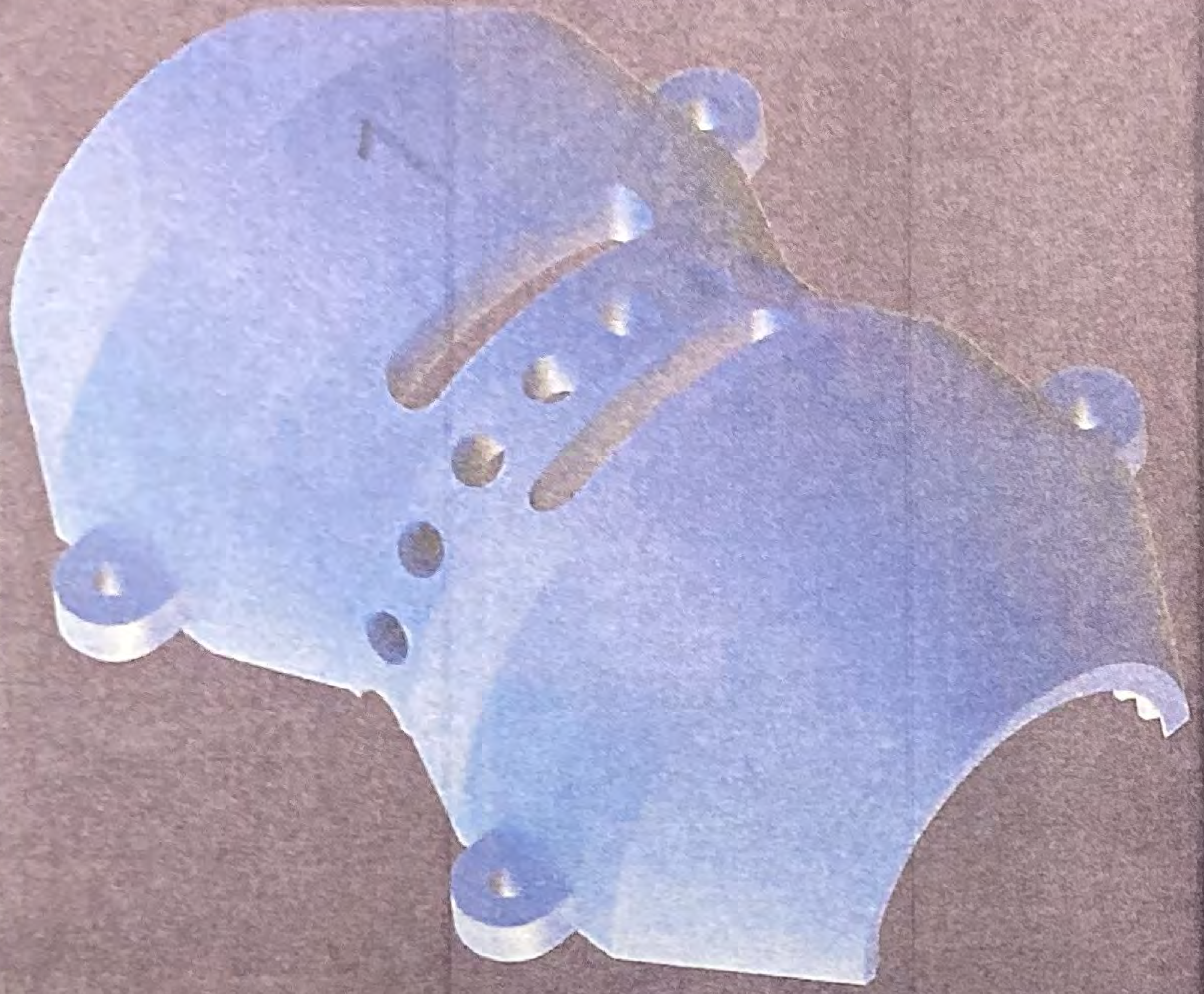
Ionic Plasma Thruster



Paul Besch-Turner
Tracey Roethel
Peter Zsenits
Mentors:
Vincenzo Stornello
Donna Himmelberg
Eugene Gordon



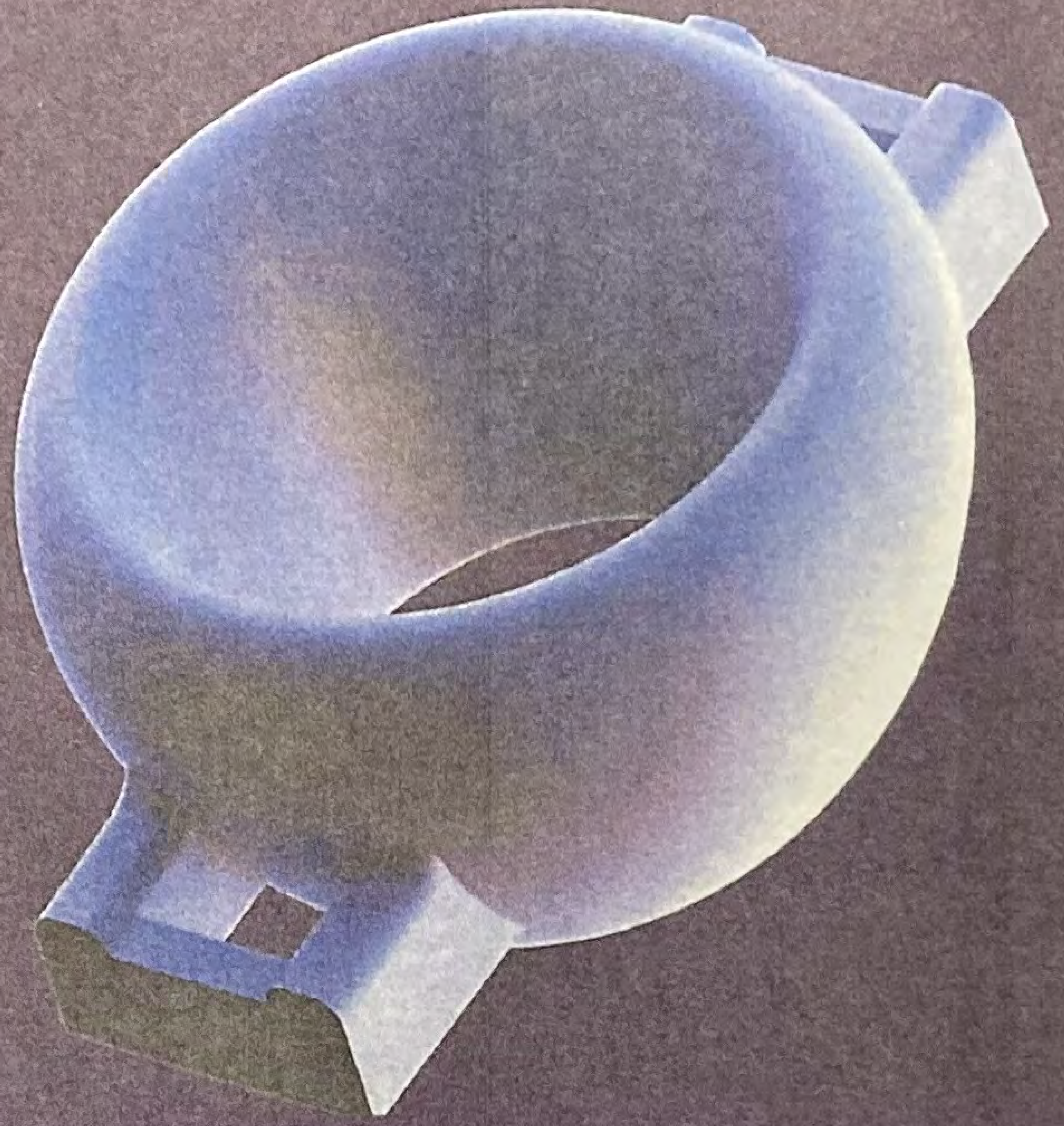
Fairport
Kwadropus Propulsion



Requirements

We are tasked to create a thrust system that allows the Kwadropus robot to return to a wall in microgravity.

HUNCH requirements



Our Solution

Our design utilizes ionic wind to produce a low thrust, low noise, solid state thruster, which can also be used for traversing mid-air.

Come check out our website!

Still have questions? Email us at kwadropus@gmail.com

Special thanks:

Dr. Bob Carter (RIT)
Integza (YouTube)