

# 2022 Design and Prototype Finalists

## Combination Electro/Solid Magnet Boots

Students: Gideon Glendon, Israel White, Niko  
Teacher: David Laughlin  
School: Bridgeland, Texas

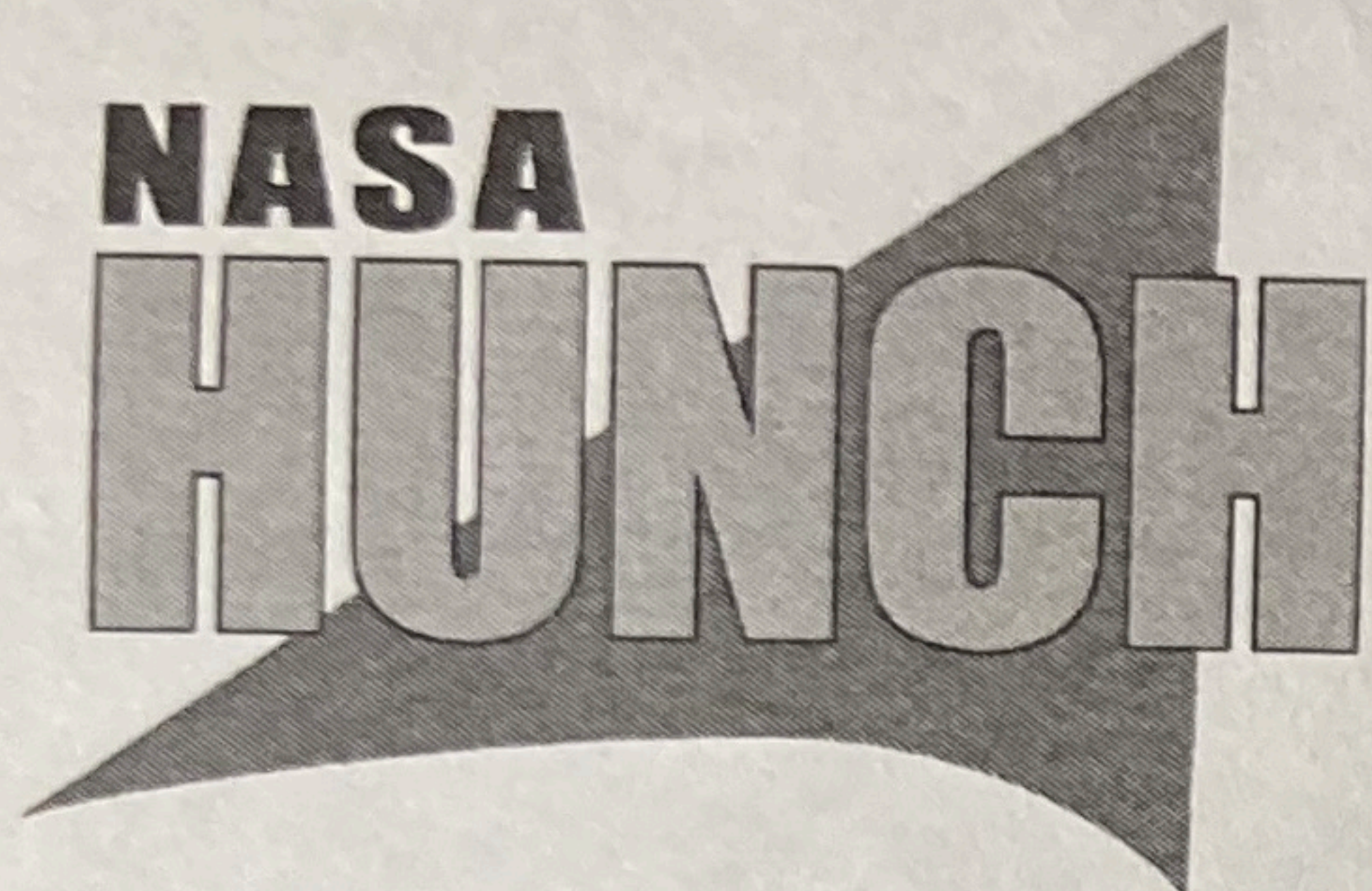
Students: Calvin Brown, Andrew Olafsrud, Mikella Chang, Jaxen Flegel  
Teacher: Frederick Hermann  
School: Makua Lani Christian Academy, Hawaii

Students: Joseph Cady, Zachary Blenkhorn, Nicholas Aguiar, Aidan Juhl  
Teacher: Kristin Magas  
School: Tri-County Regional Vocational Technical, Massachusetts









Hoffman

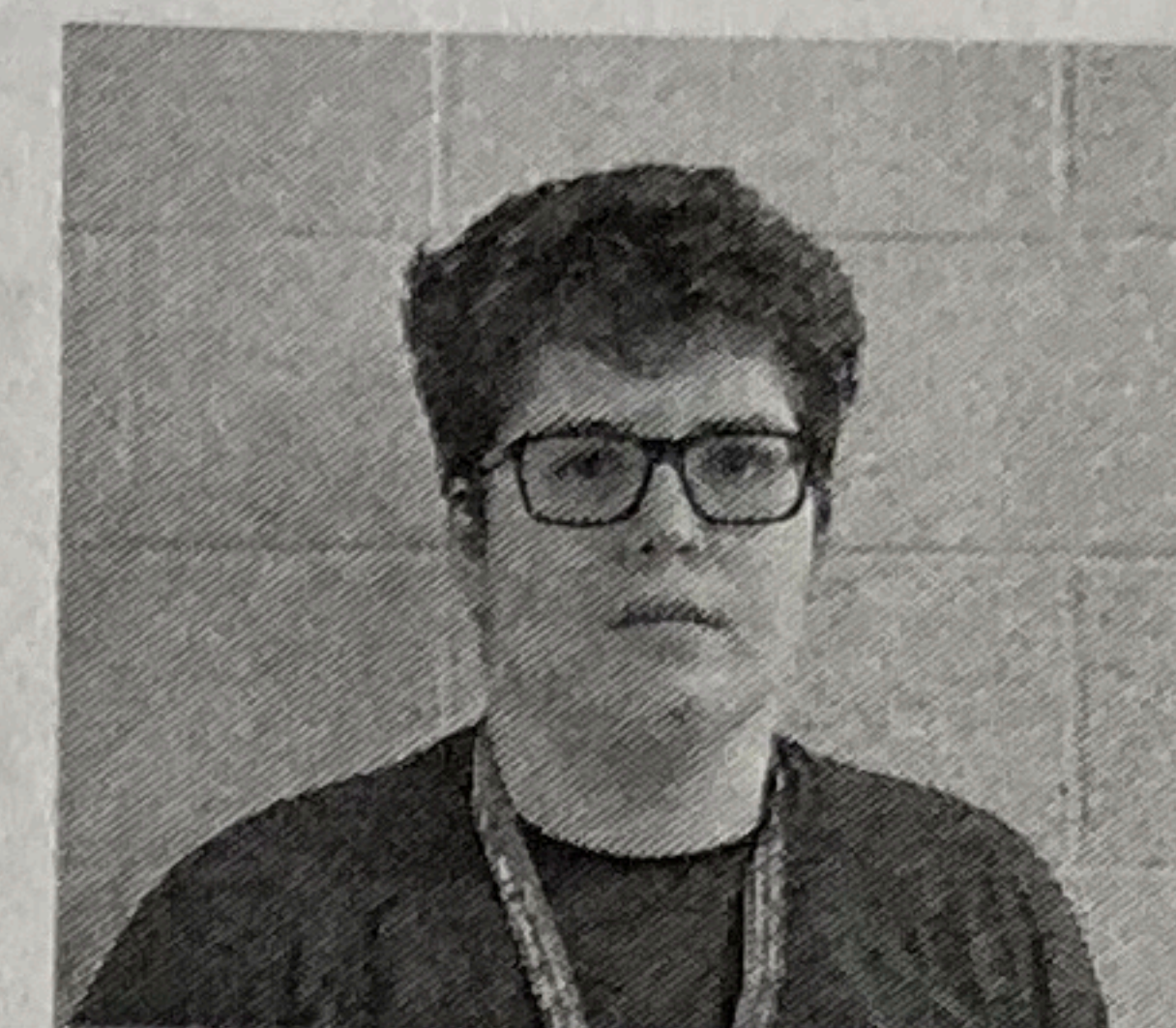
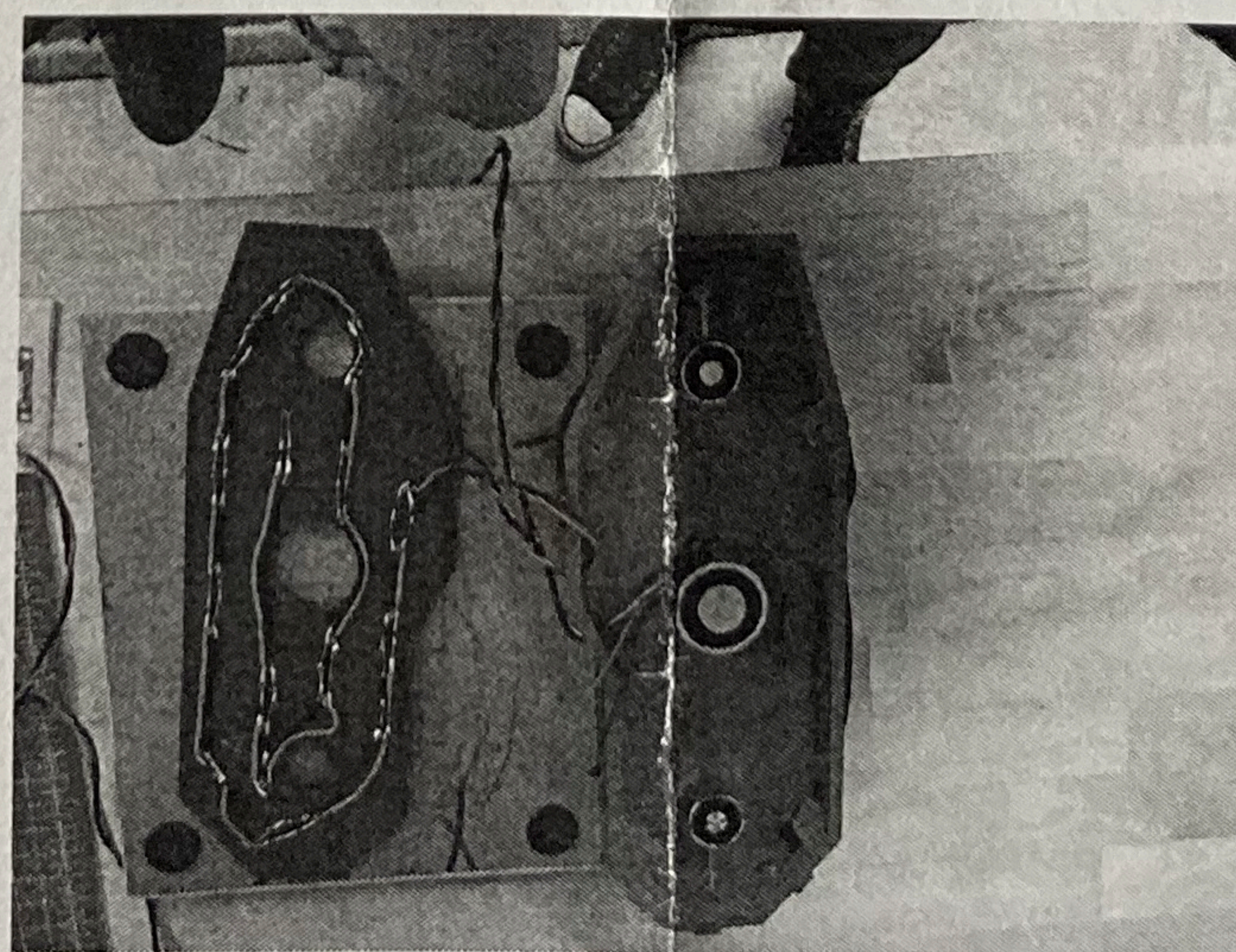
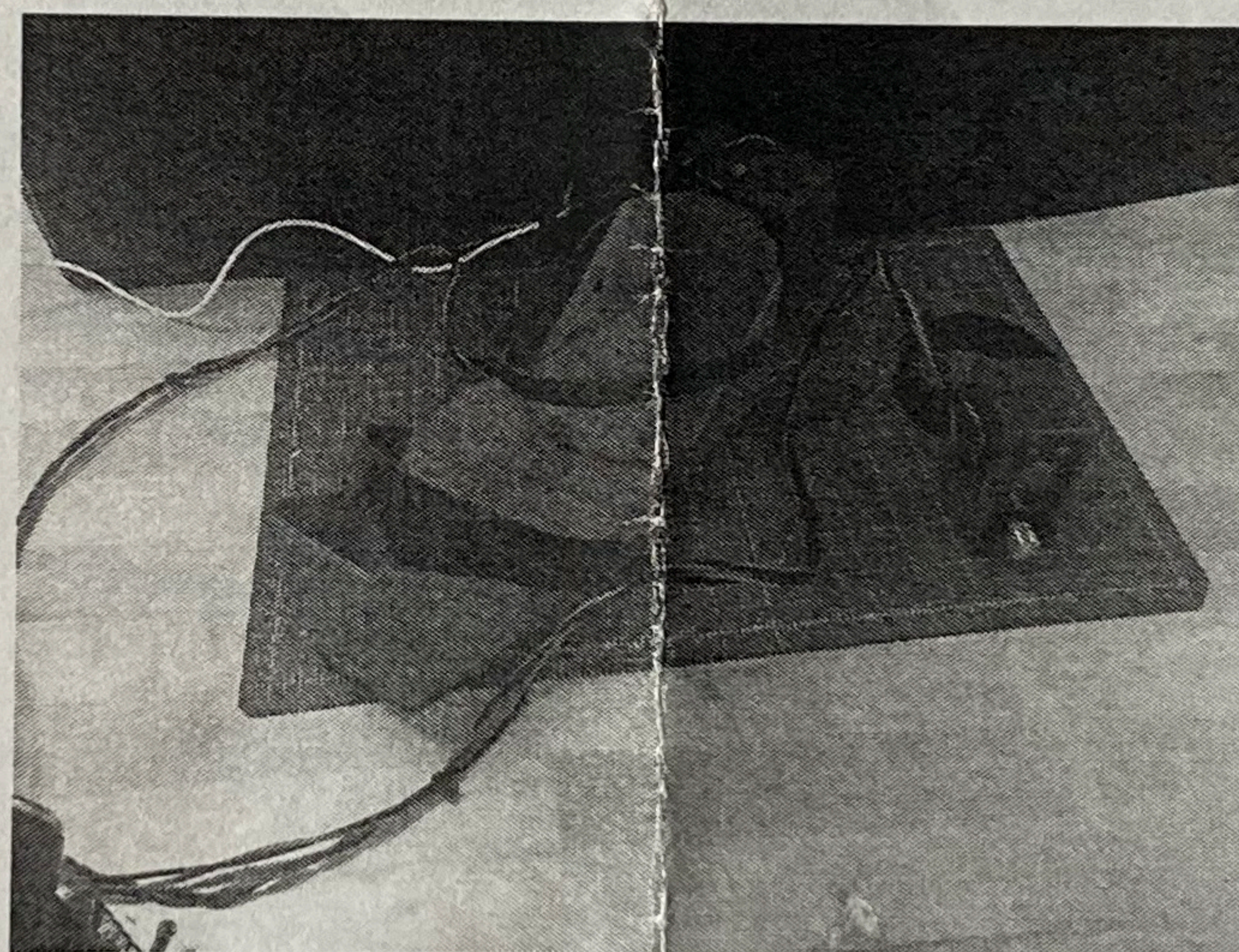
# PROJECT MAG

## Magnetic Boots

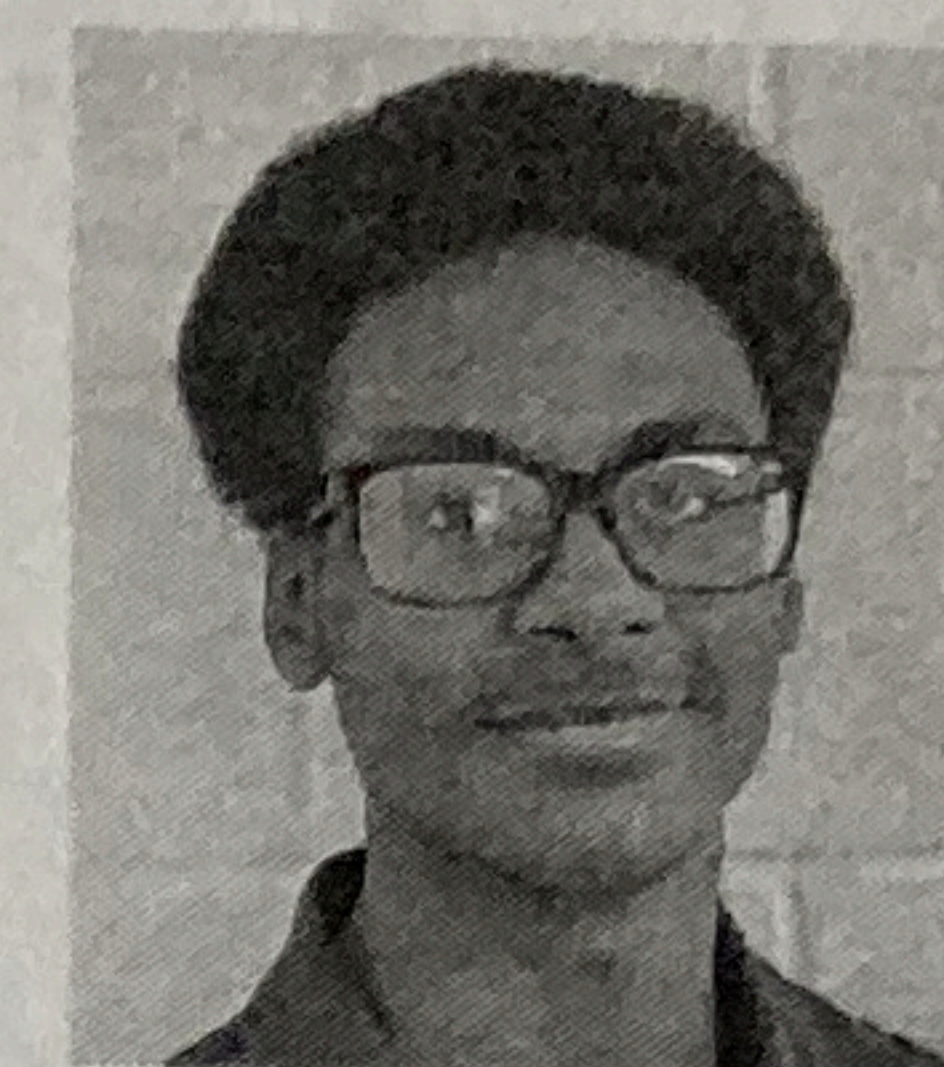
### Our Product Description

Project MAG is a set of specialized magnetic boots designed for use outside of a spacecraft to ease spacewalks. Primarily made of 3D printed materials, it is a very simple and easy to use machine. Our design allows our power source to be on the back of our boot, increasing efficiency of space management. Being able to control the output voltage of the magnets. The LED lights helps to see where your stepping and is on a separate power source. Lastly, it is designed for nine in a half to a ten size shoe.

### Prototype



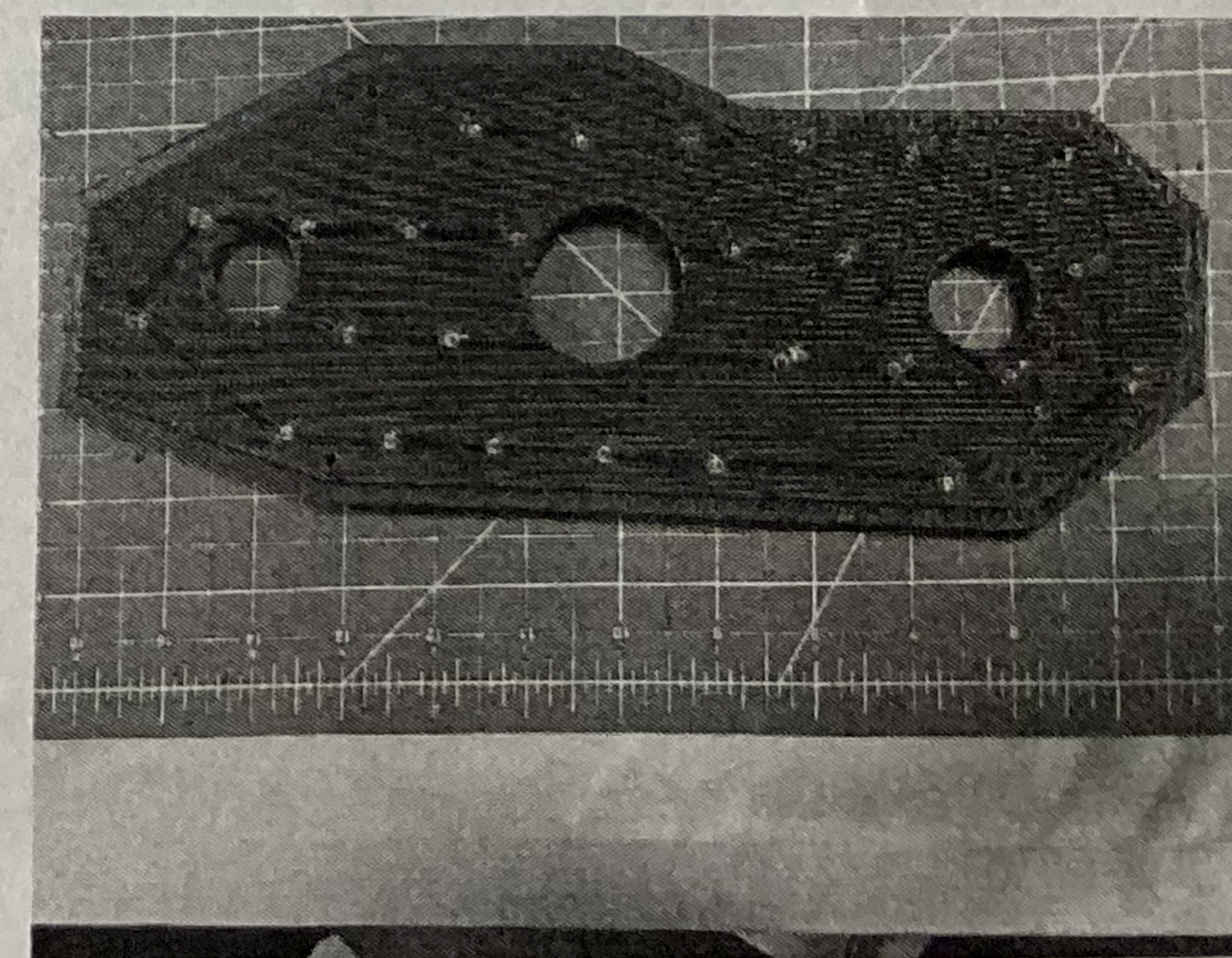
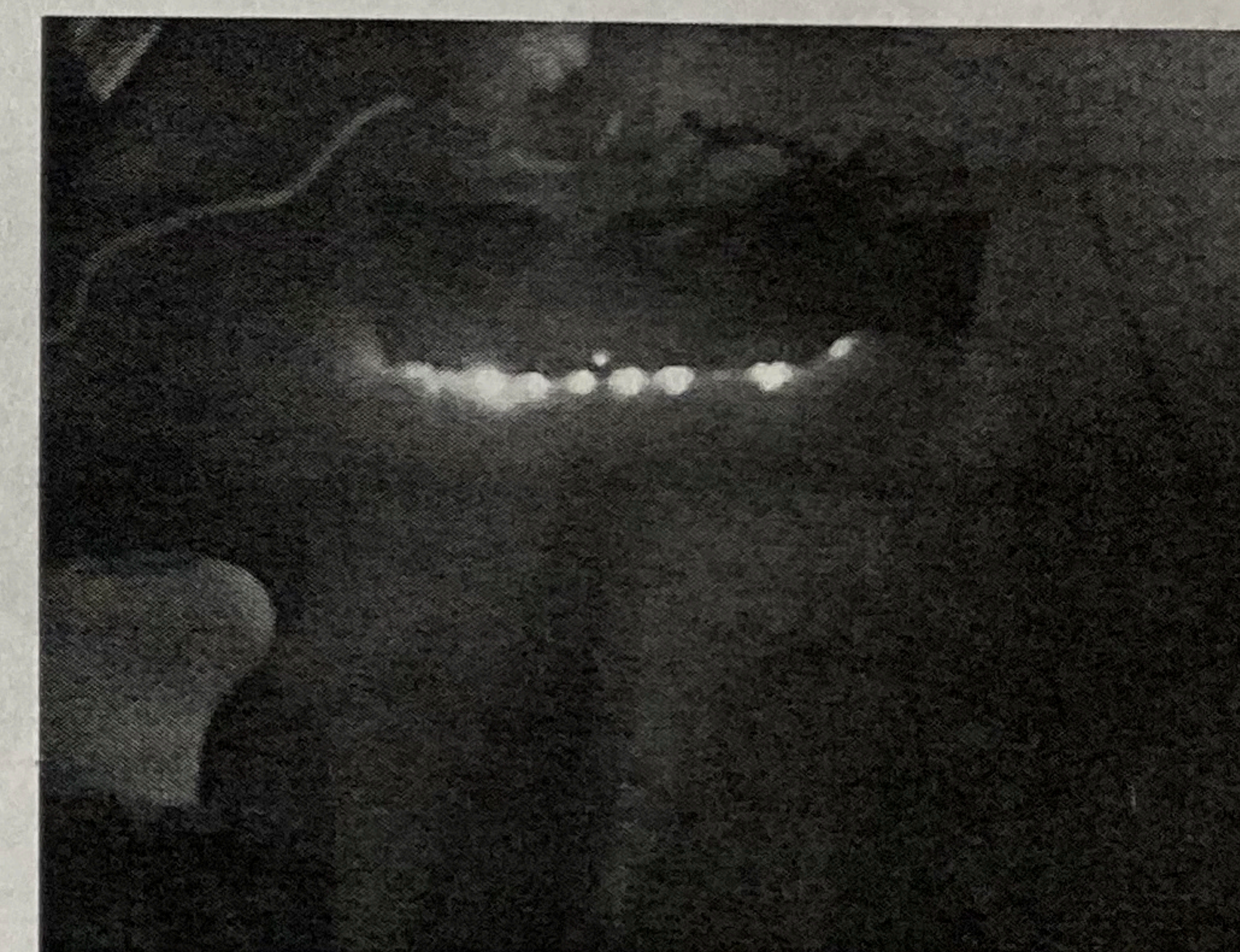
Gideon Glendon



Israel White



Niko





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\* **SMOOTH**

\* **STRONG**

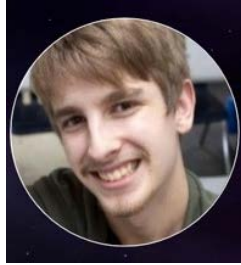
\* **SAFE**

Our flexible design focuses on allowing astronauts to maintain their natural gait and walk comfortably with fluid natural movement, while ensuring that the walking process does not hinder the integrity or strength of the magnetic hold of the boots. The design also allows astronauts to fully lock down onto the hull while working. The astronaut can also manually activate full magnetic hold as a safety feature.

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## Our Team

Makua Lani Christian Academy



Calvin Brown



Andrew Olafsrud



Mikella Chang



Jaxen Flegel

Supervisor: Mr. Herrmann

## Magnetic Boots





## How It Works

The electromagnet is activated **ONLY** when both front and rear switches are engaged.

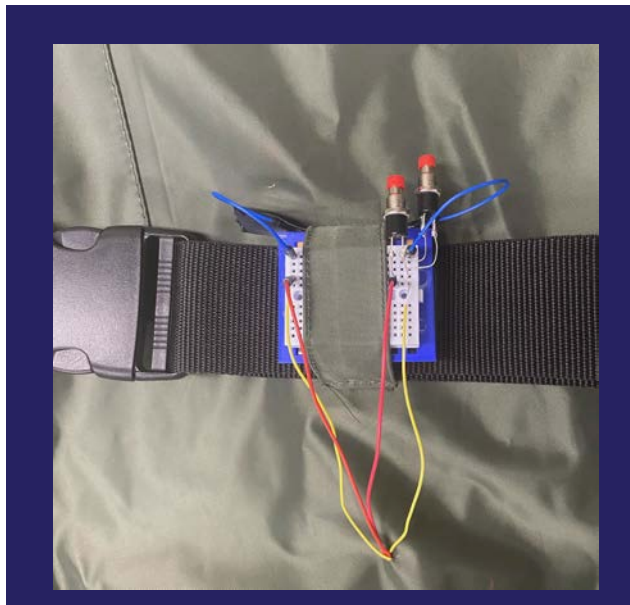
Neodymium magnets hold both the front and the rear portions of the boot down so that the push switches are engaged while the boot is flat.

The neodymium magnets are strong enough to prevent the switches from being released unintentionally, but not so strong as to prevent the astronaut from being able to disengage when desired.

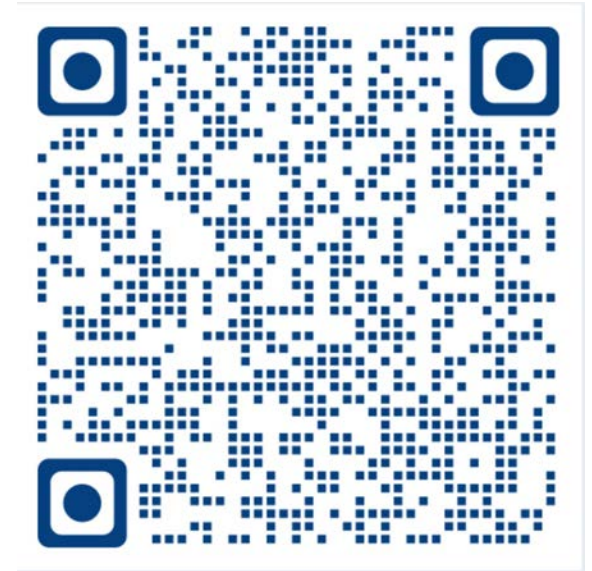


## Belt Control and Battery Housing

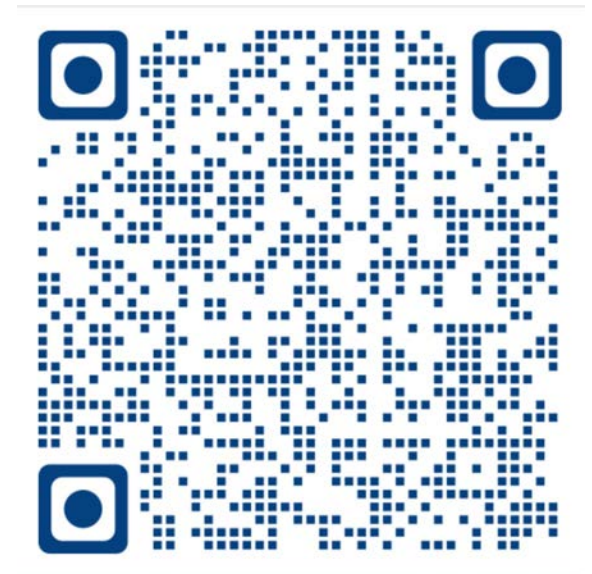
- Blue wires connect power to the circuit
- Right button gives power to the whole circuit (on/off switch)
- Left button activates emergency hold
- Battery housed in blue container



## Magnetic Boot Closeup



## Magnetic Boots Walking Demo







# JANZ Magnes

School: Tri-County Regional Vocational Technical High School

Teacher: Mrs. Magas



Team left to right: Joseph Cady, Zachary Blenkhorn, Nicholas Aguiar, Aidan Juhl

Joseph Cady (Accountant and Notetaker)

Zachary Blenkhorn (Corresponder and Scheduler)

Nicholas Aguiar (Project Manager and Lead Prototyper)

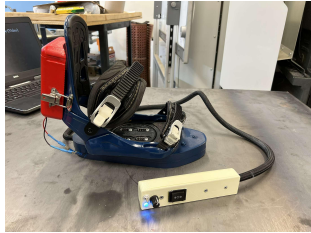
Aidan Juhl (Lead CAD and Editor)



Our Magnetic roller skates are designed to allow the astronaut to smoothly roll across the surface of the spacecraft that they are working on. We based our sole design on snowboard bindings that we had. The bindings are screwed into the sole. The sole includes magnetic wheels embedded in a flat bottom surface. There are also electromagnets within the sole that can provide extra attraction. We made a controller that has a potentiometer to control the strength of the electromagnets. The controller also includes a two way switch to control the forward and reverse movement of the wheels. The electronics are powered by a battery that is placed in a battery pack that is attached to the back of the binding using clamps that are screwed on.

Pros:	Cons:	Future:	Process:
<ul style="list-style-type: none"><li>• Smooth translation</li><li>• Always attracted</li><li>• Adjustable attraction</li><li>• Low effort to move</li><li>• Ergonomic</li><li>• Easy to take on and off</li><li>• Easy repair</li></ul>	<ul style="list-style-type: none"><li>• Requires batteries</li><li>• Slow</li><li>• Limited force</li><li>• Not hands free</li></ul>	<ul style="list-style-type: none"><li>• Use stronger motors</li><li>• Use a better battery</li><li>• Better materials</li><li>• Design hands free controls</li></ul>	<ul style="list-style-type: none"><li>• Determine the problem</li><li>• Research previous solutions</li><li>• Generate ideas</li><li>• Sketch the ideas</li><li>• Narrow down/combine ideas</li><li>• Sketch new ideas</li><li>• Make a materials list</li><li>• Split up to attempt two designs</li><li>• Generate prototypes</li><li>• Improve prototypes</li><li>• Combine ideas</li><li>• Create one prototype</li><li>• Improve prototype</li><li>• Create final prototype</li><li>• Improve aesthetics</li></ul>





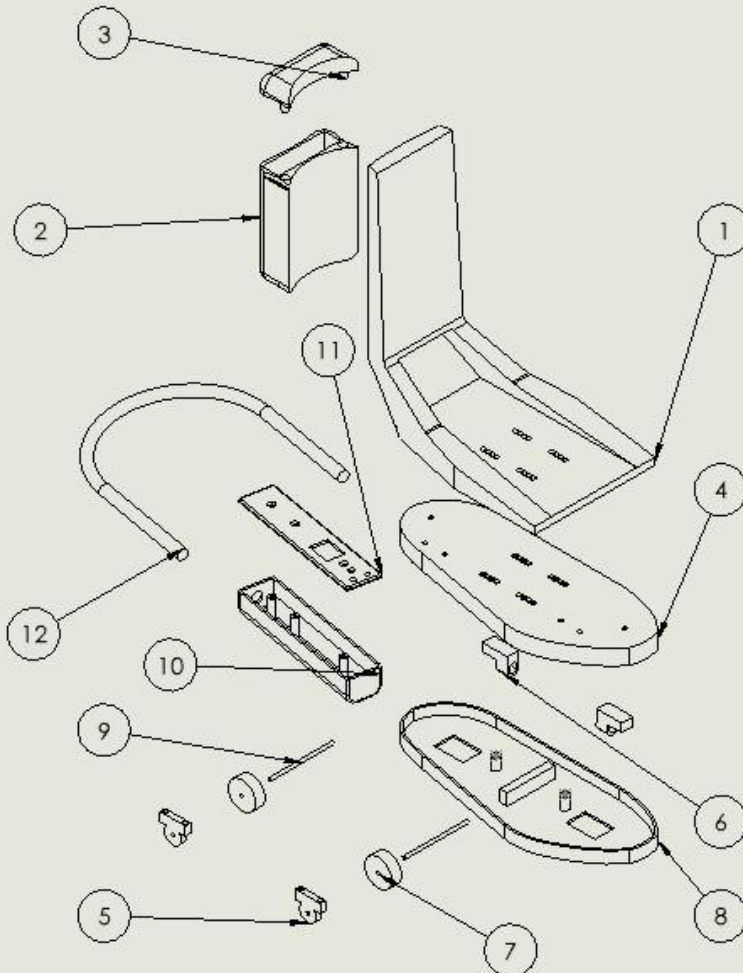
The entire shoe allows an ergonomic comfortable fit that can attach over any piece of footwear



The detachable battery pack allows for easy repair and replacement if there is ever a problem with the battery



The wheels allow for fluid movement across the outside of any spacecraft made of ferromagnetic materials.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Boot temp	fiftyone fifty snowboard binding	1
2	Battery holder	ABS 3D printed	1
3	Battery holder lid	ABS 3D printed	1
4	Shoe	ABS 3D printed	1
5	Axle holder	ABS 3D printed	2
6	motor mount	(ABS 3D printed) contains room for an N20 gear motor 326:1 gear ratio	2
7	wheel temp	Jireh magnetic wheels	2
8	shoe top	ABS 3D printed	1
9	axle temp	Basic vex v5 axle	2
10	controller bottom	ABS 3D printed	1
11	controller top	(ABS 3D printed) contains pockets for a potentiometer and a 3 position 6 pin switch	1
12	wire cover	Any wire cover wil work	1